San Diego County, California

CONTRACT DOCUMENTS
FOR THE CONSTRUCTION OF

OLIVENHAIN MUNICIPAL WATER DISTRICT NEW AND REMODELED OPERATIONS AND ADMINISTRATION FACILITIES ENCINITAS, CALIFORNIA

OMWD WO# _____

SEPTEMBER 2018

THIS PAGE INTENTIONALLY LEFT BLANK.

OLIVENHAIN MUNICIPAL WATER DISTRICT

OPERATIONS AND ADMINISTRATIVE FACILITIES

DIVISION 00 – BIDDING AND CONTRACT REQUIREMENTS

PAGE #	ITEM
1 - 8	NOTICE INVITING SEALED PROPOSALS (BIDS)
1 - 2	BID FORM CHECKLIST
1 - 22	BID FORM
1 - 2	BID BOND
1 - 4	AGREEMENT
1 - 2	PERFORMANCE BOND
1 - 2	PAYMENT BOND
1 - 2	CONTRACTOR'S CERTIFICATE RE: WORKMAN'S COMPENSATION
1 - 2	CERTIFICATE OF INSURANCE (WORKMAN'S COMPENSATION)
1 - 2	INSURANCE ENDORSEMENT (WORKMAN'S COMPENSATION)
1 - 4	CERTIFICATE OF INSURANCE (LIABILITY)
1 - 2	INSURANCE ENDORSEMENT (LIABILITY)
1 - 4	CERTIFICATE OF INSURANCE (BUILDER'S RISK "ALL RISK")
1 - 2	INSURANCE ENDORSEMENT (BUILDER'S RISK "ALL RISK)
	GENERAL PROVISIONS
1 - 4	TABLE OF CONTENTS
1 - 52	MAIN BODY
1 - 4	PUBLIC CONTRACT CODE SECTION 20104, ET SEQ
1 - 20	SUPPLEMENT TO GENERAL PROVISIONS

DIVISION 01 - GENERAL REQUIREMENTS

011000	SUMMARY
011400	WORK CONSTRAINTS
012100	ALLOWANCES
012500	SUBSTITUTION PROCEDURES
013000	ADMINISTRATIVE REQUIREMENTS (PROCURE CONTRACT LANGUAGE)
013100	PROJECT MANAGEMENT AND COORDINATION
013110	CONTRACTOR PERSONNEL
013203	CONSTRUCTION PROGRESS DOCUMENTATION
013216	PULL PLANNING PROCESS PROCEDURES
013240	PROGRESS SCHEDULES AND REPORTS
013300	SUBMITTAL PROCEDURES
013523	PROJECT SAFETY REQUIREMENTS
013700	SCHEDULE OF VALUES
014000	QUALITY REQUIREMENTS

OLIVENHAIN MUNICIPAL WATER DISTRICT

OPERATIONS AND ADMINISTRATIVE FACILITIES

014200 REFERENCES
014219 REFERENCE STANDARDS
014500 TEST & BALANCE
015000 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS
015001 FACILITIES FOR ONSITE OWNER REPRESENTATION
015002 TEMPORARY FACILITIES FOR OMWD STAFF (TO BE ISSUED AS AN ADDENDUM)
016000 PRODUCT REQUIREMENTS
017300 EXECUTION
017329 CUTTING AND PATCHING
017419 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
017700 CLOSEOUT PROCEDURES
017823 OPERATION AND MAINTENANCE DATA
017839 PROJECT RECORD DOCUMENTS
017900 DEMONSTRATION AND TRAINING
019113 GENERAL COMMISSIONING REQUIREMENTS

DIVISION 02 - EXISTING CONDITIONS
024116 STRUCTURE DEMOLITION
024119 SELECTIVE DEMOLITION

DIVISION 03 - CONCRETE
030130 MAINTENANCE OF CAST-IN-PLACE CONCRETE
031000 CONCRETE FORMWORK
032000 CONCRETE REINFORCEMENT
033000 CAST-IN-PLACE CONCRETE
033010 CONCRETE FLOORS

DIVISION 04 - MASONRY
042200 CONCRETE UNIT MASONRY

DIVISION 05 - METALS
051200 STRUCTURAL STEEL
055000 METAL FABRICATIONS
055213 PIPE AND TUBE RAILINGS

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES
061000 ROUGH CARPENTRY
061010 MICROLLAM LVL SPECIFICATIONS
061020 PARALLAM PSL SPECIFICATIONS

061053 MISCELLANEOUS ROUGH CARPENTRY
061600 SHEATHING
062023 INTERIOR FINISH CARPENTRY
064116 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION
071326 SELF-ADHERING SHEET WATERPROOFING
071413 HOT FLUID-APPLIED RUBBERIZED ASPHALT WATERPROOFING
071900 WATER REPELLENTS
072100 THERMAL INSULATION
072119 FOAMED-IN-PLACE INSULATION
073210 CONCRETE ROOF TILE
075590 BITUMINOUS MEMBRANE ROOFING
076200 SHEET METAL FLASHING AND TRIM
077160 ROOF EXPANSION ASSEMBLIES
077200 ROOF ACCESSORIES
078400 FIRESTOPPING
078413 PENETRATION FIRESTOPPING
078443 FIRE RESISTANT JOINT SYSTEMS
079200 JOINT SEALANTS
079219 ACOUSTICAL JOINT SEALANTS

DIVISION 08 - OPENINGS
081113 HOLLOW METAL DOORS AND FRAMES
081416 FLUSH WOOD DOORS
083113 ACCESS DOORS AND FRAMES
084113 ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS
084123 SLIDING GLASS DOORS (TO BE ISSUED AS AN ADDENDUM)
085113 ALUMINUM WINDOWS
086223 TUBULAR DAYLIGHTING DEVICES
087100 DOOR HARDWARE
088000 GLAZING
088140 MIRRORED GLASS

DIVISION 09 - FINISHES
090561 MOISTURE VAPOR EMISSION CONTROL
092400 CEMENT PLASTERING
092900 GYPSUM BOARD ASSEMBLIES
092950 GYPSUM BOARD SHAFT WALL ASSEMBLIES
093013 CERAMIC TILING

094100 SOLID SURFACE COUNTERTOPS
095110 ACOUSTICAL PANEL CEILINGS
096520 SHEET VINYL FLOORING COVERINGS
096800 CARPET TILE
099113 EXTERIOR PAINTING
099123 INTERIOR PAINTING

DIVISION 10 – SPECIALTIES
101000 MARKERBOARDS
101400 ENVIRONMENTAL GRAPHICS
101550 TOILET PARTITIONS
102000 LOUVERS
102600 WALL AND DOOR PROTECTION
102813 TOILET ACCESSORIES
104413 FIRE EXTINGUISHER CABINETS
104416 FIRE EXTINGUISHERS
105113 METAL VENTED WARDROBE LOCKERS
108116 PEST CONTROL / TERMITE TENTING (TO BE ISSUED AS AN ADDENDUM)

DIVISION 11 - EQUIPMENT
114000 APPLIANCES
115200 AUDIO VISUAL EQUIPMENT (TO BE ISSUED AS AN ADDENDUM)
116000 BOTTLE FILLING STATION (ELKAY CUT SHEET)

DIVISION 12 - FURNISHINGS

122123 ELECTRONIC ROLLER SHADE SYSTEM (TO BE ISSUED AS AN ADDENDUM)
122124 MANUAL ROLLER SHADE SYSTEM

DIVISION 21 - FIRE SUPPRESSION
211300 AUTOMATIC FIRE SPRINKLER SYSTEM

DIVISION 22 – PLUMBING
220500 COMMON WORK RESULTS FOR PLUMBING
220553 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT
220700 PLUMBING INSULATION
221116 DOMESTIC WATER PIPING
221119 DOMESTIC WATER PIPING SPECIALTIES
221316 SANITARY WASTE AND VENT PIPING
221319 SANITARY WASTE AND VENT SPECIALTIES

221413 FACILITY STORM DRAINAGE PIPING
221423 STORM DRAINAGE PIPING SPECIALTIES
223300 ELECTRIC, DOMESTIC-WATER HEATERS
224000 PLUMBING FIXTURES

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)
230516 EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING
230517 SLEEVES AND SLEEVE SEALS FOR HVAC PIPING
230523.12 BALL VALVES FOR HVAC PIPING
230529 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
230553 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
230593 TESTING, ADJUSTING, AND BALANCING FOR HVAC
230713 DUCT INSULATION
230719 HVAC PIPING INSULATION
230923 DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC
232300 REFRIGERANT PIPING
233113 METAL DUCTS
233300 AIR DUCT ACCESSORIES
233423 HVAC POWER VENTILATORS
233713.13 AIR DIFFUSERS
233723 HVAC GRAVITY VENTILATORS
236313 VARIABLE REFRIGERANT FLOW UNITS
236314 VARIABLE REFRIGERANT FLOW INDOOR FAN COIL UNITS
238126 SPLIT SYSTEM AIR CONDITIONERS

DIVISION 26 – ELECTRICAL
260519 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
260526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
260529 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
260533 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
260543 UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS
260544 SLEEVES & SLEEVE SEALS FOR ELECTRICAL RACEWAYS & CABLING
260548 VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS
260553 IDENTIFICATION FOR ELECTRICAL SYSTEMS
262413 SWITCHBOARDS
262416 PANELBOARDS
262726 WIRING DEVICES
262813 FUSES
262816 ENCLOSED SWITCHES AND CIRCUIT BREAKERS
263213 ENGINE GENERATORS
263600 TRANSFER SWITCHES

265119 LED INTERIOR LIGHTING
265219 EMERGENCY AND EXIT LIGHTING
265613 LIGHTING POLES AND STANDARDS
265619 LED EXTERIOR LIGHTING

DIVISION 32 - EXTERIOR IMPROVEMENTS
321216 ASPHALT PAVING
321243 POUROUS FLEXIBLE PAVEMENT
321313 CONCRETE PAVING
321343 PORTLAND CEMENT PERVIOUS CONCRETE PAVEMENT
321373 CONCRETE PAVING JOINT SEALANTS
321440 DECOMPOSED GRANITE SURFACING
321413 PERMEABLE INTERLOCKING CONCRETE PAVEMENT
321723 PAVEMENT MARKINGS
321726 TACTILE WARNING SURFACING
323100 FENCES AND GATES
323113 CHAIN LINK FENCES AND GATES
328113 SOIL PREPARATION
328400 LANDSCAPE IRRIGATION
329400 LANDSCAPE PLANTING

APPENDICES
APPENDIX A STORM WATER POLLUTION PREVENTION PLAN
APPENDIX B GEOTECHNICAL DOCUMENTS

REFERENCE STANDARDS
OMWS Standard Specification and Drawings for the Construction of Water, Recycled Water and Sewer, 2017
Standard Specifications for Public Works for Construction ‘Greenbook’ (2016)
San Diego Regional Standard Drawings (2015)

END OF TABLE OF CONTENTS

NOTICE INVITING SEALED PROPOSALS (BIDS)

FOR THE CONSTRUCTION OF

NEW AND REMODELED OPERATIONS AND ADMINISTRATIVE FACILITIES

FOR THE

OLIVENHAIN MUNICIPAL WATER DISTRICT

NOTICE IS HEREBY GIVEN that the Board of Directors of said District invites and will receive sealed proposals (bids) from pre-qualified contractors up to the hour of **2:00 p.m. on the 4th day of October, 2018** for the furnishing to said District of all transportation, labor, materials, tools, equipment, services, permits, utilities, and other items necessary to construct said work. At said time, said proposals will be publicly opened and read aloud at the office of the Olivenhain Municipal Water District, 1966 Olivenhain Road, Encinitas, CA 92024, (760) 753-6466.

Bids shall conform to and be responsive to the Contract Documents for the work. Copies of the Contract Documents will be open to public inspection during business hours in the office of the District.

The District will conduct a Mandatory Pre-Bid Conference for pre-qualified contractors at the District office, 1966 Olivenhain Road, Encinitas, California, at **10:00 a.m. on September 11, 2018.** A site walk will follow the meeting. **It is mandatory that bidders attend the Pre-Bid Conference.** If a bidder does not attend at least one of the pre-bid meetings they will be deemed unresponsive and their bid will be rejected.

All questions relative to this project prior to the opening of bids shall be directed to the District (see enclosed Pre-Bid Question Form). It shall be understood that no specification interpretations will be made by telephone nor will any "or equal" products be considered for approval prior to award of the contract. Bidders are encouraged to submit their pre-bid questions as early as possible, in writing by fax or mail, so they can be answered in writing through an addendum if necessary. Questions may be taken verbally; however, written questions will be given priority, and verbal questions run the risk of not being answered. Pre-bid questions will be received up to **5:00 p.m. on September 28, 2018,** after which they will not be answered.

Contract Documents consisting of plans, specifications and bidding documents can be downloaded from the "Bids and Planning" link under "About Us" on the home page of the District's website at www.olivenhain.com. Contract documents are not available at the District. It will be the Bidder's responsibility to download and acknowledge receipt of all addenda. If you wish to be placed on the plan holders list, please send your company name, contact person, contact phone # and email to Robert.Polley@SchneiderCM.net.

Each bid shall be submitted on the bid form furnished as part of the Contract Documents and must state the Contractor's applicable license classification, license number, license expiration date, name of license holder, and relationship to Bidder. The license classification required for this project is Class A General Engineering. Each bid must be accompanied by cash, a cashier's

check, a certified check, or a bidder's bond executed by an admitted surety insurer. This proposal guarantee shall be in an amount of not less than 10 percent of the amount of the bid and made payable to the order of or for the benefit of the District. Each bid shall be sealed and delivered to District personnel at 1966 Olivenhain Road, Encinitas, CA 92024 on or before the day and hour set for the opening of bids. Bids not marked as being received by District personnel on or before the day and hour of bid opening will be rejected. It is the responsibility of the Bidder to ensure that the bid is received by District personnel on or before the day and hour of bid opening. Said cash, check, or bond shall be given as guarantee that the Bidder will enter into a contract with the District and furnish the required payment and performance bonds and insurance certificates and endorsements if awarded the work, and will be declared forfeited if the Bidder refuses to timely enter into said contract or furnish the required bonds or insurance certificates and endorsements if his bid is accepted. The proposal guarantee of unsuccessful bidders will be returned by the District no later than 60 calendar days following the date of award of contract.

Only bidders that have been pre-qualified may bid on this project.

Under the provisions of the California Public Works Apprenticeship Standards, Sections 1777.5, 1777.6, and 1777.7 of the Labor Code, a copy of the "Extract of Public Works Contract Award" has been included. This document will be filed with the California Department of Industrial Relations at the time of the award of the Contract.

The Board of Directors has obtained from the Director of the California Department of Industrial Relations a determination of the general prevailing rate of per diem, wages, and the general prevailing rate for legal holiday and overtime work in the locality in which said work is to be performed for each craft, classification, or type of worker needed. Not less than the determined rates shall be paid to all workers employed in the performance of the contract. Such rates of wages are on the file with the Department of Industrial Relations and in the office of the District and are available to any interested party upon request.

Pursuant to Public Contract Code Section 22300, the Contractor may substitute equivalent securities for retention amounts which this Contract requires. However, the District reserves the right to solely determine the adequacy of the securities being proposed by the Contractor and the value of those securities. The District shall also be entitled to charge an administrative fee, as determined by the District in its sole discretion, for substituting equivalent securities for retention amounts.

The Contractor agrees that the District's decision with respect to the administration of the provisions of public Contract Code Section 22300 shall be final and binding and not subject to subsequent litigation or arbitration of any kind as to acceptance of any securities being proposed, the value of these securities, the costs of administration and the determination of whether or not the administration should be accomplished by an independent agency or by the District. The District shall be entitled, at any time, to request the deposit of additional securities of a value designated by the District, in the District's sole discretion, to satisfy this requirement. If the District does not receive satisfactory securities within 12 calendar days of the date of the written request, the District shall be entitled to withhold amounts due Contractor until securities of satisfactory value to the District have been received.

Pursuant to Section 995.710 of the Code of Civil Procedures, the Contractor may substitute any of the instruments specified in Code of Civil Procedure Section 995.710 for the performance and payment bonds required by the Contract Documents. All such substitutions shall be subject to review and approval by the District. Contractor agrees to pay all attorney's fees and all other fees, costs, and expenses incurred by the District in reviewing substitutes proposed by the Contractor and in preparing and implementing any agreements determined appropriate by the District to adequately protect District.

All bidders shall agree to obtain and maintain in full effect all required insurance with limits not less than the amounts indicated. Bidders who fail to comply with the insurance requirements of this contract may have their bids rejected as nonresponsive at the election of the District.

Pursuant to California Labor Code Section 6705, the cost of sheeting, shoring, and bracing of trenches, or equivalent method, where part of the job, shall constitute a separate bid item under these contract documents.

The Board of Directors of the District reserves the right to select the schedule(s) under which the bids are to be compared and contract(s) awarded, to reject any and all bids, and to waive any and all irregularities or defects in any bid.

OLIVENHAIN MUNICIPAL WATER DISTRICT

Dated: _____

_____

GEORGE R. BRIEST, P.E.
ENGINEERING MANAGER

THIS PAGE INTENTIONALLY LEFT BLANK.

STATE OF CALIFORNIA — DEPARTMENT OF INDUSTRIAL RELATIONS
DIVISION OF APPRENTICESHIP STANDARDS

TO: California Department of Industrial Relations
Division of Apprenticeship Standards
P.O. Box 603
San Francisco, California 94101

FROM: AWARDING AGENCY

861818000
Olivenhain Municipal Water District
1966 Olivenhain Road
Encinitas, CA 92024-9761

EXTRACT OF
PUBLIC WORKS CONTRACT AWARD

A CONTRACT TO PERFORM PUBLIC WORKS UNDER LABOR CODE SEC. 1777.5 HAS BEEN AWARDED TO:

2. NAME OF GENERAL CONTRACTOR		3. CONTRACTOR'S LICENSE NO.
4. MAIL ADDRESS (STREET NUMBER OR P.O. BOX)	5. CITY	
	6. ZIP CODE	7. TELEPHONE NUMBER
8. ADDRESS OR LOCATION OF PUBLIC WORKS SITE (INCLUDE CITY AND/OR COUNTY)		
9. CONTRACT OR PROJECT NUMBER	10. DOLLAR AMOUNT OF CONTRACT AWARD $	
11. STARTING DATE (ESTIMATED OR ACTUAL) MONTH DAY YEAR / / / (Use Numbers)	12. COMPLETION DATE (ESTIMATED OR ACTUAL) MONTH DAY YEAR / / / (Use Numbers)	13. NUMBER OF WORKING DAYS
14. TYPE OF CONSTRUCTION (HIGHWAY, SCHOOL, HOSPITAL, ETC.)	15. ❍ NEW CONSTRUCTION ❍ ALTERATIONS	
16. CLASSIFICATION OR TYPE OF WORKERS (CARPENTER, PLUMBER, ETC.) THAT WILL BE EMPLOYED BY THE CONTRACTOR(S)		
17. Is language included in the Contract Award to effectuate the provisions of Section 1777.5, as required by the Labor Code?. . . . . ❍ YES ❍ NO Is language included in the Contract Award to effectuate the provisions of Section 1776, as required by the Labor Code?. . . . . ❍ YES ❍ NO		
18. SIGNATURE	19. TITLE	20. DATE
21. PRINTED OR TYPED NAME		22. TELEPHONE NUMBER

Duplication of this form is permissible

NOTICE

Labor Code, Division 2, Part 7, Chapter 1, Article 2, Section 1773.3 states:

> "An award agency whose public works contract falls within the jurisdiction of Section 1777.5 shall, within five days of the award, send a copy of the award to the Division of Apprenticeship Standards. When specifically requested by a local joint apprenticeship committee, the division shall notify the local joint apprenticeship committee regarding all such awards applicable to the joint apprenticeship committee making the request. Within five days of a finding of any discrepancy regarding the ratio of apprentices to journeymen, pursuant to the certificated fixed number of apprentices to journeymen, the awarding agency shall notify the Division of Apprenticeship Standards."
>
> (Added by Stats. 1978, Ch. 1249.)

Submission of the "Extract of Public Works Contract Award" (see reverse side of this Notice) will satisfy the above noted requirement.

Also note Labor Code Sections 1776(g), 1777.5 and 1777.7.

PRE-BID QUESTION FORM

FOR THE CONSTRUCTION OF

NEW AND REMODELED OPERATIONS AND ADMINISTRATIVE FACILITIES

FOR THE

OLIVENHAIN MUNICIPAL WATER DISTRICT

Prior to the opening of bids, all questions relative to this project **shall be directed to Olivenhain Municipal Water District, 1966 Olivenhain Road, Encinitas, CA 92024, Attn: Robert Polley, Schneider CM or via e-mail Robert.Polley@SchneiderCM.net.** Bidders are encouraged to submit their pre-bid questions as early as possible, in writing t, so they can be answered in writing through addendum, if necessary. Questions may be taken verbally; however, **written questions will be given priority**, and verbal questions run the risk of not being answered. **Pre-bid questions will be received up to 5:00 p.m., September 28, 2018, after which no questions will be taken or answered.**

THIS PAGE INTENTIONALLY LEFT BLANK.

BID FORM CHECKLIST

(To be placed in the Bidder's Contract Documents in front of the Table of Contents)

Bid Form Page	Requirement	Initial
1 of 14	BIDDING INSTRUCTIONS- Examination of the site and review of the Contract Documents has been completed	
1 of 14	BIDDING INSTRUCTIONS- Bid Schedule(s) and all Bid Forms are to be submitted with this Bid From Checklist	
2 of 14	BID FORM- Fill out the form and acknowledge all addenda in the spaces provided at the end of the first paragraph	
3 thru 6 of 14	BID SCHEDULES- Fill out all items in the Bid Schedule(s), including dollar amounts in words and in numbers for each item	
7 of 14	DESIGNATION OF SUBCONTRACTORS- Fill in all information required on the form	
8 of 14	LISTING OF MANUFACTURERS- Fill in all information required on the form	
9 of 14	Fill in the type of Bid Bond enclosed in the first paragraph, and list all principals of the company in the third paragraph	
10 of 14	Fill in Bidder's license classification, license number, and all other information required in the fourth paragraph, including signature and date	
13 of 14	CERTIFICATE OF DRUG-FREE WORKPLACE- Fill in Bidder's name at the top and Certification section at the bottom of the page, including signature and date	
12 of 14	CERTIFICATE OF NONDISCRIMINATION- Fill in all information required on the form, including signature and date	
13 of 14	NONCOLLUSION AFFIDAVIT- Fill in all information required on the form including signature and date and provide notarization	
14 of 14	INSURANCE ACKNOWLEDGEMENT- Fill in all information required on the form and provide signature and date where indicated	
1 of 2	BID BOND- Fill in all required information including dollar amount	
2 of 2	BID BOND- Fill in all required information, provide signatures of the bidder and surety where indicated, provide notarization for principal of bidder and surety, and attach a certified Power of Attorney for surety	
00810-2	1.05 MARKING AND ADDRESSING BID ENVELOPE- Contract Documents are sealed in an envelope marked and addressed as required in this section	

Date: _____ Signature of Bidder: _____

THIS PAGE INTENTIONALLY LEFT BLANK.

BIDDING INSTRUCTIONS

FOR THE CONSTRUCTION OF

OLIVENHAIN MUNICIPAL WATER DISTRICT
NEW AND REMODELED OPERATIONS AND ADMINISTRATION FACILITIES

Prior to the opening of bids, all questions relative to this project shall be directed to the Owner. Bidders are encouraged to submit their pre-bid questions as early as possible, by email, so they can be answered via email through addendum, if necessary. Pre-bid questions will be received up to **February 24, 2010** after which they will not be answered.

Bidders have agreed to obtain and maintain in full effect all required insurance with limits not less than the amounts indicated. Insurers must be authorized to do business and have an agent for service of process in California, have an "A" policyholder's rating and a financial rating of at least Class VI in accordance with the most current rating by A.M. Best Company. Bidders who fail to comply with the insurance requirements of this Contract may have their bids rejected as nonresponsive at the election of the Owner.

The Bidder's attention is directed to Article 3-1 "Award of Contract or Rejection of Bids" in the General Provisions concerning the above conditions.

There are two Bid Schedules. In order for the District to consider a Bidder's proposal and for a proposal to be considered responsive, both schedules must be completed. The District reserves the right to select either of the Bid Schedules. If the project is awarded, it will be to the lowest responsive bidder for the Bid Schedule selected by the District.

Bidders must satisfy themselves of the character of the work to be performed by examination of the site and review of the Contract Documents. After bids have been submitted, the Bidder expressly waives the right to assert that there was a misunderstanding concerning the nature of the work to be done.

The Contract Documents contain the provisions required for the construction of the Project. Information obtained from an officer, agent, or employee of the District or any other personnel shall not affect the risks or obligations assumed by the Contractor, or relieve him from fulfilling any of the conditions of the Contract.

Bids shall be made on the Bid Form and Bid Bond included within these Contract Documents. Bidders shall designate the subcontractors and list the manufacturers of materials to be used in the Project on the Designation of Subcontractors form included with these Contract Documents. All subcontractors listed to perform any of the work must be licensed in the State of California. No single Subcontractor may perform more than 25% of the work listed in the Bid Schedule unless specifically approved in advance by the District prior to the submission of bids. The District reserves the right to find a bid non-responsive in the sole discretion of the District if a Bidder lists any unlicensed subcontractors to perform any of the work.

The Bidder shall submit with the bid the completed Certificate of Drug-Free Workplace, Certificate of Nondiscrimination, Noncollusion Affidavit, Designation of Subcontractors, and Insurance Acknowledgment included in the Bid Form. And the Bidder shall complete the Bid Form Checklist located before the Table of Contents and include it with the Bid Form.

THIS PAGE INTENTIONALLY LEFT BLANK.

BID FORM
PROPOSAL TO
OLIVENHAIN MUNICIPAL WATER DISTRICT
ENCINITAS, CALIFORNIA

FOR THE CONSTRUCTION OF

NEW AND REMODELED OPERATIONS AND ADMINISTRATION FACILITIES

Name of Bidder: _____

Business Address: _____

_____ Phone No.: _____

TO THE GOVERNING BODY OF THE OLIVENHAIN MUNICIPAL WATER DISTRICT

Pursuant to and in compliance with your Notice Inviting Sealed Proposals (Bids) and the other documents relating thereto, the undersigned Bidder, being fully familiar with the terms of the Contract Documents, local conditions affecting the performance of the Contract, the character, quality, quantities, and scope of the work, and the cost of the work at the place where the work is to be done, hereby proposes and agrees to perform within the time stipulated in the Contract, including all of its component parts and everything required to be performed, and to furnish any and all of the labor, material, tools, equipment, transportation, services, permits, utilities, and all other items necessary to perform the Contract and complete in a workmanlike manner, all of the work required in connection with the construction of said work all in strict conformity with the Plans and Specifications and other Contract Documents, including Addenda Nos. ___, ___ and ___ for the prices hereinafter set forth.

The undersigned as Bidder, declares that the only persons or parties interested in this proposal as principals are those named herein; that this proposal is made without collusion with any person, firm, or corporation; and he proposes and agrees, if the proposal is accepted, that he will execute a Contract with the District in the form set forth in the Contract Documents and that he will accept in full payment thereof the following prices, to wit:

THIS PAGE INTENTIONALLY LEFT BLANK.

BID SCHEDULE I

OLIVENHAIN MUNICIPAL WATER DISTRICT
NEW AND REMODELED OPERATIONS AND ADMINISTRATION FACILITIES
ENCINITAS, CALIFORNIA

Item	Item Description and Price in Words	Price in Figures
I.A	Mobilization, Demobilization, Bonds, Permits, and Insurance: All incidental work including temporary facilities during construction and compliance with applicable laws and regulations in accordance with the requirements of the Contract Documents for the work defined as “Schedule A” for the lump sum price of: (Price in Words)	$ _____
I.B	Site Work: All labor, materials, and equipment for earthwork (including fine grading); importing of materials; disposal of surplus material; demolition and disposal of debris; potholing for the verification of existing utilities at crossings and connection points; construction of curbs, gutters and pavements; pavement markings and striping; fencing; cleanup and site restoration; transport and disposal services, permits, and fees; and incidental work, complete in place, in accordance with the requirements of the Contract Documents and specifically defined by plan sheet number “C-5” inclusive of Schedule A for the lump sum price of: (Price in Words)	$ _____
I.C	Building: All labor, materials, and equipment for the construction of the building project including foundations, building slabs, structural framing system, wall systems, doors, windows, roof system, (include 20% allowance for breakage of concrete tiles) other interior and exterior building components not included in any other bid item and incidental work, complete in place, in accordance with the requirements of the Contract Documents as defined by all work entitled “Schedule A” for the lump sum price of: (Price in Words)	$ _____
I.C1	Allowance for removal and replacement of existing plywood roof sheathing with new 5/8” plywood.	

Item	Item Description and Price in Words	Price in Figures
	1,500 SF new plywood sheathing: Unit Price _____SF	$_____
I.D	Landscape: All labor, materials, and equipment for the installation of landscaping for the project, complete in place, in accordance with the requirements of the Contract Documents as defined by all work entitled “Schedule A” for the lump sum price of: (Price in Words)	$_____
I.E	Temporary trailers for District personnel: All labor, materials, and equipment required for the rental, installation, and removal of temporary trailers including installation and maintenance of all temporary utilities including, but not limited to: potable water, electrical, phone, data, and sewage for District personnel, complete in place, in accordance with the requirements of the Contract Documents for the duration of the project as defined by all work entitled “Schedule A” for the lump sum price of: (Price in Words)	$_____
I.F	Shoring: All labor, materials, and equipment required for shoring, complete in place, in accordance with the requirements of the Contract Documents as defined by all work entitled “Schedule A” for the lump sum price of: (Price in Words)	$_____
I.G	All labor, materials, and equipment required for the installation of Boardroom audio visual equipment, LED screens in conference rooms, and sound masking in accordance with the requirements of the Contract Documents as defined by all work entitled “Schedule A” for the lump sum price of: (Price in Words)	$ To be provided as an addendum
I.H	All labor, materials, and equipment required for the installation of phone cabling and phone cable management, cable trays and Cat 6A cables in accordance with the requirements of the Contract Documents as defined by all work entitled “Schedule A” for the lump sum price of: (Price in Words)	$To be provided as an addendum

Item	Item Description and Price in Words	Price in Figures
I.I	All labor, materials, and equipment required for the installation of phone cabling and phone cable management, cable trays and Cat 6A cables in accordance with the requirements of the Contract Documents as defined by all work entitled “Schedule A” for the lump sum price of: (Price in Words)	$ To be provided as an addendum
	Total, Bid Schedule I: (Price in Words)	$_____

BID SCHEDULE II

OLIVENHAIN MUNICIPAL WATER DISTRICT
NEW AND REMODELED OPERATIONS AND ADMINISTRATION FACILITIES
ENCINITAS, CALIFORNIA

Item	Item Description and Price in Words	Price in Figures
II.A	Mobilization, Demobilization, Bonds, Permits, and Insurance: All incidental work including temporary facilities during construction and compliance with applicable laws and regulations in accordance with the requirements of the Contract Documents for the work as defined by "Schedule A" and "Schedule B" for the lump sum price of: (Price in Words)	$ _____
II.B	Site Work: All labor, materials, and equipment for earthwork (including fine grading); importing of materials; disposal of surplus material; demolition and disposal of debris; potholing for the verification of existing utilities at crossings and connection points; construction of curbs, gutters and pavements; pavement markings and striping; fencing; cleanup and site restoration; transport and disposal services, permits, and fees; and incidental work, complete in place, in accordance with the requirements of the Contract Documents as defined by plan sheet number "C-5" inclusive of Schedule A and Schedule B for the lump sum price of: (Price in Words)	$ _____
II.C.	Building: All labor, materials, and equipment for the construction of the building project including foundations, building slabs, structural framing system, wall systems, doors, windows, roof system, (include 20% allowance for breakage of concrete tiles) other interior and exterior building components not included in any other bid item and incidental work, complete in place, in accordance with the requirements of the Contract Documents as defined by all work entitled "Schedule A" and "Schedule B" for the lump sum price of: (Price in Words)	$ _____

Item	Item Description and Price in Words	Price in Figures
II.C.1	Allowance for removal and replacement of existing plywood roof sheathing with new 5/8" plywood.	
	1,500 SF new plywood sheathing: Unit Price: _____ SF	$_____
II.D	Landscape:	
	All labor, materials, and equipment for the installation of landscaping for the project, complete in place, in accordance with the requirements of the Contract Documents as defined by all work entitled "Schedule A" and "Schedule B" for the lump sum price of:	
	(Price in Words)	$_____
II.E.	Temporary trailers for District personnel	
	All labor, materials, and equipment required for rental, the installation and removal of temporary trailers including installation and maintenance of all temporary utilities including, but not limited to: potable water, electrical, phone, data, and sewage for District personnel, complete in place, in accordance with the requirements of the Contract Documents for the duration of the project as defined by all work entitled "Schedule A" and "Schedule B" for the lump sum price of:	
	(Price in Words)	$_____
II.F	Shoring:	
	All labor, materials, and equipment required for shoring, complete in place, in accordance with the requirements of the Contract Documents as defined by all work entitled "Schedule A" and "Schedule B" for the lump sum price of:	
	(Price in Words)	$_____
II.G	All labor, materials, and equipment required for the installation of Boardroom audio visual equipment, LED screens in conference rooms, and sound masking in accordance with the requirements of the Contract Documents as defined by all work entitled "Schedule A" for the lump sum price of:	
	(Price in Words)	$To be provided as an addendum

Item	Item Description and Price in Words	Price in Figures
II.H	All labor, materials, and equipment required for the installation of access/security system, security cameras and fire alarm integration in accordance with the requirements of the Contract Documents as defined by all work entitled “Schedule A” for the lump sum price of:	
	(Price in Words)	$To be provided as an addendum
II.I	All labor, materials, and equipment required for the installation of phone cabling and phone cable management, cable trays and Cat 6A cables in accordance with the requirements of the Contract Documents as defined by all work entitled “Schedule A” for the lump sum price of:	
	(Price in Words)	$To be provided as an addendum
	Total, Bid Schedule II:	$_____
	(Price in Words)	

DESIGNATION OF SUBCONTRACTORS

In compliance with the provisions of Section 4100-4114 of the Public Contract Code of the State of California, and any amendments thereof, each Bidder shall set forth below, the name and location of the mill, shop or office of each subcontractor who will perform work or labor, or render service to the Contractor in an amount in excess of one-half (1/2) of one percent (1%) of the total bid, and the portion of the work which will be done by each subcontractor. All subcontractors listed must be licensed to perform the subcontract work in the State of California. No single Subcontractor may perform work in excess of 25% of the total work listed in the Bid Schedule unless specifically approved by the District in advance of submission of the bid. Bidders who list any unlicensed subcontractors on this form may have their bid rejected as non-responsive in the sole discretion of District.

If the Bidder fails to specify a subcontractor for any portion of the work in excess of one-half (1/2) of one percent (1%) of the total bid to be performed under the Contract, he shall be deemed to have agreed to perform such portion himself, and he shall not be permitted to subcontract that portion of the work except under conditions permitted by law.

Subletting or subcontracting any portion of the work as to which no subcontractor was designated in the original bid shall only be permitted in case of public emergency or necessity, or otherwise permitted by law, and then only after a finding reduced to writing as a public record of the District.

Trade	% of Work To Be Done Schedule I	% of Work To Be Done Schedule II	Name of Subcontractor	Address

THIS PAGE INTENTIONALLY LEFT BLANK

ACCOMPANYING THIS PROPOSAL IS _____

_____

_____(insert the words "cash", "a cashier's check", "a certified check", or "a Bidder's bond" as the case may be) in an amount equal to at least 10 percent of the total amount of the Bid, payable to the

OLIVENHAIN MUNICIPAL WATER DISTRICT

The undersigned deposits the above-named security as a proposal guarantee and agrees that it shall be forfeited to the District as liquidated damages in case this proposal is accepted by the District and the undersigned fails to execute a contract with the District as specified in the Contract Documents or fails to furnish the required payment and performance bonds, and insurance certificates and endorsements. Should the District be required to engage the services of an attorney in connection with the enforcement of this bid, Bidder promises to pay District's reasonable attorneys' fees, incurred with or without suit.

The names of all persons interested in the foregoing proposals as principals are as follows: (NOTICE - If Bidder or other interested person is a corporation, state legal name of corporation, also names of the president, secretary, treasurer, and manager thereof; if a general partnership, state true name of firm, also names of all individual partners composing firm; if a limited partnership, the names of all general partners and limited partners; if Bidder or other interested person is an individual, state first and last names in full; if the Bidder is a joint venture, state the complete name of each venturer).

_____

_____

_____

_____

_____

The District has determined the license classification necessary to bid and perform the subject contract. In no case shall this Contract be awarded to a specialty contractor whose classification constitutes less than a majority of the project. When a specialty contractor is authorized to bid a portion of the work of this contract, all work to be performed outside of the contractor's license specialty, except work specifically authorized by the District, shall be performed by a licensed subcontractor in compliance with the Subletting and Subcontracting Fair Practices Act commencing with Section 4100 et seq., of the Public Contract Code. See Business and Professions Code Section 7059.

The Contractor's license classification(s) required for this project are as follows:

CLASS A – GENERAL ENGINEERING or CLASS B – GENERAL BUILDING

_____

It is the Owner's intent that "plans," as used in Public Contract Code Section 3300, is defined as the construction Contract Documents, which include both the Plans and the Specifications.

Bidder warrants and represents that it has at least five (5) years of successful experience performing the type of work required by this Contract.

Bidder warrants and represents, under penalty of perjury, that license(s) required by California State Contractor's License Law for the performance of the subject project are in full effect and proper order. Bidders must state, under penalty of perjury, the Contractor's applicable license classification, license number, license expiration date, name of license holder, and relationship to Bidder. Any bid not containing this information may be considered nonresponsive and may be rejected by the District.

Bidders relying upon licenses of Responsible Managing Employees (RME) or Responsible Managing Officers (RMO) agree to provide the District with all information it determines necessary to verify that the Bidder complies with California State Contractor's License Law.

License Classification: _____

License Number: _____

Expiration Date: _____

Name of License Holder: _____

Relationship to Bidder: _____

Name of Bidder: _____

Signatures: _____

_____

_____

_____

Dated: _____,

NOTE: If Bidder is a corporation, the legal name of the corporation shall be set forth above, together with the signature of the officer or officers authorized to sign contracts on behalf of the corporation and the corporate seal; if Bidder is a partnership, the true name of the firm shall be set forth above, together with the signature of the partner or partners authorized to sign contracts on behalf of the partnership; if the Bidder is an individual, his signature shall be placed above; if the Bidder is a joint venture, the name of the joint venture shall be set forth above with the signature of an authorized representative of each venturer.

CERTIFICATE OF DRUG-FREE WORKPLACE

BIDDER: _____

The Bidder named above hereby certifies compliance with Government Code Section 8355 in matters relating to providing a drug-free workplace. The above named Bidder will:

1. Publish a statement notifying employees that unlawful manufacture, distribution, dispensation, possession, or use of a controlled substance is prohibited and specifying actions to be taken against employees for violations, as required by Government Code Section 8355(a).

2. Establish a Drug-Free Awareness Program as required by Government Code Section 8355(b), to inform employees about all of the following:

   (a) The dangers of drug abuse in the workplace,

   (b) The person's or organization's policy of maintaining a drug-free workplace,

   (c) Any available counseling, rehabilitation and employee assistance programs, and

   (d) Penalties that may be imposed upon employees for drug abuse violations.

3. Provide as required by Government Code Section 8355(c), that every employee who works on the proposed contract or loan:

   (a) Will receive a copy of the company's drug-free policy statement, and

   (b) Will agree to abide by the terms of the company's statement as a condition of employment on the contract or loan.

CERTIFICATION

I, the official named below, hereby swear that I am duly authorized legally to bind the Bidder to the above described certification. I am fully aware that this certification, executed on the date and in the county below, is made under penalty of perjury under the laws of the State of California.

Official's Name: _____

Date Executed: _____ Executed in County of: _____

Official's Signature: _____

Title: _____

THIS PAGE INTENTIONALLY LEFT BLANK.

CERTIFICATE OF NONDISCRIMINATION

1. During the performance of this contract, Bidder and its subcontractors shall not unlawfully discriminate against any employee or applicant for employment because of race, religion, color, national origin, ancestry, physical handicap, medical condition, marital status, age (over 40) or sex. Bidders and subcontractors shall insure that the evaluation and treatment of their employees and applicants for employment are free of such discrimination. Bidder and subcontractors shall comply with the provisions of the Fair Employment and Housing Act (Government Code Section 12900 et seq.) and the applicable regulations promulgated thereunder (California Administrative Code, Title 2, Section 7285.0 et seq.). The applicable regulations of the Fair Employment and Housing Commission implementing Government Code, Section 12900, set forth in Chapter 5 of Division 4 of Title 2 or the California Administrative Code are incorporated into this contract by reference and made a part hereof as if set forth in full. Bidder and its subcontractor shall give written notice of their obligations under this clause to labor organizations with which they have a collective bargaining or other agreement.

2. This Bidder shall include the nondiscrimination and compliance provisions of this clause in all subcontracts to perform work under the contract.

THE UNDERSIGNED CERTIFIES THAT THE BIDDER WILL COMPLY WITH THE ABOVE REQUIREMENTS.

Bidder Name: _____

Certified By:

Name: _____ Title: _____

Signature: _____ Date: _____

THIS PAGE INTENTIONALLY LEFT BLANK.

NONCOLLUSION AFFIDAVIT

State of _____)
) ss.
County of _____)

I, _____, being duly sworn, deposes and says that he or she is _____ of _____, the party making the foregoing bid, that the bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the bidder has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that the bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference, with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other bidder, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and, further, that the bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company association, organization, bid depository, or to any member or agent thereof the effectuate a collusive or sham bid.

Signature of Bidder: _____

Subscribed and sworn to before me on this _____ day of _____, 20___.

_____
Notary Public

THIS PAGE INTENTIONALLY LEFT BLANK.

INSURANCE ACKNOWLEDGMENT

On behalf of the Bidder making this proposal, the undersigned warrants and represents that the Bidder has carefully read and understood all of the insurance requirements of the Contract Documents and has included the full cost of providing insurance meeting all requirements of the Contract Documents in the bid.

Upon request by District prior to the time of Award, the Bidder agrees to promptly provide District with letters from insurance companies meeting the requirements of the Contract Documents verifying that they are prepared to issue insurance to Bidder meeting all requirements of the Contract Documents. The failure of Bidder to provide District with this proof of insurance prior to the time of Award shall entitle District to reject the Bidder's bid as nonresponsive and to Award the bid to the next lowest Bidder at the sole discretion of District.

The failure of Bidder to provide District with insurance meeting all requirements of the Contract Documents within 15 calendar days after the Award, shall constitute a material breach of the Contract, entitling District to terminate the Contract and call the bid bond.

By dating and executing this Insurance Acknowledgment, Bidder hereby accepts all terms and conditions of this Insurance Acknowledgment and agrees to be bound by all of its terms.

Dated: _____

_____
(Name of Bidder)

_____
(Signature)

_____
(Typed Name and Title)

THIS PAGE INTENTIONALLY LEFT BLANK

BID BOND

We, _____ as Principal, and _____ as Surety, jointly and severally, bind ourselves, our heirs, representatives, successors and assigns, as set forth herein, to the

OLIVENHAIN MUNICIPAL WATER DISTRICT

(herein called Owner) for payment of the penal sum of _____ _____ Dollars ($_____) lawful money of the United States. Principal has submitted the accompanying bid for the construction of

OLIVENHAIN MUNICIPAL WATER DISTRICT
NEW AND REMODELED OPERATIONS
AND ADMINISTRATION FACILITIES
ENCINITAS, CALIFORNIA

If the Principal is awarded the Contract and enters into a written contract, in the form prescribed by the Owner, at the price designated by his bid, and files two bonds with the Owner, one to guarantee payment for labor and materials and the other to guarantee faithful performance, in the time and manner specified by the Owner, and carries all insurance in type and amount which conforms to the Contract Documents and furnishes required certificates and endorsements thereof, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

Forfeiture of this bond, or any deposit made in lieu thereof, shall not preclude the Owner from seeking all other remedies provided by law to cover losses sustained as a result of the Principal's failure to do any of the foregoing.

Principal and Surety agree that if the Owner is required to engage the services of an attorney in connection with the enforcement of this bond, each shall pay Owner's reasonable attorney's fees incurred with or without suit.

Executed on _____, 20____

_____
Principal

By:_____

(Seal if Corporation) Title:_____

(Attach Acknowledgment of Authorized Representative of Principal)

Any claims under this bond may be addressed to:

_____ (name and address of Surety)

_____

_____

_____ (name and address of Surety's agent for service of process in California, if different from above)

_____

_____

_____ (telephone number of Surety's agent in California)

(Attach Acknowledgment)

_____
Surety

By:_____
(Attorney-in-Fact)

NOTICE:

No substitution or revision to this bond form will be accepted. Sureties must be authorized to do business in and have an agent for service of process in California. A certified copy of the Power of Attorney must be attached.

AGREEMENT

THIS AGREEMENT, made and entered into by and between the

OLIVENHAIN MUNICIPAL WATER DISTRICT

hereinafter referred to as "OWNER" and

_____ ;

a corporation under the laws of the state of _____ ;

a partnership composed of _____

_____ ;

a joint venture composed of _____

_____ ;

an individual doing business as _____ ;

hereinafter referred to as "CONTRACTOR."

OWNER and CONTRACTOR agree as follows:

(1) **SCOPE OF WORK:** CONTRACTOR will furnish all materials and will perform all of the work for the construction of the

OLIVENHAIN MUNICIPAL WATER DISTRICT
NEW AND REMODELED OPERATIONS
AND ADMINISTRATION FACILITIES
ENCINITAS, CALIFORNIA

in accordance with the plans and specifications and other contract documents therefor.

(2) **TIME OF COMPLETION:** The work shall be completed within the times set forth in the Special Provisions. Time is of the essence.

(3) **CONTRACT SUM:** OWNER will pay CONTRACTOR in accordance with the prices shown in the Bid Form.

(4) **PAYMENTS:** Monthly progress payments and the final payment will be made in accordance with the General Provisions as modified by the Special Provisions. The filing of the notice of completion by OWNER shall be preceded by acceptance of the work made only by an action of the Governing Body of OWNER in session.

(5) **COMPLIANCE WITH PUBLIC CONTRACTS LAW:** OWNER is a public agency in the State of California and is subject to the provisions of law relating to public contracts. It is agreed

that all provisions of law applicable to public contracts are a part of this Contract to the same extent as though set forth herein and will be complied with by CONTRACTOR.

(6) **CONTRACT DOCUMENTS:** The complete contract includes all the contract documents set forth herein, to wit: Notice Inviting Sealed Proposals (Bids), Bid Form, Bid Bond, Agreement, Performance Bond, Payment Bond, Contractor's Certificate Regarding Workers' Compensation, Certificate of Insurance (Workers' Compensation and Employer's Liability), Insurance Endorsement (Workers' Compensation and Employer's Liability), Certificate of Insurance (Liability), Insurance Endorsement (Liability), Certificate of Insurance (Builders' Risk "All Risk"), Insurance Endorsement (Builders' Risk "All Risk"), General Provisions, Special Provisions, Standard Specifications, Standard Drawings, Referenced Permits, Drawings, Plans, and also addenda thereto and supplemental agreements.

This Agreement is executed by the OWNER pursuant to an action of its Governing Body in session on _____, 20____ , authorizing the same, and CONTRACTOR has caused this Agreement to be duly executed.

Dated: _____, 20____ By: _____
(Authorized Representative of Owner)

Title: GENERAL MANAGER

Dated: _____, 20____ _____
(Contractor)

By: _____
(Authorized Representative of Contractor)

Title: _____

(Seal if Corporation)

(Attach Acknowledgment for Authorized Representative of Contractor)

APPROVED:

_____
(Attorney for OWNER)

CERTIFICATE OF CONTRACTOR

I, _____ , certify that I am a/the

_____

[designate sole proprietor, partner in partnership, or specify corporate office, e.g., secretary] in the entity named as CONTRACTOR in the foregoing contract.

I hereby expressly certify that the name of the entity to which I am associated is _____

_____;

that this entity is in good standing and has complied with all applicable laws and regulations, and that I have been expressly authorized by the proper parties in this entity to execute this contract on behalf of the above-named entity.

_____
(Signature)

ATTEST:

_____

Name:_____
(Please Type)

Title:_____

THIS PAGE INTENTIONALLY LEFT BLANK.

PERFORMANCE BOND

We, _____ as Principal,

and _____ as Surety, jointly and severally, bind ourselves, our heirs, representatives, successors and assigns, as set forth herein, to the

OLIVENHAIN MUNICIPAL WATER DISTRICT

(herein called Owner) for payment of the penal sum of _____

_____ Dollars

($_____), lawful money of the United States. Owner has awarded Principal a contract for the construction of

OLIVENHAIN MUNICIPAL WATER DISTRICT
NEW AND REMODELED OPERATIONS
AND ADMINISTRATION FACILITIES
ENCINITAS, CALIFORNIA

THE CONDITION OF THIS OBLIGATION IS SUCH that if the Principal shall in all things abide by and well and truly keep and perform the covenants, and agreements in the said contract, and any alteration thereof made as therein provided, on his part to be kept and performed at the time and in the manner therein specified, including all guarantees of workmanship and/or materials, and shall indemnify and save harmless the Owner, the Engineer/Architect, the Owner's Representative, and their consultants, and each of their directors, officers, employees, and agents, as therein stipulated, this obligation shall become null and void, otherwise, it shall be and remain in full force and effect.

Surety agrees that no change, extension of time, alteration, or addition to the terms of the contract, or the work to be performed thereunder, or the plans and specifications shall in any wise affect its obligation on this bond, and it does hereby waive notice thereof.

Principal and Surety agree that if the Owner is required to engage the services of an attorney in connection with the enforcement of this bond, each shall pay Owner's reasonable attorney's fees incurred, with or without suit, in addition to the above sum.

Executed in four original counterparts on _____, 20____

_____
PRINCIPAL

By:_____

(Seal if Corporation) Title:_____

(Attach Acknowledgment of Authorized Representative of Principal)

Any claims under this bond may be addressed to:

_____ (name and address of Surety)

_____

_____

_____ (name and address of Surety's agent for service of process in California, if different from above)

_____

_____

_____ (telephone number of Surety's agent in California)

(Attach Acknowledgment) _____
SURETY

By:_____
(Attorney-in-Fact)

APPROVED:

_____
(Attorney for OWNER)

NOTICE:

No substitution or revision to this bond form will be accepted. Sureties must meet all requirements of Code of Civil Procedure Section 995.660(a). A certified copy of the Power of Attorney must be attached.

PAYMENT BOND

We, _____ as Principal,

and _____ as Surety, jointly and severally, bind ourselves, our heirs, representatives, successors and assigns, as set forth herein, to the

OLIVENHAIN MUNICIPAL WATER DISTRICT

(herein called Owner) for payment of the penal sum of _____

_____ Dollars

($_____), lawful money of the United States. Owner has awarded Principal a contract for the construction of

OLIVENHAIN MUNICIPAL WATER DISTRICT
NEW AND REMODELED OPERATIONS
AND ADMINISTRATION FACILITIES
ENCINITAS, CALIFORNIA

If Principal or any of his subcontractors fails to pay any of the persons named in Section 3181 of the California Civil Code, or amounts due under the Unemployment Insurance Code with respect to work or labor performed under the contract or during the one-year guarantee period, or for any amounts required to be deducted, withheld, and paid over to the Franchise Tax Board from the wages of employees of the contractor and his subcontractors pursuant to Section 13020 of the Unemployment Insurance Code, with respect to such work and labor, then Surety will pay the same in an amount not exceeding the sum specified above, and also will pay, in case suit is brought upon this bond, such reasonable attorney's fees as shall be fixed by the court.

This bond shall inure to the benefit of any of the persons named in Section 3181 of the California Civil Code, so as to give a right of action to them or their assigns in any suit brought upon this bond.

Surety agrees that no change, extension of time, alteration, or addition to the terms of the contract, or the work to be performed thereunder, or the plans and specifications shall in any wise affect its obligation on this bond, and it does hereby waive notice thereof.

Principal and Surety agree that should Owner become a party to any action on this bond that, each will also pay Owner's reasonable attorney's fees incurred therein in addition to the sum above set forth.

Executed in four original counterparts on _____, 20____

_____
PRINCIPAL

By:_____

(Seal if Corporation) Title:_____

(Attach Acknowledgment of Authorized Representative of Principal)

Any claims under this bond may be addressed to:

_____ (name and address of Surety)

_____

_____

_____ (name and address of Surety's agent for service of process in California, if different from above)

_____

_____

_____ (telephone number of Surety's agent in California)

(Attach Acknowledgment)

_____
SURETY

By:_____
(Attorney-in-Fact)

APPROVED:

_____
(Attorney for OWNER)

NOTICE:

No substitution or revision to this bond form will be accepted. Sureties must meet all requirements of Code of Civil Procedure Section 995.660(a). A certified copy of the Power of Attorney must be attached.

CONTRACTOR'S CERTIFICATE
REGARDING WORKERS' COMPENSATION

Name of Contract: **OLIVENHAIN MUNICIPAL WATER DISTRICT NEW AND REMODELED OPERATIONS AND ADMINSTRATION FACILITIES ENCINITAS, CALIFORNIA**

Name of Owner: **OLIVENHAIN MUNICIPAL WATER DISTRICT**

Labor Code Section 3700:

"Every employer except the State shall secure the payment of compensation in one or more of the following ways:

(a) By being insured against liability to pay compensation in one or more insurers duly authorized to write compensation insurance in this State.

(b) By securing from the Director of Industrial Relations a certificate of consent to self-insure, which may be given upon furnishing proof satisfactory to the Director of Industrial Relations of ability to self-insure and to pay any compensation that may become due to his employees.

(c) For all political subdivisions of the state, including each member of a pooling arrangement under a joint exercise of powers agreement (but not the state itself), by securing from the Director of Industrial Relations a certificate of consent to self-insure against workers' compensation claims, which certificate may be given upon furnishing proof satisfactory to the director of ability to administer workers' compensation claims that may become due to its employees. On or before March 31, 1979, a political subdivision of the state which, on December 31, 1978, was uninsured for its liability to pay compensation, shall file a properly completed and executed application for a certificate of consent to self-insure against workers' compensation claims. The certificate shall be issued and be subject to the provisions of Section 3702."

I am aware of the provisions of Section 3700 of the Labor Code which require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the work of this Contract.

Dated: _____, 20____ _____
(Contractor)

By: _____
(Authorized Representative of Contractor)

Title: _____

(Seal if Corporation)

(Labor Code Section 1861 provides that the above certificate must be signed and filed by the Contractor with the Owner prior to performing any work under this Contract.)

CERTIFICATE OF INSURANCE

Name of Contract: **OLIVENHAIN MUNICIPAL WATER DISTRICT NEW AND REMODELED OPERATIONS ANDADMINISTRATION FACILITIES ENCINITAS, CALIFORNIA**

Name of Owner: **OLIVENHAIN MUNICIPAL WATER DISTRICT**

Type of Insurance: **WORKERS' COMPENSATION INSURANCE AND EMPLOYER'S LIABILITY INSURANCE**

THIS IS TO CERTIFY that the following policy has been issued by the below-stated company in conformance with the requirements of Articles 8-1 and 8-2 of the General Provisions and is in force at this time.

The Company will give at least 30 days' written notice by certified mail to the Owner and Engineer/Architect prior to any material change or cancellation of said policy.

POLICY NUMBER / EXPIRATION DATE	TYPE OF INSURANCE	LIMITS OF LIABILITY	
	A. WORKERS' COMPENSATION	Statutory Limits Under the Laws of the State of California	
	B. EMPLOYER'S LIABILITY	Each Employee	Each Accident
	Bodily Injury By Accident	$	$
	Bodily Injury By Disease	$	$

Named Insured (Contractor)	Insurance Company
Street Number	Street Number
City and State	City and State

By: _____
(Company Representative)

(SEE NOTICE BELOW)

State of _____)
) ss.
County of _____)

On this ____ day of _____ , 20 ___ before me personally came _____ to me known, or proved to me on the basis of satisfactory evidence, who being duly sworn, did depose and say: that _____ is an authorized representative of the _____ and acknowledged to me that _____ executed the within instrument on behalf of said insurance company.

In witness whereof, I have signed and affixed my official seal on the date in this certificate first above written.

_____
NOTARY PUBLIC

Insurance Company Agent for Service of Process in California:

_____ Name	_____ Agency
_____ Street Number	_____ Street Number
_____ City and State	_____ City and State
_____ Telephone Number	_____ Telephone Number

This certificate or verification of insurance is not an insurance policy and does not amend, extend, or alter the coverage afforded by the policies listed herein. Notwithstanding any requirement, term, or condition of any contract or other document with respect to which this certificate or verification of insurance may be issued or may pertain, the insurance afforded by the policies described herein is subject to all the terms, exclusions, and conditions of such policies.

NOTICE:

No substitution or revision to the above certificate form will be accepted. If the insurance called for is provided by more than one insurance company, a separate certificate in the exact above form shall be provided for each insurance company.

Insurers must be authorized to do business and have an agent for service of process in California, have an "A" policyholder's rating and a financial rating of at least Class VI in accordance with the most current rating by A.M. Best Company.

INSURANCE ENDORSEMENT

Name of Contract: **OLIVENHAIN MUNICIPAL WATER DISTRICT NEW AND REMODELED OPERATIONS AND ADMINISTRATION FACILITIES ENCINITAS, CALIFORNIA**

Name of Owner: **OLIVENHAIN MUNICIPAL WATER DISTRICT**

Type of Insurance: **WORKERS' COMPENSATION INSURANCE AND EMPLOYER'S LIABILITY INSURANCE**

This endorsement forms a part of Policy No. _____.

ENDORSEMENT:

It is agreed that with respect to such insurance as is afforded by the policy, the Company waives any right of subrogation it may acquire against the Owner, the Engineer/Architect, the Owner's Representative, and their consultants, and each of their directors, officers, employees, and agents by reason of any payment made on account of injury, including death resulting therefrom, sustained by any employee of the insured, arising out of the performance of the above-referenced contract.

This endorsement does not increase the Company's total limits of liability.

_____	_____
Named Insured (Contractor)	Insurance Company
_____	_____
Street Number	Street Number
_____	_____
City and State	City and State

By: _____
(Company Representative)

(SEE NOTICE ON PAGE 2 OF 2)

State of _____)
) ss.
County of _____)

On this ____ day of _____ , 20 ___ before me personally came _____ to me known, or proved to me on the basis of satisfactory evidence, who being duly sworn, did depose and say: that _____ is an authorized representative of the _____ and acknowledged to me that _____ executed the within instrument on behalf of said insurance company.

In witness whereof, I have signed and affixed my official seal on the date in this certificate first above written.

_____
NOTARY PUBLIC

NOTICE:

No substitution or revision to the above endorsement form will be accepted. If the insurance called for is provided by more than one policy, a separate endorsement in the exact above form shall be provided for each policy.

Insurers must be authorized to do business and have an agent for service of process in California, have an "A" policyholder's rating and a financial rating of at least Class VI in accordance with the most current rating by A.M. Best Company.

CERTIFICATE OF INSURANCE

Name of Contract: **OLIVENHAIN MUNICIPAL WATER DISTRICT NEW AND REMODELED OPERATIONS AND ADMINISTRATION FACILITIES ENCINITAS, CALIFORNIA**

Name of Owner: **OLIVENHAIN MUNICIPAL WATER DISTRICT**

Type of Insurance: **LIABILITY INSURANCE**

THIS IS TO CERTIFY that the following policies will be issued by the below-stated company in conformance with the requirements of Articles 2-3, 8-1 and 8-3 of the General Provisions. The policy shall be an occurrence policy with a deductible not to exceed $25,000.

POLICY NUMBER **EXPIRATION DATE**	**TYPE OF INSURANCE**	**LIMITS OF LIABILITY** In Thousands (1,000) Occurrence	 Aggregate
_____	**A. GENERAL LIABILITY** Bodily Injury, Personal Injury, and Property Damage Combined	$	$
_____	**B. EXCESS GENERAL LIABILITY**	$	$
_____	**C. AUTOMOBILE LIABILITY** Bodily Injury and Property Damage Combined	$	$
_____	**D. EXCESS AUTOMOBILE LIABILITY**	$	$

The following types of coverage are included in said policies (indicate by "X" in space):

A. GENERAL LIABILITY

Comprehensive Form----------YES___ NO___

Premises-Operations ----------YES___ NO___

Explosion and Collapse Hazard----------YES___ NO___

Underground Hazard ----------YES___ NO___

Products/Completed Operations Hazard----------YES___ NO___

Contractual Insurance ----------YES___ NO___

Broad Form Property Damage Including Completed Operations ----------YES___ NO___

Independent Contractors ----------YES___ NO___

Personal Injury ----------YES___ NO___

B. EXCESS GENERAL LIABILITY

Umbrella Form----------YES___ NO___

Other Than Umbrella Form----------YES___ NO___

If other than Umbrella Form, please explain below:

C. AUTOMOBILE LIABILITY

Comprehensive Form Including Loading and Unloading----------YES___ NO___

Owned----------YES___ NO___

Hired ----------YES___ NO___

Non-Owned ----------YES___ NO___

D. EXCESS AUTOMOBILE LIABILITY

Umbrella Form----------YES___ NO___

Other Than Umbrella Form----------YES___ NO___

If other than Umbrella Form, please explain below:

This certificate or verification of insurance is not an insurance policy and does not amend, extend, or alter the coverage afforded by the policies listed herein. However, the insurance provided shall meet the requirements of the Contract Documents and include coverage as specified in this certificate.

The Company will give at least 30 days' written notice by certified mail to the Owner and the Engineer/Architect prior to any material change or cancellation of said policies.

_____	_____
Named Insured (Contractor)	Insurance Company
_____	_____
Street Number	Street Number
_____	_____
City and State	City and State

By: _____
(Company Representative)

(SEE NOTICE ON PAGE 4 OF 4)

State of _____)
) ss.
County of _____)

On this ____ day of _____ , 20 ___ before me personally came _____ to me known, or proved to me on the basis of satisfactory evidence, who being duly sworn, did depose and say: that _____ is an authorized representative of the _____ and acknowledged to me that _____ executed the within instrument on behalf of said insurance company.

In witness whereof, I have signed and affixed my official seal on the date in this certificate first above written.

_____
NOTARY PUBLIC

Insurance Company Agent for Service
of Process in California:

Name	Agency
Street Number	Street Number
City and State	City and State
Telephone Number	Telephone Number

NOTICE:

No substitution or revision to the above certificate form will be accepted. if the insurance called for is provided by more than one insurance company, a separate certificate in the exact above form shall be provided for each insurance company.

Insurers must be authorized to do business and have an agent for service of process in California, have an "A" policyholder's rating and a financial rating of at least Class VI in accordance with the most current rating by A.M. Best Company.

INSURANCE ENDORSEMENT

Name of Contract: **OLIVENHAIN MUNICIPAL WATER DISTRICT NEW AND REMODELED OPERATIONS AND ADMINISTRATION FACILITIES ENCINITAS, CALIFORNIA**

Name of Owner: **OLIVENHAIN MUNICIPAL WATER DISTRICT**

Type of Insurance: **LIABILITY INSURANCE**

This endorsement forms a part of Policy No._____.

ENDORSEMENT:

The Owner, the Engineer/Architect, the Owner's Representative, and their consultants, and each of their directors, officers, employees, and agents are included as additional insureds under said policies but only while acting in their capacity as such and only as respects operations of the named insured, his contractors, any subcontractor, any supplier, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable in the performance of the above-referenced contract. This insurance shall not apply if the loss or damage is ultimately determined to be the result of the sole and exclusive negligence (including any connected with the preparation or approval of maps, drawings, opinions, reports, surveys, designs, or specifications) of one or more of the aforesaid additional insureds. The insurance afforded to these additional insureds is primary insurance. If the additional insureds have other insurance which might be applicable to any loss, the amount of this insurance shall not be reduced or prorated by the existence of such other insurance.

The Contractual Liability Insurance afforded is sufficiently broad to insure all of the matters set forth in the article entitled "Indemnity" in the General Provisions of the above-referenced contract except those matters set forth in the third paragraph thereof.

This endorsement does not increase the Company's total limits of liability.

_____	_____
Named Insured (Contractor)	Insurance Company
_____	_____
Street Number	Street Number
_____	_____
City and State	City and State

By: _____
(Company Representative)

(SEE NOTICE ON PAGE 2 OF 2)

State of _____)
) ss.
County of _____)

On this ____ day of _____ , 20 ___ before me personally came _____ to me known, or proved to me on the basis of satisfactory evidence, who being duly sworn, did depose and say: that _____ is an authorized representative of the _____ and acknowledged to me that _____ executed the within instrument on behalf of said insurance company.

In witness whereof, I have signed and affixed my official seal on the date in this certificate first above written.

_____
NOTARY PUBLIC

NOTICE:

No substitution or revision to the above endorsement form will be accepted. If the insurance called for is provided by more that one policy, a separate endorsement in the exact form shall be provided for each policy.

Insurers must be authorized to do business and have an agent for service of process in California, have an "A" policyholder's rating and a financial rating of at least Class VI in accordance with the most current rating by A.M. Best Company.

CERTIFICATE OF INSURANCE

Name of Contract: **OLIVENHAIN MUNICIPAL WATER DISTRICT NEW AND REMODELED OPERATIONS AND ANDMINISTRATION FACILITIES ENCINITAS, CALIFORNIA**

Name of Owner: **OLIVENHAIN MUNICIPAL WATER DISTRICT**

Type of Insurance: **BUILDERS' RISK "ALL RISK" INSURANCE**

THIS IS TO CERTIFY that a policy will be issued by the below-stated company in conformance with the requirements of Articles 2-3, 8-1 and 8-4 of the General Provisions:

POLICY NUMBER	**EXPIRATION DATE**	**LIMITS OF LIABILITY**
		$_____
		(Not Less Than Contract Amount)
		Deductible:
		$_____
	(Not Sooner Than Contract Completion Date)	(Not More Than $25,000)

This certificate or verification of insurance is not an insurance policy and does not amend, extend, or alter the coverage afforded by the policies listed herein. Notwithstanding any requirement, term, or condition of any contract or other document with respect to which this certificate or verification of insurance may be issued or may pertain, the insurance afforded by the policies described herein is subject to all the terms, exclusions, and conditions of such policies.

The Company will give at least 30 days' written notice by certified mail to the Owner and the Engineer/Architect prior to any material change or cancellation of said policy.

Named Insured (Contractor)	Insurance Company
Street Number	Street Number
City and State	City and State

By: _____
(Company Representative)

(SEE NOTICE ON PAGE 3 OF 3)

State of _____)
) ss.
County of _____)

On this ____ day of _____ , 20 ___ before me personally came _____ to me known, or proved to me on the basis of satisfactory evidence, who being duly sworn, did depose and say: that _____ is an authorized representative of the _____ and acknowledged to me that _____ executed the within instrument on behalf of said insurance company.

In witness whereof, I have signed and affixed my official seal on the date in this certificate first above written.

_____
NOTARY PUBLIC

Insurance Company Agent for Service
of Process in California:

Name	Agency
Street Number	Street Number
City and State	City and State
Telephone Number	Telephone Number

NOTICE:

No substitution or revision to the above certificate form will be accepted. If the insurance called for is provided by more than one insurance company, a separate certificate in the exact above form shall be provided for each insurance company.

Insurers must be authorized to do business and have an agent for service of process in California, have an "A" policyholder's rating and a financial rating of at least Class VI in accordance with the most current rating by A.M. Best Company.

THIS PAGE INTENTIONALLY LEFT BLANK.

INSURANCE ENDORSEMENT

Name of Contract: **OLIVENHAIN MUNICIPAL WATER DISTRICT NEW AND REMODELED OPERATIONS AND ADMINISTRATION FACILITIES ENCINITAS, CALIFORNIA**

Name of Owner: **OLIVENHAIN MUNICIPAL WATER DISTRICT**

Type of Insurance: **BUILDERS' RISK "ALL RISK" INSURANCE**

This endorsement forms a part of Policy No. _____.

ENDORSEMENT:

The Owner, the Engineer/Architect, the Owner's Representative, and their consultants, and each of their directors, officers, employees, and agents are included as additional insureds under said policy but only while acting in their capacity as such with respect to the above-referenced contract.

The insurance afforded to these additional insureds is primary insurance. If the additional insureds have other insurance which might be applicable to any loss, the amount of this insurance shall not be reduced or prorated by the existence of such other insurance.

This endorsement does not increase the Company's total limits of liability.

_____	_____
Named Insured (Contractor)	Insurance Company
_____	_____
Street Number	Street Number
_____	_____
City and State	City and State

By: _____
(Company Representative)

(SEE NOTICE ON PAGE 2 OF 2)

State of _____)
) ss.
County of _____)

On this ____ day of _____ , 20 ___ before me personally came _____ to me known, or proved to me on the basis of satisfactory evidence, who being duly sworn, did depose and say: that _____ is an authorized representative of the _____ and acknowledged to me that _____ executed the within instrument on behalf of said insurance company.

In witness whereof, I have signed and affixed my official seal on the date in this certificate first above written.

_____
NOTARY PUBLIC

NOTICE:

No substitution or revision to the above endorsement form will be accepted. If the insurance called for is provided by more than one policy, a separate endorsement in the exact above form shall be provided for each policy.

Insurers must be authorized to do business and have an agent for service of process in California, have an "A" policyholder's rating and a financial rating of at least Class VI in accordance with the most current rating by A.M. Best Company.

GENERAL PROVISIONS
TABLE OF CONTENTS

PAGE

SECTION 1 DEFINITIONS, TERMS, AND ABBREVIATIONS ---- 1

1-1 DEFINITIONS ---- 1
1-2 TERMS ---- 2
1-3 ABBREVIATIONS ---- 2

SECTION 2 PROPOSAL REQUIREMENTS AND CONDITIONS ---- 2

2-1 CONTRACT DOCUMENTS ---- 2
2-2 LICENSE AND BIDDER'S EXPERIENCE ---- 3
2-3 PROPOSALS ---- 3
2-4 WITHDRAWAL OF BID ---- 3
2-5 BIDDERS INTERESTED IN MORE THAN ONE BID ---- 4
2-6 INTERPRETATION OF PLANS AND OTHER CONTRACT DOCUMENTS ---- 4
2-7 ADDENDA ---- 4
2-8 EXISTING CONDITIONS AND EXAMINATION OF CONTRACT DOCUMENTS ---- 4

SECTION 3 AWARD AND EXECUTION OF CONTRACT ---- 5

3-1 AWARD OF CONTRACT OR REJECTION OF BIDS ---- 5
3-2 EXECUTION OF CONTRACT ---- 6
3-3 BONDS ---- 6
3-4 INSURANCE REQUIREMENTS ---- 7
3-5 FAILURE TO EXECUTE CONTRACT ---- 7

SECTION 4 SCOPE OF WORK ---- 7

4-1 WORK TO BE DONE ---- 7
4-2 CHANGES IN THE WORK ---- 7
4-3 OBSTRUCTIONS ---- 8
4-4 UTILITIES ---- 8
4-5 PLANS AND SPECIFICATIONS FURNISHED BY THE DISTRICT ---- 9
4-6 FINAL CLEANUP ---- 9

SECTION 5 QUALITY OF THE WORK ---- 10

5-1 AUTHORITY OF THE DISTRICT'S REPRESENTATIVE ---- 10
5-2 SUPPLEMENTAL DRAWINGS ---- 10
5-3 CONFORMITY WITH CONTRACT DOCUMENTS AND ALLOWABLE DEVIATIONS ---- 10
5-4 MANUFACTURER'S INSTRUCTIONS ---- 10
5-5 COORDINATION OF PLANS AND SPECIFICATIONS ---- 11
5-6 INTERPRETATION OF PLANS AND SPECIFICATIONS ---- 11
5-7 ERRORS OR DISCREPANCIES NOTED BY CONTRACTOR ---- 11
5-8 SUPERVISION AND SUPERINTENDENCE ---- 12
5-9 SHOP DRAWINGS ---- 12
5-10 QUALITY AND SAFETY OF MATERIALS AND EQUIPMENT ---- 13
5-11 STANDARDS, CODES, SAMPLES, AND TESTS ---- 14

PAGE

5-12 OBSERVATION OF WORK BY DISTRICT'S REPRESENTATIVE ---- 14
5-13 REMOVAL OF DEFECTIVE AND UNAUTHORIZED WORK ---- 15
5-14 ONE-YEAR GUARANTEE ---- 15

SECTION 6 PROSECUTION AND PROGRESS ---- 16

6-1 CONTRACTOR'S LIABILITY ---- 16
6-2 ASSIGNMENT ---- 16
6-3 CONSTRUCTION SCHEDULE AND PROSECUTION OF WORK ---- 17
6-4 TIME FOR COMPLETION AND FORFEITURE DUE TO DELAY ---- 22
6-5 EXTENSION OF TIME ---- 23
6-6 USE OF COMPLETED PORTIONS ---- 24

SECTION 7 LEGAL RELATIONS AND RESPONSIBILITIES ---- 26

7-1 OBSERVING LAWS AND ORDINANCES ---- 26
7-2 PERMITS AND LICENSES ---- 26
7-3 INVENTIONS, PATENTS, AND COPYRIGHTS ---- 27
7-4 PUBLIC CONVENIENCE AND SAFETY ---- 27
7-5 RESPONSIBILITY FOR LOSS, DAMAGE, OR INJURIES ---- 28
7-6 CONTRACTOR'S RESPONSIBILITY FOR THE WORK ---- 29
7-7 PRESERVATION OF PROPERTY ---- 29
7-8 REGIONAL NOTIFICATION CENTER CONTACT ---- 30
7-9 EXCAVATION PLANS FOR WORKER PROTECTION REQUIRED BY LABOR CODE SECTION 6705 ---- 31
7-10 SAFETY ---- 31
7-11 PERSONAL LIABILITY ---- 32
7-12 DEFENSE AND INDEMNITY ---- 32
7-13 HOURS OF LABOR ---- 33
7-14 PREVAILING WAGE ---- 33
7-15 TRAVEL AND SUBSISTENCE PAYMENTS ---- 34
7-16 APPRENTICES ---- 34
7-17 WARRANTY OF TITLE ---- 34
7-18 PROPERTY RIGHTS IN MATERIALS ---- 35
7-19 MUTUAL RESPONSIBILITY OF CONTRACTORS ---- 35
7-20 TERMINATION FOR BREACH ---- 36
7-21 NOTICE AND SERVICE THEREOF ---- 37
7-22 PARTIAL INVALIDITY ---- 37
7-23 ATTORNEYS' FEES ---- 37
7-24 LANDS AND RIGHTS-OF-WAY ---- 38
7-25 NO WAIVER OF RIGHTS OR REMEDIES ---- 38
7-26 TAXES ---- 38
7-27 ASSIGNMENT OF ANTI-TRUST ACTIONS ---- 39
7-28 PAYROLL RECORDS ---- 39
7-29 MODIFICATION ---- 40
7-30 JURISDICTION AND VENUE ---- 40
7-31 HAZARDOUS WASTE ---- 40
7-32 EXCAVATIONS BELOW FOUR (4) FEET ---- 41

PAGE

7-33 ARBITRATION ---- 41

SECTION 8 CONTRACTOR'S INSURANCE ---- 42

8-1 GENERAL ---- 42
8-2 WORKERS' COMPENSATION INSURANCE AND EMPLOYER'S LIABILITY INSURANCE ---- 42
8-3 LIABILITY INSURANCE ---- 42
8-4 BUILDERS' RISK "ALL RISK" INSURANCE ---- 43
8-5 CONTRACTOR'S LIABILITY NOT LIMITED BY INSURANCE ---- 44

SECTION 9 ESTIMATES AND PAYMENTS ---- 44

9-1 PAYMENT FOR CHANGES IN THE WORK ---- 44
9-2 PROGRESS PAYMENTS ---- 45
9-3 FINAL ESTIMATE AND PAYMENT ---- 46
9-4 DISTRICT'S RIGHT TO WITHHOLD CERTAIN AMOUNTS AND MAKE APPLICATION THEREOF ---- 46
9-5 WITHHELD CONTRACT FUNDS ---- 47
9-6 REQUIRED RELEASES ---- 48

SECTION 10 AUTHORITY AND STATUS OF DISTRICTS REPRESENTATIVES ---- 48

10-1 STATUS OF DISTRICTS REPRESENTATIVES ---- 48
10-2 AUTHORITY OF DISTRICT'S REPRESENTATIVES ---- 48

SECTION 11 FORMS ---- 49

11-3 RELEASE FORM ---- 49

THIS PAGE INTENTIONALLY LEFT BLANK.

GENERAL PROVISIONS

SECTION 1 DEFINITIONS, TERMS, AND ABBREVIATIONS

1-1 DEFINITIONS

Whenever the following terms occur in the Contract Documents, the meaning shall be interpreted as follows:

ACCEPTANCE, FINAL ACCEPTANCE - The formal action by the District accepting the work as being complete.

ACCEPTED BID - The bid (proposal) accepted by the District.

ATTORNEY FOR DISTRICT – Wesley W.Peltzer, A Professional Corporation of Attorneys at Law.

BIDDER - Any individual, partnership, corporation, joint venture, or other combination thereof submitting a proposal for the work contemplated, acting directly or through an authorized representative.

CALENDAR DAY - Means all days of the week including Saturdays, Sundays and Holidays with the first day counted being the first day following the date specified.

CONTRACT - The written agreement executed between the District and the Contractor covering the performance of the work.

CONTRACTOR - The individual, partnership, corporation, joint venture, or other combination thereof who has entered into the contract with the District for the performance of the work. The term "Contractor" means the Contractor or his authorized representative.

CONTRACT DOCUMENTS - The Contract Documents set forth in the Agreement; also any and all supplemental agreements amending or extending the work contemplated. Supplemental agreements are written agreements covering alterations, amendments, or extensions to the contract and include contract change orders.

DAYS - Unless otherwise specified, days shall mean calendar days.

ENGINEER/ARCHITECT – Infrastructure Engineering Corporation, 14271 Danielson Street, Poway, California 92064 (Engineer); Jeff Katz Architecture, 6353 Del Cerro Boulevard, San Diego, California, 92120 (Architect). The term "Engineer/Architect" means the Engineer or the Architect or his authorized representative. Refer to Section 00810, Article 1.01.

DISTRICT - The public entity identified as such in the Agreement. The term "District" means the District or his authorized representative.

DISTRICT'S REPRESENTATIVE - The person or firm authorized by the District to represent it during the performance of the work by the Contractor. The term "District's Representative" means the District's Representative or his assistants.

PLANS, DRAWINGS - The Plans (drawings), or reproductions thereof, which show the location, character, dimensions, and details of the work to be done.

SPECIAL PROVISIONS - Additions, deletions, and changes to the General Provisions and Standard Specifications.

SPECIFICATIONS - The directions, provisions, and requirements contained in the General Provisions and Standard Specifications as supplemented by the Special Provisions.

STANDARD SPECIFICATIONS - The Contract Documents identified or referenced as such.

SUBCONTRACTOR - An individual, partnership, corporation, joint venture, or other combination thereof who has a contract with the Contractor to perform any of the work at the site. Subcontractor also means an individual, partnership, corporation, joint venture, or other combination thereof who has a contract with another subcontractor to perform any of the work at the site.

STANDARD DRAWINGS, STANDARD PLANS - That portion of the Plans identified or referenced as such.

UTILITY - Public or private fixed works for the transportation of fluids, gases, power, signals, or communications.

WORK - Any and all obligations, duties, and responsibilities necessary to complete the construction assigned to, or undertaken by, the Contractor pursuant to the Contract Documents including all materials, equipment, and supplies incorporated or to be incorporated in the construction. Also, the completed construction or parts thereof required to be provided under the Contract Documents.

1-2 TERMS

Wherever the terms "required," "permitted," "ordered," "designated," "directed," "prescribed," or terms of like import are used, it shall be understood that the requirements, permission, order, designation, direction, or prescription of the District's Representative is intended. Similarly, the terms "acceptable," "satisfactory," "or equal," or terms of like import shall mean acceptable to or satisfactory to the District's Representative, unless otherwise expressly stated. The word "provide" shall be understood to mean furnish and install.

1-3 ABBREVIATIONS

Wherever abbreviations are used, they shall have the meanings as set forth in the Special Provisions.

SECTION 2 PROPOSAL REQUIREMENTS AND CONDITIONS

2-1 CONTRACT DOCUMENTS

The Contract Documents are set forth in the Agreement form and the definition of "Contract Documents" is in Article 1-1 DEFINITIONS.

2-2 LICENSE AND BIDDER'S EXPERIENCE

No bid will be accepted from a bidder who is not licensed to conduct business in the state of California and licensed to perform the class of work defined by the Contract Documents. All bidders shall complete the Bidder's Experience form as part of their bid. Bidders failing to complete and submit the Bidder's Experience form with their bid may be treated as nonresponsive at the option of the District. Bidders unable to demonstrate five (5) years of successful prior experience performing the type of work required by this contract may also be rejected as nonresponsive.

2-3 PROPOSALS

Bids shall be made upon the Bid Form furnished by the District and a part of the Contract Documents. The Bid Form shall be submitted in its entirety. All bids shall be properly executed and with all items filled in; the signatures of all persons signing shall be in longhand. Erasures, interlineations, or other corrections shall be authenticated by affixing in the margin immediately opposite the correction the initials of a person signing the bid. Written amounts shall govern in case of discrepancy between the amounts stated in writing and the amounts stated in figures. If the unit price and the total amount named by a bidder for any item are not in agreement, the unit price alone shall be considered as representing the bidder's intention, and the totals shall be corrected to conform thereto.

Bids shall not contain any recapitulation of the work to be done. Alternative proposals will not be considered, except as called for. No oral, telegraphic, or telephonic proposals or modifications will be considered.

Bids shall be accompanied by a "Proposal Guarantee" in the form of cash, a cashier's check, a certified check, or bidder's bond executed by an admitted surety insurer, in an amount not less than 10% of the amount of bid, and made payable to or for the benefit of the District. Said cash, check, or bond shall be given as a guarantee that the bidder will enter into a contract and furnish the required bonds or substitutes and insurance certificates and endorsements if awarded the contract, and in case of refusal or failure to enter into said contract and furnish the required bonds or substitutes and insurance certificates and endorsements within 15 calendar days after notice of award by the District in writing, the cash or the check and the money represented by said check shall be forfeited to the District, or in the event that a bond is deposited, said security shall be forfeited. Forfeiture does not preclude the District from seeking all other remedies provided by law to recover losses sustained as a result of the Contractor's failure to enter into the contract or to furnish the required bonds or insurance certificates and endorsements.

Bids shall be sealed in an envelope marked and addressed as set forth in the Special Provisions. Bids shall be delivered to personnel of the District at the location designated in the Notice Inviting Sealed Proposals (Bids) on or before the day and hour set for the opening of bids. Bids not marked as being received by personnel of the District on or before the day and hour of bid opening will be rejected. It is the responsibility of the bidder to ensure that the bid is received by personnel of the District on or before the day and hour of bid opening.

2-4 WITHDRAWAL OF BID

A bidder may withdraw his bid by a signed written request any time prior to the day and hour for receiving bids designated in the Notice Inviting Sealed Proposals. Thereafter the Bid may be

withdrawn only as permitted in accordance with Public Contract Code Section 5100, et seq., regarding relief of Bidders.

The withdrawal of a bid does not prejudice the right of a bidder to file a new bid so long as the new bid is delivered as set forth in Article 2-3 PROPOSALS prior to the closing time specified for all bids.

2-5 BIDDERS INTERESTED IN MORE THAN ONE BID

No person, partnership, or corporation shall be allowed to make or file, or be interested in more than one bid for the work, unless alternative bids are called for. A person, partnership, or corporation submitting a subproposal to a bidder, or who has quoted prices on material to a bidder, is not thereby disqualified from submitting a subproposal or quoting prices to other bidders.

2-6 INTERPRETATION OF PLANS AND OTHER CONTRACT DOCUMENTS

If any person or entity contemplating submitting a bid for the proposed contract is in doubt as to the true meaning of any part of the Plans, Specifications, or other Contract Documents, or finds discrepancies in, or omissions from the Plans and Specifications or other Contract Documents, he may submit to the Engineer/Architect a written request for an interpretation or correction thereof. The person submitting the request will be responsible for its prompt delivery. An interpretation or correction of the Contract Documents will be made only by Addendum duly issued by the Engineer/Architect. A copy of such Addendum will be mailed or delivered to each person or entity that has received a set of such documents. The District and the Engineer/Architect will not be responsible for any other explanation or interpretation of the documents.

2-7 ADDENDA

Addenda issued before the time in which to submit bids expires shall be included in the bid and shall be made a part of the contract.

2-8 EXISTING CONDITIONS AND EXAMINATION OF CONTRACT DOCUMENTS

The bidder represents that he has carefully examined the Contract Documents and the site where the work is to be performed and that he has familiarized himself with all local conditions and federal, state and local laws, ordinances, rules, and regulations that may affect in any manner the performance of the work. The bidder further represents that he has studied all surveys and investigation reports about subsurface and latent physical conditions pertaining to the jobsite, that he has performed such additional surveys and investigations as he deems necessary to complete the work at his bid price, and that he has correlated the results of all such data with the requirements of the Contract Documents. The submittal of a bid shall be conclusive evidence that the bidder has investigated and is satisfied as to the conditions to be encountered, including locality, uncertainty of weather and all other contingencies, and as to the character, quality, quantities, and scope of the work.

The Plans and Specifications for the work show subsurface conditions or otherwise hidden conditions as they are supposed or believed by the Engineer/Architect to exist; but it is not intended or to be inferred that the conditions as shown thereon constitute a representation that such conditions are actually existent. Except as otherwise specifically provided in the Contract Documents, the District, the Engineer/Architect, and their consultants shall not be liable for any loss

sustained by the Contractor as a result of any variance of such conditions as shown on the Plans and the actual conditions revealed during the progress of the work or otherwise.

Where the District or the Engineer/Architect or their consultants have made investigations of subsurface conditions in areas where the work is to be performed, such investigations were made only for the purpose of study and design. The conditions indicated by such investigations apply only at the specific location of each boring or excavation at the time the borings or excavations were made. Where such investigations have been made, bidders or Contractors may inspect the records as to such investigations subject to and upon the conditions hereinafter set forth. The inspection of the records shall be made at the office of the Engineer/Architect.

The records of such investigations are not a part of the contract and are shown solely for the convenience of the bidder or Contractor. It is expressly understood and agreed that the District, the Engineer/Architect, and their consultants assume no responsibility whatsoever in respect to the sufficiency or accuracy of the investigations; the records thereof; or of the interpretations set forth therein or made by the District's consultants, the Engineer/Architect or his consultants in the use thereof by the Engineer/Architect, and there is no warranty or guarantee, either express or implied, that the conditions indicated by such investigations or records thereof are representative of those existing throughout such areas, or any part thereof, or that unlooked-for developments may not occur, or that materials other than, or in proportions, densities, or other characteristics different from, those indicated may not be encountered.

When a log of test borings showing a record of the data obtained by the investigation of subsurface conditions by the District, the Engineer/Architect, or their consultants is included with the Plans or other documents, it is expressly understood and agreed that said log of test borings does not constitute a part of the contract, represents only the opinion of the District or the Engineer/Architect or their consultants as to the character of the materials encountered by them in the test borings, is included in the Plans or other documents only for the convenience of bidders, and its use is subject to all of the conditions and limitations set forth in this article.

The availability or use of information described in this article is not to be construed in any way as a waiver of the provisions of the first paragraph in this article and a bidder or Contractor is cautioned to make such independent investigations and examination as he deems necessary to satisfy himself as to conditions to be encountered in the performance of the work.

No information derived from such inspection of records of investigations or compilation thereof made by the District, the Engineer/Architect, or their consultants will in any way relieve the bidder or Contractor from any risk or from properly fulfilling the terms of the contract nor entitle the Contractor to any additional compensation.

SECTION 3 AWARD AND EXECUTION OF CONTRACT

3-1 AWARD OF CONTRACT OR REJECTION OF BIDS

The award of the contract, if it be awarded, will be to the lowest responsible responsive bidder complying with the instructions contained in the Contract Documents. The District, however, reserves the right to select the schedules under which the bids are to be compared, to reject any and all bids, and to waive any irregularity in bids received. If, in the judgment of the District, a bid is

unbalanced or if the bidder is not responsible, it shall be considered sufficient grounds for rejection of the entire bid.

The District shall have the period of time set forth in the Special Provisions after the opening of bids within which to accept or reject the bids. No bidder may withdraw his bid during said period. The District will return the proposal guarantees, except any guarantees which have been forfeited, and except bidders' bonds, to the respective bidders whose proposals they accompanied after the execution of the contract by the successful bidder or rejection of all bids or upon receipt of a written request therefor received after said period of time set forth in the Special Provisions. The proposal guarantee of the unsuccessful bidders will be returned by the District no later than 60 calendar days following the date of award of contract.

Before award of the contract, any bidder shall furnish upon request proof of required insurance, a recent statement of his financial condition, and previous construction experience or such other evidence of his qualifications as may be requested by the District. If a bidder fails to furnish in a timely manner the information requested, it shall be considered sufficient grounds for rejection of such bidder's entire bid.

3-2 EXECUTION OF CONTRACT

The form of agreement, bonds, and other documents which the successful bidder, as Contractor, will be required to execute are included as a part of the Contract Documents.

The contract shall be signed by the successful bidder and returned to the District, together with the bonds or substitutes and insurance certificates and endorsements, within 15 calendar days or such additional time as may be allowed by the District from the date of the mailing of notice from the District to the bidder or from the date of personal delivery of notice from the District to the bidder that the agreement is ready for signature. The agreement, bonds or substitutes, insurance certificates and endorsements, and other documents to be executed by the Contractor shall be executed in original-quadruplicate, one each of which shall be filed with the District and one each with the Attorney for the District and the Engineer/Architect for the District.

3-3 BONDS

The successful bidder, simultaneously with execution of the Contract Documents, shall either furnish a Payment Bond and Performance Bond each in an amount equal to 100% of the contract amount, or equivalent cash or securities in lieu of these bonds in accordance with Code of Civil Procedure Section 995.710. The failure of Contractor to make a written request to District to use alternative securities meeting the requirements of Code of Civil Procedure Section 995.710 at the time the Contract Documents are signed shall be deemed a waiver of the right of Contractor to subsequently substitute these alternative securities. Alternative securities proposed by the Contractor shall be subject to review and approval by District. Contractor agrees to provide District with a deposit in a sum determined adequate by the District to cover all attorney’s fees and all other fees, costs, and expenses incurred by the District in reviewing Contractor’s request to use alternative securities in lieu of the required bonds and to prepare all agreements determined necessary by District to adequately protect District’s interest. Performance and Payment Bonds shall be furnished by surety companies meeting the requirements of Code of Civil Procedure Section 995.660(a) and shall be completed on the forms furnished as part of the Contract

Documents. Surety companies, to be acceptable to District, must meet all requirements of Code of Civil Procedure Section 995.660(a).

If at any time a surety on any such bond fails to comply with Code of Civil Procedure Section 995.660(a), the Contractor shall, within 10 calendar days after notice from the District, substitute new bonds with surety companies meeting all requirements of Code of Civil Procedure Section 995.660(a). All premiums on these new bonds shall be paid solely by the Contractor. No further progress payments shall be deemed due nor shall be made until the new surety or sureties shall have furnished new bonds to District meeting all requirements of Code of Civil Procedure Section 995.660(a).

The Performance Bond and the Payment Bond, or alternative securities meeting the requirements of Code of Civil Procedure Section 995.710 approved by the District, must remain in full effect throughout the period of the Work and for a period of one-year thereafter as required by Article 5-14 ONE-YEAR GUARANTEE.

3-4 INSURANCE REQUIREMENTS

The successful bidder will be required to furnish the District proof of full compliance with all insurance requirements as specified in SECTION 8 CONTRACTOR'S INSURANCE. The forms of Certificate of Insurance and Endorsement which the successful bidder, as Contractor, will be required to furnish are included as a part of the Contract Documents.

3-5 FAILURE TO EXECUTE CONTRACT

Failure by a bidder to whom the contract is awarded to execute the contract or to furnish the required bonds or insurance certificates and endorsements shall be just cause for the annulment of the award and the forfeiture of the proposal guarantee.

A bidder who is awarded the contract and fails to execute the contract or furnish the required bonds or substitutes, or insurance certificates and endorsements shall be liable to the District for all damages resulting therefrom including reasonable attorneys' fees. The proposal guarantee forfeited shall not be a limitation thereon.

SECTION 4 SCOPE OF WORK

4-1 WORK TO BE DONE

The work to be done consists of furnishing all transportation, labor, materials, tools, equipment, services, permits, utilities, temporary facilities, AV, furnishings and all other items which are necessary or appurtenant to construct and complete the entire project and construct the project designated in the Contract Documents and plans.

4-2 CHANGES IN THE WORK

The District may require changes in, additions to, or deductions from the work, including complete termination thereof. Adjustment, if any, in the amounts to be paid to the Contractor by reason of any such change, addition, or deduction shall be determined as set forth in SECTION 9 ESTIMATES AND PAYMENTS.

The District's Representative may order minor changes in the work not involving an increase or decrease in the contract amount, not involving a change in the time for completion, and not inconsistent with the purposes for which the work is being constructed. If the Contractor believes that any order for minor changes in the work for which the contract amount or time for completion should be changed, he shall not proceed with the changes in the work so ordered and shall within seven calendar days of the receipt of such order notify the District's Representative in writing of his estimate of the changes in the contract amount and time for completion he believes to be appropriate.

No payment for changes in the work will be made and no changes in the time for completion by reason of changes in the work will be made, unless the changes are covered by a written change order approved by the District in advance of the Contractor's proceeding with the changed work.

4-3 OBSTRUCTIONS

The Contractor shall remove and dispose of all structures, debris, or other obstructions of any character necessary to accommodate the work. Where such obstructions consist of improvements not required by law to be removed by the District thereof, all such improvements shall be removed, maintained, and permanently replaced by the Contractor at his expense except as otherwise specifically provided in the Contract Documents.

4-4 UTILITIES

The Engineer/Architect has endeavored to determine the existence of utilities at the site of the work from the records of the Districts of known utilities in the vicinity of the work. The positions of these utilities as derived from such records are shown on the Plans. The service connections to these utilities are not shown on the Plans.

The Contractor shall make his own investigations, including exploratory excavations and x-ray to determine the locations and type of existing service laterals or appurtenances when their presence can be inferred from the presence of other visible facilities, such as buildings, meter and junction boxes, on or adjacent to the site of the work. If the Contractor discovers utility facilities not identified in the Plans or Specifications or in a position different from that shown in the Plans and Specifications, he shall immediately notify in writing the District's Representative and the District of the utility facility.

The District shall have the responsibility for the timely removal, relocation, protection, and temporary maintenance of existing main or trunkline utility facilities which are not indicated in the Plans and Specifications with reasonable accuracy.

In case it should be necessary to remove, relocate, protect, or temporarily maintain a utility because of interference with the work, the work on such utility shall be performed and paid for as follows:

When it is necessary to remove, relocate, protect, or temporarily maintain an existing main or trunkline utility facility not indicated in the Plans and Specifications with reasonable accuracy, the District will compensate the Contractor for the costs of locating, for the costs of repairing damage not due to the failure of the Contractor to exercise reasonable care, for the costs of removing, relocating, protecting, or temporarily maintaining such utility facilities, and for the costs for equipment on the site necessarily idled during such work. These

costs, the work to be done by the Contractor in locating, removing, relocating, protecting, or temporarily maintaining such utility facilities shall be covered by a written change order conforming to the provisions of Article 4-2 CHANGES IN THE WORK and Article 9-1 PAYMENT FOR CHANGES IN THE WORK. The District may make changes in the alignment and grade of the work to obviate the necessity to remove, relocate, protect, or temporarily maintain such utility facilities or to reduce the costs of the work involved in removing, relocating, protecting, or temporarily maintaining such utility facilities. Changes in alignment and grade will be ordered in accordance with Article 4-2 CHANGES IN THE WORK.

When it is necessary to remove, relocate, protect, or temporarily maintain a utility (other than [1] existing main or trunkline utility facilities not indicated in the Plans and Specifications with reasonable accuracy, or [2] existing service laterals or appurtenances when their presence cannot be inferred from the presence of other visible facilities, such as buildings, meter and junction boxes, on or adjacent to the site of the work) the cost of which is not required to be borne by the District thereof, the Contractor shall bear all expenses incidental to the work on the utility or damage thereto. The work on the utility shall be done in a manner satisfactory to the District thereof; it being understood that the District of the utility has the option of doing such work with his own forces, or permitting the work to be done by the Contractor. No representations are made that the obligations to remove, relocate, protect, or temporarily maintain any utility and to pay the cost thereof is or is not required to be borne by the District of such utility, and it shall be the responsibility of the Contractor to investigate to find out whether or not said cost is required to be borne by the District of the utility.

The right is reserved to governmental agencies and to Districts of utilities to enter at any time upon any street, alley, right-of-way, or easement for the purpose of making changes in their property made necessary by the work and for the purpose of maintaining and making repairs to their property.

4-5 PLANS AND SPECIFICATIONS FURNISHED BY THE DISTRICT

The District will furnish to the Contractor free of charge (1) one conformed set of Plans and Specifications reasonably necessary for the execution of the work. The Contractor shall keep one set of Plans and Specifications in good order available to the District's Representative at the site of the work.

4-6 FINAL CLEANUP

Upon completion and before making application for acceptance of the work, the Contractor shall per CBC 1170.3.1 clean all rights-of-way, streets, borrow pits, and all other grounds occupied by him in connection with the work of all rubbish, excess materials, temporary structures, and equipment, and all parts of the work and grounds occupied by him shall be left in a neat and presentable condition.

SECTION 5 QUALITY OF THE WORK

5-1 AUTHORITY OF THE DISTRICT'S REPRESENTATIVE

The District's Representative shall decide any and all questions which may arise as to the interpretation of the Plans and Specifications and shall have authority to disapprove or reject materials and equipment furnished and work performed which, in his opinion, is not in accordance with the Contract Documents. The District's Representative shall also have the authority to require the Contractor or any subcontractor to replace any workman or supervisor who, in his opinion, is not performing the work in a safe manner, fails to follow the instructions of the District's Representative, fails to perform work in accordance with the Contract Documents, fails to properly supervise the work, or demonstrates lack of competence to perform the particular work assigned to the workman or supervisor. The failure of the Contractor or any subcontractor to replace a worker or supervisor as directed by the District's Representative shall constitute a material breach of this agreement. Neither the District's Representative nor the District shall be liable to Contractor, any subcontractor, or any other person or entity for removing a workman or supervisor in accordance with the terms of this article.

5-2 SUPPLEMENTAL DRAWINGS

The Plans shall be supplemented by such drawings as are necessary to better define the work. All such drawings delivered to the Contractor by the District's Representative shall be deemed written instructions to the Contractor. If the Contractor believes that any supplemental drawings call for changes in the work for which the contract amount or time for completion should be changed, he shall not proceed with the changes in the work so called for and shall within seven calendar days of the receipt of the supplemental drawings notify the District's Representative in writing of his estimate of the changes in the contract amount and time for completion he believes to be appropriate.

No payment for changes in the work will be made and no change in the time for completion by reason of changes in the work will be made, unless the changes are covered by a written change order approved by the District in advance of the Contractor's proceeding with the changed work.

5-3 CONFORMITY WITH CONTRACT DOCUMENTS AND ALLOWABLE DEVIATIONS

The work shall conform to the lines, grades, dimensions, tolerances, and material and equipment requirements shown on the Plans or set forth in the Specifications. Although measurement, sampling, and testing may be considered evidence as to such conformity, the District's Representative shall be the sole judge as to whether the work or materials deviate from the Plans and Specifications, and his decision as to any allowable deviations therefrom shall be final.

If specific lines, grades, and dimensions are not shown on the Plans, those furnished by the District's Representative shall govern.

5-4 MANUFACTURER'S INSTRUCTIONS

All materials and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the instructions of the applicable manufacturer, fabricator, supplier, or distributor, except as otherwise specifically provided in the Contract Documents.

5-5 COORDINATION OF PLANS AND SPECIFICATIONS

The Plans, Specifications, and other Contract Documents are essential parts of the contract, and a requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for the complete work. In the event of an apparent difference between Plans and Specifications, reference shall be made to the District's Representative whose decision thereon shall be final.

Special Provisions shall govern over General Provisions and Standard Specifications.

5-6 INTERPRETATION OF PLANS AND SPECIFICATIONS

Figured dimensions on drawings shall govern, but work not dimensioned shall be as directed. Work not particularly shown or specified shall be the same as similar parts that are shown or specified. Large-scale details shall take precedence over smaller scale drawings as to shape and details of construction. Specifications shall govern as to materials and workmanship. Plans and Specifications are intended to be fully complementary and to agree. The Specifications calling for the higher quality material or workmanship shall prevail. Materials or work described in words which so applied have a well known technical or trade meaning shall be deemed to refer to such recognized standards. In the event of any discrepancy between any drawings and the figures thereon, the figures shall be taken as correct. In the event of any doubt or question arising respecting the true meaning of the Plans or Specifications, reference shall be made to the District's Representative whose decision thereon shall be final.

5-7 ERRORS OR DISCREPANCIES NOTED BY CONTRACTOR

It is the duty of the Contractor to promptly notify the District's Representative in writing of any design, materials, or specified method that the Contractor believes may prove defective or insufficient. If the Contractor believes that a defect or insufficiency exists in design, materials, or specified method and fails to promptly notify the District's Representative in writing of this belief, the Contractor waives any right to assert that defect or insufficiency in design, materials, or specified method at any later date in any legal or equitable proceeding against District, or in any subsequent mediation, arbitration, or settlement conference between the District and the Contractor. The District's Representative, on receipt of any such notice, will promptly investigate the circumstances and give appropriate instructions to the Contractor. Until such instructions are given, any work done by the Contractor after he comes to the belief that a defect or insufficiency exists in design, materials, or specified method which is directly or indirectly affected by such alleged defect or insufficiency in design, materials, or specified method will be at his own risk and he shall bear all cost arising therefrom.

If the Contractor, either before commencing work or in the course of the work, finds any discrepancy between the Plans and the Specifications or between either of them and the physical conditions at the site of the work or finds any error or omission in any of the Plans or in any survey, he shall promptly notify the District's Representative of such discrepancy, error, or omission. If the Contractor observes that any Plans or Specifications are at variance with any applicable law, ordinance, regulation, order, or decree, he shall promptly notify the District's Representative in writing of such conflict. The District's Representative, on receipt of any such notice, will promptly investigate the circumstances and give appropriate instructions to the Contractor. Until such instructions are given, any work done by the Contractor after his discovery of such error,

discrepancy, or conflict which is directly or indirectly affected by such error, discrepancy, or conflict will be at his own risk and he shall bear all cost arising therefrom.

5-8 SUPERVISION AND SUPERINTENDENCE

The Contractor shall supervise and direct the work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the work in accordance with the Contract Documents. The Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction, but the Contractor shall not be solely responsible for the negligence of others in the design or selection of a specific means, method, technique, sequence, or procedure of construction which is indicated in and required by the Contract Documents except as otherwise provided in Article 5-7 ERRORS OR DISCREPANCIES NOTED BY CONTRACTOR.

The Contractor shall be responsible to see that the completed work complies with the Contract Documents.

The Contractor shall designate and keep on the work at all times during its progress a competent superintendent who shall not be replaced without written notice to the District's Representative. The superintendent will be the Contractor's representative at the site and shall have authority to act on behalf of the Contractor. All communications given to the superintendent shall be as binding as if given to the Contractor. During periods when the work is suspended, the Contractor shall make appropriate arrangements for any emergency work which may be required.

Whenever the superintendent is not present on any particular part of the work where the District's Representative may desire to inform the Contractor relative to interpretation of the Plans and Specifications or to the disapproval or rejection of materials or work performed, the District's Representative may so inform the foreman or other worker in charge of the particular part of the work in reference to which the information is given. Information so given shall be as binding as if given to the superintendent.

5-9 SHOP DRAWINGS

Shop drawings are drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data which are prepared by the Contractor or any subcontractor, manufacturer, supplier, or distributor and which illustrates some portion of the work. Reference specification section Submittal Procedures 013300, Part 2.1.C.

The Contractor shall review, mark with his approval, and submit for review by the District's Representative shop drawings as called for in the Special Provisions and Standard Specifications or requested by the District's Representative. Shop drawings shall be submitted in sextuplet to the District's Representative and be accompanied by the Shop Drawing Submittal Form included at the end of the General Provisions. Shop drawings shall show the name of the project, the name of the Contractor, and, if any, the names of suppliers, manufacturers, and subcontractors. Shop drawings shall be submitted with promptness and in orderly sequence so as to cause no delay in prosecution of the work.

Shop drawings shall be complete in all respects. If the shop drawings show any deviations from the requirements of the Plans and Specifications because of standard shop practices or other reasons, the deviations and the reasons therefor shall be set forth in the Shop Drawing Submittal Form.

By submitting shop drawings, the Contractor represents that material, equipment, and other work shown thereon conforms to the Plans and Specifications, except for any deviations set forth in the Shop Drawing Submittal Form.

Within 14 calendar days after receipt of said shop drawings, the District's Representative will return shop drawings to the Contractor via Procore with any comments noted thereon. If so noted by the District's Representative, the Contractor shall correct the drawings and resubmit them in the same manner as specified for the original submittal. The Contractor in the Shop Drawing Submittal Form accompanying resubmitted shop drawings shall direct specific attention to revisions other than the corrections requested by the District's Representative on previous submittals.

The review by the District's Representative is only of general conformance with the design concept of the project and general compliance with the Plans and Specifications and shall not be construed as relieving the Contractor of the full responsibility for: providing materials, equipment, and work required by the contract; the proper fitting and construction of the work; the accuracy and completeness of the shop drawings; selecting fabrication processes and techniques of construction; and performing the work in a safe manner.

No portion of the work requiring a shop drawing submittal shall be commenced until the submittal has been reviewed by the District's Representative and returned to the Contractor with a notation indicating that resubmittal is not required.

If the Contractor believes that any shop drawing or communication relative thereto calls for changes in the work for which the contract amount or time for completion should be changed, he shall not proceed with the changes in the work so called for and shall within seven calendar days of the receipt of the shop drawings notify the District's Representative in writing of his estimates of the changes in the contract amount and time for completion he believes to be appropriate.

No payment for changes in the work will be made and no change in the time for completion by reason of changes in the work will be made, unless the changes are covered by a written change order approved by the District in advance of the Contractor's proceeding with the changed work.

5-10 QUALITY AND SAFETY OF MATERIALS AND EQUIPMENT

All equipment, materials, and supplies to be incorporated in the work shall be new, unless otherwise specified. All equipment, materials, and supplies shall be produced in a good and workmanlike manner. When the quality of a material, process, or article is not specifically set forth in the Plans and Specifications, the best available quality of the material, process, or article shall be provided.

Whenever any material, process, or article is indicated or specified by grade, patent or proprietary name, or by name of manufacturer, such Specification shall be deemed to be used for the purpose of facilitating description of the materials, process, or articles desired and shall be deemed to be followed by the words "or equal", and the Contractor may offer any material, process, or article which shall be substantially equal or better in every respect to that so indicated or specified; provided, however, that if the material, process, or article offered by the Contractor is not, in the opinion of the District's Representative, equal or better in every respect to that specified, then the Contractor must furnish the material, process, or article specified or one that in the opinion of the District's Representative is the substantial equal or better in every respect. In the event that the

Contractor furnishes material, process, or article more expensive than that specified, the difference in cost of such material, process, or article so furnished shall be borne by the Contractor.

In accordance with Public Contract Code Section 3400, the Contractor shall submit data substantiating requests for substitution of "equal" items within 35 calendar days after award of the contract. This 35-day period of time is included in the number of days allowed for the completion of the work.

All materials, equipment, and supplies provided shall, without additional charge to District, fully conform with all applicable state and federal safety laws, rules, regulations, and orders, and it shall be Contractor's responsibility to provide only such materials, equipment, and supplies notwithstanding any omission in the Contract Documents therefor or that a particular material, equipment, or supply was specified.

All machinery and equipment provided by the Contractor for the work shall include locking mechanisms capable of locking any shut-down devices on the machinery and equipment before commencement of any repairs or other work. Any machinery or equipment provided by the Contractor, which does not have this locking ability, shall be altered at the expense of the Contractor to provide these locking mechanisms without compromising any safety features on the equipment or machinery prior to the commencement of any repairs or work on the equipment or machinery. The Contractor shall not commence any work or repairs on any machinery or equipment which has been shut down until the locking mechanism has been activated and the Contractor has tagged the applicable machinery or equipment with a tag stating "Danger Do Not Operate." This tag shall include the name of the employee who locked the equipment prior to the commencement of any work or repairs. The Contractor shall insure that all equipment and machinery fully complies with Title 8 of California Administrative Code Sections 3202, 3314, 6003, 2320.4-2320.6, 2530.43, and 2530-86 at all times during performance of the work.

5-11 STANDARDS, CODES, SAMPLES, AND TESTS

Whenever reference is made to a standard, code, Specification, or test and the designation representing the date of adoption or latest revision thereof is omitted, it shall mean the latest revision of such standard, code, Specification, or test in effect on the day the Notice Inviting Sealed Proposals (Bids) is dated.

Tests shall be made in accordance with commonly recognized procedures of technical organizations and such special procedures as may be prescribed elsewhere in the Plans and Specifications. The Contractor shall furnish without charge such samples for testing as may be required by the District's Representative.

5-12 OBSERVATION OF WORK BY DISTRICT'S REPRESENTATIVE

The District's Representative shall at all times have access to the work during construction and shall be furnished with every reasonable facility for ascertaining full knowledge respecting the progress, workmanship, and character of materials and equipment used and employed in the work.

Whenever the Contractor varies the normal period during which work or any portion of it is carried on each day, he shall give timely notice to the District's Representative so that the District's Representative may, if he wishes, be present to observe the work in progress. If the Contractor

fails to give such timely notice, any work done in the absence of the District's Representative will be subject to rejection.

The Contractor shall give timely notice to the District's Representative in advance of backfilling or otherwise covering any part of the work so that the District's Representative may, if he wishes, observe such part of the work before it is concealed.

The observation, if any, by the District's Representative of the work shall not relieve the Contractor of any of his obligations to fulfill the contract as prescribed. Defective work shall be made good, and materials and equipment furnished and work performed which is not in accordance with the Contract Documents may be rejected notwithstanding the fact that such materials, equipment, and work have been previously observed by the District's Representative or that payment therefor has been included in an estimate for payment.

5-13 REMOVAL OF DEFECTIVE AND UNAUTHORIZED WORK

Any work which does not conform the requirements of the Contract Documents or which is found unacceptable or deficient by the District or the District's Representative shall be remedied or removed and replaced by the Contractor at the Contractor's sole cost and expense, together with any other work which may be displaced in so doing, and no compensation will be allowed the Contractor for such removal, replacement, or remedial work. All materials found inadequate or deficient by the District or the District's Representative shall be immediately removed from the site.

Any work done beyond the lines and grades shown on the Plans or established by the District or any changes in, additions to, or deductions from the work done without written authority from the District will be considered as unauthorized and will not be paid for. Work so done will be ordered remedied, removed, or replaced by the District or the District's Representative at the Contractor's sole cost and expense.

Upon failure on the part of Contractor to comply promptly with any order of the District or District's Representative made under the provisions of this article the District or District's Representative shall have authority to cause all non-conforming materials, rejected work, or unauthorized work to be remedied, removed, or replaced at the Contactor's sole cost and expense and to deduct all fees and costs incurred by the District including staff time from any monies due or to become due the Contractor under this contract.

5-14 ONE-YEAR GUARANTEE

Besides guarantees required elsewhere, the Contractor shall and hereby does guarantee all work, materials, parts, equipment and supplies to be free from all defects due to faulty materials or workmanship for a period of one-year after the date of formal acceptance of the work by the Board of Directors of District except for any portion of the work that is utilized or placed into service by the District in accordance with the provisions of Article 6-6 USE OF COMPLETED PORTIONS. The guarantee period for portions of the work so utilized or placed into service shall be one-year commencing on the date of the written notification to the Contractor described in Article 6-6 USE OF COMPLETED PORTIONS. The Contractor shall repair or remove and replace any and all such work, together with any other work which may be displaced in so doing, that is found to be defective by District in workmanship and/or materials, equipment, parts or supplies within the one-year period, at the Contractor's sole cost and expense, ordinary wear and tear and unusual abuse or neglect excepted. In the event the Contractor fails to correct all defects identified by the District

within seven (7) consecutive days after written notice of the defects from District, the District is hereby authorized to proceed to have the defects remedied and made good at the sole expense of the Contractor who hereby agrees to pay the cost and charges therefore immediately on demand. Such action by the District will not relieve the Contractor of the guarantees required by this article or elsewhere in the Contract Documents.

The Performance Bond and the Payment Bond shall continue in full force and effect for the guarantee period.

If, in the opinion of the District, defective work creates a dangerous condition or requires immediate correction or attention to prevent further loss to the District or to prevent interruption of operations of the District, the District may require the Contractor to correct the defects in a shorter period of time determined solely by District. If the Contractor does not correct the defects within the time specified by District, District may proceed to make such corrections or provide such attention; and all fees and costs of such correction or attention shall be charged against the Contractor. Such action by the District will not relieve the Contractor of the guarantees required by this article or elsewhere in the Contract Documents.

This article does not in any way limit the guarantee on any items for which a longer guaranty is specified or on any items for which a manufacturer or supplier gives a guarantee for a longer period. The Contractor agrees to act as a co-guarantor with such manufacturer or supplier and shall furnish the District all appropriate guarantee or warranty certificates upon completion of the project. No guarantee period whether provided for in this article or elsewhere in this contract shall in any way limit the liability of the Contractor or his subcontractors, materialmen, suppliers, sureties or insurers for the full statutory periods provided by California law.

SECTION 6 PROSECUTION AND PROGRESS

6-1 CONTRACTOR'S LIABILITY

The Contractor shall be solely liable and responsible to the District for all acts and omissions of the Contractor's directors, officers, agents, Districts, and employees and for all acts and omissions of all subcontractors, materialmen and suppliers and their respective directors, officers, managers, members, agents, Districts and employees performing any of the work or providing any materials or supplies included as part of the work. The District, the Engineer/Architect and the District's Representative shall not be liable in any way for any acts or omissions of the Contractor, any subcontractors, any materialmen, any suppliers, or any of their respective directors, officers, managers, members, agents, employees or Districts. Nothing contained in the Contract Documents shall create any contractual relationship between any subcontractor materialman, or supplier and the District. The Contactor shall bind all subcontractors to all terms of the Contract Documents for all work being performed by those subcontractors.

The divisions and sections of the Specifications and the identifications of any Drawings shall not control the Contractor in dividing the work among subcontractors.

6-2 ASSIGNMENT

The performance of the contract may not be assigned, except upon the written consent of the District. Consent will not be given to any proposed assignment which would relieve the original

Contractor or his sureties or insurers of their responsibilities under the contract, nor will the District consent to any assignment of a part of the work under the contract.

Upon obtaining a prior written consent of the District, the Contractor may assign moneys due or to become due him under the contract, to the extent permitted by law, but any assignment of moneys shall be subject to all proper setoffs in favor of the District and to all deductions provided for in the contract, and particularly all money withheld, whether assigned or not, shall be subject to being used by the District for the completion of the work in the event that the Contractor should be in default therein.

No assignment of this contract will be approved unless it shall contain a provision that the funds to be paid to the assignee under the assignment are subject to a prior lien for services rendered or materials supplied for performance of the work called for under the contract in favor of all persons, firms, or corporations rendering such services or supplying such materials and that the District may withhold funds due until all work required by the Contract Documents is completed to the District's satisfaction.

In the event of bankruptcy of the Contractor, whether voluntary or involuntary, this Agreement may be automatically terminated at the election of the District. The election to terminate in accordance with this provision shall be deemed effective as of the date the District mails notice of termination in accordance with this section to the Contractor at the Contractor's last known address without any further action of any party. Upon termination in accordance with this provision, the Contractor shall be entitled to no further payments over and above the reasonable value of the actual Work completed as of the date the termination notice is mailed.

6-3 CONSTRUCTION SCHEDULE AND PROSECUTION OF WORK

NOTE: For additional Project Schedule Requirements reference Section 013240 Progress Schedule and reports

6-3 CONSTRUCTION SCHEDULE AND COMMENCEMENT OF WORK. Except as otherwise provided herein and unless otherwise prohibited by permits from other agencies as may be required by law the Contractor shall begin work within seven (10) calendar days after receipt of the "Notice to Proceed".

6-3.1 Pre-Construction Meeting. After, or upon, notification of contract award, the Construction Manager/District’s Representative will set the time and location for the Preconstruction Meeting. Attendance of the Contractor’s management personnel responsible for the management, administration, and execution of the project is mandatory for the meeting to be convened. Failure of the Contractor to have the Contractor’s responsible project personnel or subcontractor’s representatives attend the Preconstruction Meeting will be grounds for default by Contractor. No separate payment will be made for the Contractor’s attendance at the meeting. The notice to proceed will only be issued on or after the completion of the preconstruction meeting.

6-3.1.1 Baseline Construction Schedule Submittal. The Contractor shall submit the Baseline Construction Schedule per the submittal requirements of Section 013300 & 013240. The submittal of the Baseline Construction Schedule shall include each item and element of Sections 6-3.2 through 6-3.2.9 and shall be on hard (paper) copy and electronic media conforming to Section 6-3.3.3 Electronic Media.

6-3.2 Preparation and Review of the Baseline Construction Schedule. The Contractor shall prepare the Baseline Construction Schedule as a Critical Path Method (CPM) Schedule in the precedence diagram method (activity-on-node) format. The Baseline Construction Schedule shall depict a workable plan showing the sequence, duration, and interdependence of all activities required to represent the complete performance of all project work as well as periods where work is precluded. The Baseline Construction Schedule shall begin with the projected date of issuance of the notice to proceed and conclude with the date of final completion per the contract duration. The Baseline Construction Schedule shall include detail of all project phasing, staging, and sequencing, including all milestones necessary to define beginning and ending of each phase or stage.

6-3.2.1 Time-Scaled Network Diagram. As a part of the Baseline Construction Schedule the Contractor shall prepare and submit to the District's Representative a complete time-scaled network diagram showing all of the activities, logic relationships, and milestones comprising the schedule.

6-3.2.2 Tabular Listing. As a part of the Baseline Construction Schedule the Contractor shall prepare and submit to the District's Representative a tabular listing of all of the activities, showing for each activity the identification number, the description, the duration, the early start, the early finish, the late start, the late finish, the total float, and all predecessor and successor activities for the activity described.

6-3.2.3 Bar Chart. As a part of the Baseline Construction Schedule the Contractor shall prepare and submit to the District's Representative a chart showing individual tasks and their durations arranged with the tasks on the vertical axis and duration on the horizontal axis. The bar chart shall use differing texture patterns or distinctive line types to show the critical path.

6-3.2.4 Schedule Software and Project Management Software. The Contractor shall use commercially available software equal to the latest version of Primavera (P6) and compatible with Windows to prepare the Baseline Construction Schedule and all updates thereto. OMWD will also use ProCore project management software for these projects. The Contractor shall submit to OMWD all data files via ProCore with all network information contained thereon, in a format readable by Primavera.

OMWD will coordinate one ProCore training session for the Contractor if requested prior to submittal of the first baseline schedule. Any classes shall be presented on Mondays through Thursdays between the hours of 8:00 a.m. and 5:00 p.m. The on-site training shall be held at 1966 Olivenhain Rd, Encinitas, California. The dates and times of the on-site training shall be submitted to the District's Representative for approval five working days before the start of the on-site training. The on-site training shall be completed prior to the submittal of the first Baseline Construction Schedule.

6-3.2.5 Schedule Activities. Except for submittal activities, activity durations shall not be shorter than 1 working day. The Baseline Construction Schedule shall include 50 or more activities, including submittals, interfaces between utility companies and other agencies, project milestones and equipment and material deliveries. The number of activities will be sufficient, in the judgment of the District's Representative, to communicate the Contractor's plan for project execution, to accurately describe the project work, and to allow monitoring and evaluation of progress and of

time impacts. Each activity's description shall accurately define the work planned for the activity and each activity shall have recognizable beginning and end points.

6-3.2.6 Float. Float or slack time within the schedule is available without charge or compensation to whatever party or contingency first exhausts it.

6-3.2.7 Restraints to Activities. Any submittals, utility interfaces, or any furnishing of OMWDsupplied materials, equipment, or services, which may impact any activity's construction shall be shown as a restraint to those activities. Time periods to accommodate the review and correction of submittals shall be included in the schedule.

6-3.2.8 Late Completion. A Baseline Construction Schedule showing a project duration longer than the specified contract duration will not be acceptable and will be grounds for determination of default by Contractor.

6-3.2.9 Early Completion. The Baseline Construction Schedule will show the Contractor's plan to support and maintain the project for the entire contractual time span of the project. Should the Contractor propose a project duration shorter than contract duration, a complete Baseline Construction Schedule must be submitted, reflecting the shorter duration, in complete accordance with all schedule requirements of Section 6-3. The District's Representative may choose to accept the Contractor's proposal of a project duration shorter than the duration specified; provided OMWD is satisfied the shortened Baseline Construction Schedule is reasonable and OMWD and all other entities, public and private, which interface with the project are able to support the provisions of the shortened Baseline Construction Schedule. OMWD's acceptance of a shortened duration project will be confirmed through the execution of a contract change order revising the project duration and implementing all contractual requirements including liquidated damages in accordance with the revised duration.

6-3.2.10 District's Representative's Review. The Construction Schedule is subject to the review of the District's Representative. The District's Representatives determination that the Baseline Construction Schedule proposed by the Contractor complies with the requirements of these supplemental provisions shall be a condition precedent to issuance of the Notice to Proceed by the Districts Representative. If The Districts Representative determines that the Construction Schedule does not meet the requirements of these specifications the Contractor shall correct the Construction Schedule to meet these specifications and resubmit it to the Districts Representative. Failure of the Contractor to obtain The Districts Representative's determination that the initial Construction Schedule proposed by the Contractor complies with the requirements of these supplemental provisions within thirty (30) working days after the date of the preconstruction meeting may be grounds for termination of the contract. Days used by the Districts Representative to review the initial Construction Schedule will not be included in the 30 working days.

The Districts Representative will review and return to the Contractor, with any comments, the Baseline Construction Schedule within 15 working days of submittal. The Baseline Construction Schedule will be returned marked as per Sections 6-3.2.10.1 through 6-3.2.10.3.

6-3.2.10.1 "Accepted." The Contractor may proceed with the project work upon issuance of the Notice to Proceed, and will receive payment.

6-3.2.10.2 “Accepted with Comments.” The Contractor may proceed with the project work upon issuance of the Notice to Proceed. The Contractor must resubmit the schedule incorporating the comments prior to receipt of payment.

6-3.2.10.3 “Not Accepted.” The Contractor must resubmit the schedule incorporating the corrections and changes of the comments prior to receipt of payment. The Notice to Proceed will not be issued by The District’s Representative if the changes of the comments are not submitted as required hereinbefore and marked “Accepted” or “Accepted with Comments” by the District’s Representative. The Contractor, at the sole option of the District’s Representative, may be considered as having defaulted the contract under the provisions of the contract if the changes of the comments are not submitted as required hereinbefore and marked “Accepted” by The District’s Representative.

6-3.3 Preparation of Schedule Updates and Revisions. The Contractor shall meet with the District’s Representative during the last week of each month to agree upon each activity’s schedule status and shall submit monthly updates of the Baseline Construction Schedule confirming the agreements no later than the fifth working day of the following month. The monthly update will be submitted on hard (paper) copy and electronic media conforming to Section 6-3.3.3 Electronic Media per the submittal requirements of Section 013300 and will include each item and element of Sections 6-3.2 through 6-3.2.9 and 6-3.3.1 through 6-3.3.6.

6-3.3.1 Actual Activity Dates. The actual dates each activity was started and/or completed during the month. After first reporting an actual date, the Contractor shall not change that actual date in later updates without specific notification to The District’s Representative with the update.

6-3.3.2 Activity Percent Complete. For each activity underway at the end of the month, the Contractor shall report the percentage determined by The District’s Representative as complete for the activity.

6-3.3.3 Electronic Media. The schedule data files shall be submitted using approve project management software as described in section 6-3.2.4. “Schedule Software and Project Management Software”. The schedule data files shall be readable by the software specified in Section 6-3.2.4 “Schedule Software and Project Management Software” and shall be free of file locking, encryption or any other protocol that would impede full access of all data stored on it.

6-3.3.4 List of Changes. A list of all changes made to the activities or to the interconnecting logic, with an explanation for each change.

6-3.3.5 Change Orders. Each monthly update will include the addition of the network revisions reflecting the change orders approved in the previous month. The network revisions will be as agreed upon during the review and acceptance of the Contractor’s change orders.

6-3.3.6 Bar Chart. Each monthly update will include a chart showing individual tasks and their durations arranged with the tasks on the vertical axis and duration on the horizontal axis. The bar chart shall use differing texture patterns or distinctive line types to show the critical path.

6-3.4 District’s Representative’s Review of Updated Construction Schedule. The District’s Representative will review and return the Updated Construction Schedule to the Contractor, with any comments, within 5 working days of submittal. The Updated Construction Schedule will be returned marked as per Sections 6-3.4.1 through 6-3.4.3. Any Updated Construction Schedule

marked “Accepted with Comments” or “Not Accepted” by the District’s Representative will be returned to the Contractor for correction. Upon resubmittal the District’s Representative will review and return the resubmitted Updated Construction Schedule to the Contractor, with any comments, within 5 working days. Failure of the Contractor to submit a monthly updated construction schedule will invoke the same consequences as the District’s Representative returning a monthly updated construction schedule marked “Not Accepted”.

6-3.4.1 “Accepted.” The Contractor may proceed with the project work, and will receive payment for the schedule.

6-3.4.2 “Accepted with Comments.” The Contractor may proceed with the project work. The Contractor must resubmit the Updated Construction Schedule to the District’s Representative incorporating the corrections and changes noted in the District’s Representative’s comments prior to receipt of payment.

6-3.4.3 “Not Accepted.” The Contractor must resubmit the Updated Construction Schedule to the District’s Representative incorporating the corrections and changes noted in the District’s Representative’s comments prior to receipt of payment. The Contractor, at the sole option of the District’s Representative, may be considered as having defaulted the contract under the provisions of the contract if the changes of the comments are not submitted and marked “Accepted” by the District’s Representative before the last day of the month in which the Updated Construction Schedule is due. If the Contractor fails to submit the corrected Updated Construction Schedule as required herein the Contractor may elect to proceed with the project at its own risk. Should the Contractor elect not to proceed with the project, any resulting delay, impact, or disruption to the project will be the Contractor’s responsibility.

6-3.5 Late Completion or Milestone Dates. Should the Schedule Update indicate a completion or contractually required milestone date later than the properly adjusted contract or milestone duration, OMWD may withhold Liquidated Damages for the number of days late. Should a subsequent “Accepted” Schedule Update remove all or a portion of the delay, all or the allocated portion of the previously held Liquidated Damages shall be released in the monthly payment to the Contractor immediately following the “Accepted” schedule.

6-3.6 Interim Revisions. Should the actual or projected progress of the work become substantially different from that depicted in the Project Schedule, independently of and prior to the next monthly update, the Contractor will submit a revised Baseline Construction Schedule, with a list and explanation of each change made to the schedule. The Revised Construction Schedule will be submitted per the submittal requirements of Section 013300 and per the schedule review and acceptance requirements of Section 6-3, including but not limited to the acceptance and payment provisions. As used in this section “substantially different” means a time variance greater than 5 percent of the number of days of duration for the project.

6-3.7 Final Schedule Update. The Contractor shall prepare and submit a final schedule update when one hundred percent of the construction work is completed. The Contractor’s Final Schedule Update must accurately represent the actual dates for all activities. The final schedule update shall be prepared and reviewed per Sections 6-3.3 Preparation of Schedule Updates and Revisions and 6-3. 4 District’s Representatives Review of Updated Construction Schedule. Acceptance of the final schedule update is required for completion of the project and release of any and all funds retained.

6-3.8 Measurement and Payment of Construction Schedule. The Contractor's preparation, revision and maintenance of the Construction Schedule are incidental to the work and no separate payment will be made therefore.

6-3.9 PROSECUTION OF WORK. To minimize public inconvenience and possible hazard and to restore street and other work areas to their original condition and state of usefulness as soon as practicable, the Contractor shall diligently prosecute the Work to completion. If the District's Representative determines that the Contractor is failing to prosecute the Work to the proper extent, the Contractor shall, upon orders from the District's Representative, immediately take steps to remedy the situation. All costs of prosecuting the Work as described herein shall be included in the Contractor's Bid. Should the Contractor fail to take the necessary steps to fully accomplish said purposes, after orders of the District's Representative, the District's Representative may suspend the work in whole or part, until the Contractor takes said steps. As soon as possible under the provisions of the Specifications, the Contractor shall backfill all excavations and restore to usefulness all improvements existing prior to the start of the Work. If Work is suspended through no fault of the Agency, all expenses and losses incurred by the Contractor during such suspensions shall be borne by the Contractor. If the Contractor fails to properly provide for public safety, traffic, and protection of the Work during periods of suspension, OMWD may elect to do so, and deduct the cost thereof from monies due the Contractor. Such actions will not relieve the Contractor from liability.

6-3.10 Written Notice and Report. The Contractor shall provide written notice to the District's Representative within two hours of the beginning of any period that the Contractor has placed any workers or equipment on standby for any reason that the Contractor has determined to be caused by OMWDor by any organization that OMWD may otherwise be obligated by. The Contractor shall provide continuing daily written notice to the District's Representative, each working day, throughout the duration of such period of delay. The initial and continuing written notices shall include the classification of each workman and supervisor and the make and model of each piece of equipment placed on standby, the cumulative duration of the standby, the Contractor's opinion of the cause of the delay and a cogent explanation of why the Contractor could not avoid the delay by reasonable means. Should the Contractor fail to provide the notice(s) required by this section the Contractor agrees that no delay has occurred and that it will not submit any claim(s) therefore.

6-3.11 Contract Time Accounting. The District's Representative will make a daily determination of each working day to be charged against the Contract time. These determinations will be discussed and the Contractor will be furnished a periodic statement showing allowable number of working days of Contract time, as adjusted, at the beginning of the reporting period. The statement will also indicate the number of working days charged during the reporting period and the number of working days of Contract time remaining. If the Contractor does not agree with the statement, it shall file a written protest within 15 days after receipt, setting forth the facts of the protest. Otherwise, the statement will be deemed to have been accepted.

6-4 TIME FOR COMPLETION AND FORFEITURE DUE TO DELAY

The Contractor shall complete all or any designated portion of the work called for under the contract within the time set forth in Supplemental Provisions. Time is of the essence in this contract.

Failure of the Contractor to perform any covenant or condition contained in the Contract Documents within the time period specified shall constitute a material breach of this contract entitling the District to terminate the contract unless the Contractor applies for, and receives, an extension of time in accordance with the procedures set forth in this article and Article 6-5 EXTENSION OF TIME.

Failure of the District to insist upon the performance of any covenant or condition within the time period specified in the Contract Documents shall not constitute a waiver of the Contractor's duty to complete performance within the designated periods unless the waiver is in writing.

The District's agreement to waive a specific time provision or to extend the time for performance shall not constitute a waiver of any other time provisions contained in the Contract Documents. Failure of the Contractor to complete performance promptly within the additional time authorized in the waiver or extension of time agreement shall constitute a material breach of this contract entitling the District to terminate.

In accordance with Government Code 53069.85, Contractor agrees to forfeit and pay District the amount per day set forth in the Special Provisions for each and every day of delay which shall be deducted from any payments due or to become due the Contractor.

The Contractor shall not be deemed in breach of this contract and no forfeiture due to delay shall be made because of any delays in the completion of the work due to unforeseeable causes beyond the control and without the fault or negligence of the Contractor provided the Contractor requests an extension of time in accordance with the procedures set forth in this article and Article 6-5 EXTENSION OF TIME. Unforeseeable causes of delay beyond the control of Contractor shall include acts of God, acts of a public enemy, acts of the government, acts of the District, or acts of another contractor in the performance of a contract with the District, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and weather, or delays of subcontractors due to such causes, or delays caused by failure of the District or the District of a utility to provide for removal or relocation of existing utility facilities. Delays caused by actions or neglect of Contractor or his agents, servants, employees, officers, subcontractors, directors, or of any party contracting to perform part or all of the work or to supply any equipment or materials shall not be excusable delays. Excusable delays (those beyond Contractor's control) shall not entitle the Contractor to any additional compensation. The sole remedy of the Contractor shall be to seek an extension of time.

6-5 EXTENSION OF TIME

The Contractor shall not be entitled to any increase in the contract price as a result of the District's approval of any extension of time except to the extent that the District approves an increase in the contract price on a properly executed Change Order.

The time specified for completion of all of the work or any part of the work may be extended only by a written change order executed by the District or other written form executed by the District.

Requests for an extension of time must be delivered to the District's Representative within ten consecutive calendar days following the date of the occurrence which caused the delay. The request must be submitted in writing and must state the cause of the delay, the date of the occurrence causing the delay, and the amount of additional time requested. Requests for extensions of time shall be supported by all evidence reasonably available or known to the Contractor which would support the extension of time requested. Requests for extensions of time

failing to include the information specified in this article and requests for extensions of time which are not received within the time specified above shall result in the forfeiture of the Contractor's right to receive any extension of time requested.

If the Contractor is requesting an extension of time because of weather, he shall supply daily written reports to the District's Representative describing such weather and the work which could not be performed that day because of such weather or conditions resulting therefrom and which he otherwise would have performed.

The District's acceptance of the daily reports shall not be deemed an admission of the Contractor's right to receive an extension of time or a waiver of the District's right to strictly enforce the time provisions contained in the Contract Documents.

When the Contractor has submitted a request for an extension of time in accordance with the procedures of this article and Article 6-4 TIME FOR COMPLETION AND FORFEITURE DUE TO DELAY, the District will ascertain the facts and extent the delay and extend the time for completing the work if, in its judgment, the findings of fact justify such an extension, and its findings of facts thereon shall be final and conclusive. An extension of time may be granted by the District after the expiration of the time originally fixed in the contract or as previously extended, and the extension so granted shall be deemed to commence and be effective from the date of such expiration.

Any extension of time shall not release the sureties upon any bond required under the contract.

6-6 USE OF COMPLETED PORTIONS

When the work or any portion of it is sufficiently complete to be utilized or placed into service, the District shall have the right upon written notification to the Contractor to utilize such portions of the work and to place the operable portions into service and to operate same.

Upon said notice and commencement of utilization or operation by the District, the Contractor shall be relieved of the duty of maintaining the portions so utilized or placed into operation; provided, however, that nothing in this article shall be construed as relieving the Contractor of the full responsibility for completing the work in its entirety, for making good defective work and materials, for protecting the work from damage, and for being responsible for damage and for the work as set forth in the General Provisions and other Contract Documents nor shall such action by the District be deemed completion and acceptance, and such action shall not relieve the Contractor, his sureties, or insurers of the provisions of SECTION 8 CONTRACTOR'S INSURANCE, of Article 7-12 INDEMNITY, and of Article 5-14 ONE-YEAR GUARANTEE.

6-7 TIME OF COMPLETION

6-7.1 General. The Contractor shall complete the Work within the time set forth in the Contract. The Contractor shall complete each portion of the Work within such time as set forth in the Contract for such portion. The time of completion of the Contract shall be expressed in working days. The Contractor shall diligently prosecute the work to completion within ____ working days after the starting date specified in the Notice to Proceed.

6-7.2 Working Day. A working day is any day within the period between the start of the Contract time as defined in Section 6-1 and the date provided for completion, or upon field acceptance by the Engineer for all work provided for in the Contract, whichever occurs first, other than:

1. Saturday,

2. Sunday,

3. Any day designated as a holiday by OMWD,

4. Any other day designated as a holiday in a Master Labor Agreement entered into by the Contractor or on behalf of the Contractor as an eligible member of a contractor association,

5. Unless otherwise approved in writing by OMWD, the hours of work shall be between the hours of 7:00 a.m. and 4:00 p.m. on Mondays through Fridays, excluding OMWD holidays. The Contractor shall obtain the written approval of the District's Representative if the Contractor desires to work outside said hours or at any time during weekends and/or holidays. This written permission must be obtained at least 48 hours prior to such work. The District's Representative/OMWD may approve work outside the hours and/or days stated herein when, in his/her sole opinion, such work conducted by the Contractor is beneficial to the best interests of OMWD. The Contractor shall pay the inspection costs of such work.

6-8 COMPLETION, ACCEPTANCE, AND WARRANTY.

Note: this section shall be supplemented with Technical Specifications including Section 017700 – Close out Procedures.

The Work will be inspected by the District's Representative for acceptance upon receipt of the Contractor's written assertion that the Work has been completed. The District's Representative will not accept the Work or any portion of the Work before all of the Work is completed and all outstanding deficiencies that may exist are corrected by the Contractor and the

District's Representative is satisfied that all the materials and workmanship, and all other features of the Work, meet the requirements of all of the specifications for the Work. Use, temporary, interim or permanent, of all, or portions of, the Work does not constitute acceptance of the Work. If, in the District's Representative's judgment, the Work has been completed and is ready for acceptance the District's Representative will so certify to the Board. Upon such certification by the District's Representative the Board may accept the completed Work. Upon the Board's acceptance of the Work the District's Representative will cause a "Notice of Completion" to be filed in the office of the San Diego County Recorder. The date of recordation shall be the date of completion of the Work.

All work shall be warranted for one (1) year after recordation of the "Notice of Completion" and any faulty work or materials discovered during the warranty period shall be repaired or replaced by the Contractor, at its expense. Twenty-five percent of the faithful performance bond shall be retained as a warranty bond for the one year warranty period. The Contractor shall replace or repair any such defective work in a manner satisfactory to the District's Representative, after notice to do so from the District's Representative, and within the time specified in the notice. If the Contractor fails to make such replacement or repairs within the time specified in the notice, OMWD may perform this work and the Contractor's sureties shall be liable for the cost thereof.

6-9 LIQUIDATED DAMAGES. Failure of the Contractor to complete the Work within the time allowed will result in damages being sustained by OMWD. For each consecutive calendar day in excess of the time specified for completion of Work, the Contractor shall pay OMWD, or have

withheld monies due it, the sum of Two Thousand Dollars ($2,000.00). Such sum is liquidated damages and shall not be construed as a penalty, and may be deducted from payments due the Contractor if such delay occurs. Execution of the Contract shall constitute agreement by OMWD and Contractor that $2,000 per day is the minimum value of costs and actual damages caused by the Contractor to complete the Work within the allotted time. Any progress payments made after the specified completion date shall not constitute a waiver of this paragraph or of any damages.

SECTION 7 LEGAL RELATIONS AND RESPONSIBILITIES

7-1 OBSERVING LAWS AND ORDINANCES

The Contractor shall keep himself fully informed of all existing and future laws, ordinances, and regulations which in any manner affect those engaged or employed to perform any of the work or providing any materials or supplies or which in any way affect the conduct of the work and of all statutes, laws, rules, regulations, orders, decisions, and decrees of any court or governmental agency having any jurisdiction or authority over all or any of the work or the conduct of the work, including all federal, state and local safety rules, regulations, and orders. This shall expressly include all ordinances, rules, regulations, and requirements applying to the work or the conduct of the work enacted by the District. If any discrepancy or inconsistency is discovered in the Plans, Specifications, or contract for the work the relation to any such law, rule, regulation, ordinance, order or decree, the Contractor shall forthwith report the same to the District's Representative in writing and cease operations on that part of the work until the District's Representative has given him appropriate instructions as provided for Article 5-7 ERRORS OR DISCREPANCIES NOTED BY CONTRACTOR.

The Contractor shall at all times observe and comply with and shall cause all of his directors, officers, agents, managers, members, Districts, employees, subcontractors, materialmen and suppliers to observe and comply with all existing and future laws, ordinances, regulations, orders, and decrees, and shall hold harmless, indemnify, and defend the District, the Engineer/Architect, the District's Representative, and their consultants, and each of their directors, officers, employees, and agents from and against any and all liability, claims, causes of action, damages, losses, claim fees and costs, staff time, expenses, fees, and costs, including all costs of defense and attorneys' fees, arising from or based on the violation any such law, ordinance, regulation, order, or decree by the Contractor, any subcontractor, any materialman or supplier or any of their respective directors, officers, agents, managers, members, Districts, or employees.

7-2 PERMITS AND LICENSES

The Contractor shall be solely liable and responsible for securing all permits and licenses necessary to perform all of the work, for paying all fees and charges necessary to secure any such permit, license, or approval, and for giving all notices which are appropriate or necessary to the proper and safe prosecution of the work. The District shall have no obligation to procure any permit, license, or approval necessary to perform all or any portion of the work. The Contractor shall also be solely liable and responsible for fully complying with all requirements of any permits, licenses or approvals pertaining to all or any of the work. The failure of Contractor to strictly comply with all requirements of any permits, licenses, or approvals applying to all or any of the work shall constitute a material breach of the contract.

7-3 INVENTIONS, PATENTS, AND COPYRIGHTS

The Contractor shall pay all royalties and assume all costs arising from the use of any invention, design, process, materials, equipment, product, or device which is the subject of patent rights or copyrights.

The Contractor shall hold harmless, indemnify, and defend the District, the Engineer/Architect, the District's Representative, and their consultants, and each of their directors, officers, employees, and agents from and against all claims, damages, losses, expenses, and other costs, including costs of defense and attorneys' fees, arising out of any infringement of patent rights or copyrights incident to the use in the performance of the work or resulting from the incorporation in the work of any invention, design, process, materials, equipment, product or device, and shall defend all such claims in connection with any alleged infringement of such rights.

7-4 PUBLIC CONVENIENCE AND SAFETY

The Contractor shall conduct his operations at all times in a manner that creates the least possible obstruction and inconvenience to the public, and he shall have under construction no greater length or amount of work than he can prosecute properly with due regard to the rights of the public and all property Districts in the area of the work. The Contractor shall be solely liable and responsible for ensuring that all of the work is conducted at all times in a safe manner that does not injure or damage any workers, members of the public or private or public property.

Convenient access to driveways, houses, and buildings along the line of work shall be maintained and temporary crossings shall be provided and maintained in good condition at all times during performance of the work. Not more than one crossing or intersecting street or road shall be closed at any one time.

The Contractor shall provide and maintain such fences, barriers, directional signs, lights, and flagmen as are necessary to give adequate warning to the public at all times of any conditions to be encountered as a result of the work and to give directions to the public. The Contractor shall ensure that all unsafe conditions created by the work are promptly remedied and that any unsafe conditions created by the work are protected by barriers, safeguards and warnings preventing vehicular, bicycle or walking access in any unsafe areas.

It shall also be the sole responsibility of the Contractor to ensure that the work is performed at all times in a manner that does not injure or harm any person or injure or damage any real or personal property of any person or entity.

The Contractor shall perform the work only the areas expressly identified on the drawings. The Contractor must operate entirely within the limits of the project site. No equipment or materials may be parked, stockpiled, or stored outside the project site or designated Contractor staging areas. The Contractor shall not enter onto, occupy, or disturb any privately owned land or any public or private habitat not scheduled for removal in the approved plans with any men, tools, materials, dirt, or equipment except with the prior express written consent of the District and all Districts of any privately-owned land. The Contractor has been advised, and understands, that any request to enter onto, occupy, or disturb any privately-owned land or habitat must be submitted to the general manager of the District for written approval prior to entering onto, occupying, or disturbing any privately-owned land or public or private habitat for any purpose. The violation of this section by Contractor shall constitute a material breach of this contract.

The Contractor and any subcontractors, materialmen, or suppliers shall not, at any time, conduct any of the work in any manner that creates any public or private nuisance or trespass on the land of any private party or public agency. It shall be the sole responsibility of Contractor to conduct the work at all times in a manner that avoids creating any nuisance or trespass on any real or personal property owned by any private party or public agency.

The Contractor hereby agrees to indemnify, defend, and hold harmless the District, Engineer/Architect, the District's Representative, and their consultants, and each of their directors, officers, employees, and agents from and against any and all liability, claims, causes of action, actions, damages, losses, fees, costs, or expenses, of whatever type or nature, including all costs of defense, attorneys' fees, and claim fees or costs, arising out of or resulting from performance of any of the work by the Contractor, its subcontractors, materialmen, or suppliers, or their respective directors, officers, agents, managers, members, Districts, or employees which results in any injury or damage to persons or property including wrongful death regardless of whether or not such claim, cause of action, damage, loss or expense is caused in whole or in part by the negligence, active or passive, of District, the Engineer/Architect, or the District's Representative excepting only those claims and causes of action caused by the sole active negligence or intentional misconduct of the District, the Engineer/Architect, or the District's Representative. From and after the date of submission of any claim or demand to District, the indemnified parties shall recover from the Contractor all attorneys fees, expert fees and costs, claim costs, and staff time involved in handling the claim or any subsequent action on the claim at the standard hourly rates for staff handling the claim or action.

7-5 RESPONSIBILITY FOR LOSS, DAMAGE, OR INJURIES

The Contractor shall be solely responsible for all liability, claims, causes of action, demands, losses, costs, fees, expenses, and damages, of whatever type or nature, from any cause arising out of or resulting from or in connection with the performance of any of the work, excepting only those claims and causes of action caused solely and exclusively by the active negligence or intentional misconduct of the District, the Engineer/Architect, the District's Representative, or their consultants, directors, officers, employees, and agents. This exclusive responsibility shall extend to all liability, claims, causes of action, demands, losses, costs, fees, and expenses, of whatever type or nature, after completion of the work as well as during the progress of the work.

In the event any hazardous or toxic materials, including but not limited to asbestos, are utilized in construction or hazardous or toxic materials are otherwise encountered during construction, the Contractor shall take all appropriate precautions to protect persons and property and shall comply with all applicable regulations for the installation and handling of such hazardous or toxic materials. The Contractor is solely responsible for protection of all persons and property that could be affected by any construction or work and for the proper handling and disposal of all such hazardous or toxic materials.

Contractor has been advised that the District has Material Safety Data Sheets (hereinafter "MSDS") available for review on any hazardous chemical they may be exposed to while working in or around District facilities. It shall be the sole responsibility of Contractor to request and inspect these MSDS forms prior to commencement of any work and to alert all employees and agents of Contractor of potential hazardous waste exposure from District facilities. It shall be the sole responsibility of Contractor to provide the District's Representative with completed MSDS forms for all hazardous or toxic substances that the Contractor utilizes as part of the work prior to the use of any hazardous or

toxic substances and to provide these MSDS forms to the Contractor's agents and employees prior to their exposure to any hazardous or toxic substance utilized by the Contractor. Further, Contractor shall comply with all provisions contained in General Industry Safety Orders Section 5194 of Title 8 of the California Administrative Code (the California Hazardous Communication Regulation) at all times during performance of the work.

7-6 CONTRACTOR'S RESPONSIBILITY FOR THE WORK

Until formal acceptance of the work by action of the Board of Directors of District, the Contractor shall be solely liable and responsible for all aspects of the work and all equipment materials and supplies to be provided as part of the work (including materials for which he has received partial payment or materials which have been furnished by the District) and shall bear the sole risk of injury, loss, or damage to any of the work, or any materials, supplies, or equipment being used or provided in conjunction with the work from any act of nature or the elements and from all other causes, whether arising from the execution or from the non-execution of the work.

The Contractor, at the Contractor's sole cost and expense, shall rebuild, repair, restore, and make good all injuries, losses, or damages whatsoever to any portion of the work or to any materials, equipment, or supplies from any cause before completion and formal acceptance of the work by formal action of the Board of Directors of District and shall solely bear the expense thereof. Where the District or the District's Representative determines it is necessary to protect the work or materials from any damage or injury, the Contractor shall at his sole expense provide suitable drainage and erect any additional structures and take all additional protective actions determined necessary or appropriate by either the District or the District's Representative to protect the work or materials from further damage or injury. The suspension of the work or the granting of an extension of time from any cause whatsoever shall not relieve the Contractor of his sole responsibility for the work, materials, or equipment as specified herein.

In an emergency affecting the safety of life or property, including any adjoining property, the Contractor, without special instructions or authorizations, shall promptly act to prevent such threatened loss or injury. The Contractor shall also promptly implement any and all directions given by the District or the District's Representative to protect the safety of life or property during any emergency as determined by District.

Notwithstanding the foregoing provisions of this section, the Contractor shall not be responsible for the cost of repairing or restoring damage to the work where the damage has been determined to have been caused solely by an Act of God in excess of 5% of the contract and amount provided that the work damaged is built in accordance with accepted and applicable building standards and in strict compliance with the Plans and Specifications. For the purpose of this paragraph, "Acts of God" shall include only earthquakes in excess of a magnitude of 3.5 on the Richter Scale and tidal waves. No other actions of the elements, nature, or man shall be treated as Acts of God under this paragraph.

7-7 PRESERVATION OF PROPERTY

The Contractor shall be solely liable and responsible for avoiding injury or damage or interfering with the construction or operation of any and all existing improvements or facilities, all utility facilities, all personal and real property whether owned by any public agency or private party, and any and all trees, shrubbery, landscaping and habitat that are not to be removed. The Contractor

shall be solely liable and responsible for any and all damage and injury to any real or personal property of any person or entity both during and after performance of the work.

All trees, shrubbery, and landscaping that are not to be removed, and all lines, fences, signs, survey markers and monuments, buildings and structures, conduits, pipelines both under or above ground, all sewer and water pipelines or facilities, all highway or street facilities, and any and all other improvements, facilities, habitat, trees, or landscaping within or adjacent to the work not to be removed in the approved plans shall be protected by the Contractor from all injury or damage and the Contractor shall provide and install suitable safeguards to protect all such objects from any injury or damage. If any of the foregoing objects are injured or damaged either during or after performance of the work, they shall be promptly replaced or restored to a condition as good as when the Contractor commenced work or as good as required by the Plans and Specifications if any such objects or are part of the work being performed, at the Contractors sole cost and expense. The District, the Engineer/Architect and the Districts Representative and their respective Directors, officers, agents and employees shall have no liability whatsoever for any injury or damage caused in whole or in part by the actions or omissions of the Contractor, any subcontractor, any materialmen or supplier, or any of their respective directors, officers, agents, employees, managers, or members except where the injury or damage is caused by the sole and exclusive active negligence or intentional misconduct of the District, the Engineer/Architect, the Districts Representative, or their consultants, directors, officers, employees, and agents. The Contractor shall also be solely liable and responsible for any and all damage or injury to any landscaping or habitat caused in whole or in part by the actions or omissions of the Contractor, any subcontractor, any materialmen or supplier, or their respective directors, officers, agents, employees, managers, Districts, or members.

The fact that any pipeline or other underground facility is not shown on the Plans, shall not relieve the Contractor of his responsibility under this section.

In addition to any requirements imposed by law, the Contractor shall shore up, brace, underpin, and protect all foundations, structures, or improvements adjacent to or adjoining the site of the work which are in any way affected by the excavations or by any of the work. Whenever any notice is required to be given by the District or the Contractor at any adjacent or adjoining landDistrict or other party before commencement of any work, this notice shall be given by the Contractor.

7-8 REGIONAL NOTIFICATION CENTER CONTACT

The Contractor, except in an emergency, shall contact the appropriate regional notification center prior to commencing any excavation work. Notify the center at least two working days in advance or up to a maximum of 14 calendar days in advance of any excavation work. The Contractor shall delineate the proposed excavation site with white paint on paved surfaces or with markings such as flags or stakes in unpaved areas. The Contractor shall provide the regional notification center with all job site location information. The regional notification center will assign to the Contractor a Dig Alert Number which validates the Contractor's excavation permit and will notify all of its members having subsurface installations in the area. No excavation shall be commenced and carried out by the Contractor until all existing subsurface installations have been field marked and the District has been given the Dig Alert Number by the Contractor.

Emergency shall be defined as a sudden, unexpected occurrence, involving a clear and imminent danger, demanding immediate action to prevent or mitigate loss of, or damage to, life, health,

property, or essential public services. Emergency includes such occurrences as fire, flood, earthquake, or other soil or geologic movements, as well as such occurrences as riot, accident, or sabotage (Government Code Section 4216).

Subsurface installation means any underground pipeline, conduit, duct, wire, or other structure operated or maintained in or across a public street or public right-of-way (Government Code Section 4216).

7-9 EXCAVATION PLANS FOR WORKER PROTECTION REQUIRED BY LABOR CODE SECTION 6705

If the total amount of the contract is in excess of $25,000, the Contractor shall submit to the District for acceptance, in advance of excavation, a detailed Plans showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of any trench or trenches 5 feet or more in depth. The Plans shall be prepared by a registered civil or structural engineer. As a part of the Plans, a note shall be included stating that the registered civil or structural engineer certifies that the Plans complies with all CAL-OSHA Construction Safety Orders and regulations, or that the registered civil or structural engineer certifies that the Plans is not less effective than the shoring, bracing, sloping, or other provisions of the Safety Orders and regulations.

The District or the Engineer/Architect or their consultants may have made investigations of subsurface conditions in areas where the work is to be performed. If so, these investigations are identified in the Special Provisions and the records of such investigations are available for inspection at the office of the Engineer/Architect. The detailed Plans showing the design of shoring, etc., which the Contractor is required to submit to the District for acceptance in advance of excavation will not be accepted by the District if the Plans are based on subsurface conditions which are more favorable than those revealed by the investigations made by the District or the Engineer/Architect or their consultants; nor will the Plans be accepted if it is based on soils-related design criteria which is less restrictive than the criteria set forth in the report on the aforesaid investigations of subsurface conditions.

The detailed Plans showing the design of shoring, etc., shall include surcharge loads for nearby embankments and structures, for spoil banks, and for construction equipment and other construction loadings. The Plans shall indicate for all trench conditions the minimum horizontal distances from the side of the trench at its top to the near side of the surcharge loads.

Nothing contained in this article shall be construed as relieving the Contractor of the full responsibility for providing shoring, bracing, sloping, or other provisions which are adequate for worker protection.

7-10 SAFETY

In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for conditions of the jobsite, including safety of all persons and property during performance of the work, and the Contractor shall fully comply with all state, federal and other laws, rules, regulations, and orders relating to safety of the public and workers. Also, see technical specification Section 013523 “Project Safety Requirements”.

The right of the Engineer/Architect or the District's Representative to conduct construction review or observation of the Contractor's performance will not include review or observation of the adequacy of the Contractor's safety measures in, on, or near the construction site.

7-11 PERSONAL LIABILITY

No director, officer, employee, or agent of the District, the Engineer/Architect, the District's Representative, or their consultants shall be personally responsible for any liability arising under or by virtue of the contract.

7-12 DEFENSE AND INDEMNITY

The Contractor hereby agrees to indemnify, defend, and hold harmless the District, the Engineer/Architect, and the District's Representative and their respective directors, officers, agents, employees and consultants from and against any and all liability, claims, demands, causes of action, actions, damages, losses, fees, costs, or expenses, of whatever type or nature, including all costs of defense and attorneys' fees, caused in whole or in part, or claimed to be caused in whole or in part, by any act or omission of the Contractor, any subcontractor, any supplier or materialman or any of their respective directors, officers, agents, employees, managers, members, or Districts except only those claims and causes of action caused by the sole active negligence or intentional misconduct of the District, the Engineer/Architect or the District's Representative or their respective agents or employees. This indemnification shall extend to all claims, demands, causes of action, actions, or liability occurring after completion of the project as well as during the progress of the Work.

The Contractor further agrees to indemnify, defend, and hold harmless the District, the Engineer/Architect, and District's Representative and their respective directors, officers, agents, employees, and consultants from and against any and all liability, claims, causes of action, actions, losses, fees, costs, expenses, or damages, of whatever type or nature, including all costs of defense and attorneys' fees, as a result of the failure of or claimed failure of the Contractor to strictly comply with any of the Contractor's obligations under this contract. This indemnity shall expressly include claims by the District for any injury, damages, losses, costs, fees or expenses arising from or related to the failure of the Contractor or any of his subcontractors, materialmen, or suppliers to strictly comply with all terms of this contract or as a result of any improper workmanship or defective supplies or materials.

The Contractor's indemnity obligations as contained in this section shall remain in full force and effect and shall apply whether or not the claim, cause of action, damage, cost, fee, or expense is covered by any applicable insurance policy and regardless of any position that may be taken by any insurance company regarding a defense or coverage for any claim or cause of action asserted. From and after the date any claim or demand is submitted to District covered by these indemnity provisions, the indemnified parties shall be entitled to recover from Contractor all fees and costs incurred in investigating the claim, all staff time involved in handling the claim or any subsequent action on the claim at staff's ordinary hourly rates, all expert fees and costs, all attorneys' fees, and all court costs. The Contractor shall also be solely liable and responsible for paying any and all damages, fees or costs awarded to the claimant as a result of any settlement or final judgment of any cause of action or action covered by these indemnity provisions. This indemnity shall expressly include all wrongful death actions as well as any actions asserting any damage or injury to any persons or real or personal property.

From and after submission of any claim or demand to any of the indemnified parties, the indemnified party shall be entitled to appoint their own independent counsel to represent them and the Contractor shall pay all fees, costs, and expenses of whatever type or nature (including all staff time) incurred by each of the indemnified parties within thirty (30) consecutive days of receipt of a demand for reimbursement of these costs, fees, or expenses by each of the indemnified parties. A breach of this indemnity provision by Contractor shall constitute a material breach of the contract.

7-13 HOURS OF LABOR

The Contractor shall forfeit as a penalty to the District $25 for each worker employed in the execution of the contract by the Contractor or any subcontractor under him for each calendar day during which such worker is required or permitted to work more than 8 hours in any one calendar day and 40 hours in any one calendar week in violation of the provisions of the Labor Code and, in particular, Section 1810 to Section 1815 thereof, inclusive, except that work performed by employees of Contractors in excess of 8 hours per day and 40 hours during any one week shall be permitted upon compensation for all hours worked in excess of 8 hours per day at not less than one and one-half times the basic rate of pay as provided in said Section 1815.

7-14 PREVAILING WAGE

The Contractor shall comply with Labor Code Section 1775. In accordance with said Section 1775, the Contractor shall forfeit as a penalty to the District $50 for each calendar day or portion thereof for each worker paid less than the stipulated prevailing rates for such work or craft in which such worker is employed for any work done under the contract by him or her or by any subcontractor under him or her in violation of the provisions of the Labor Code and in particular, Labor Code Sections 1770 to 1780, inclusive. In addition to said penalty and pursuant to said Section 1775, the difference between such stipulated prevailing wage rates and the amount paid to each worker for each calendar day or portion thereof for which each worker was paid less than the stipulated prevailing wage rate shall be paid to each worker by the Contractor. Pursuant to Labor Code Section 1775, to the extent there is insufficient money due a contractor to cover all penalties forfeited and amounts due, the Division of Labor Standards Enforcement shall be notified of the violation and the Division of Labor Standards Enforcement shall be entitled to maintain an action in any court of competent jurisdiction to recover the penalties and the amounts due pursuant to Labor Code Section 1775.

Section 1776 of the Labor Code requires each contractor and its subcontractors to keep accurate payroll records showing the name, address, social security number, work classification, straight time, and overtime hours worked each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker, or other employee employed by him or her in connection with the work required by these Contract Documents. These payroll records shall be made available for inspection or furnished to all employees, any representative of the District, the Division of Labor Standards Enforcement, and the Division of Apprenticeship Standards of the Department of Industrial Relations. Contractor shall provide a certified copy of these payroll records to any of the aforementioned parties within 10 calendar days after receipt of a written request for these records. Contractor understands that it is the responsibility of the Contractor to ensure that these payroll records are maintained by Contractor and all subcontractors performing the work in accordance with Labor Code Section 1776(h). The payroll records shall be on forms provided by the Division of Labor Standard Enforcement or provide the same information as the information required by this form.

Pursuant to Labor Code Section 1777.1, whenever any contractor or subcontractor performing a public works project is found by the Labor Commissioner or the District to be in violation of Labor Code Section 1770 et seq., except Section 1775, the contractor or subcontractor or any firm, corporation, partnership, or association of which the contractor or any subcontractor has a substantial interest, shall be ineligible to bid on or to receive any public works contract for a period of not less than one-year or more than three years. The period of debarment shall run from the date the determination of the violation is made by the Labor Commissioner.

The District shall be entitled to withhold wages and penalties due as a result of any violation of the Labor Code from Payments due the Contractor in accordance with Labor Code Section 1726. These withheld amounts shall be paid to the Labor Commissioner for disbursement in accordance with Labor Code Section 1730. The Contractor's right to recover these wages and penalties shall be limited as provided in the Labor Code.

7-15 TRAVEL AND SUBSISTENCE PAYMENTS

Each worker needed to execute the work must be paid travel and subsistence payments as defined in the applicable collective bargaining agreements filed in accordance with Labor Code Section 1773.8.

7-16 APPRENTICES

Attention is directed to the provisions in Sections 1777.5, 1777.6, and 1777.7 of the Labor Code concerning the employment of apprentices by the Contractor or any subcontractor under him.

The Contractor and any subcontractor under him shall comply with the requirements of Sections 1777.5 and 1777.6 of the Labor Code in the employment of apprentices.

Information relative to apprenticeship standards, wage schedules, and other requirements may be obtained from the Director of Industrial Relations, ex officio the Administrator of Apprenticeship, San Francisco, California, or from the Division of Apprenticeship Standards and its branch offices.

Willful violations of Section 1777.5 will result in the Contractor, and the business entity under which the Contractor is doing business, being denied the right to bid on, or to receive, any public works contract for a period of up to one year for the first violation and for a period of up to three years for the second and subsequent violations commencing from the date the determination of noncompliance by the Administrator of Apprenticeship Council. In addition, if the Contractor violates Section 1777.5, he will forfeit as a civil penalty the sum of $50 for each calendar day of non-compliance which shall be withheld from progress payments by District upon notice from the Department of Industrial Relations. (Labor Code Section 1777.7.)

7-17 WARRANTY OF TITLE

No materials, supplies, or equipment for the work under this contract shall be purchased subject to any chattel mortgage or under a conditional sale contract or other agreement by which an interest therein or any part thereof is retained by the seller or supplier. The Contractor warrants clear and good title to all materials, supplies, and equipment installed and incorporated in the work and agrees upon completion of all work to deliver the premises together with all improvements and appurtenances constructed or placed thereon by him to the District free from any claims, liens, encumbrances, or charges and further agrees that neither he nor any person, firm, or corporation

furnishing any material or labor for any work covered by the contract shall have any right to a lien upon the premises or any improvement or appurtenance thereon, provided that this shall not preclude the Contractor from installing metering devices or other equipment of utility companies or of municipalities, the title of which is commonly retained by the utility company or the municipality. Nothing contained in this article, however, shall defeat or impair the right of such persons furnishing materials or labor under any bond given by the Contractor for their protection or any right under any law permitting such persons to look to funds due the Contractor in the hands of the District. The provisions of this article shall be inserted in all subcontracts and material contracts, and notices of its provision shall be given to all persons furnishing materials for the work when no formal contract is entered into for such materials.

7-18 PROPERTY RIGHTS IN MATERIALS

Nothing in the contract shall be construed as vesting in the Contractor any right of property in the materials used after they have been attached or affixed to the work or the soil. All such materials shall become the property of the District upon being so attached or affixed. Soil, stone, gravel, and other materials found at the site of the work and which conform to the Plans and Specifications for incorporation into the work may be used in the work. No other use shall be made of such materials except as may be otherwise described in the Plans and Specifications.

7-19 MUTUAL RESPONSIBILITY OF CONTRACTORS

Nothing in the contract shall be interpreted as granting to the Contractor exclusive occupancy of the site of the project. The Contractor must ascertain to his own satisfaction the scope of the project and the nature of any other contracts that have been or may be awarded by the District in the construction of the project, to the end that the Contractor may perform this contract in the light of such other contracts, if any.

The Contractor shall not cause any unnecessary hindrance or delay to any other contractor working on the project. If the performance of any contract for the project is likely to be interfered with by the simultaneous performance of some other contract or contracts, the District's Representative shall decide which contractor shall cease work temporarily and which contractor shall continue or whether the work under the contracts can be coordinated so that the contractors may proceed simultaneously. On all questions concerning conflicting interest of contractors performing related work, the decision of the District's Representative shall be binding upon all contractors concerned and the District, the Engineer/Architect, the District's Representative, and their consultants shall not be responsible for any damages suffered or extra costs incurred by the Contractor resulting directly or indirectly from the award or performance or attempted performance of any other contract or contracts on the project or caused by a decision or omission of the District's Representative respecting the order of precedence in the performance of the contracts.

If through acts of neglect on the part of the Contractor, any other contractor or any subcontractor shall suffer loss or damage on the work, the Contractor agrees to settle with such other contractor or subcontractor by agreement or arbitration, if such other contractor or subcontractor will so settle. If such other contractor or subcontractor shall assert any claim against the District, the Engineer/Architect, the District's Representative, or their consultants or any of their directors, officers, employees, or agents on account of any damage alleged to have been so sustained, the District shall notify the Contractor who shall hold harmless, indemnify, and defend the District, the Engineer/Architect, the District's Representative, and their consultants, and each of their directors,

officers, employees, and agents against any such claim, including all attorneys' fees and any other costs incurred by the indemnified parties relative to any such claim.

7-20 TERMINATION FOR BREACH

If the Contractor refuses or fails to prosecute the work or any separable part thereof with such diligence as will ensure its completion within the time specified herein, or any extension thereof, or fails to complete such work within such time, or if the Contractor should be adjudged a bankrupt, or if he should make a general assignment for the benefit of his creditors, or if a receiver should be appointed on account of his insolvency, or if he files a petition to take advantage of any debtor's act, or if he or any of his subcontractors should violate any of the provisions of the contract, or if he should persistently or repeatedly refuse or should fail, except in cases for which extension of time is provided, to supply enough properly skilled workmen or proper materials to complete the work in the time specified, or if he should fail to make prompt payment to subcontractors or for material or labor, or if he should persistently disregard laws, ordinances, or instructions given by the District or District's Representative, the District may, without prejudice to any other right or remedy, serve written notice upon the Contractor and his surety of his intention to terminate the contract, said notice to contain the reasons for such intention to terminate the contract, and unless within ten days after the service of such notice such violations shall cease and satisfactory arrangements for the corrections thereof be made, the contract shall upon the expiration of said ten days cease and terminate. In such case, the Contractor shall not be entitled to receive any further payment until the work is finished.

In the event of any such termination, the District shall immediately serve written notice thereof upon the surety and the Contractor, and the surety shall have the right to take over and perform the contract; provided, however, that if the surety within 15 calendar days after the serving upon it of a notice of termination does not give the District written notice of its intention to take over and perform the contract or does not commence performance thereof within 30 calendar days from the date of serving said notice, the District may take over the work and prosecute the same to completion by contract or by any other method it may deem advisable for the account and at the expense of the Contractor, and his surety shall be liable to the District for any excess cost or other damage occasioned the District thereby, and in such event the District may, without liability for so doing, take possession of and utilize in completing the work such materials, appliances, plants, and other property belonging to the Contractor that may be on the site of the work and be necessary therefor. For any portion of such work that the District elects to complete by furnishing its own employees, materials, tools, and equipment, the District shall be compensated for such in accordance with the schedule of compensation for force account work in Article 9-1 PAYMENT FOR CHANGES IN THE WORK.

If the unpaid balance of the contract price exceeds the direct and indirect costs of completing the work, including, but not limited to, all costs to District arising from professional services and attorneys' fees and all costs generated to insure or bond the work of substituted contractors or subcontractors utilized to complete the work, such excess shall be paid to Contractor. If such costs exceed the unpaid balance, Contractor shall pay the difference to District promptly upon demand; on failure of Contractor to pay, the surety shall pay on demand by District. Any portion of such difference not paid by Contractor or surety within 30 calendar days following the mailing of a demand for such costs by District shall earn interest at the rate of 10% per annum or the maximum rate authorized by California law, whichever is lower.

The foregoing provisions are in addition to and not in limitation of any other rights or remedies available to the District.

7-21 NOTICE AND SERVICE THEREOF

Any notice required or given under the contract shall be in writing, be dated, and signed by the party giving such notice or his duly authorized representative, and be served as follows:

If to the District, by personal delivery or by deposit in the United States mail.

If to the Contractor, by personal delivery to the Contractor or to his authorized representative at the site of the project or by deposit in the United States mail.

If to the surety or any other person, by personal delivery to said surety or other person or by deposit in the United States mail.

All mailed notices shall be in sealed envelopes, shall be sent by certified mail with postage prepaid, and shall be addressed to the addresses in the Contract Documents or such substitute addresses which a party designates in writing and serves as set forth herein.

7-22 PARTIAL INVALIDITY

If any provision of this contract is held by a court of competent jurisdiction to be invalid, void, or unenforceable, the remaining provisions shall nevertheless continue in full force without being impaired or invalidated in any way.

7-23 ATTORNEYS' FEES

In the event any arbitration proceeding, administrative proceeding or litigation in law or in equity, including an action for declaratory relief, is brought to invalidate, enforce, or interpret any term or provision of this contract, the prevailing party shall recover all attorneys' fees, all expert fees and costs, and all costs of the proceeding which shall be determined by the Court or the presiding officer at the proceeding authorized to make a determination of the issues or in a separate action brought for that purpose, in addition to any other relief provided by California law.

If any party to this agreement becomes a party to any litigation, administrative proceeding or arbitration concerning the invalidation, enforcement or interpretation of the provisions of this agreement or the performance of this agreement by reason of any act or omission of another party or authorized representative of another party to this agreement and not by any act or omission of a party that becomes a party to that proceeding or any act or omission of its authorized representatives, the party that causes another party to become involved in the proceeding shall be liable to that party for all expert fees and costs, all attorneys' fees, and all costs of the proceeding. The award of these expert fees and costs, attorneys' fees, and costs shall be determined as provided above.

From and after any date of submission of any demand or claim to District or any of the other indemnified parties covered by any indemnity provisions of this contract, the indemnified party shall be entitled to appoint their own independent counsel to represent them and the Contractor shall pay all fees and costs incurred by the indemnified parties to investigate and evaluate the claim or cause of action, for all staff time at the hourly rates of each staff member handling the claim or cause of

action, all attorneys' fees, all expert fees and costs, and all court costs when and as these fees and costs are incurred by each of the indemnified parties. The Contractor agrees to pay all of these fees, costs, and expenses to each of the indemnified parties not later than thirty (30) days following a demand for reimbursement of these fees, costs, and expenses by each of the indemnified parties. Amounts not paid by the Contractor within this thirty (30) day period shall earn interest at the rate of one percent (1%) per month until paid by Contractor in full.

In the event opposing parties have each prevailed on one or more cause of action actually contested or admitted by pleadings or pre-hearing documents on file, the presiding officer may offset such fees and costs between prevailing parties after considering the necessity of the proceeding and the importance of the issue or issues upon which a party has prevailed. However, the court or presiding officer shall have no authority to relieve the Contractor of the Contractor's obligation to pay all damages, fees, costs, and expenses of each of the indemnified parties as provided in the indemnity provisions of this contract.

The term "prevail" as used in this section shall include any action at law, in equity, or pursuant to arbitration in which either party has been successful including, but not limited to, demurrers, motions to strike, judgments on the pleadings, summary judgments or summary adjudications of issues, any other motion of whatever type or nature, or any trial proceeding or motion.

7-24 LANDS AND RIGHTS-OF-WAY

The lands and rights-of-way for the facility to be constructed will be provided by the District. The Contractor shall make his own arrangements and pay all expenses for additional area required by him outside the limits of the District's lands and rights-of-way.

Work in public right-of-way shall be done in accordance with the requirements of the permit issued by the public agency in whose right-of-way the work is located in addition to conforming to the Plans and Specifications. If a permit is not required, the work shall conform to the standards of the public agency involved in addition to conforming to the Plans and Specifications.

7-25 NO WAIVER OF RIGHTS OR REMEDIES

No action or failure to act by the District, Engineer/Architect, or District's Representative shall constitute a waiver of any right or duty afforded any of them under the Contract Documents, nor shall any such action or failure to act constitute an approval of or acquiescence in an breach of this contract by Contractor. No oral waiver of any rights or remedies granted to the District, Engineer/Architect, or District's Representative shall be effective for any purpose. To be effective, the waiver must be in writing and executed by an authorized representative of District, the Engineer/Architect, or the District's Representative. Contractor has been informed, and understands, that the Engineer/Architect and District's Representative have no authority whatsoever to waive any rights or remedies granted to the District by this contract or to alter any term or provision of the Contracts Documents or the approved Plans and Specifications. Any such purported waiver shall be void and unenforceable.

7-26 TAXES

The Contractor shall pay all sales, consumer, use, and other taxes.

NOTICE OF TAXABLE POSSESSORY INTEREST - The terms of this document may result in the creation of a possessory interest. If such a possessory interest is vested in a private party to this document, the private party may be subjected to the payment of personal property taxes levied on such interest.

7-27 ASSIGNMENT OF ANTI-TRUST ACTIONS

In entering into a public works contract or subcontract to supply goods, services, or materials pursuant to a public works contract, the Contractor or subcontractor offers and agrees to assign to the awarding body all rights, title, and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 U.S.C. Section 15) or under the Cartwright Act (Chapter 2 [commencing with Section 16700] of Part 2 of Division 7 of the Business and Professions Code), arising from purchases of goods, services, or materials pursuant to the public works contract or the subcontract. This assignment shall be made and become effective at the time the awarding body tenders final payment to the Contractor, without further acknowledgment by the parties.

In submitting a bid to a public purchasing body, the bidder offers and agrees that if the bid is accepted, it will assign to the purchasing body all rights, title, and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 U.S.C. Section 15) or under the Cartwright Act (Chapter 2 [commencing with Section 16700] of Part 2 of Division 7 of the Business and Professions Code), arising from purchases of goods, materials, or services by the bidder for sale to the purchasing body pursuant to the bid. Such assignment shall be made and become effective at the time the purchasing body tenders final payment to the bidder.

Contractor shall insure that a comparable provision is included in all subcontracts at all tier levels which are executed pursuant to this Agreement.

7-28 PAYROLL RECORDS

It shall be the responsibility of the Contractor to maintain an accurate payroll record showing the name, address, social security number, work classification, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each employee in accordance with Labor Code Section 1776, and to ensure that each subcontractor also complies with all provisions of Labor Code Section 1776 and this contract provision.

All payroll records shall be certified as accurate by the applicable contractor or subcontractor or its agent having authority over such matters.

The Contractor shall ensure that all payroll records are available for inspection at the Contractor's principal office during normal business hours and shall notify the District, in writing, of the place where all payroll records are located from time to time.

The Contractor shall furnish a copy of all payroll records, upon request, to employees or their authorized agents, to the District, to the Division of Labor Standards Enforcement, and to the Division of Apprenticeship Standards of the Department of Industrial Relations. The Contractor shall also furnish a copy of payroll records to the general public upon request provided the public request is made through the District, the Division of Apprenticeship Standards, or the Division of Labor Standards Enforcement of the Department of Industrial Relations. In no event shall members of the general public be given access to payroll records at the Contractor's principal office.

Records made available to the general public in accordance with the prior paragraph shall be marked or obliterated in such a manner that the name and address of the Contractor and/or subcontractor and the name, address, and telephone number of all employees does not appear on the modified record.

The Contractor shall file a certified copy of any requested payroll records with the entity that requested such records within ten days of the date a written request for payroll records has been received.

Failure of the Contractor to comply with any provisions of this article or Labor Code Section 1776 within ten days of the date of a written request for compliance is received shall result in a forfeiture of up to $50 per calendar day or portion thereof, for each worker, until strict compliance is obtained. Upon notification by the Division of Apprenticeship Standards or the Division of Labor Standards Enforcement of the Department of Industrial Relations, the District shall withhold penalties under this article or Labor Code Section 1776 from the Contractor's payments then due.

7-29 MODIFICATION

This contract may not be altered in whole or in part except by modification in writing and properly executed by all parties hereto or by change as provided herein.

7-30 JURISDICTION AND VENUE

In the event any legal or equitable proceeding is commenced to invalidate, enforce, or interpret any of the terms or provisions of this contract, the parties expressly agree that jurisdiction and venue shall lie only in the Superior Court located in the North County Judicial District, County of San Diego, State of California. The Contractor acknowledges and agrees that this contract has been executed and requires performance solely within the jurisdiction and venue of the North County Judicial District and that the contract requires work solely within the jurisdiction and venue of the North County Judicial District.

7-31 HAZARDOUS WASTE

It shall be the responsibility of the Contractor to pay all fees and costs associated with removal and cleanup of any hazardous waste used at or brought to the job site by the Contractor, any subcontractor, or any agent, representative, or employee of the Contractor or any subcontractor. The Contractor shall identify and remove all such hazardous waste in accordance with all federal, state, and local rules and regulations and shall promptly notify the District's Representative of any such hazardous waste. If hazardous waste is discovered during performance of the work which has not been brought to, or used at, the job site by the Contractor, any subcontractor, or any agent, representative, or employee of the Contractor or any subcontractor, the Contractor shall identify and remove this hazardous waste in accordance with all federal, state, and local rules and regulations and in accordance with directions of the District and the Contractor shall be entitled to request an increase in compensation due for these removal and cleanup costs in accordance with Article 9-1 PAYMENT FOR CHANGES IN THE WORK.

7-32 EXCAVATIONS BELOW FOUR (4) FEET

If any work required by this contract includes digging trenches or other excavations that extend deeper than four feet below the surface, the Contractor shall promptly, and before the following conditions are disturbed, notify the District in writing of any:

Material that the Contractor believes may be material that is hazardous waste, as defined in Section 25117 of the Health and Safety Code, that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with the provisions of existing law.

Subsurface or latent physical conditions at the site differing from those indicated.

Unknown physical conditions at the site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the contract.

Nothing in this article is intended to relieve the Contractor of his responsibility to carefully examine the Contract Documents and the site where the work is to be performed in accordance with Article 2-8 EXISTING CONDITIONS AND EXAMINATION OF CONTRACT DOCUMENTS; to familiarize himself with all local conditions and federal, state, and local laws, ordinances, rules, and regulations that may affect the performance of any work; to study all surveys and investigation reports about subsurface and latent physical conditions pertaining to the job site; to perform such additional surveys and investigations as the Contractor deems necessary to complete the work at his bid price; and to correlate the results of all such data with the requirements of the Contract Documents.

If the District determines that hazardous waste exists and that conditions exist which Contractor could not discover through the investigations required by the preceding paragraph, the District shall notify the Contractor and the Contractor may request a change order in accordance with Article 9-1 PAYMENT FOR CHANGES IN THE WORK. Nothing in this article shall relieve the Contractor of the obligation to pay all fees and costs associated with removal and cleanup of any hazardous waste used at, or brought to, the job site by the Contractor as specified in Article 7-31 HAZARDOUS WASTE. Nor shall this article relieve the Contractor of responsibility for site conditions discoverable by any investigation required by the preceding paragraph.

In the event that a dispute arises between the District and the Contractor involving hazardous waste and whether site conditions differ materially from those the Contractor could or should have discovered by the investigations required by this contract, the Contractor shall not be excused from the scheduled completion date provided in the Contract Documents and shall proceed with all work in the manner and in the time required by the Contract Documents.

7-33 ARBITRATION

All public works claims between the Contractor and District relating to this contract where the total claims of both parties are equal to or less than $375,000 shall be submitted to mediation first and then to arbitration in accordance with Public Contract Code Section 20104, et seq. A copy of Public Contract Code Section 20104, et seq stating these arbitration requirements is attached following the General Provisions. When a total payment of the Contractor and the District exceed a total of $375,000, this section shall not apply and neither the District nor the Contractor shall have any obligation to arbitrate the claim.

SECTION 8 CONTRACTOR'S INSURANCE

8-1 GENERAL

The Contractor shall not commence or continue to perform any work unless he, at his own expense, has in full force and effect all required insurance. The Contractor shall not permit any subcontractor to perform work on this project unless the Workers' Compensation Insurance requirements have been complied with by such subcontractor.

The types of insurance the Contractor shall obtain and maintain are Workers' Compensation Insurance and Employer's Liability Insurance, Liability Insurance, Builders' Risk "All Risk" Insurance, all as set forth herein.

Workers' Compensation Insurance and Employer's Liability Insurance and Liability Insurance shall be maintained in effect for the full guarantee period.

Insurers must be authorized to do business and have an agent for service of process in California, have an "A" policyholder's rating and a financial rating of at least Class VIII in accordance with the most current rating by A.M. Best Company.

As evidence of specified insurance coverage, the Contractor shall provide certificates of insurance and endorsements on the forms provided as a part of the Contract Documents. No alteration or substitution of said forms will be allowed.

8-2 WORKERS' COMPENSATION INSURANCE AND EMPLOYER'S LIABILITY INSURANCE

Upon execution of the Agreement, the Contractor shall provide a Certificate(s) of Insurance certifying that he has obtained for the period of the contract full Workers' Compensation Insurance coverage for no less than the statutory limits and Employer's Liability Insurance coverage in limits not less than the amounts set forth in the Special Provisions, for all persons whom he employs or may employ in carrying out the work under the contract. At the same time, the Contractor shall provide the Insurance Endorsement(s) on the forms provided as part of the Contract Documents. This insurance shall be in strict accordance with the requirements of the most current and applicable state Workers' Compensation Insurance laws.

8-3 LIABILITY INSURANCE

Upon execution of the Agreement, the Contractor shall provide a Certificate(s) of Insurance showing that he has Liability Insurance coverage in limits not less than the amounts set forth in the Special Provisions. At the same time, the Contractor shall provide the Insurance Endorsement(s) on the forms provided as part of the Contract Documents.

All liability insurance shall include occurrence coverage with a deductible amount not exceeding the amount specified on the liability certificate form.

Included in such insurance shall be a "Cross Liability" or "Severability of Interest" clause.

The Liability Insurance coverage shall include each of the following types of insurance:

A. General Liability

(1) Comprehensive Form.

(2) Premises-Operations.

(3) Explosion and Collapse Hazard.

(4) Underground Hazard.

(5) Products/Completed Operations Hazard.

(6) Contractual Insurance.

(7) Broad Form Property Damage Including Completed Operations.

(8) Independent Contractors.

(9) Personal Injury.

B. Automobile Liability

(1) Comprehensive Form Including Loading and Unloading.

(2) Owned.

(3) Hired.

(4) Non-Owned.

The Liability Insurance shall include as additional insureds: the District, the Engineer/Architect, the District's Representative, and their consultants, and each of their directors, officers, employees, and agents. The insurance afforded to these additional insureds shall be primary insurance. If the additional insureds have other insurance which might be applicable to any loss, the amount of the insurance provided under this article on LIABILITY INSURANCE shall not be reduced or prorated by the existence of such other insurance.

8-4 BUILDERS' RISK "ALL RISK" INSURANCE

Upon execution of the Agreement, the Contractor shall provide a Certificate(s) of Insurance showing that he has obtained for the period of the contract Builders' Risk "All Risk" completed value insurance coverage (including any damage attributable directly or indirectly to surface water, runoff, rainfall or flood but excluding earthquake and tidal wave) upon the entire project which is the subject of the contract and including completed work and work in progress. At the same time, the Contractor shall provide the Insurance Endorsement(s) on the forms provided as a part of the Contract Documents. Such insurance shall include as additional insureds: the District, the Engineer/Architect, the District's Representative, and their consultants, and each of their directors, officers, employees, and agents.

Such insurance may have a deductible clause but not to exceed $25,000.

8-5 CONTRACTOR'S LIABILITY NOT LIMITED BY INSURANCE

Nothing contained in these insurance requirements is to be construed as limiting the liability of the Contractor or the right of the District to secure damages in excess of any insurance which may be provided.

SECTION 9 ESTIMATES AND PAYMENTS

9-1 PAYMENT FOR CHANGES IN THE WORK

The Contractor shall not be entitled to any increase in the contract price due to any change in the work unless the Contractor submits a written request within seven calendar days from the date of the event which causes the Contractor to request a change in the price.

Changes in, additions to, or deductions from the work, including increases or decreases in the quantity of any item or portion of the work, shall be set forth in a written change order executed by the District and by the Contractor which shall specify:

The changes, additions, and deductions to be made.

The increase or decrease in compensation due the Contractor, if any.

Adjustment in the time of completion, if any.

Adjustment in the compensation due the Contractor shall be determined by one or more of the following methods in the order of precedence listed below:

Unit price contained in the contract.

Mutually agreeable lump sum or unit prices. If requested by the District's Representative, the Contractor shall furnish an itemized breakdown of the quantities and prices used in computing proposed lump sum and unit prices.

Force account whereby the Contractor is compensated for furnishing labor, materials, tools, and equipment as follows:

Cost of labor plus 15% for workers directly engaged in the performance of the work. Cost of labor shall include actual wages paid including employer payments to or on behalf of the workers for health and welfare, pension, vacation, and similar purposes plus payments imposed on payroll amounts by state and federal laws plus subsistence and travel allowance payments to workers.

Cost of material plus 15%. Cost of material shall include sales tax, freight, and delivery charges. The District reserves the right to furnish such materials as he deems advisable and the Contractor shall not be paid the 15% markup on such materials.

For tools and equipment actually engaged in the performance of the work, rental rates plus 15%. The rental rates shall be those prevailing in the area where the work

is performed. No rental charge shall be made for the use of tools or equipment having a replacement value of $500 or less.

Subcontractor invoices to the Contractor plus 5%. Subcontractor invoices shall be based on the above-described cost of labor plus 15%, cost of material plus 15%, and tool and equipment rental rates plus 15%.

No payment shall be made for any item not set forth above, including without limitation, Contractor's overhead, general administrative expense, supervision, or damages claimed for delay in prosecuting the remainder of the work.

For force account work, the Contractor shall submit to the District's Representative for his verification, daily work sheets showing an itemized breakdown of labor, materials, tools, and equipment used in performing the work. No payment will be made for work not verified by the District's Representative.

9-2 PROGRESS PAYMENTS

The District shall, on or before the third day of each calendar month after actual construction work is started, prepare the Progress Estimate and Payment Form as directed in Proore included at the end of the General Provisions. The Contractor and the District's Representative shall review each work item and agree on the total value of work performed during the previous month. In the event the Contractor and the District's Representative cannot agree on the estimated total value of work during the previous month, the estimated total value of work performed as determined by the District's Representative during the previous month shall be used. No progress payment will be processed by the District until all information required by the Progress Estimate and Payment Form has been completed and the Contractor has signed the form. By signing the Progress Estimate and Payment Form, the Contractor expressly waives and releases any claims the Contractor may have, of whatever type or nature, for the period specified which is not shown as a retention amount or a disputed claim on the Release Form included at the end of the General Provisions. The Contractor shall submit to the District within seven days from signing the Progress Estimate and Payment Form a completed and signed Release Form that corresponds to the same pay estimate work period. The District shall have no obligation to pay the Contractor for any work done until the Release Form has been executed by the Contractor and submitted to the District for the corresponding pay period in accordance with Article 9-6 REQUIRED RELEASES.

Properly submitted Progress Estimate and Payment Form with corresponding Release Form shall be paid by the District within thirty days after receipt. Properly submitted forms not paid within this thirty-day period shall earn interest at the legal rate set forth in subdivision (a) of Section 685.010 of the Code of Civil Procedure. The Contractor and District agree that the thirty-day period for payment shall not commence until the Contractor has executed and submitted the Release Form to the District for the corresponding pay period.

In preparing any progress payment with the Contractor, the District's Representative will use the cost breakdown as required by Article 6-3 CONTRACTOR'S CONSTRUCTION SCHEDULE AND COST BREAKDOWN. No allowance shall be made for materials delivered but not installed. In evaluating any progress payment, the District's Representative may take into consideration along with other facts and conditions deemed by him to be proper, the ratio of the difficulty or cost of the work done to the probable difficulty or cost of the work remaining to be done. District shall retain

ten percent (10%) of such estimated value as part security, for the fulfillment of the contract by Contractor, unless Contractor has substituted adequate equivalent securities as required by Article 9-5 WITHHELD CONTRACT FUNDS. The progress payment by the District shall pay to the Contractor the balance of such estimated value after deducting therefrom all previous payments and all sums to be retained under the terms of the contract.

9-3 FINAL ESTIMATE AND PAYMENT

Contractor shall not make any request for the final payment until all work required by the Plans and Specifications of the Contract Documents has been completed to the satisfaction of the District's Representative. Upon receipt of a request from Contractor for final payment, the District's Representative will make a final inspection of the work done and advise the Contractor of additional work required before final payment will be processed. All prior progress estimates and payments shall be subject to correction in the final estimate and payment.

The final payment shall not be due and payable until 60 calendar days after the date of filing a notice of completion of the accepted work. The date of completion shall be determined in accordance with Public Contract Code Section 7107. In the event of a dispute between the District and the Contractor, District shall be entitled to withhold an amount up to 150% of the disputed amount.

It is mutually agreed between the parties to the contract that no certificate given or payment made under this contract shall constitute evidence of performance of the contract and no payment by District shall be construed as an acceptance of any defective work or improper materials.

Contractor shall not be entitled to payment of the final amount due until Contractor has executed a Release Form in accordance with Article 9-6 REQUIRED RELEASES. Contractor hereby expressly agrees that payment of the final mount due under the contract shall release the District, the Engineer/Architect, the District's Representative, and their consultants, and each of their directors, officers, employees, and agents, from any and all claims relating to the work for which Contractor is being paid. It is the declared intention of the parties that this provision comply with Public Contract Code Section 7100 and that this section shall be construed as in compliance with Public Contract Code Section 7100 to the maximum feasible extent.

9-4 DISTRICT'S RIGHT TO WITHHOLD CERTAIN AMOUNTS AND MAKE APPLICATION THEREOF

In addition to the amounts which the District may retain under Sections 9-2 and 9-3 of this contract, the District may withhold a sufficient amount or amounts from any payment otherwise due to the Contractor (including any final payment) as may be necessary or appropriate in District's sole and exclusive judgment to cover each of the following:

Payments which are or may be past due and payable for properly filed claims against the Contractor or any subcontractors for any labor, materials, or equipment furnished in or about the performance of the work on the project under this contract including any amounts asserted as attorneys' fees, costs, or interest by the claimant.

All fees, costs, and expenses estimated by the District for correcting any work determined to be defective by the District.

Any amounts determined appropriate or necessary by the District to cover the District's estimate of any damages paid or payable as a result of any claim or cause of action on the contract caused, or claimed to be caused by any action or omission of Contractor, any subcontractor, supplier or materialmen or their respective directors, officers, agents, employees, members, managers or consultants and all fees, costs, and expenses, including all attorneys' fees, expert fees and costs, staff time at each staff members' normal hourly rates and all court costs estimated by the District in responding to the claim or cause of action.

Any amounts determined necessary or appropriate by District to cover all of the indemnity obligations of Contractor under this contract.

Any amounts claimed by the District as forfeiture due to delay and any and all other amounts, fees, costs, or expenses estimated by the District as offsets.

The District has the express authority to withhold any amount or amounts determined appropriate by District from time to time from any payments otherwise due Contractor to cover all or any of the preceding items in the District's sole and exclusive judgment. The District may also apply all or any portion of any such withheld amount or amounts to the payment of any claims in such amounts and at such times as are determined appropriate by District, in District's discretion. In withholding any sums permitted by this section or in paying any claims, the District shall be deemed the agent of the Contractor and any payments made by the District on any claim shall be considered as a payment made under the contract by the District to the Contractor. The District shall not be liable to the Contractor for District's withholding of any and all amounts permitted by this section or District's payment of any claims as permitted by this section. Such withholdings and payments may be made by District at any time without prior judicial determination of the merits of any claims or causes of action. The District will render to the Contractor a proper account of any funds withheld or disbursed as permitted by this section.

9-5 WITHHELD CONTRACT FUNDS

Pursuant to Public Contract Code Section 22300, the Contractor may substitute equivalent securities for retention amounts which this Contract requires. However, the District reserves the right to solely determine the adequacy of the securities being proposed by the Contractor and the value of those securities. The District shall also be entitled to charge an administrative fee, as determined by District in its sole discretion, for substituting equivalent securities for retention amounts.

The Contractor agrees that the District's decision with respect to the administration of the provisions of Section 22300 shall be final and binding and not subject to subsequent litigation or arbitration of any kind as to acceptance of any securities being proposed, the value of these securities, the costs of administration and the determination of whether or not the administration should be accomplished by an independent agency or by the District. The District shall be entitled, at any time, to request the deposit of additional securities of a value designated by the District, in District's sole discretion, to satisfy this requirement. If the District does not receive satisfactory securities within 12 calendar days of the date of the written request, District shall be entitled to withhold amounts due Contractor until securities of satisfactory value to District have been received.

9-6 REQUIRED RELEASES

In accordance with Public Contract Code Section 7100, the Contractor shall not be entitled to any payment specified in this Contract which is undisputed until such time as the Contractor has executed the Release Form included at the end of the General Provisions releasing the District from all claims relating to work for which the Contractor is being paid. The Release Form contains space for the Contractor to claim any disputed amount and to designate the retention amount for each pay period associated with the release. Contractor hereby expressly agrees that failure on his part to designate any disputed amount or to designate the correct retention amount for each release period on the Release Form shall constitute an express waiver of the right of the Contractor to claim any disputed amount or any retention amount at any later date. The District shall have no obligation to pay the Contractor for any work done until the Release Form at the end of the General Provisions has been executed by the Contractor and submitted to the District.

SECTION 10 AUTHORITY AND STATUS OF DISTRICTS REPRESENTATIVES

10-1 STATUS OF DISTRICTS REPRESENTATIVES

The Contractor has been informed, and understands, that the Engineer/Architect and the District's Representative are not agents or employees of District. They are independent contractors retained by District to assist in preparation of the design plans for the work and in supervising the work to be performed by the Contractor. District does not direct the Engineer/Architect or the District's Representative in the performance of their respective duties and obligations. District shall not be liable for any errors or omissions of the Engineer/Architect, the Districts Representative or their respective directors, officers, agents or employees.

10-2 AUTHORITY OF DISTRICT'S REPRESENTATIVES

Contractor has been informed, and understands, that the Engineer/Architect and the District's Representative have no authority to alter any of the terms or provisions of the Contract Documents or to alter any of the requirements contained in the plans and specifications approved by District. In the event that Contractor desires to modify any term or provision of the Contract Documents or to modify any of the requirements of the approved plans and specifications, a written request must be submitted with the requested changes to the District through the District's Representative. Only the general manager of District has the authority to alter or modify any of the terms or provisions of the Contract Documents. No modification or change to the Contract Documents shall be effective for any purpose unless the change or modification has been expressly approved, in writing, by the general manager of District. Any requested changes by the Contractor to the approved plans and specifications must be submitted to the District's Engineer for review and approval through the District's Representative. No changes to the approved plans or specifications shall be effective for any purpose unless the District's Engineer has expressly approved of the change, in writing. The Contractor is expressly prohibited from entering onto private property, disturbing any habitat, or using private property to stockpile, store, or spread any men, tools, equipment, materials, or dirt without the express prior written consent of the general manager of District. The violation of this section by Contractor or any of its subcontractors, materialmen, or suppliers or their respective directors, officers, managers, members, agents, consultants or employees shall constitute a material breach of this Agreement.

SECTION 11 FORMS

11-3 RELEASE FORM

The Contractor shall complete the Release Form included at the end of the General Provisions and submit it to the District for the corresponding pay period in accordance with Article 9-6, REQUIRED RELEASES. Duplication of this form is permissible to comply with the requirements of the Contract Documents. No substitution or revision to this form will be accepted. No payment request to the Contractor will be processed until the Release Form has been fully completed and submitted by the Contractor.

THIS PAGE INTENTIONALLY LEFT BLANK.

RELEASE FORM

District: **OLIVENHAIN MUNICIPAL WATER DISTRICT** OMWD W.O. No. 179934

Project: **NEW AND REMODELED OPERATIONS AND ADMINISTRATION FACILITIES** District's Rep Acct No. _____

Contractor: _____ Contractor Job No. _____

PAY ESTIMATE NO. _____ Date Prepared _____

PERIOD WORK PERFORMED: _____

The above-named Contractor hereby acknowledges payment in full for all compensation of whatever nature due the Contractor for all labor and materials furnished and for all work performed on the above-referenced project for the period specified above with the exception of contract retention amounts and disputed claims specifically shown below.

RETENTION AMOUNT FOR THIS PERIOD: $_____

DISPUTED CLAIMS: Description and Amount

The Contractor further expressly waives and releases any claims the Contractor may have, of whatever type or nature, for the period specified which is not shown as a retention amount or a disputed claim on this form. This release and waiver has been made voluntarily by Contractor without any fraud, duress, or undue influence by any person or entity.

Contractor further certifies, warrants and represents that all bills for labor, materials and work due Subcontractors for the specified period have been paid in full and the parties signing below on behalf of Contractor have express authority to execute this release.

Dated: _____ Contractor: _____

By: _____ Title: _____

By: _____ Title: _____

Distribution: ☐ District ☐ Contractor ☐ Engineer ☐ Finance

THIS PAGE INTENTIONALLY LEFT BLANK.

Article 1.5

RESOLUTION OF CONSTRUCTION CLAIMS

Section
20104. Application of article; provisions included in plans and specifications.
20104.2. Claims; requirements; tort claims excluded.
20104.4. Civil action procedures; mediation and arbitration; trial de novo; witnesses.
20104.6. Payment on undisputed portion of claim; interest on arbitration awards or judgments
20104.8. Repealed.

Article 1.5 was added by Stats. 1994, c. 726 (A.B. 3069), § 22, eff. Sept. 22, 1994.

Former Article 1.5, Resolution of Construction Claims, consisting of §§20104 to 20104.8, added by Stats. 1990, c. 1414 (A.B. 4165), § 2, was repealed by Stats. 1990, c. 1414 (A.B. 4165), § 2, operative Jan. 1, 1994.

§ 20104. Application of article; provisions included in plans and specifications

(a) (1) This article applies to all public works claims of three hundred seventy-five thousand dollars ($375,000) or less which arise between a contractor and local agency.

(2) This article shall not apply to any claims resulting from a contract between a contractor and a public agency when the public agency has elected to resolve any disputes pursuant to Article 7.1 (commencing with Section 10240) of Chapter 1 of Part 2.

(b) (1) "Public work" has the same meaning as in Sections 3100 and 3106 of the Civil Code, except that "public work" does not include any work or improvement contracted for by the state or the Regents of the University of California.

(2) "Claim" means a separate demand by the contractor for (A) a time extension, (B) payment of money or damages arising from work done by, or on behalf of, the contractor pursuant to the contract for a public work and payment of which is not otherwise expressly provided for or the claimant is not otherwise entitled to, or (C) an amount the payment of which is disputed by the local agency.

(c) The provisions of this article or a summary thereof shall be set forth in the plans or specifications for any work which may give rise to a claim under this article.

(d) This article applies only to contracts entered into on or after January 1, 1991.

(Added by Stats. 1994, c. 726 (A.B. 3069), § 22, eff. Sept. 22, 1994.)

Historical and Statutory Notes

1990 Legislation

Former § 20104 was renumbered Public Contract Code § 20103.5 and amended by Stats. 1990, c. 1414 (A.B. 4165), § 1.

Former § 20104, added by Stats. 1990, c. 1414 (A.B. 4165), § 2, relating to application of article regarding resolution of construction claims, was repealed by Stats. 1990, c. 1414 (A.B. 4165), § 2, operative Jan. 1, 1994. See, now, this section.

Derivation: Former § 20104, added by Stats. 1990, c. 1414, § 2.

§ 20104.2 Claims; requirements; tort claims excluded

For any claim subject to this article, the following requirements apply:

(a) The claim shall be in writing and include the documents necessary to substantiate the claim. Claims must be filed on or before the date of final payment. Nothing in this subdivision is intended to extend the time limit or supersede notice requirements otherwise provided by contract for the filing of claims.

(b) (1) For claims of less than fifty thousand dollars ($50,000), the local agency shall respond in writing to any written claim within 45 days of receipt of the claim, or may request, in writing, within 80 days of receipt of the claim, any additional documentation supporting the claim or relating to defenses to the claim the local agency may have against the claimant.

(2) If additional information is thereafter required, it shall be requested and provided pursuant to this subdivision, upon mutual agreement of the local agency and the claimant.

(3) The local agency's written response to the claim, as further documented, shall be submitted to the claimant within 15 days after receipt of the further documentation or within a period of time no greater than that taken by the claimant in producing the additional information, whichever is greater.

(c) (1) For claims of over fifty thousand dollars ($50,000) and less than or equal to three hundred seventy-five thousand dollars ($375,000), the local agency shall respond in writing to all written claims within 60 days of receipt of the claim, or may request, in writing, within 30 days of receipt of the claim, any additional documentation supporting the claim or relating to defenses to the claim the local agency may have against the claimant.

(2) If additional information is thereafter required, it shall be requested and provided pursuant to this subdivision, upon mutual agreement of the local agency and the claimant.

(3) The local agency's written response to the claim, as further documented, shall be submitted to the claimant within 30 days after receipt of the further documentation, or within a period of time no greater than that taken by the claimant in producing the additional information or requested documentation, whichever is greater.

(d) If the claimant disputes the local agency's written response, or the local agency fails to respond within the time prescribed, the claimant may so notify the local agency, in writing, either within 15 days of receipt of the local agency's response or within 15 days of the local agency's failure to respond within the time prescribed, respectively, and demand an informal conference to meet and confer for settlement of the issues in dispute. Upon a demand, the local agency shall schedule a meet and confer conference within 30 days for settlement of the dispute.

(e) Following the meet and confer conference, if the claim or any portion remains in dispute, the claimant may file a claim as provided in Chapter 1 (commencing with Section 900) and Chapter 2 (commencing with Section 910) of Part 3 of Division 3.6 of Title 1 of the Government Code. For purposes of those provisions, the running of the period of time within which a claim must be filed shall be tolled from the time the claimant submits his or her written claim pursuant to subdivision (a) until the time that claim is denied as a result of the meet and confer process, including any period of time utilized by the meet and confer process.

(f) This article does not apply to tort claims and nothing in this article is intended nor shall be construed to change the time periods for filing tort claims or actions specified by Chapter 1 (commencing with Section 900) and Chapter 2 (commencing with Section 910) of Part 3 of Division 3.6 of Title 1 of Government Code.

(Added by Stats. 1994, c. 726 (A.B. 3069), § 22, eff. Sept. 22, 1994.)

Historical and Statutory Notes

1990 Legislation

Former § 20104.2, added by Stats. 1990, c. 1414 (A.B. 4165), § 2, amended by Stats. 1991, c. 1029 (A.B. 1086), § 1, relating to requirements for claims filed under the article, was repealed by Stats. 1990, c. 1414 (A.B. 4165), § 2, operative Jan. 1, 1994. See, now, this section.

Derivation: Former § 20104.2, added by Stats. 1990, c. 1414, § 2, amended by Stats. 1991, c. 1029, § 1.

Library Reference

California Practice Guide: Alternative Dispute Resolution, Knight, Fannin & Disco, see Guide's Table of Statutes for chapter paragraph number references to paragraphs discussing this section.

Civil Procedure Before Trial, Well & Brown, Guide's Table of Statutes for chapter paragraph number references to paragraphs discussing this section.

§ 20104.4 Civil action procedures, mediation and arbitration; trial de novo; witnesses

The following procedures are established for all civil actions filed to resolve claims subject to the article:

(a) Within 60 days, but no earlier than 30 days, following the filing or responsive pleadings, the court shall submit the matter to nonbinding mediation unless waived by mutual stipulation of both parties, The mediation process shall provide for the selection within 15 days by both parties of a disinterested third person as mediator, shall be commenced within 30 days of the submittal, and shall be concluded within 15 days from the commencement of the mediation unless a time requirement is extended upon a good cause showing to the court or by stipulation of both parties. If the parties fail to select a mediator within the 15-day period, any party may petition the court to appoint the mediator.

(b) (1) If the matter remains in dispute, the case shall be submitted to judicial arbitration pursuant to Chapter 2.5 (commencing with Section 1141.10) of Title 3 of Part 3 of the Code of Civil Procedure, notwithstanding Section 1141.11 of that code. The Civil Discovery Act of 1986 (Article 3 (commencing with Section 2016) of Chapter 3 of Title 3 of Part 4 of the Code of Civil Procedure) shall apply to any proceeding brought under this subdivision consistent with the rules pertaining to judicial arbitration.

(2) Notwithstanding any other provision of law, upon stipulation of the parties, arbitrators appointed for purposes of this article shall be experienced in construction law, and , upon stipulation of the parties, mediators and arbitrators shall be paid necessary and reasonable hourly rates of pay not to exceed their customary rate, and such fees and expenses shall be paid equally by the parties, except in the case of arbitration where the arbitrator, for good cause, determines a different division. In no event shall these fees or expenses be paid by state or county funds.

(3) In addition to Chapter 2.5 (commencing with Section 1141.10) of Title 3 of Part 3 of the Code of Civil Procedure, any party who after receiving an arbitration award requests a trial de novo but does not obtain more favorable judgment shall, in addition to payment of costs and fees under that chapter, pay the attorney's fees of the other party arising out of the trail de novo.

(c) The court may, upon request by any party, order any witnesses to participate in the mediation or arbitration process.

(Added by Stats. 1994, c. 726 (A.B. 3069), § 22, eff. Sept. 22, 1994.)

Historical and Statutory Notes

1990 Legislation

Former § 20104.4, added by Stats. 1990, c. 1414 (A.B. 4165), § 2, amended by Stats. 1991, c. 1029 (A.B. 1086), § 2, relating to procedures for civil actions filed to resolve construction claims, was repealed by Stats. 1990, c. 1414 (A.B. 4165), § 2, operative Jan. 1, 1994. See, now, this section.

Derivation: §20104.4, added by Stats. 1990, c. 1414, § 2, amended by Stats. 1991, c. 1029, § 2.

Library Reference

California Practice Guide: Alternative Dispute Resolution, Knight, Fannin & Disco, see Guide's Table of Statutes for chapter paragraph number references to paragraphs discussing this section.

§ 20104.6 Payment on undisputed portion of claim; interest on arbitration awards or judgments

(a) No local agency shall fail to pay money as to any portion of a claim which is undisputed except as otherwise provided in the contract.

(b) In any suit filed under Section 20104.4, the local agency shall pay interest at the legal rate on any arbitration award or judgment. The interest shall begin to accrue on the date the suit is filed in a court of law.

(Added by Stats. 1994, c. 726 (A.B. 3069), § 22, eff. Sept. 22, 1994.)

Historical and Statutory Notes

1990 Legislation

Former § 20104.6, added by Stats. 1990, c. 1414 (A.B. 4165), § 2, relating to payment of undisputed portion of claims, was repealed by Stats. 1990, c. 1414 (A.B. 4165), § 2, operative Jan. 1, 1994. See, now, this section.

Derivation: Former § 20104.6, added by Stats. 1990, c. 1414, § 2.

§ 20104.8 Repealed by Stats. 1990, c. 1414 (A.B. 4165), § 2, operative Jan. 1, 1994

Historical and Statutory Notes

The repealed section, added by Stats. 1990, c. 1414 (A.B. 4165), § 2, related to application of the article to specified contracts and provided for repeal of the article on Jan 1, 1994.

SECTION 00810 – SUPPLEMENT TO GENERAL PROVISIONS

1.01 DEFINITIONS

Whenever the following terms occur in the Contract Documents, the meaning shall be interpreted as follows:

ARCHITECT – HB&A Architects, 306N. West El Norte Parkway, #407, Escondido, California 92026, Tel: (760)-738-8608 and their engineers as noted on the plans

ATTORNEY FOR Owner – Alfred E. Smith, Nossaman LLP, 777 South Figueroa Street, 34th Floor, Los Angeles, California 90017, (213) 612-7831

BOARD OF DIRECTORS - Board of Directors of the Olivenhain Municipal Water District.

CONSTRUCTION MANAGER – Schneider CM, 7459 Circulo Sequoia, Carlsbad, CA 92009, Tel: (619) 905-5522

CONTRACT TIME – The number of consecutive days stated in the contract documents commencing from the date of the notice of award, for completion of the Work.

DATE OF AWARD OF CONTRACT - The date of the District Resolution (formal action of the Board of Directors of the District) awarding the Contract.

DISTRICT - Olivenhain Municipal Water District (OMWD), 1966 Olivenhain Road, Encinitas, California 92024, (760) 753-6466.

DISTRICT'S REPRESENTATIVE - The Owner's Representative.

DRAWINGS or PLANS – Construction drawings entitled, **"Olivenhain New and Remodeled Operations and Administration Facilities"** and referenced Standard Drawings or Regional Standard Drawings.

ENGINEER / DESIGN ENGINEER – As listed on the Plans.

OWNER - Olivenhain Municipal Water District (OMWD), 1966 Olivenhain Road, Encinitas, California 92024, Tel: (760) 753-6466; Fax: (760) 753-1578.

OWNER'S REPRESENTATIVE - The person or engineering/architectural firm authorized by the District to represent it during the performance of the work and until final acceptance. The Owner's Representative is referred to throughout the Contract Documents as if singular in number and masculine in gender. The Owner's Representative means the Owner's Representative and his assistants.

PUBLIC WORKS SPECIFICATIONS - Standard Specifications for Public Works Construction 2006 Edition by APWA/AGC, the "GREENBOOK" with 2000 Regional Supplement Amendments.

REGIONAL STANDARD DRAWINGS – Standard Drawings for Agencies in the San Diego Region as recommended by the Regional Standards Committee and published by the San Diego County Department of Public Works, April 2006.

SPECIAL PROVISIONS - Section 00810 of the specifications.

SPECIFICATIONS - Division 1 to 32 of the technical specifications contained in these Contract Documents, and those technical specifications contained in the Drawings.

STANDARD DRAWINGS - Drawings A-1.1 through G-15 of the Olivenhain Municipal Water District, Standard Specifications and Drawings for the Construction of Water, Recycled Water, and Sewer Facilities, dated 2017, with revisions.

STANDARD SPECIFICATIONS - Divisions 1 through 15 of the Olivenhain Municipal Water District, Standard Specifications and Drawings for the Construction of Water, Recycled Water, and Sewer Facilities, dated 2017, with revisions.

STATE STANDARD SPECIFICATIONS - State of California, Department of Transportation, Standard Specifications, May 2006, Caltrans.

STATE STANDARD PLANS - State of California, Department of Transportation, Standard Plans, May 2006, Caltrans.

WATER AUTHORITY – San Diego County Water Authority

Whenever the following terms appear in the State Standard Specifications or Public Works Specifications, the meaning shall be interpreted as follows:

AGENCY, BOARD or DEPARTMENT - The Owner.

ENGINEER - The Owner's Representative.

1.02 TERMS

Command type sentences used in the Contract Documents refer to and are directed to the Contractor.

1.03 ABBREVIATIONS

Interpret abbreviations used on the Drawings and in the Specifications as explained on the Drawings.

1.04 MARKING AND ADDRESSING BID ENVELOPE

Bids shall be made on the Bid Form and Bid Bond included within the Contract Documents. Complete and include the Bid Form Checklist together with the completed Bid Form and Bid Bond when submitting a bid. Seal the Contract Documents with the filled out bid in an envelope marked and addressed as follows:

BID FOR CONSTRUCTION OF:
VILLAGE PARK RECYCLED WATER PROJECT

OLIVENHAIN MUNICIPAL WATER DISTRICT
Attention: George R. Briest, Engineering Manager
1966 Olivenhain Road
Encinitas, California 92024

1.05 AWARD OF CONTRACT OR REJECTION OF BIDS

Within a period of 60 calendar days after the opening of bids, the District will accept or reject the bids.

1.06 CONTRACTOR'S LICENSING REQUIREMENTS

The District has determined the license classification necessary to bid and perform the subject contract. In no case shall this contract be awarded to a specialty contractor whose classification constitutes less than a majority of the portion of the work of this contract, all work to be performed outside of the contractor's license specialty, except work specifically authorized by District, shall be performed by a licensed subcontractor in compliance with the Subletting and Subcontractor Fair Practices Act commencing with Section 4100 et seq., of the Public Contract Code. See Business and Professions Code Section 7059.

The Contractor's license classification required for this project is a California State Contractor's License Class A.

It is the District's intent that "plans", as used in Public Contract Code Section 3300, is defined as the construction Contract Documents, which include both the Drawings and the Specifications

1.07 TIME FOR COMPLETION AND FORFEITURE DUE TO DELAY

Schedule A: The work for Schedule A shall be completed within FOUR HUNDRED AND TWENTY (420) CONSECUTIVE CALENDAR DAYS from and after the date of the Notice to Proceed.

Schedules A and B: The work for Schedules A and B shall be completed within FOUR HUNDRED AND EIGHTY (480) CONSECUTIVE CALENDAR DAYS from and after the date of the Notice to Proceed.

The Contractor will not be permitted to begin work until the agreement, bonds or substitutes, insurance certificates and endorsements are acceptable to the District and Attorney for Owner. This period of time is set forth in Paragraph 3-2 Execution of Contract in the General Provisions. Time is of the essence in this contract.

Schedule restriction: The temporary access road and lower gate relocation must be installed and approved, and temporary facilities for District staff to be occupied by the District prior to the administrative and operations buildings being released to the Contractor.

The Contractor shall complete all work in its entirety as specified in the Contract Documents within these time periods. Time of completion shall also include time for all submittals and coordination required to satisfy the requirements of these Contract Documents.

The Contractor agrees that the work shall be prosecuted regularly, diligently, and uninterruptedly and at such rate of progress as will insure full completion thereof within the Time for completion stated above. It is expressly understood and agreed, by and between Contractor and Owner that the Time for completion is reasonable for the completion of the

WORK, taking into consideration the average climatic range, usual industrial conditions prevailing in this locality, and lead time required to procure equipment.

Pursuant to Government Code 53069.85, forfeiture for each day completion is delayed beyond the time allowed for will be at the rate of $2,000.00 per day.

1.08 PERMITS

The Contractor shall obtain all required permits and provide copies of all permits to the District's Representative prior to starting work, including the San Diego County Air Pollution Control District's permits for construction and operation of diesel generators. The Contractor shall comply with the ordinances, directives, and regulations of the respective agencies with jurisdiction over the area of the work. All work not specifically covered in the required permits shall conform to the requirements of these Specifications. The cost of all permits and plan check review shall be borne by the Contractor and included in the Contractor's bid.

The Contractor shall be responsible for developing haul routes for the importing or exporting of materials or equipment for the project and obtaining all required permits from the affected agencies of jurisdiction, i.e., City of Carlsbad. The Contractor shall provide copies of all haul route permits to the District's Representative prior to starting work. The Contractor shall comply with the ordinances, directives, and regulations of the respective agencies with jurisdiction over the area of the work. All costs for transport fees, dump fees, plan or haul route reviews, permits, and related incidentals shall be borne by the Contractor and included in the Contractor's bid.

1.09 USE OF ASBESTOS PRODUCTS NOT PERMITTED

The intent of the Contract Documents is to provide asbestos-free components throughout the project in accordance with the recent Environment Protection Agency stated policy seeking a ban on the use of all products containing asbestos. Where the Contract Documents or the referenced specifications, standards, codes, or tests refer to products containing asbestos, the Contractor shall provide acceptable alternatives under those documents, or in the absence of such referenced alternatives, he shall submit a proposed substitute to the District's Representative for review and acceptance.

1.10 ASBESTOS CEMENT PIPE REMOVAL AND DISPOSAL

If asbestos cement pipe must be cut and handled in the field to accomplish the work, the Contractor is solely responsible for and shall take all appropriate precautions for protecting against threats to health and safety of the work force and general public arising out of construction involving asbestos. The Contractor shall comply with all applicable regulations for the handling, cutting, shaping, installation and disposal of asbestos. Asbestos cement pipe to be disposed shall be properly manifested, prepared for transport following criteria of County of San Diego Department of Public Works, Solid Waste Division, and delivered to a landfill permitted for disposal of non-friable asbestos containing materials. The completed Generator copy (yellow) manifest shall be returned to the District's Representative. All cost for disposal of the AC pipe shall be included in the Contractor's bid.

1.11 ABATEMENT OF AIR POLLUTION

Comply with all applicable Federal, State, County, and City laws and regulations concerning the prevention and control of air pollution.

Conduct construction activities and equipment in a manner so as to minimize atmospheric emissions or discharges of air contaminants. Equipment or vehicles that show excessive emissions of exhaust gases shall not be operated on the site.

1.12 NOISE CONTROL REQUIREMENTS

A. The Contractor shall comply with all local sound control and noise level rules, regulations and ordinances which apply to any work performed pursuant to the Contract.

B. Each internal combustion engine, used for any purpose on the job or related to the job, shall be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine shall be operated on the project without said muffler.

C. Each vehicle equipped with a back-up alarm shall use a white noise back-up alarm Brigade BBS-97 or equal at all times.

D. Noise level requirements shall apply to all equipment on the job or related to the job, including but not limited to trucks and transient equipment that may or may not be owned by the Contractor. The use of loud sound signals shall be avoided in favor of light warnings except those required by safety for the protection of personnel.

1.13 AMOUNT OF LIABILITY INSURANCE

A. Employer's Liability Insurance:

1. Bodily injury coverage by accident shall be for not less than $2,000,000 for each employee and $2,000,000 for each accident.

2. Bodily injury coverage by disease shall be for not less than $2,000,000 for each employee and $2,000,000 for each disease.

General Liability:

Bodily injury, personal injury, and property damage coverage shall be in a combined single limit of not less than $2,000,000 for each occurrence and $5,000,000 aggregate.

Automobile Liability:

Bodily injury and property damage coverage shall be in a combined single limit of not less than $2,000,000 for each occurrence.

Builder's Risk Insurance:

Builder's risk insurance shall be provided for the full contract amount.

Earthquake and Tidal Wave Insurance:

Earthquake and Tidal Wave Insurance is not required for this project.

Additional Insured:

In addition to the additional insureds required for Liability insurance in the General Provisions, 8-3 LIABILITY INSURANCE, and 8-4 BUILDER'S RISK "ALL RISK" INSURANCE, the OWNER and each of its directors, officers, employees, and agents and its Design Engineer shall be named as additional insureds for all Liability insurance and Builders' Risk Insurance provided herein.

1.14 USE OF THE STANDARD DRAWINGS

Where the Drawings or Specifications make reference to the Standard Drawings, construct the item in accordance with the details and materials as specified in the Contract Documents. For items not included in the Standard Drawings that are part of the Contract Documents, construct the item in accordance with the Olivenhain Municipal Water District, Standard Specifications and Drawings for the Construction of Water, Recycled Water, and Sewer Facilities dated 2017 with revisions. These District Standard Drawings and Standard Specifications are available on the District's website.

1.15 PRECEDENCE OF CONTRACT DOCUMENTS

In the event of a conflict between contract documents the document highest in precedence shall control. The precedence of contract documents shall be the latest edition of the following documents listed in order of highest to lowest precedence:

1. Permits from other Agencies as required by law
2. Approved Change Orders, most recently issued
3. Contract Addenda, most recently issued
4. Contract Documents
5. Carlsbad General Provisions and Supplemental Provisions
6. Project Technical Specifications
7. Olivenhain Municipal Water District Standard Specifications
8. Project Plans
9. Standard Drawings
    a. Olivenhain Municipal Water District Standard Drawings
    b. San Diego Regional Standard Drawings
10. Standard Specifications for Public Works Construction, as amended
11. Reference Specifications
12. Manufacturer's Installation Recommendations

Detail drawings shall take precedence over general drawings.

Change Orders, Supplemental Agreements, and approved revisions to the Plans and Specifications will take precedence over items 4 through 9 above.

1.16 CONSTRUCTION SCHEDULE AND BID BREAKDOWN

The Contractor shall conform with the requirements of Article 6-3 Contractor's CONSTRUCTION SCHEDULE AND COST BREAKDOWN of the General Provisions within 15 days after the date of award of contract. Submit to the District's Representative a construction progress schedule and bid breakdown in bar chart form. Divide each lump sum bid item into its major elements of work and show separately labor, materials and equipment costs. The District's Representative will use this cost breakdown as a basis for the monthly progress estimate and payment. The schedule shall specifically include and identify the construction sequence requirements defined on the plans.

1.17 STORM WATER POLLUTION PREVENTION-

A. Olivenhain Municipal Water District (District) has prepared a Storm Water Pollution Prevention Plan (SWPPP) for the project. The Contractor is responsible for Implementation, Maintenance, Inspection, Monitoring and Construction/Installation of all Best Management Practices (BMPs) required by the SWPPP, Construction General Permit (CGP), and the Erosion Control Plan for the purpose of preventing the discharge of pollutants from the construction site throughout the duration of the project. The Contractor is to provide all labor, materials and equipment to perform all work necessary to accomplish the work described below and per the Plans, Specifications, Special Provisions and applicable State Permits listed in the Bid Documents and References herein.

B. SCOPE OF WORK

1. The District will provide the Contractor with the SWPPP and file the Notice of Intent (NOI), the necessary Annual Reports, and the Notice of Termination (NOT). The District will also designate a SWPPP Manager in writing to the Contractor. The Contractor shall provide the services of a Qualified Stormwater Practitioner (QSP) and will be responsible for adhering to and implementing the monitoring requirements set forth in the SWPPP and the CGP as well as coordination with the District supplied QSP. The name of the QSP, together with their qualifications and certifications, shall be submitted to the District as a formal submittal.

2. No work shall commence on the project prior to the District submitting the Permit Registration Documents (PRDs) and a Waste Discharge Identification Number (WDID#) being issued by the SWRCB.

3. The SWPPP shall remain within the project limits at all times during the duration of the project or at a location approved by the District. The Contractor shall make the SWPPP available at all times per the requirements of the CGP.

4. The Contractor shall monitor the National Oceanic Atmospheric Administration (NOAA) website at www.noaa.gov for the current weather conditions on a daily basis.

Contractor shall inform the District of any potential rain and/or storm conditions. A printed copy of the NOAA forecast shall be attached to all inspection reports.

5. The Contractor's QSP shall perform all of the required maintenance according to the appropriate sections and attachments per the CGP for the established risk level of the project. Inspections and reporting shall continue for the duration of the project until the NOT has been accepted by the SWRCB.

   The District's QSP shall perform all of the required inspections and reporting according to the appropriate sections and attachments per the CGP for the established risk level of the project. Inspections and reporting shall continue for the duration of the project until the NOT has been accepted by the SWRCB.

6. Inspection reports provided by the District's QSP shall be kept on site in the SWPPP binder. The Contractor shall be responsible to send an electronic copy of each inspection report to the District's Project Manager and SWPPP Manager no later than the end of each week for review.

7. Each report must be accompanied with appropriate pictures to adequately document the effectiveness of installed BMPs and SWPPP practices.

8. District's QSP will upload all reports to SMARTS.

C. DELIVERABLES

1. After the construction project is complete, the Contractor shall deliver hardcopies of all inspections reports, an electronic copy of all pictures, and any miscellaneous SWPPP documents to the District.

2. The delivery of the required reports and pictures to the District shall be within 14 days of project completion.

D. NON-COMPLIANCE

1. Should the Contractor not install all required BMPs per the CGP and SWPPP as determined by the District's QSP, in his/her sole discretion, the site shall be deemed to be out of compliance. The Contractor will have 48 hours, upon notification by the District, to install or repair any BMPs necessary to keep the project in compliance with the CGP. If after the 48 hour time frame, the project is still considered out of compliance, the District may take any actions necessary to return the project back into compliance with the requirements of the CGP and SWPPP. Any and all costs expended by the District to bring the project back in compliance as determined by the SWPPP Manager, in his/her sole discretion, shall be charged to the Contractor.

2. If the District receives any non-compliance notifications or fines from Governing Municipalities and/or the State, the Contractor shall indemnify and defend the District. Any and all costs resulting from a violation and/or fine will be borne by the Contractor to include District staff, legal, and consulting costs at the Contractor's sole expense.

3. The District and the District's QSPr will be onsite, throughout the duration of the project, to monitor and verify that all reporting and BMP Implementation is being performed per the requirements of the CGP.

4. If at any time the site is deemed to be out of compliance as determined by the District's QSP, in his/her sole discretion, the District reserves the right to stop all construction activities. The site will remain inactive until the Contractor performs all the necessary actions to return the project back in compliance with the requirements of the CGP and SWPPP.

5. There will not be any days given to the Contractor for an extension of the contract for the time the site is deemed to be out of compliance. The Contractor is solely responsible for maintaining all of the necessary BMPs at all times and ensure the project meets all of the CGP and SWPPP requirements.

E. IMPLEMENTATION OF BMPs

1. The Contractor shall be responsible to protect the site at all times per the requirements of the CGP and the project SWPPP.

2. The Contractor shall be responsible to protect but is not limited to the following:

   A. Stockpiles (Soil, Asphalt, Concrete, Sand, Gravel and other material)
   B. Concrete Washouts
   C. Trash Containers and Dumpsters
   D. Slopes and Disturbed areas
   E. Equipment and Vehicles
   F. Bagged and Boxed materials
   G. Liquid and Hazardous materials
   H. Portable Toilets and Storage Facilities

3. The Contractor shall install, implement and maintain the BMPs to the Maximum Extent Practical (MEP) to prevent or reduce pollutant discharges to local storm drain, storm drain conveyance systems and/or receiving waters from construction activities. BMPs are to be installed per the California Stormwater Quality Association (CASQA) BMP Handbook (2009) and shall be applied to but not limited to the following:

   A. Erosion Control on Slopes

B. Erosion Control on Flat areas; or BMPs to desilt runoff from flat areas
C. Runoff Velocity Reduction
D. Sediment Control
E. Offsite Sediment Tracking Control
F. Materials Management
G. Stockpile Management
H. Waste Management
I. Vehicle and Equipment Management
J. Temporary Soil Stabilization
K. Storm Drain Inlet Protection
L. Wind Erosion Control
M. De-watering an Hydrostatic Operations
N. Materials Pollution Control
O. Water Conservation
P. Structure Painting and Construction
Q. Paving Operations
R. Planned Construction Operations
S. Downstream Erosion Control
T. Prevention of Non-Storm Water Discharges
U. Protection of Ground Water

4. BMPs are to be installed by qualified personnel only. The Contractor's QSP is responsible to inspect all BMPs for proper installation per the CGP, CASQA BMP Handbook, Erosion Control Plan, and the SWPPP.

5. The Contractor shall inform the District of any BMP failures, malfunctions, breeches and/or discharges during the course of construction. The Contractor will be responsible for the repair and clean up of any breech and or discharge caused or related to their work at no additional cost to the District.

6. The Contractor shall be responsible for maintaining proper dust control during the course of construction per the (spell out first) Air Quality Management District (AQMD) standards.

7. All entrances and exits of work and storage areas shall be inspected on a daily basis. Any dirt, dust, or debris leaving the project site will be the sole responsibility of the Contractor to correct immediately upon occurrence.

8. All slopes and stockpiles that have been inactive for 14 days or in the event of a rain storm shall be properly protected per the requirements of the CGP and SWPPP.

9. Contractor shall be responsible to implement Post Construction BMPs for permanent control of erosion from slopes and required vegetation areas. These BMPs shall include but are not limited to:

   A. BMPs and Landscaping shown on the erosion control and project plans
   B. Structures to convey runoff safely from slopes and walls
   C. Vegetation or alternative stabilization of all disturbed slopes
   D. Re-vegetation of any natural drainage systems to the MEP

F. TERMINATION

1. At the end of the project, the Contractor shall be responsible for removal of all temporary BMP measures, all construction related materials, equipment, trash/litter/debris, portable toilets, stockpiles of materials and any trash and concrete washout containers. The Contractor is responsible to re-install, plant, repair or replenish, any vegetation, landscaping or permanent structure damaged or disturbed during the course of construction of which is not called out or listed on the bid documents and plans.

G. TRAINING

1. Prior to the commencement of construction, all personnel that will be on site shall go through a formal SWPPP training provided by the District. This training will take place at a mutually agreed upon location and will last for 1 hour. Additional training shall take place at a minimum of once a month as determined by the Owner's Representative throughout the course of construction and until such time that an NOT has been filed and accepted by the SWRCB.

H. REFERENCES

1. State Water Resources Control Board (SWRCB) Construction General Permit (CGP) Order No. 2010-0014-DWQ National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000002, Waste Discharge Requirements for Discharges of Storm Water Runoff Associated with Construction Activity.

2. California Stormwater Quality Association, CASQA Construction BMP Handbook/Portal.

3. San Diego County Ordinance No. 9424
   (Watershed Protection, Stormwater Management and Discharge Control)

1.18 ACCESS OF DISTRICT'S REPRESENTATIVE TO CONFINED SPACES IN STRUCTURES UNDER CONSTRUCTION

A. The Contractor shall be aware that some or all portions of the work may be designated as a PERMIT REQUIRED CONFINED SPACE. The Contractor is required to provide the Owner with a copy of the Contractor's Confined Space Program for Owner's review and acceptance prior to beginning work. Contractor's Confined Space Program shall be in compliance with Cal-OSHA's Confined Space regulatory requirements. The Contractor is required to perform all work in accordance with Cal-OSHA Confined Space requirements and Title 8, Subchapter 20 "*Tunnel Safety Orders*".

The Contractor shall provide the following assistance to the personnel of the District's Representative when said personnel must enter confined spaces in structures under construction or structures which have not been accepted by the District.

1. Training program for the personnel of the District's Representative relevant to the specific structures being entered.
2. Testing equipment and personnel to operate said equipment for testing the atmosphere in the confined spaces for oxygen deficiency, explosive gases, and toxic gases.
3. Authorized competent person to stand by each confined space while entrants are inside the space.
4. Safety equipment (breathing apparatus, harnesses, and rescue equipment) in good working order.
5. Communication equipment.
6. Access equipment (hoists and ladders).
7. Signs.
8. Alarm system.
9. Ventilation system.

The Contractor shall identify confined spaces on the project, mark them with warning signs per CAL/OSHA requirements, and notify the District's Representative that these structures now exist.

1.19 PROTECTION OF EXISTING UTILITIES

The Contractor shall coordinate their efforts with the District and shall take every precaution to protect all existing utilities and structures at the project site. The Contractor shall be responsible for all Underground Service Alert notification and mark outs prior to the beginning of work.

1.20 COORDINATION WITH DISTRICT OPERATIONS

B. The Contractor shall coordinate all work with the District sufficiently ahead of time so as to not interfere with the District's operation of their systems or facilities. The Contractor shall submit a detailed sequence of work to the District for all work. This proposed sequence of work shall be reviewed with the District prior to construction for consistency with the

Sequence of Work as described in these Contract Documents and the District's required operation and shut-down plan.

C. The District will operate all existing valves. Therefore, the Contractor must coordinate connection work with operations. Once the pipelines have been isolated, the Contractor shall dechlorinate and drain all lines.

D. In the event the Contactor causes an interruption to District business operations, Contractor shall halt all activities until District business operations are fully restored.

1.21 PRE-CONSTRUCTION CONFERENCE AND PROGRESS MEETINGS

A Pre-Construction Conference shall be scheduled prior to start of project as described in Section 013100 Project Management - Coordination. The District, the Contractor, and the District's Construction Manager shall be present. The Contractor's detailed sequence of work and a list of labor, material and equipment rates for additional work shall be established and maintained throughout the project. Contractor shall identify all personnel assigned to the project and a complete set of approved submittal data for use by inspection personnel. Contractor shall have a designated representative for this project.

The Contractor shall also attend a project planning meeting as described in Specification Section 013100 Project Management - Coordination.

1.22 HOURS OF WORK

Except for scheduled utility cut-over or outages, hours of work shall be 7:00 A.M. to 5:00 P.M Monday through Friday. Saturday work will only be allowed with prior written approval by the Owner and shall be restricted to enclosed portion of the buildings. Overtime and shift work may be established as short-term procedure by Contractor with written notice to and written permission from Owner. **Absolutely no equipment shall be started or warmed up prior to 7:00 AM or after 5:00 PM.** No work other than overtime and shift work approved by Owner shall be done between the hours of 5:00 P.M. and 7:00 A.M., nor on weekends, or District recognized holidays, except such work as is necessary for the proper care and protection of the work already performed, except in case of emergency, and as specified herein. The District recognized holidays are as follows:

Christmas Day	Tuesday, December 25, 2018
New Year's Day	Tuesday, January 1, 2019
Martin Luther King Day	Monday, January 21, 2019
Presidents' Day	Monday, February 18, 2019
Memorial Day	Monday, May 27, 2019
Fourth of July	Thursday, July 4, 2019
Labor Day	Monday, September 2, 2019
Veterans Day	Monday, November 11, 2019
Thanksgiving Day	Thursday, November 28 2019
Day after Thanksgiving	Friday, November 29, 2019
Christmas Day	Wednesday, December 25, 2019
New Year's Day	Wednesday, January 1, 2020
Martin Luther King Day	Monday, January 20, 2020
Presidents' Day	Monday, February 17, 2020

Memorial Day	Monday, May 25, 2020
Fourth of July	Friday, July 4, 2020

1.23 CONSTRUCTION SURVEYS

A. LAND MONUMENTS

The Contractor shall notify the District and the District's Representative of any existing Federal, State, City, County, and private land monuments encountered. All monuments shall be preserved, or if necessary to be destroyed during performance of the Work, shall be replaced by a licensed surveyor under contract to the Contractor. Appropriate record of survey drawings shall be filed with the City of Carlsbad and County of San Diego for all replaced monuments. When government monuments are encountered, the Contractor shall notify the District's Representative at least two (2) weeks in advance of the proposed construction and provide for surveying of the existing monument before it is disturbed or destroyed.

B. CONSTRUCTION STAKING

1. The Contractor shall furnish construction staking to execute the work as described in the Contract Documents. Preserve all construction stakes, reference points, and other survey points. In case of their loss or destruction, the Contractor shall be liable for their replacement. If the field survey stakes are not available for review by the District's Representative, the work may not proceed.

1.24 GEOTECHNICAL WORK

A. SUBSURFACE INVESTIGATIONS

Geotechnical investigation(s) pertaining to the project site have been performed for this project and are included as part of these contract documents. This report, other available investigation reports and the project site should be thoroughly reviewed by each potential Contractor prior to submission of a bid.

1. The Contractor may make independent subsurface, soil, or geotechnical investigations of the project site in order to satisfy himself of the subsurface conditions that may be encountered. No additional compensation will be made for such investigations.

2. Bidders shall make their own independent evaluation of the rippability of rock and include all costs associated with the proper equipment to excavate, remove and dispose of rock in their bid. Blasting will only be permitted upon the approval of the District if a benefit to the District and the project can be demonstrated.

B. CONSTRUCTION TESTING

1. The Owner shall furnish compaction testing for all bedding, backfill, and soil compaction testing.

2. The Owner shall furnish all materials testing and special inspections called for in the Contract Documents.

3. When any work is determined to be unsatisfactory, faulty or defective, or does not conform to the requirements of the Contract Documents, the costs incurred by the Owner for additional tests or inspections shall be reimbursed by the Contractor. Said costs shall be paid by the Owner and deducted from progress payments to the Contractor.

1.25 CONSTRUCTION WATER

Refer to Section 015000

1.26 POWER AND LIGHTING

Refer to Section 015000

1.27 CONTRACTOR STAGING AND LAYDOWN AREA

The Contractor shall locate all staging and laydown areas that he may require for the performance of the Work. The District has not acquired any staging areas for the Contractor to stockpile material, locate a job site trailer, maintain equipment from, or perform any of the activities required to complete the work for the project. The District has identified a potential site for a job site trailer as shown in the Drawings. Staging areas are available on District property on the project site. For any area to be used by the Contractor other than the areas identified on the project site, the Contractor shall coordinate with the property owner, obtain written permission from the property owner for use of the area, coordinate with any resource or permitting agency that may have jurisdiction over the area, obtain and pay for any permits or agreements and provide any environmental mitigation required, and pay any fees or rental charges required for use of the area. The Contractor shall provide to the District Representative a copy of the letter from the Property Owner giving permission to use their property as a staging/laydown area. The Contractor shall be responsible for returning all areas used to their original conditions. At least 14 days prior to moving onto any site, the Contractor shall submit to the District Representative a copy of the written permission letter from the Property Owner of that area, and a description of any permits and mitigation actions that are required for use of the area. Submittals shall be in accordance with Section 013300. All requests for the use of privately-owned land must be submitted to the Owner for written approval by the District's General Manager prior to its use. The Owner may deny use of any privately owned property for this project in its sole discretion.

1.28 DUST CONTROL AND CLEANUP

A. Throughout all phases of construction, including suspension of work, and until final acceptance of the project, the Contractor shall keep the work site clean and free from rubbish and debris. The Contractor shall also abate dust nuisance by cleaning or sweeping and sprinkling with water or other means as necessary, in accordance with the San Diego Air Pollution Control District's regulations. The use of water resulting in mud on public streets and/or private property will not be permitted as a substitute for cleaning, sweeping, or other methods. Every day, and as required by the Owner's Representative, the Contractor shall furnish and operate a motorized, self-loaded sweeper with water spray nozzles to keep paved areas affected by the work acceptably clean and dust free.

1.29 SANITATION AND DRINKING WATER

A. Reference Section 015000

1.30 SAFETY

A. Owner and its inspectors, consultants, agents and other representatives are in no way responsible for safety and are there only to observe the work compliance with plans and specifications.

B. The Contractor acknowledges responsibility for jobsite and acknowledges that the District, Engineer and their agents, employees, consultants and representatives will not have any such responsibility. To the fullest extent permitted by law the Contractor shall indemnify, defend and hold harmless the District, Engineer, their present companies, subsidiaries, agents, and employees from and against all claims, damages, losses and expenses, including but not limited to attorney fees and claim costs, arising out of or resulting from performance of work by the Contractor, its subcontractors, or their agents and employees, which results in damage, loss or expense is caused in whole or in part by the negligence, active or passive, or District, Engineer, their parent and subsidiary companies, as well as their agents and employees, excepting only the sole negligence of District, Engineer, their parent or subsidiary companies and their agents and employees.

1.31 INDEMNIFICATION

A. Contractor hereby releases and agrees to indemnify, defend, hold harmless the District, Engineer, their parent and subsidiary companies, agents, employees, consultants and representatives for any and all damage to persons or property or wrongful death regardless of whether or not such claim, damage, loss or expense is caused in whole or in part by the negligence, active or passive, of District, Engineer, their parent and subsidiary companies, as well as their agents and employees, excepting only the sole negligence of District, Engineer, their parent or subsidiary companies and their agents and employees to the fullest extent permitted by law. Such indemnification shall extend to all claims, demands, actions, or liability for injuries, death or damages occurring after completion of the project, as well as during the work's progress. Contractor further agrees that it shall accomplish the above at its own cost, expense and risk exclusive of and regardless of any applicable insurance policy or position taken by any insurance company regarding coverage.

B. Contractor shall defend, indemnify and hold the District, Engineer, its employees, officers, or agents, harmless against any and all claims by any parties arising from, or related to, any and all damages, including legal costs and attorney's fees, resulting from interference with, interruption of, damage to, or any and all injuries which result from damage caused to subsurface installation, which is unforeseen and despite Engineer's/Architect's effort during the design process was not located, excepting only the gross negligence or willful misconduct of Engineer in providing its services.

1.32 AUDIO-VIDEO DOCUMENTATION OF PROJECT SITE

A minimum of two (2) weeks prior to start of construction and delivery of any equipment, materials or supplies to the site, the Contractor shall provide pre-construction digital color audio-video documentation as specified herein for the purpose of establishing the surface

conditions existing in all of the areas to be affected by the construction and to avoid potential construction repair disputes.

Digital color audio-video documentation shall consist of the recordation of surface features taken along the entire area of the project, including all work, storage, and staging areas and all intersecting roadways. Prior to audio-video taping of the project, all areas to be documented shall be investigated visually with notations made of items not readily visible by taping methods.

Coverage of the digital color audio-video documentation shall include, but not be limited to: all existing driveways, sidewalks, curbs, streets, signs, landscaping, trees, catch basins, fences, monuments, fencing, visible utilities and all buildings located within the zone of influence. Of particular concern are any existing faults, fractures, cracks, defects or other features. Front and/or side yard areas of residential homes within the zone of influence of construction shall also be recorded. Audio description shall be made simultaneously with and support the video coverage.

Two (2) copies of the digital color audio-video documentation shall be provided to the Owner's Representative on DVD, USB Flash Drive or other electronic data storage device suitable to the Owner prior to the start of construction. Utility mark out (USA) shall be completed prior to the audio-video documentation and shall be included in the pre-construction audio-video documentation. Any project areas not fully documented shall be re-shot as directed by the Owner's Representative.

Construction work shall not commence until audio-video documentation has been delivered to the Owner's Representative.

1.33 MEASUREMENT AND PAYMENT

A. General:

1. The measurement and payment provisions of these Contract Documents shall govern over those of referenced standards, if any.

2. The price set forth in the Bid Form for the work shall include all costs and expenses incidental to completing the work, and payment of the price bid will be payment in full under this contract, except as provided by Article 9-1 PAYMENT FOR CHANGES IN THE WORK of the General Provisions.

3. As a condition precedent to approval of the Contractor's monthly payment application by the District's Representative, the Contractor shall attend all progress or issue resolution meetings scheduled by the District's Representative. In addition, the Contractor shall submit a monthly construction schedule properly updated and accurately showing the work completed to date and the work yet to be performed in the remaining Contract time. The Contractor agrees failure to comply with the foregoing to the satisfaction of the District's Representative shall delay the monthly progress payment to the Contractor without penalty to the District.

Lump Sum Work Items Listed in the Bid Schedules:

4. The lump sum prices include full compensation for furnishing the labor, materials, tools, and equipment and doing all the work involved to complete the work included in

lump sum work items listed in the Bid Schedules and defined by the Contract Documents.

5. The application for payment for a lump sum payment item will be for that specific work item based on the percentage completed. The percentage complete will be based on the value of partially completed work relative to the value of the item when entirely completed and ready for service. The application for payment will be in accordance with Article 9-2 PROGRESS PAYMENTS of the General Provisions.

Unit Price Work Items Listed in the Bid Schedules:

6. The unit prices include full compensation for furnishing the labor, materials, tools, and equipment and doing all the work involved to complete the work included in the unit price work items listed in the Bid Schedules and defined by the Contract Documents.

7. The application for payment for a unit price payment item will be for that specific work item based on the units of work that are entirely completed and ready for service. The application for payment will be in accordance with Article 9-2 PROGRESS PAYMENTS of the General Provisions.

Work Items Not Listed in the Bid Schedules:

8. The General Provisions and items in the Special Provisions which are not listed in the Bid Schedules of the Bid Form are, in general, applicable to more than one listed work item, and no separate work item is provided therefor. Include the cost of work not listed but necessary to complete the project designated in the Contract Documents in the various listed work items of the Bid Form.

9. The bids for the work are intended to establish a total cost for the work in its entirety. Should the Contractor feel that the cost for the work has not been established by specific items in the Bid Form, he shall include the cost for that work in some related bid item so that his proposal for the project does reflect his total cost for completing the work in its entirety.

1.34 NOTICE OF COMPLETION

Contractor shall apply for acceptance of the work encompassed in the Schedule(s) awarded. Upon substantial completion of the work encompassed in the Schedule(s), the District, at the District's sole discretion, will issue a Notice of Substantial Completion for this work.

1.35 GUARANTEE

For all work encompassed in the Schedule(s) awarded, a one-year guarantee shall be furnished by the Contractor as required in the General Provisions, Article 5-14, except that any guarantee included for materials or equipment beyond the period specified herein shall be solely the responsibility of the guarantor and not the Contractor. This guarantee period shall commence with the District's issuance of a Notice of Substantial Completion .

1.36 LABOR COMPLIANCE PROGRAM AND CONTRACTOR REGISTRATION WITH STATE OF CALIFORNIA

In accordance with requirements defined by the California State Legislature via Senate Bill 854, all contractors and subcontractors involved with public works project shall be registered with the State Department of Industrial Relations. Registration is completed through an on-line application process and the payment of a fee to the State. The registration process requires contractors and subcontractors to provide workers' compensation coverage to its employees, hold a valid Contractors State Board License, have no delinquent unpaid wage or penalty assessments, and not be subject federal or state debarment. The registration form is located on the State Department of Industrial Relations website:

http://www.dir.ca.gov/DLSE/dlsepublicworks.html

Prior to start of construction, the Contractor shall submit to the District evidence of completing this registration for the prime firm and all subcontracting firms. Failure to submit the requested documentation shall be cause for delay of the project and subject to forfeiture due to delay in accordance with paragraph 1.07 of the Supplement to General Provisions.

1.37 PUBLIC NOTICE BY CONTRACTOR

For work involving the temporary closure of a marked crosswalk or sidewalk, Contractor shall post a notice of the closure at each end of the crosswalk/sidewalk not less than 7 days prior to the scheduled date of closure. In addition to any other public notice requirements, the notice shall include the project name, project logo, District's project hotline number, and estimated times and dates for closure.

END OF SECTION

SECTION 011000

SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work under separate contracts.
5. District-furnished products.
6. Access to site.
7. Coordination with occupants.
8. Work restrictions.
9. Specification and drawing conventions.

B. Related Section:

1. Division 1 Section "Construction Facilities and Temporary Controls" for limitations and procedures governing temporary use of District's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: Olivenhain – New and Remodeled Operations and Administration Facilities.

1. Project Location: 1966 Olivenhain Road, Encinitas, CA 92024

B. District: Olivenhain Municipal Water District, 1966 Olivenhain Road, Encinitas CA 92024

1. District's Representative: George Briest, Engineering Manager

C. Architect:

1. Architect's Representative: Mark Baker, Architect of Record

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and consists of the following:

1. Site and building demolition and site grading, paving and site improvements including landscaping as defined by the contract documents.

2. Building improvements defined as “Schedule A” which include 11,794 sq. ft. of interior improvements and 6,878 sq. ft. of new building construction.

3. Building improvements defined as “Schedule B” which include 1,428 sq. ft. of interior improvements and 4,203 sq. ft. of new building construction.

B. Type of Contract

1. Project will be constructed under a single General Contractor.

1.5 PHASED CONSTRUCTION

A. The Work shall be conducted in up to two (2) phases.

1. All demolition and all site improvements.

2. Building improvements and expansion identified as “Schedule A and Schedule B.”

1.6 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

1.7 ACCESS TO SITE

A. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated. Contractor to coordinate with the District on site access.

1. Limits: Confine construction operations to areas indicated on Drawings.
2. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to District, District's employees, and

emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weather tight condition throughout construction period. Repair damage caused by construction operations.

1.8 COORDINATION WITH OCCUPANTS

A. Full District Occupancy: District shall have access to the site and adjacent building(s) during the entire construction period. Cooperate with District during construction operations to minimize conflicts and facilitate District usage. Perform the Work so as not to interfere with District's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities including onsite retail client, OMWD's customer service representatives, lower lot facilities and Building J. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from District and approval of authorities having jurisdiction.
2. Notify the District not less than 72 hours in advance of activities that will affect District's operations. Refer to the General Conditions for a list of notification time-frames.

B. District Limited Occupancy of Completed Areas of Construction: District reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to District acceptance of the completed Work.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited District occupancy.
3. Before limited District occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, District will operate and maintain mechanical and electrical systems serving occupied portions of Work.
4. On occupancy, District will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.9 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday.

1. Weekend Hours: Refer to the General Conditions for weekend work requirements.
2. Early Morning Hours: No work to begin earlier then 7:00am.
3. Hours for Utility Shutdowns: Refer to the General Conditions.
4. Hours for Core Drilling or Noisy work: Refer to the General Conditions. All noisy work for utility cutovers is to be performed during regular work hours Monday through Friday in preparation of after-hours or weekend cutovers.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by District or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify District no less than a minimum two (2) weeks of proposed utility interruptions.

2. Notify District 30 days in advance of proposed utility interruption as it relates to moving District personnel into temporary modular trailers.
3. Obtain District's written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to District occupancy with District.

1. Notify District no less than a minimum one (1) week in advance of proposed disruptive operations.
2. Obtain District's written permission before proceeding with disruptive operations.

E. Nonsmoking Building: Smoking is not permitted within the building or within 50 feet (8 m) of entrances, operable windows, or outdoor air intakes.

F. Controlled Substances: Use of tobacco products and other controlled substances as noted above is not permitted.

G. Employee Identification: General Contractor to provide identification tags for Contractor’s personnel working on the Project site. Require personnel to utilize identification tags at all times.

H. Employee Screening: Comply with District's requirements regarding drugs and Background screening of General Contractor's personnel working on the Project site.

1. Maintain list of approved screened personnel with District's Representative.

1.10 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by General Contractor unless specifically stated otherwise.

B. Division 1 General Requirements: Requirements of Sections in Division 1 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 011400

WORK CONSTRAINTS

PART 1 – GENERAL

1.1 SUMMARY

A. The WORK is to be constructed within the Olivenhain Municipal Water District (OMWD) parcels as defined by the Contract Documents. The OMWD is a secured facility. Consideration must be given throughout the construction process to maintain the secured facility.

1.3 ADMINISTRATIVE, OPERATIONS AND MAINTENANCE ACCESS

A. CONTRACTOR shall provide safe, continuous access for administrative, operations and maintenance personnel. A clearly delineated vehicular path to maintenance facilities shall be provided at all times.

B. OMWD provides secure employee parking for its staff. The CONTRACTOR shall be mindful of the employee vehicles, and keep a safe buffer zone, delineated with traffic control devices if necessary, between the vehicles and the work area.

1.4 DISPOSAL OF MATERIALS

A. CONTRACTOR cannot stockpile on site any material for disposal, but shall dispose of the materials as they accumulate, at least weekly.

1.5 SITE SECURITY

A. The CONTRACTOR shall provide a list of workers employed on the site to the OMWD Operations Building front counter. (This is instead of requiring all workers to sign in individually every morning.) Visitors not on this list must sign in daily.

B. Despite the cameras, fences and gates, from time to time there are break-ins and things are stolen from the site. CONTRACTOR is advised that OMWD cannot guarantee the security of the site.

1.6 LAY-DOWN OR STAGING AREA

A. There is a limited area available for staging and material lay-down. Refer to supplemental general specifications for letter of permission requirements and Appendix C – Lay Down Limits Plan

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

3.1 WORK BY OTHERS

A. There are currently no other active projects at this site. However, this site is the main administration and operation hub for OMWD and other projects may come up during construction of this project.

3.2 GENERAL REQUIREMENTS FOR EXECUTION OF WORK

A. Locate temporary facilities in a manner that minimizes interference to OMWD's operation and maintenance personnel.

B. Confine materials and equipment to the designated staging areas to the extent possible.

END OF SECTION 011400

SECTION 012100

ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

1. An Allowance has been established for conditions that may be encountered during the course of Construction.

B. Related Sections:

1. Divisions 02 through 12 Sections for items of Work covered by allowances.

1.3 SUBMITTALS

A. Submit proposals for proposed changes designated as allowances, in the format specified for Change Orders.

B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

C. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

D. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.4 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.5 ALLOWANCE COST PROPOSALS

A. Allowance cost proposals shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.

B. Unless otherwise indicated, Contractor's cost proposals shall be inclusive of all material and labor, overhead and profit, and other costs, as included in the General Conditions for Change Orders.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. See Division 0 General Conditions for Allowance Schedule.

1. The following is a description of the Allowance Items listed:

a. (AI-1) For cutting and patching of asphaltic concrete paving beyond the scope of work = $5.00/sf

b. (AI-2) For cutting and patching of concrete paving beyond the scope of work = $10.00/sf

c. (A1-3) For roof sheathing replacement = $10.00/square foot.

d. (A1.4) For wall mural per keynote number 2 on Interior Sheet ID2.1 = $3,000.00

2. The allowances in the schedule includes material costs, receiving, handling, and installation, and Contractor overhead and profit.

END OF SECTION 012100

SECTION 012500

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

1.3 RELATED REQUIREMENTS:

A. Section 016000 - Product Requirements.
B. Divisions 02 through 32 Sections for specific requirements and limitations for substitutions.

1.4 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1.5 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use form provided at the end of this section.

2. Documentation: Show compliance with requirements for substitutions and the following as applicable:

3. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.

4. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by District and separate contractors that will be necessary to accommodate proposed substitution.

5. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

6. Product Data, including drawings and descriptions of products and fabrication and installation procedures.

7. Samples, where applicable or requested.

8. Certificates and qualification data, where applicable or requested.
9. List of similar installations for completed projects with project names and addresses and names and addresses of architects and District.

10. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

11. Research reports evidencing compliance with building code in effect for Project.

12. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
13. Cost information including a proposal of change, if any, in the Contract Sum.

14. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.

15. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

B. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

1. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
2. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.6 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.7 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

1.1 SUBSTITUTIONS

A. Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution does not require revisions to the Contract Documents.
2. Requested substitution is consistent with the Contract Documents and will produce indicated results.
3. Requested substitution provides sustainable design characteristics that specified product provided for achieving LEED prerequisites and credits.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's construction schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.

8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

Part 3 - EXECUTION (Not Used)

END OF SECTION 012500

Substitution Request Form

Re: _____ _____
Section # Project Name

_____
Item

To: _____
Architect

From: _____
General Contractor

We hereby submit for your consideration the following product comparisons of the specified item and the proposed substitution:

A. Comparison	Specified Item	Substitution
1. Product Name/Model	_____	_____
2. Manufacturer	_____	_____
Address	_____	_____
Phone Number	_____	_____
3. Product Cost	_____	_____
Installation/Labor Cost	_____	_____
4. Delivery Time	_____	_____
Installation Time	_____	_____
5. Product Characteristics	_____	_____
6. Dimensions	_____	_____
Effects	_____	_____
7. Guarantee/Warranty	_____	_____
8. ICBO No.	_____	_____
9. UL Rating	_____	_____

B. Substantiating Data: Attach manufacturer's literature for both specified item and substitution.

C. Samples: Provide samples for both specified item and substitution.

D. Similar Projects

1. _____ _____
Name Date

_____
Address

2. _____ _____
Name Date

_____
Address

E. Maintenance Service/Parts:

Name: _____

Address: _____

F. What effect does this substitution have on applicable code requirements?

_____

G. Change Date: Attach complete information for changes to be made to drawings and project manual.

****

- Certification of equal performance and assumption of liability for equal performance.
- The Contractor shall agree to pay for costs involved in changing the building design; including engineering, drafting and detail cost caused by the proposed substitution.

Submitted by:

_____ _____
Signature Printed Name

_____
Title

_____ _____
Firm Date

_____
Address

_____ _____ _____
Telephone Fax Email

Remarks:

_____

_____

_____

_____

Signature must be by persons having authority to legally bind his firm to the above terms. Failure to provide legally binding signature will result in retraction of approval.

This page left intentionally blank.

SECTION 013000

ADMINISTRATIVE REQUIREMENTS (PROCORE)

COLLABORATION SOFTWARE

1. SUMMARY
    a. Contractor shall use the owner provided project management collaboration software Procore (www.procore.com) to submit, track, distribute and collaborate on project documentation and action items.
    b. The intent of utilizing a web-based construction management application is to reduce cost and schedule risk, improve quality and safety, and maintain a healthy team dynamic by improving information flow, reducing non-productive activities, reducing rework and decreasing turnaround times.
2. SOFTWARE CAPABILITIES (including but not limited to)
    a. Daily Log
        i. Provide daily log entry from web and mobile with automatic capture of daily weather conditions.
        ii. Provide ability to attach photographs to entries directly from mobile.
        iii. Provide reporting capabilities to easily report on man-hours and activities for a certain time frame and contractor.
    b. Dashboards
        i. Provide a dashboard that shows the status of all currently assigned items with drill down capability to see the subject, assignee and due date of each item.
    c. Deficiency Tracking
        i. Provide a means for recording, assigning and confirming completion of any deficiency or observation noted during the course of construction. Must be accessible from web and mobile.
    d. Directory
        i. Provide a directory of all team member's contact information that is accessible from web and mobile.
    e. Documents
        i. Provide a storage location for miscellaneous project documents with the ability to have a folder hierarchy and privacy settings on folders.
        ii. There should not be a storage limit.
        iii. Provide download tracking.
        iv. Provide the ability to revision and check out files, with access to all previous revisions.

f. Drawings
    i. Provide access to a system maintained current set of drawings on web and mobile, with access to all previous revisions as well.
    ii. Provide automatic hyperlinking capability for detail callouts.
    iii. Provide drawing markup capabilities on web and mobile.
    iv. Provide ability to link RFIs, Submittals, Punchlist Items, Photos and Project Documents to the drawings.
    v. Drawing Markups should be carried forward when new revisions are uploaded.
    vi. Markups and linked documentation should be able to be public or private.
g. Financial Management
    i. Provide ability to manage contracts, payment applications and change orders through the software.
    ii. Provide ability to view contracts and change orders from web and mobile.
h. Inspections
    i. Provide ability to create inspections from web and mobile.
    ii. Provide ability to create a deficiency item from an inspection that can be assigned and tracked to completion.
i. Meetings
    i. Provide ability to create, edit and view meeting minutes from web and mobile.
    ii. Provide ability to create action items with assignees and due dates from a meeting item.
j. Mobile Accessibility
    i. Provide native mobile applications for iOS and Android phones at a minimum that provide access to relevant project documentation, including as-built versions of Drawings and Specifications, even when there is no internet access.
k. Photos
    i. Provide ability to upload and view photos from web and mobile.
    ii. Provide ability to markup photos from mobile to clarify anything important in the photo.
    iii. Provide ability to link photos to specific locations on drawings.
l. Punchlist
    i. Provide ability to create punchlist items from web and mobile and link them to specific locations on the drawings.

ii. Provide ability to distribute punch list items to all contractors, for contractors to mark them as resolved with photographic proof of resolution via mobile, and for the items to be marked as complete via mobile or web. .

m. Requests for Information (RFIs)

i. Provide ability to create RFIs with assignees, due dates and attachments.

ii. Provide ability for assignees to respond to RFIs both via the software and by responding to the system generated email.

iii. Provide an auto-generated log of all RFIs.

n. Schedule

i. Provide ability to display schedules from typical scheduling software such as Microsoft Project, Primavera P3, Primavera P6 or Asta Powerproject.

o. Specifications

i. Provide ability to upload project specifications and manage them at the individual specification level.

ii. Provide ability to view and search specifications on web and mobile.

iii. Provide ability to upload revisions to individual specifications and maintain all revision history.

iv. Provide an auto-generated current specification log that provides access to the current version of each specification.

v. Provide ability to link specifications to submittals and view the specification from the submittal.

p. Submittals

i. Provide ability to upload a submittal register of all expected submittals.

ii. Provide ability to create multi-step approval workflows for submittals, with reminder notifications for the current assignee.

iii. Provide the ability to upload any file type without size restrictions.

iv. Provide an auto-generated submittal log.

3. TECHNOLOGY

a. Fully web based with mobile apps for Windows, iOS and Android phones.

b. Accessible without logging in through a virtual private network (VPN).

c. Works on the current version of Internet Explorer, Google Chrome, Mozilla Firefox and Apple Safari browsers.

d. Can generate emails automatically, and all attachments are included in the emails via download links to avoid emails not being delivered due to size.

e. PDF output of forms such as RFIs, Submittals, Meetings, Change Orders, etc. should be available and customizable.

4. TRAINING AND SUPPORT
    a. The software selected must provide support to all parties via email, phone and live chat at no additional charge.
    b. The software selected must provide training in the form of self-paced learning videos as well as interactive webinars.
    c. The contractor shall hold a kickoff meeting with the Owner and applicable consultants at the beginning of the project to discuss how the software will be used, routing & naming protocols, etc.
5. PROCEDURES
    a. RFIs and Submittals
        i. The Contractor will be responsible for submitting all RFIs and Submittals through the software and assigning them to the appropriate parties.
        ii. Architects / Engineers / Consultants etc. are responsible for posting all responses to these items via the software, including all relevant attachments.
        iii. The Contractor will distribute responses to all affected subcontractors and confirm agreement with the response by closing the item.
    b. Construction Documentation
        i. The Contractor will manage Drawings, Specifications and Documents in the software to ensure that the current version of all applicable construction documentation is available to the entire team via web and mobile.
        ii. The Contractor will ensure that all RFIs which modify the current drawings are posted to the drawings and available via web and mobile within 24 hours of the RFI being responded to.
    c. Contractor will record and distribute meeting minutes and action items via the software.
    d. Contractor will take daily site photos and make them publicly available.
    e. Punchlist
        i. All punch list items will be managed through the software.
        ii. Punchlist items will be created by the Contractor while walking with the Owner and applicable consultants.
        iii. It will be at the Owner's discretion whether or not Punchlist Items can be closed while a representative from the Owner or applicable consultant is not present.
    f. General

i. It is intended that the contractor will utilize the software for at least all functions identified in “Section B – Software Capabilities.”

6. PRICING
    a. The cost of Procore Technologies services is paid in full by the Owner
    b. The software allows for unlimited users to ensure that all parties have access to the system.

END OF SECTION 013000

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 013100

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General project coordination procedures.
2. Administrative and supervisory personnel.
3. Coordination drawings.
4. Requests for Information (RFIs).
5. Project meetings.

B. Related Sections:

1. Section 013203: "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 017300: "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 017700: "Closeout Procedures" for coordinating closeout of the Contract.
4. Section 013000: "Administrative Requirements

1.3 DEFINITIONS

A. RFI: Request for information: DCM, Architect, or Contractor seeking information from each other during construction.

1.4 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Pre-installation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.
9. Project closeout activities.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings in accordance with requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
f. Indicate required installation sequences.
g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Constructon Manager and the Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire protection, fire alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate sub-framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:

    a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
    c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:

a. Runs of vertical and horizontal conduit 1-1/4 inch diameter and larger.
b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire alarm locations.
c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
d. Location of pull boxes and junction boxes, dimensioned from column center lines.

8. Fire Protection System: Show the following:

a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. Review: DCM will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are the Contractor's responsibility. If the DCM determines that the coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, the DCM will so inform the Contractor, who shall make changes as directed and resubmit.
10. Coordination Drawing Prints: Prepare coordination drawing prints in accordance with requirements of Division 1 Section "Submittal Procedures."

1.6 KEY PERSONNEL

A. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and email addresses. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.7 REQUESTS FOR INFORMATION OR INTERPRETATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. DCM will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor’s work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.

2. Project number.
3. Date.
4. Name of Contractor.
5. Name of DCM
6. Name of Architect.
7. RFI number, numbered sequentially.
8. RFI subject.
9. Specification Section number and title and related paragraphs, as appropriate.
10. Drawing number and detail references, as appropriate.
11. Field dimensions and conditions, as appropriate.
12. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
13. Contractor's signature.
14. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: AIA Document G716, CSI Form 13.2A, or Contractor's comparable form. The Contractor is to use Primavera Contract Manager for all RFI coordination, See General Conditions.

D. DCM's Action: DCM will review each RFI, determine action required, and respond. Allow five working days for Architect's response for each RFI. RFIs received by DCM after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for coordination information already indicated in the Contract Documents.
    d. Requests for adjustments in the Contract Time or the Contract Sum.
    e. Requests for interpretation of Architect's actions on submittals.
    f. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 1 Section "Contract Modification Procedures."

    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify the DCM and Architect within seven days if Contractor disagrees with response.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Use CSI Log Form 13.2B or Contractor's comparable form. Include the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.8 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify the DCM and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: The DCM will record significant conference discussions, agreements, and disagreements, including required corrective measures and actions. Distribute the meeting minutes to each party present, to parties who should have been present, and to other parties requiring information within three days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner, DCM and Architect.

1. Conduct the conference to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner, DCM, Architect, and their consultants; Contractor and its superintendent; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect progress, including the following:

a. Tentative construction schedule.
b. Phasing.
c. Critical work sequencing and long-lead items.

d. Designation of key personnel and their duties.
e. Lines of communications.
f. Procedures for processing field decisions and Change Orders.
g. Procedures for RFIs.
h. Procedures for testing and inspecting.
i. Procedures for processing Applications for Payment.
j. Distribution of the Contract Documents.
k. Submittal procedures.
l. Preparation of record documents.
m. Use of the premises and existing building(s).
n. Work restrictions.
o. Working hours.
p. Owner's occupancy requirements.
q. Responsibility for temporary facilities and controls.
r. Procedures for moisture and mold control.
s. Procedures for disruptions and shutdowns.
t. Construction waste management and recycling.
u. Parking availability.
v. Office, work, and storage areas.
w. Equipment deliveries and priorities.
x. First aid.
y. Security.
z. Progress cleaning.

4. Minutes: The DCM will record significant conference discussions, agreements, and disagreements, including required corrective measures and actions. Distribute the meeting minutes to each party present, to parties who should have been present, and to other parties requiring information of the meeting.

C. Pull Planning Schedule Collaboration: DCM to facilitate Last Planner® System, Pull Planning techniques. Creating commitment to schedules by ALL Project team members.
1. Attendees: All key stakeholders relevant to the success of the project; including but not limited to DCM, OMWD staff, Prime contractor's project staff, ALL trade contractor's site representatives including temporary trailer suppliers shall attend the meeting.
1. Agenda: Review and Introduction into the over-all intent of Pull Planning, the technics and the processes of creating Pull Planning Project Schedules, 6-Week Pull Planning Sessions, Weekly and Daily Pull Planning Updates. During initial Pull Planning the following will be reviewed:

a. Pull Planning versus traditional scheduling methods
b. Overall Contract Durations.
c. Options.
d. Making **"reliable commitments"**
e. Phasing Requirements.
f. Develop MILESTONE Plan.
g. Develop Phase Plan (Activities and sequence of work).

h. Develop first 6-WEEK Pull Plan.
i. Develop WEEKLY WORK PLANS.
j. Possible conflicts.
k. Percent Complete Plan.
l. Root Cause Analysis.
m. Create Buy-In

2. Minutes: The DCM is responsible for facilitating meeting will record significant conference discussions, agreements, and disagreements, including required corrective measures and actions. Distribute the meeting minutes to each party present, to parties who should have been present, and to other parties requiring information within three days of the meeting.
3. Do not proceed with Pull Planning if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Pre-installation Conferences: The Contractor shall conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility problems.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written recommendations.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.

u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Minutes: The Contractor is responsible for conducting meeting will record significant conference discussions, agreements, and disagreements, including required corrective measures and actions. Distribute the meeting minutes to each party present, to parties who should have been present, and to other parties requiring information within three days of the meeting.
4. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

E. Project Closeout Conference: Schedule and conduct a Project closeout conference, at a time convenient to Owner, DCM, IOR and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

a. Preparation of record documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Submittal of written warranties.
d. Requirements for preparing operations and maintenance data.
e. Requirements for demonstration and training.
f. Preparation of Contractor's punch list.
g. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
h. Submittal procedures.
i. Owner's partial occupancy requirements.
j. Installation of Owner's furniture, fixtures, and equipment.
k. Responsibility for removing temporary facilities and controls.

4. Minutes: The DCM will record significant conference discussions, agreements, and disagreements, including required corrective measures and actions. Distribute the meeting minutes to each party present, to parties who should have been present, and to other parties requiring information.

F. Progress Meetings: The DCM will conduct progress meetings at weekly intervals or at intervals approved by Owner.

1. Contractor shall coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner, DCM, Project Inspector and Architect, each contractor, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

        1) Review schedule for next period.

    b. Review present and future needs of each entity present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.
        7) Site utilization.
        8) Temporary facilities and controls.
        9) Progress cleaning.
        10) Quality and work standards.
        11) Status of correction of deficient items.
        12) Field observations.
        13) Status of RFIs.
        14) Status of proposal requests.
        15) Pending changes.
        16) Status of Change Orders.
        17) Pending claims and disputes.
        18) Documentation of information for payment requests.

4. Minutes: The DCM will record significant conference discussions, agreements, and disagreements, including required corrective measures and actions. Distribute the meeting minutes to each party present, to parties who should have been present, and to other parties requiring information of the meeting.

    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or

recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 013110

CONTRACTOR PERSONNEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Contractor shall employ competent personnel as indicated in this section.

B. Related Sections:

1. Section 013100 – Project Management and Coordination.

1.3 KEY CONTRACTOR PERSONNEL

A. Contractor shall assign the following minimum personnel to the project:

1. Project Manager: Full time.
2. Project Superintendent: Full time.
3. Assistant Project Manager: Full time through 50% completion.

1.4 REQUIREMENTS FOR KEY PERSONNEL

A. Project Manager shall have a minimum of ten years experience as Project Manager or Superintendent on similar projects.

B. Superintendent shall have a minimum of ten years experience as Superintendent on similar projects.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013110

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 013203

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's construction schedule.
2. Daily construction reports.

B. Related Requirements:

1. Section 011000: “Summary”.
2. Section 011400: “Work Constraints”
3. Section 013000: "Administrative Requirements (Procore)"
4. Section 013300: "Submittal Procedures"

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Except for Milestone Activities, activities included in a schedule consume time and resources.

1. Critical Activity: An activity, if delayed, would result in the delay to the overall completion.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.
4. Milestone Activity: An activity that does not occupy time or resources, but highlights an event.

B. Activity Codes: Values assigned to schedule activities to organize the schedule into groups for reporting and analysis. Examples include Responsibility, Building, and Site Area.

C. Calendar: Defines the week for different activities within the CPM schedule. Examples of calendars include 5-day week minus holidays, 7-day week, and 6-day week.

Different calendar types may be used in the CPM schedule.

D. Constraint: In the CPM schedule, a constraint is used to affect the float, duration, or date of an activity.

E. Cost Loading: Applying the Contract Price to the CPM schedule activities. Each work activity is assigned a value that accurately reflects the estimated cost of the described work, including labor, materials, equipment, etc. The sum of the activities values shall equal the Contract Price. Updates to the cost loaded schedule shall constitute the means by which Progress Payments are determined. CPM Schedules for this Contract shall be cost loaded.

F. CPM: Critical path method, which is a method of planning and scheduling a project where activities are arranged based on activity relationships.

1. CPM Network: A sequence of inner-connected activities. Network calculations determine the Critical (Longest) Path and when activities can be performed.

G. Critical (Longest) Path: The network of schedule activities that establishes the minimum overall Project duration.

H. Data Date: The date used as the starting point for schedule calculations. For baseline CPM schedules, the Data Date is the first date of Contract Time. For monthly updates, the Data Date is the first workday of the month.

I. Delay: An interruption of work.

J. Milestone: The starting or ending point of an activity or linked series of activities. A milestone in the schedule contains zero duration.

1. Key Milestone: A major event. A Key Milestone includes, but is not limited to the following: Notice to Proceed, Substantial Completion, Phase Start Date, and Phase Finish Date. The District Construction Manager may direct the Contractor to add additional Key Milestones.
2. Contractual Milestone: A milestone tied to Liquidated Damages. Substantial Completion is both a Key and Contractual Milestone.

K. Float: The measure of leeway in starting and completing an activity.

1. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
2. Total float is the amount of time by which a part of the Work may be delayed from its early dates before it delays a succeeding activity.
3. Contract Float: The amount of time between the Contractor's anticipated dates for early completion of the Work, or specified part, and the corresponding Contract Time.
4. Ownership of Float: Total float and contract float belong to the project and are not for the exclusive benefit of any party. Total float and contract float are jointly owned, and are resources available to the District or the Contractor on a first-come-first-served-basis for the benefit of the project. The District Construction

Manager shall monitor float to determine if any float erosion is for the benefit of the project

5. Float Manipulation: Utilizing unrealistic or inflated durations, imposed dates, artificial logic and/or lags, preferential logic, date constraints, and others that results in an impact to Float. Do not manipulate float. Instead, add detail within the schedule in order to mitigate the use of Float manipulation. Provide a detailed written explanation in the Baseline Narrative for items seen as potential float manipulation if directed by District Construction Manager. After a review of the Baseline Schedule and the detailed written explanation, any such actions ultimately seen as Float manipulation by the District Construction Manager may result in direction for a Baseline revision and re-submittal.

L. Lag: An adjustment of time between tied CPM schedule activities.

M. Near-Critical Activity: A non-critical activity with a Total Float value within 10 workdays of the Critical (Longest) Path.

N. P6: Primavera Professional Project Management, an industry standard CPM scheduling application.

O. Percent Complete: The portion of an activity that is complete based on the measurement of work accomplished. Percent completes are ultimately decided by the District Construction Manager.

P. Relationships: Ties between activities within the CPM schedule.

Q. Target Schedule: A different version of the CPM schedule that can be used as a basis for comparison against another CPM schedule.

R. TIA: Time Impact Analysis.

1.4 INFORMATIONAL SUBMITTALS

A. Submit required submittals per the following:

1. Indication of type of schedule being submitted (Baseline, Monthly Schedule Update, Time Impact Analysis, etc.)
2. PDF electronic file(s).
3. Electronic software file (for all CPM schedule submittals). Provide a unique file name in the schedule software for all CPM Schedules.

    a. Submit a P6 “XER” file and a P6 “XML” file.

4. Two (2) paper copies of all required reports and charts unless directed otherwise by the District Construction Manager.

B. Reports: As part of every CPM schedule submittal, submit each of the following reports:

1. Detailed Gantt Chart: Individual columns on left shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, calendar identifier, total float, budgeted cost, predecessor details and successor details. Activities shall be grouped in a manner acceptable to the District Construction Manager. All activities shall be depicted, and activities shall be sorted by early start dates, then total float and early finish dates. Gantt Chart shall be on a page of sufficient width required to display entire schedule for Contract Time. Size of paper/sheet is at discretion of District Construction Manager, and sheet size shall range from 11" x 17" to 36" x 48". Gantt Chart shall depict relationship lines between activities and shall also clearly show the Critical (Longest) Path.

    a. Columns on monthly updates shall also include: current month's activity percent complete and cost percent complete.
    b. For Monthly Schedule Updates, Time Impact Analyses, Recovery Schedules and Schedule Revisions, an additional bar shall be depicted on all CPM schedules to indicate the accepted Baseline schedule.

2. Critical Path Gantt Chart: A Detailed Gantt Chart, but filtered to only show Critical (Longest) Path activities. Size of paper/sheet is at discretion of the District Construction Manager, but shall range from 8.5" x 11" to 11" x 17".
3. Cash Flow Report: For the Baseline schedule submittals only, generate a report from the CPM software application that clearly shows the incremental (histogram) and cumulative (curve) projected costs by month for both the early and late dates.
4. Progress Payment Summary Layout: For each Monthly Schedule Update submittal, prepare as a layout from the CPM software application. This Layout shall act as the Schedule of Values.

    a. Activities shall be coded, grouped and summarized in a manner acceptable to the District Construction Manager. See Activity Codes Dictionary at the end of this section.
    b. Columns shall include: budgeted cost, activity percent complete, cost percent complete, period actual cost, cumulative actual cost, cost to complete, cost completion.

5. Schedule Narrative Report: With every CPM schedule submittal, submit a schedule narrative. The narrative report shall contain the following:

    a. Baseline Schedule: Explanations of assumptions in baseline schedule development including:

        1) General work sequencing, including phasing and interim housing considerations.
        2) Crew movements, and flow of work.
        3) Justification of Critical (Longest) Path path.
        4) Long lead equipment or material items.
        5) Constraints and challenges to completing the work.
        6) Lags used, with a detailed explanation for each use.
        7) Constraints used, with a detailed explanation for each use.

8) Coordination assumptions, both with subcontractors (for example, coordination drawings, Building Information Modeling, etc.) and other parties (for example, District, Architect/Engineer, School Site Staff, Utility entities, etc.)
9) Work week schedule, work hours and non-working days, including holidays.
10) Person(s) preparing and providing input towards schedule submittal.

b. Monthly Update: Items in this narrative report shall include:

1) Physical progress accomplished during the report period, broken down by each building and site area (for example, parking lot, play field, second floor, etc.).
2) Explanation of Critical (Longest) Path if changed from previous month's update (or accepted Baseline, if first Monthly Schedule Update).
3) Explanation of potential delays and/or problems and their estimated impact on performance, Key and Contractual Milestone dates, and the overall Completion date.
4) All Notices of Delay submitted to the District Construction Manager.
5) Alternatives for possible schedule recovery to mitigate delay or potential delay.
6) Known or anticipated problems with delivery of materials or equipment.
7) Approved weather impact dates incurred in previous month, along with affected CPM schedule activity identification numbers and activity descriptions.
8) Description of approved incorporated change orders for the report period, if any.

6. For each Monthly Schedule Update submittal: A copy of the Monthly Schedule Update markup documentation.
7. Key Plan: Develop a key plan in the form of one or several sketches showing limits of work, lay down areas, site access points, utility connection/tie-in points, phasing, sequencing, and general work procession. Contractor may use Site Plan drawings or similar drawings.
8. Other variations of the above reports, as directed by the District Construction Manager.

C. Daily Construction Reports: Submit to District Construction Manager as described herein.

D. Qualification Data: For Scheduler, in the form of a résumé.

1.5 QUALITY ASSURANCE

A. Scheduler Qualifications: Retain or employ an experienced specialist in CPM scheduling and reporting, with a minimum of three (3) years' experience in scheduling work of similar nature, scope and value, and capable of satisfying the requirements

described herein. The Scheduler is to provide planning, evaluation, reporting and delay analysis using CPM scheduling. Neither the Contractor's Project Manager nor Superintendent may also be the Scheduler.

1. Within the first three (3) days of Contract Time, submit for review and acceptance by the District Construction Manager the résumé of scheduling personnel retained or employed by the Contractor. The résumé shall include projects of similar nature, scope and value, and the Scheduler's role/job title on each listed project; a phone or in-person interview of the proposed Scheduler may be required. The District Construction Manager has the right to reject a Scheduler based upon a lack of experience as required by this Section, or based on a lack of performance and timeliness of schedule submittals on past projects. If the District Construction Manager does not accept the submitted Scheduler, submit another résumé within seven (7) days of notice from the District Construction Manager. The District Construction Manager, at any time during performance of the work, may request that the Scheduler be replaced if the District Construction Manager determines that the Scheduler's work is unsatisfactory. In this instance, submit another résumé within seven (7) days of notice from the District Construction Manager. If the Contractor wants to replace the Scheduler, the new Scheduler's résumé shall be submitted to the District Construction Manager for acceptance or rejection. The Scheduler must be accepted by the District Construction Manager prior to starting any site related work. Any delays due to the lack of an accepted Scheduler shall be deemed inexcusable.
2. Meetings: Scheduler shall attend all meetings related to alleged delays and time impact.

B. Schedule Software: All CPM schedules shall be prepared with a Windows operating system based CPM scheduling computer software program that is Primavera P6 Professional Project Management version 16 or later.

1.6 COORDINATION

A. Coordinate Contractor's construction schedule with the list of subcontracts, submittal register, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, SHORT-TERM CPM SCHEDULE

A. Prepare and submit a Short-Term CPM Schedule submittal to the District Construction Manager. The Short-Term Schedule shall detail the plan for the first sixty (60) days of

Contract Time, and shall be used to measure performance and determine progress payments until the Contactor's Baseline Construction Schedule is accepted.

B. The same requirements for the Baseline CPM Schedule shall apply to the Short-Term CPM Schedule, with the following exceptions: (i) only those activities covering the first sixty (60) days of Contract Time shall be reviewed; (ii) all reports described herein shall only cover the first sixty (60) days of Contract Time.

C. Within the first twenty-two (22) days of Contract Time, the Short-Term CPM Schedule submittal shall be submitted to the District Construction Manager.

1. The deduction for Contractor's delayed submission of the complete Short-Term CPM Schedule submittal is $150 per day; the same amount applies to late re-submittals. Any deduction shall occur on the first progress payment after the Short-Term CPM Schedule has been accepted. Refer to paragraph 1.4 herein regarding Submittal items.

D. The District Construction Manager will notify the Contractor that the Short-Term CPM schedule submittal has been accepted, accepted as noted, or requires a revision and re-submittal within seven (7) days of receipt. At the District Construction Manager's discretion, the Contractor, the Contractor's Scheduler, and the District Construction Manager will have a Short-Term CPM Schedule Review Meeting to review and make any necessary adjustments. If a re-submittal is required, the Contractor has five (5) days after the receipt of comments to submit a revision to the District Construction Manager. The District Construction Manager will notify the Contractor that the re-submittal has been accepted, accepted as noted, or requires a revision and re-submittal within five (5) days of receipt. At the District Construction Manager's discretion, another Review Meeting may be required. The cycle of seven (7) days to prepare a re-submittal, and five (5) days for District Construction Manager review shall continue until the Short-Term CPM Schedule has been accepted. Because the cost-loaded CPM schedule is the means by which progress payments are determined, no progress payments will occur until the District Construction Manager accepts the Short-Term CPM Schedule.

E. Upon acceptance, the Short-Term CPM Schedule shall represent the Contractor's plan for performance of the work during the first sixty (60) days of Contract Time. The Short-Term CPM Schedule shall be incorporated into first sixty (60) days of the Contractor's Baseline CPM Schedule. Submit to the District Construction Manager an update, for acceptance or rejection, of the short-term CPM schedule each month, until the complete Baseline Schedule is accepted. If a Short-Term CPM Schedule is accepted late in a month, the Contractor is still required to submit a Monthly Schedule Update for the previous period (for example, if a Short-Term CPM Schedule is accepted on January 26, the Contractor is required to submit Monthly Schedule Update with a January 1 Data Date).

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, BASELINE

A. Baseline Schedule: Prepare and submit a baseline CPM schedule that shows the breakdown of all work into activities to the extent required to effectively plan and

execute the Project, track and report work progress, effectively analyze time impacts and show all logical relationships (ties) between activities. The District Construction Manager will accept, accept as noted, or direct the Contractor to revise and re-submit, the Baseline Schedule submittal. The District Construction Manager's Baseline Schedule review will be based on the District Construction Manager's evaluation of the Baseline Schedule's reasonableness and compliance with the Contract Documents. The Contract CPM Schedule shall be the basis for monitoring the Contractor's progress against milestone dates and Contract Time, and the evaluation and reconciliation of extensions in Contract Time. The Baseline Schedule shall communicate and constitute the Contractor's detailed intent for planning and executing the work. Construct the Baseline Schedule based on the Contract Documents, including any addenda received during the bid phase. Coordinate with all subcontractors when developing the Baseline Schedule.

1. Breakout of Work into multiple Schedules: Even if multiple school sites or DSA numbers are attributed to a Contract, multiple schedules that break out work by school site, DSA number, etc., are not allowed.
2. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.

    a. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
    b. Early Completion: If the District Construction Manager accepts an early completion schedule and the District Construction Manager does not revise the Contract completion date, the Baseline must first include a float activity that fills the time between the early completion and the contractual substantial completion date. The Contractor agrees to forego any extended overhead between early completion noted in the Baseline and the contractual substantial completion date.

3. Activities in the Baseline Schedule shall comply with the following:

    a. Activity Duration: Estimate the amount of time to start and complete each activity. Define field work activities so no activity is longer than 15 workdays, unless specifically allowed by District Construction Manager.
    b. Units of Time: Workdays shall be the default unit of time for an activity in the schedule. Indicate nonworking days and holidays incorporated into the schedule to correlate with Contract Time.
    c. Critical (Longest) Path: Critical (Longest) Path is to be easily identifiable. Any part of the Baseline Schedule's Critical (Longest) Path deemed unreasonable by the District Construction Manager may result in direction for a Baseline Schedule revision and re-submittal.
    d. Percentage of Activities within Critical (Longest) Path: Plan the Work and provide for and allocate resources in the execution of the Work so that the proportion of incomplete schedule activities with total float of 20 workdays or less within the Critical (Longest) Path shall not exceed 33 percent of all incomplete schedule activities, unless acceptance for a greater proportion is granted by the District Construction Manager.
    e. Procurement Cycle Activities: Procurement cycle activities include, but are

not limited to, submittals, shop drawing submittals, submittal reviews and approvals, purchasing, fabrication, and delivery. Unless waived by the District Construction Manager, include detailed procurement cycle activities as separate activities in the Baseline Schedule for each Specification section number. The detailed Procurement Cycle activities shall constitute the Submittal Schedule, and shall align with the Submittal Register. Procurement Cycle activities shall be logically tied in the Baseline Schedule to the associated construction activities. Unless waived by the District Construction Manager, include detailed procurement cycle activities as separate activities in the Baseline Schedule for each Specification Section number, with separate activities for the following:

1) Submittal Preparation.
2) Submittal Review / Approval.
3) Procurement / Fabrication.
4) Delivery.
   Note: Include the Specification Section number either within the activity's identification number or activity's name/description.

f. Submittal Review Time: Include review times indicated in Section 01 33 00 "Submittal Procedures" in Baseline Schedule.
g. Relationships and CPM Network: CPM networks shall be closed, whereby every activity shall have, at a minimum, one predecessor and one successor relationship. The exceptions to this closed network rule are the network's start and finish milestones.
h. Constraints: Constraints shall be scrutinized and shall only be used to reflect contractually and/or environmentally imposed conditions. Add schedule activities and detail to mitigate the use of Constraints. Constraints are not permitted where an activity or logical relationship is appropriate, unless specifically accepted by the District Construction Manager. The District Construction Manager may direct the Contractor to provide a detailed written explanation in the Baseline Narrative for any and all Constraints. After a review of the Baseline Schedule and the detailed written explanation, any Constraints ultimately deemed unreasonable by the District Construction Manager may result in direction for a Baseline revision and re-submittal.
i. Lags: Lags shall be scrutinized. Add schedule activities and detail to mitigate the use of Lags. Lags of less than -1 are not permitted, unless specifically accepted by the District Construction Manager. The District Construction Manager may direct the Contractor to provide a detailed written explanation in the Baseline Narrative for relationships with negative lag less than -1. After a review of the Baseline Schedule and the detailed written explanation, any lags ultimately deemed unreasonable by the District Construction Manager may result in direction for a Baseline revision and re-submittal.
j. Schedule Settings: The setting in the CPM scheduling software shall be set so that the logic is retained when calculating the schedule. Critical activities shall be defined as Longest Path. The "progress override" option shall not be utilized, unless directed otherwise by the District Construction Manager. Autocost, Resource, and Schedule calculation rules shall be set

to the default settings. Default percent complete to be used is the duration percent complete.

k. Activity Detail: Field work activities shall not reflect a combining of work located in separate buildings or site areas, work corresponding to different Specifications Sections or Uniformat Sections, work performed by different Subcontractors, or rough and finish work of the same trade. The CPM Schedule shall include activities and appropriate time for temporary items (for example, scaffolding and concrete formwork), curing, testing, items that interface with work performed by others (for example, Owner Furnished Owner Installed items), regulatory agency approvals, permitting, City of Carlsbad and utility activities, physical checkout, startup, mobilization, operational and maintenance manual preparation, equipment and systems training, cleanup, and contractor's internal punch list.

l. Activity Descriptions: Descriptions for schedule activities shall provide adequate detail that defines the activity, scope and location.

m. Activity Coding: Activities shall be mapped to the Activity Code Dictionary located at the end of this Section. Contractor may use Work Breakdown Structure (WBS) functionality in lieu of Activity Codes, or a combination of Activity Coding and WBS coding.

n. Milestones: Include Key Milestones and Contractual Milestones indicated in the Contract Documents in Schedule.

o. Negative Float: The Baseline Schedule shall not contain negative float.

p. Weather: The Baseline Schedule shall include, during the period from the start of mobilization (or start of field work activity, whichever starts first) through the date of Substantial Completion, workdays for anticipated weather delays affecting the Critical (Longest) Path.

1) This weather allowance shall be incorporated into the Contract Time. Incorporate weather allowance days into their schedule activities per the following table:

Weather Table												
	Month											
Anticipated Weather Days	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	7	5	7	2	1	1	0	0	1	2	3	5

a) If the Contract Time starts or ends in the middle of a month, the weather allowance shall be prorated. For example, if mobilization starts on February 1 and Substantial Completion is November 20 of the same year, the weather allowance is 21 workdays.

2) Unused weather allowance days become jointly owned float.

3) If the number of approved weather days in a month exceed the number depicted in the Weather Table, or if the grand total of approved weather days exceed the number allotted in the contract,

the number of weather days in excess are excusable and non-compensable.

4) Weather or the results of weather on non-scheduled workdays will not be considered. Reference documents shall include CPM schedules and Look Ahead schedules to determine scheduled workdays.
5) If the Contractor considers weather or the results of weather as an impact to the Critical (Longest) Path and/or a Contractual Milestone, the Contractor has two (2) workdays from the date in question to provide written justification for the weather day request, describing the Primavera activity/activities impacted, as well as describing how over 50 percent of the Critical (Longest) Path work for the requested day was impacted. Describe work done to mitigate weather impact.
6) The District Construction Manager determines if a weather day has been incurred, and the Critical (Longest) Path and/or Contractual Milestone so affected. If the Contractor does not provide written justification regarding weather impacts, the District Construction Manager can still determine if weather days have been incurred.
7) If weather impacts a Contractual Milestone for a phase that is not on the Critical (Longest) Path, the District Construction Manager will grant excusable and non-compensable relief equal to the number of days impacted by weather.

q. Cost Loading:

1) Costs are applied to one activity resource that is to be titled “COST”. Resource curves shall only be Linear, and P6 Expenses are not to be used.
2) Estimated values for each work activity shall be assigned to the activity’s budgeted cost in the CPM software application. Round amounts off to the nearest whole dollar.
3) No activity shall have a budgeted cost exceeding $75,000, unless specifically accepted by the District Construction Manager.
4) The Contractor’s General Conditions costs shall be set apart as a separate activity that spans the Contract Time.
5) The following are to be separate and distinct cost-loaded activities in the CPM Schedule:
   a) Bonds
   b) Insurance
   c) CPM Scheduling (preparation, updates, maintenance, etc.)
6) Do not cost load submittal or procurement activities except as accepted or directed by the District Construction Manager.
7) For materials that are eligible for payment as provided by the Contract Documents and deemed acceptable by the District Construction Manager, the Contractor may load the value of the materials on a one-day delivery activity.
8) Payment for uninstalled materials/equipment is limited to major items as determined by the District Construction Manager. 80 percent of the material/equipment delivery cost shall be loaded on to the delivery activity, and the remaining 20 percent shall be loaded on to

the associated construction activity/activities. Unless otherwise permitted, delivery costs are to be broken out by building number.

9) Mobilization: Mobilization shall be a separate activity in the CPM schedule, and shall not exceed 1 percent (1%) of the Contract Price. If requested by the District Construction Manager, provide detailed backup documentation, at a level of detail to the satisfaction of the District Construction Manager, to substantiate the Contractor's mobilization dollar amount.
10) Demobilization and Close-Out Submittals each shall be separate activities in the CPM schedule, shall be cost-loaded, and shall not be considered in any Critical (Longest) Path assessment.
11) Contractor may be directed to provide copies of all executed Subcontracts and Purchase Orders.
12) Allowances: If the Work includes items covered by allowances, include activities in the schedule for each allowance that is loaded with the cost of that allowance.
13) Change Orders: Upon District approval of a Change Order, add separate cost loaded activities for each Change Order. Change Order activities shall have the activity identification prefix of "CO" plus the Change Order number. Change Order activities must also comply with the Activity Codes Dictionary at the end of this Section, as well as the Time Impact Analysis provisions described in this Section.

B. Work Restrictions: Include any work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Work by District: Include a separate activity for each portion of the Work performed by District, including Owner Furnished Contractor Installed (OFCI) and Owner Furnished Owner Installed (OFOI) items.
2. District-Furnished Products: Include a separate activity for each product. Delivery dates indicated stipulate the earliest possible delivery date.
3. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with any existing construction.
    b. Limitations of continued occupancies.
    c. Partial occupancy before Substantial Completion.

4. Use of premises and any site-specific restrictions.

C. Baseline Schedule: Submittal, Review and Acceptance. Within the timeline specified below (Schedule Table 1), submit the Baseline Schedule to the District Construction Manager for review and acceptance.

Schedule Table 1

Description	Calendar Days for Individual Item	Cumulative Calendar Days

Contract Time Start Date, per Notice to Proceed	0	0
Contractor submits complete Baseline Schedule submittal to District Construction Manager for review (cost loading included)	45	45
District Construction Manager provides review comments (and possible acceptance) to Contractor (Meeting may be required, at District Construction Manager's discretion)	10	55

1. The deduction for Contractor's delayed submission of the complete Baseline Schedule submittal is $250 per day; this deduction also applies to re-submittals. Such deductions shall occur on the first progress payment after the Baseline Schedule has been accepted.
2. Upon submittal by the Contractor, the District Construction Manager will review the Baseline Schedule and provide comments within the timeframe shown in Schedule Table 1. The District Construction Manager may question any aspect of the Baseline Schedule submittal. If the District Construction Manager raises questions or identifies schedule deficiencies or noncompliance with the Contract Documents, a revision and re-submittal is required. Make appropriate adjustments or corrections and shall deliver to the District Construction Manager the Baseline Schedule re-submittal within 7 days of receipt of the Construction Manager's comments. Indicate in writing the adjustments or corrections made by the Contractor, including individual responses to every comment made by the Construction Manager on the previous submittal. The District Construction Manager will review and return written comments on the re-submitted Baseline Schedule within 7 days of receipt of the Contractor's re-submittal. The above process shall be repeated until the District Construction Manager provides written notification to the Contractor that the Baseline Schedule has been accepted.

    a. If the District Construction Manager conditionally accepts the Baseline Schedule submittal, the Contractor has seven (7) days to provide another Baseline Schedule submittal that addresses the conditional notes, to the satisfaction of the District Construction Manager. The District Construction Manager will review and comment on the re-submittal within five (5) days of receipt. If the Contractor fails to submit a Baseline Schedule submittal that addresses the conditional notes to the District Construction Manager's satisfaction, then the Baseline Schedule status will be revised from "Accepted as Noted" to "Revise and Re-submit".
    b. If the Baseline is not accepted after the first sixty (60) days, payments to the Contractor will cease until the Baseline is accepted. The District Construction Manager may also stop the Work if the Baseline Schedule has not been accepted after the first sixty (60) days. Delays here shall be

deemed inexcusable.

3. Upon acceptance of the Baseline Schedule, all activities and their relationships shown on the Baseline Schedule may not be changed, added, or deleted without the consent of the District Construction Manager. The Contractor may not alter activity identification numbers, or rename activities without the District Construction Manager's consent. The Contractor must request written approval from the District Construction Manager to remove activities from the CPM Schedule, and must retain the removed activities within the electronic project schedule files that are submitted to the District Construction Manager. The Contractor may appropriately code the approved removed activities to filter the same out of the reports.
4. The initial accepted Baseline Schedule is a schedule that shall reflect no progress on schedule activities. For monthly schedule updates, the baseline schedule shall serve as the primary baseline, and the previous month's update schedule shall serve as the secondary baseline. If a Revised Schedule or Recovery Schedule is submitted by the Contractor and accepted by the District Construction Manager, then the Revised Schedule or the Recovery Schedule shall serve as the primary baseline.
5. If a Baseline Schedule is accepted late in a month, the Contractor is still required to submit a Monthly Schedule Update for the previous period (for example, if a Baseline Schedule is accepted on January 26, the Contractor is required to submit Monthly Schedule Update with a January 1 Data Date).
6. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of District Construction Manager's acceptance of the schedule.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, MONTHLY SCHEDULE UPDATES

A. Contractor's Construction Schedule Updating: At monthly intervals update the schedule to reflect actual progress and forecast the remainder of the work. Submit the Monthly Schedule Update to the District Construction Manager who will either accept it, accept it with notes, or direct the Contractor to revise and resubmit. On the last workday of each month or other day determined by District Construction Manager, submit a draft schedule update for review. The Data Date shall be the 1st day of the month. For example, if the monthly update is to capture all work accomplished in April the Data Date shall be May 1st. the Draft Monthly Schedule Update shall consist of the following:

1. A hardcopy print out of the Detailed Gantt Chart distributed to the District Construction Manager. Sheets for this item are to be no larger than 11" x 17".
2. A markup of the hard copy print out showing percent completes, actual start dates and actual finish dates to indicate work accomplished during the month. Also indicate the expected finish dates or remaining duration for activities that have started but have not yet completed; remaining duration shall be the Contractor's best estimate of the time required to complete activities.

3. Within three (3) days of the draft Monthly Schedule Update submittal, meet with District Construction Manager to finalize the Monthly Schedule Update, as well as discuss required corrections and proposed revisions to the schedule.
4. After the meeting, make any needed adjustments to the schedule as directed by the District Construction Manager, make final entries in the schedule software, recalculate the schedule, and submit the final Monthly Schedule Update submittal. The Monthly Schedule Update submittal, including Progress Payment submittal items, is due no later than three (3) days following this meeting. A complete Monthly Schedule Update submittal submitted after the 10th day of the month is subject to a $100 per day deduction that shall occur no later than the next progress payment.
5. Upon receipt and review of the Monthly Schedule Update submittal, if the Monthly Schedule Update indicates a late completion to a Contractual Milestone and/or Contract Time, a Monthly Schedule Review meeting shall occur to discuss issues related to late completion, possible revisions, and possible Recovery Schedule submittal and/or Time Impact Analysis methodology and deliverables. Such a meeting shall include the District Construction Manager, District Scheduler, and Contractor (Project Manager, Superintendent and Scheduler), and shall occur prior to the following Monthly Schedule Update submittal.

B. Progress Payments:

1. The amount payable to date for an activity shall equal the activity's percent complete multiplied by the activity's budgeted cost, prior to the retention calculation.
2. The District Construction Manager will provide an Application for Progress Payment form for the Contractor to submit with each Monthly Schedule Update.

C. Monthly Schedule Update:

1. Requirements: Unless directed in writing by the District Construction Manager, the Monthly Schedule Update shall not be used to delete activities, add activities, make title changes, make activity coding changes, make Budgeted Cost changes, or to make logic changes.
    a. If the Contractor proposes to make activity additions/deletions and/or logic changes and/or duration changes within a Monthly Schedule Update, simultaneously submit two distinct Primavera schedules:
        1) Monthly Schedule Update, showing progress in just-completed month, without proposed changes.
        2) Monthly Schedule Update, showing progress in just-completed month, with proposed changes. Provide detail in the Monthly Schedule Update Narrative why changes were caused and needed.
2. Distribution: The Contractor must submit the Monthly Schedule Update package to the District Construction Manager before the District will process an Application for Progress Payment for each month.
3. Other activities in Schedule: The only activities to be added to the Monthly Schedule Updates are the following:

    a. Approved Change Orders.
    b. Approved Time Impact Analysis.

c. Approved Weather Dates (one Activity per approved Weather Date).

1) The original duration for the weather allowance activity shall be reduced each month by the number of approved weather days.

d. Procurement Cycle re-submittals (i.e., Specification re-submittal after rejection, Specification re-submittal review).

4. Review: The District Construction Manager will either accept, accept with comments, or direct a revise-and-resubmit of the Monthly Schedule Update submittal. Allow ten (10) days for the District Construction Manager's review of the Monthly Schedule Update submittal.

a. Completeness of Submittal: The District may withhold up to 5 percent of the pre-retention progress payment if, in the District Construction Manager's opinion, the Contractor has failed to meet the Monthly Schedule Update submittal requirements.
b. Acceptance of the Monthly Schedule Update submittal by the District Construction Manager shall be a condition precedent to the processing of the subsequent Progress Payment.

5. Monthly Schedule Update upon Substantial Completion:

a. Upon Substantial Completion, prepare and submit to the District Construction Manager a Monthly Schedule Update that shows all actual start and actual finish dates through Substantial Completion.
b. The District Construction Manager will estimate the cost of the Monthly Schedule Update and add this item to the final Punchlist. Upon the District Construction Manager's acceptance of this Monthly Schedule Update, the District Construction Manager will release payment of this estimated cost.

3.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, SCHEDULE CORRECTION

A. Each month, address corrections to the schedule that were identified by the District Construction Manager during the review of the last Monthly Schedule Update. These corrections generally include, but are not limited to, correction of inaccurate or missing actual dates, correction of logic for activities being driven by the data date, incorrect percent complete, and out of sequence progress. The District Construction Manager reserves the right to require the Contractor adjust, add to, or clarify any portion of the schedule that may be considered insufficient to monitor the work. No additional compensation shall be provided for such adjustments, additions, or clarifications.

B. If the Monthly Schedule Update submittal is rejected, the Contractor must individually respond to every correction and review comment received from the District Construction Manager in the re-submittal of the Monthly Schedule Update package.

C. If the submittal is conditionally accepted with noted exceptions, respond to every correction and review comment via the next Monthly Schedule Update submittal. Failure of the Contractor to specifically respond to each of the District Construction

Manager's previous review comments may result in rejection of the following submittal.

3.3 CONTRACTOR'S CONSTRUCTION SCHEDULE, LOOK AHEAD SCHEDULES

A. Look Ahead Schedule: Prepare and submit a report indicating activities performed in the one week prior and three weeks following the day of week as determined by the District Construction Manager. Due to the District Construction Manager in electronic format no later than 24 hours before the start of each weekly progress meeting, the Look Ahead Schedule shall include the following:

1. Columns on left hand side of report, indicating the following:

    a. Activity number, corresponding to the same field in the CPM schedule.

        1) Potential or approved change orders shall be included as activities with temporary activity identification numbers (for example, RFI or CCD number).

    b. Activity description, including work performed and location of work (for example, Install Footing Rebar at Building 700).
    c. Responsibility.
    d. Average estimate crew size during this time.

2. Dates on the right-hand section of report, with marks noting the specific dates that activity was performed / will be performed for each of the look ahead activities. Note with "S" on days when an activity starts, "X" for an activity in-progress, and "F" for when an activity finishes.
3. Generated in Microsoft Excel.
4. Details shall include material and equipment deliveries, non-work days such as holidays, and approved weather days.
5. Other information or formatting, at the discretion of the District Construction Manager.
6. If a progress meeting is not held in a week, a Look Ahead Schedule is still due.
7. The first Look Ahead Schedule is due no later than the day of the Preconstruction Conference.

B. Look Ahead Schedule Corrections: Upon request from the District Construction Manager, submit a revised look ahead schedule if there are significant corrections to the look ahead schedule noted during the weekly progress meeting. The revised look ahead schedule is due no later than two (2) workdays after the request has been made by the District Construction Manager.

3.4 CONTRACTOR'S DAILY REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events relating to this Contract:

1. List of subcontractors at Project site.

2. List of separate contractors at Project site.
3. Count of personnel and hours worked at Project site by trade.
4. Visitor(s) to the Project site.
5. Major Equipment at Project site.
6. Material and/or equipment deliveries.
7. Work activities performed at Project site, including CPM schedule activity identification numbers. Include separate line items for any Time & Material, RFI, ASI, CCD, potential Change Order, or approved Change Order work.
8. High and low temperatures and general weather conditions, including any precipitation totals.
9. Site Conditions.
10. Request for weather day, include CPM schedule activity identification number(s) and activity description(s) affected.
11. Action(s) taken to prepare for anticipated upcoming weather event.
12. Accidents and near-accidents.
13. Meetings and significant decisions.
14. Issues incurred or addressed.
15. Unusual events.
16. Stoppages, delays, shortages, and losses.
17. Meter readings and similar recordings.
18. Emergency procedures.
19. Orders and requests of authorities having jurisdiction.
20. Change Orders received and implemented.
21. Change Directives, Field Work Orders, or Architect's Supplemental Instructions received and implemented.
22. Services connected and disconnected.
23. Equipment or system tests and startups.
24. Partial completions and occupancies.
25. Substantial Completions authorized.

B. Daily Reports are to be prepared in such a way that all text is Optical Character Recognition (OCR) searchable, and hand-written text is not acceptable.

C. Upon receipt, the District Construction Manager will review each Daily Report. If needed, corrections to Daily Reports may be required.

D. Starting with the first day of construction activity or any activity on site, submit a separate and distinct Daily Report for each day. Daily Reports for the previous week are due no later than Monday of the following week. For example, the Daily Reports for Monday April 1st through Friday April 5th are due to the District Construction Manager no later than Monday April 8th.

3.5 CONTRACTOR'S CONSTRUCTION SCHEDULE, RECOVERY SCHEDULE

A. If Work progress or the sequencing of the Work activities differs from that indicated in the Baseline Schedule or previous Monthly Update Schedules, the District Construction Manager may direct the Contractor to submit a Recovery Schedule. The Contractor is required to prepare and submit a Recovery Schedule if the current monthly schedule update depicts negative float exceeding minimum thresholds set forth herein, or as

otherwise deemed appropriate by the District Construction Manager.

1. The Contractor is required to prepare and submit a Recovery Schedule if the current monthly schedule update, during the first third (1/3) of the Contract Time, depicts negative float in excess of thirty (30) days.
2. The Contractor is required to prepare and submit a Recovery Schedule if the current monthly schedule update, during the second third (1/3) of the Contract Time, depicts negative float in excess of twenty (20) days.
3. The Contractor is required to prepare and submit a Recovery Schedule if the current monthly schedule update, during the final third (1/3) of the Contract Time, depicts negative float in excess of ten (10) days.
4. Within fifteen (15) days of the District Construction Manager's direction, prepare and submit a Recovery Schedule to the District Construction Manager demonstrating the Contractor's plan to recover lost time, achieve all contractual milestones, and complete the work within the Contract Time. The District Construction Manager will review the Recovery Schedule and provide documented comments within ten (10) days. Appropriate recovery actions include, but are not limited to, assignments of additional labor or equipment, shift or overtime work, expediting of submittals or deliveries, overlapping of activities, or sequencing changes to increase activity concurrence. The accompanying narrative shall describe the cause of the problems and the actions planned by the Contractor to recover the schedule.
5. If the delay necessitating the Recovery Schedule is caused by the Contractor, all costs for recovery shall be borne by the Contractor.

3.6 CONTRACTOR'S CONSTRUCTION SCHEDULE, SCHEDULE REVISION

A. Schedule Revisions are defined as any changes to schedule activities or logic other than the updating of actual start and completion dates, percent complete or remaining duration; Schedule Revisions shall not be used to address delay.

B. Revise the Baseline Schedule or Monthly Schedule Update when the District Construction Manager determines that it is no longer useful as a status and control mechanism.

1. If directed by the District Construction Manager, prepare and submit within fourteen (14) days the Schedule Revision submittal for review and possible acceptance. Provide a separate narrative, the electronic data file from the CPM schedule software, and Detailed Gantt Chart showing the revised activities and how the Contractor proposes to tie them into the accepted CPM Schedule. The specific activities added and their logical ties to existing schedule activities shall be explained in detail in the schedule narrative. Provide a Primavera P6 Schedule Comparison report. The District Construction Manager will provide comments to the Contractor within ten (10) days of receipt. If the District Construction Manager accepts the specific activities and logic changes proposed in the schedule revision, promptly incorporate the revision into the next Monthly Schedule Update. Contract Time, including all contracted milestone dates, cannot be changed without an approved Contract Change Order. The Revised Schedule must be accepted by the District Construction Manager prior to its use

as a target schedule for a Monthly Schedule Update.

C. The District Construction Manager shall determine causality regarding need for Schedule Revision, and shall determine if any compensation is warranted, up to a maximum fee of $1,000.00.

3.7 CONTRACTOR'S CONSTRUCTION SCHEDULE, TIME IMPACT ANALYSIS (TIA)

A. Time Impact Analyses shall demonstrate the impacts of the delay to the Critical (Longest) Path, and shall be completed per the following:

1. If the Contractor experienced what they consider to be an excusable delay to the Critical (Longest) Path and/or contractual milestone, submit a Time Impact Analysis within ten (10) days of the completion of the delay event.
2. The District Construction Manager may also request a TIA within fourteen (14) days from the Contractor. The District Construction Manager's TIA request may be the result of viewing a monthly schedule update that indicates a late completion to the Critical (Longest) Path and/or contractual milestone, or some other event the District Construction Manager may consider to be a cause for a TIA.
3. All efforts shall be made to rectify TIAs contemporaneously.
4. Notes:

    a. The Time Impact Analysis submittal shall consist of a CPM schedule sub-network (fragnet) derived by adding activities and relationships representing the delay into the first accepted Monthly Schedule Update after the finish of the delay event that impacted the Critical (Longest) Path and/or Contractual Milestone.
    b. The TIA submittal should address the Critical (Longest) Path depicted in Monthly Schedule Updates. If the TIA is to address a Contractual Milestone that is not on the Critical (Longest) Path, the TIA should address the Critical activities related to the Contractual Milestone.
    c. If the Contractor does not submit a complete Time Impact Analysis submittal within the timeframes noted herein, a deduction of $150 per day shall be applied.

B. Multiple issues are not to be combined into a single Time Impact Analysis submittal, and such TIAs that combine issues in a single TIA submittal shall be returned to the Contractor with a status of revise-and-resubmit.

C. Include the following items with all Time Impact Analysis Request submittals:

1. A fragnet where impacts to the Critical (Longest) Path can be clearly viewed, with separate activities for each component of the Time Impact Analysis, breaking out activities by Responsible party (Contractor, Architect/Engineer, District, etc.), trade (Mechanical contractor, Concrete contractor, etc.), and site area (for example, parking lot, second floor staff restroom, library, etc.).
2. A written narrative that notes the following:

a. The number of days requested.
b. A detailed description on the cause and effect of delay.
c. A detailed description of the Contractor's daily activities relating to the delay on each day during the delay period, as well as a description of the Contractor's diligence in mitigating the delay; the mere submittal of contractor/subcontractor daily reports does not satisfy this requirement.
d. A list of additions, deletions and/or changes to activities, logic, and durations.

3. All supporting backup documentation (for example, Requests for Information, Field Work Orders, Correspondence, Notice(s) of Delay, etc.).
4. An electronic copy of the CPM schedule application file(s) used for the TIA.

D. Allow ten (10) days after receipt of the Time Impact Analysis submittal for the District Construction Manager to accept or reject the request.

E. Do not incorporate any part of the Time Impact Analysis into the Monthly Schedule Update until the associated Change Order has been approved.

F. If a Time Impact Analysis submitted by the Contractor is rejected by the District Construction Manager, request a Meet and Confer with the District Construction Management Director within seven (7) days of rejection to discuss and resolve issues related to the request. If agreement is not reached, the Contractor will be allowed thirty (30) days from the receipt of a written decision from the District Construction Management Director following the Meet and Confer meeting to give notice.

G. Where the District Construction Manager has not rendered formal decision on the Contractor's Time Impact Analysis for adjustment of Contract Time, and the parties are unable to agree as to amount of adjustment to be reflected in the CPM Schedule, reflect that amount of time adjustment in the CPM Schedule as the District Construction Manager may accept as appropriate for the interim. It is understood and agreed that such interim acceptance by the District Construction Manager will not be binding and will be made only for purpose of continuing to schedule work, until such time as a formal decision as to an adjustment, if any, of the Contract Time or any Contractual Milestone dates acceptable to the District Construction Manager has been rendered.

H. The Contractor is responsible for all costs associated with the preparation of the Time Impact Analysis for inexcusable or concurrent delays. For Critical (Longest) Path delays or delays to contractual milestones approved as excusable by the District, the Contractor will be paid up to a maximum fee of $1,000.00 per Time Impact Analysis submittal, to be invoiced as a separate Change Order after incorporation into the accepted CPM schedule. A Time Impact Analysis request without merit will not be approved, and hence, not reimbursed.

I. If a forward-looking TIA that attempts to forecast estimated upcoming impact to the Critical (Longest) Path and/or Contractual Milestone is required, immediately coordinate with the District Construction Manager to address such an issue.

3.8 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Procedures: In addition to what is specified herein, comply with procedures contained in The Associated General Contractors of America's "Construction Planning & Scheduling Manual".

B. Timely submissions of the schedules described in this Section are of great importance, and lack of or late receipt diminishes their value to the Project.

C. Because the schedule is a requirement for a proper progress payment, it is incumbent on the Contractor to submit satisfactory Short-Term Schedule and Baseline Schedule submittals within the timelines depicted herein; Look-Ahead Schedules do not satisfy the requirement regarding "Construction Progress Schedule".

D. Any CPM Schedule submittal item submitted after 3:00PM will be considered received on the following workday.

ACTIVITY CODES DICTIONARY

Code	Description	TYPICAL
BID	BID LINE ITEM NUMBER Note: Align with Bid Proposal Line Items	
PHAS	PROJECT PHASE Key Milestones and Summaries General Conditions Allowances Preconstruction Mobilization Construction 1 Construction 2 Testing Completion and Closeout Note: Include any Work Phases, Sequences, etc. called out in Contract Documents	
PCKG	WORK PACKAGE Major Milestones and Summaries Submittal / Procure / Fabricate / Deliver On-Site Work Off-Site Work Building Work Other Allowances	
AREA	BUILDING / SITE AREA Key Milestones and Summaries Submittal Prepare & Submit Submittal Review & Approval	

Procurement & Fabrication
Delivery
Administration Building 1
Library
Classroom Building 1
Classroom Building 2
Lunch Court
Cafeteria
Kitchen
Multipurpose Room
Gymnasium
Driveway
Parking Lot
Play Area
Field
Retaining Wall
Fence / Gate
Other Site Work
Note: Include actual building numbers

LOC1 LOCATION LEVEL 1
Underground Utilities
Under-slab Utilities
Foundation
Structure
1st Floor
2nd Floor
3rd Floor
Roof
Elevator
Exterior
Stairs
Hardscaping
Landscape
Note: Create additional codes as needed or determined by the District Construction Manager.

LOC2 LOCATION LEVEL 2
Administration Room No. 1
Library Room No. 1
Classroom No. 1
MDF Room
Staff Restroom
Boys Restroom
Girls Restroom
Elevator
Note: Create additional codes as needed or determined by the District Construction Manager in order to identify rooms with room number.

RESP RESPONSIBILITY
OMWD
General Contractor
Architect
Survey
Demolition
Abatement
Relocation
Concrete
Masonry
Structural Steel
Metals
Carpentry
Roofing
Openings
Finishes
Specialties
Furniture & Equipment
Special Construction
Conveying Equipment
Fire Suppression
Plumbing
Heating Ventilating & Air Conditioning
Automation
Electrical
Communications
Electronic Safety & Security
Earthwork
Exterior Improvement
Utilities
City of Carlsbad
San Diego Gas & Electric

Note: May substitute generic trade with subcontractor name; Add other Responsibility code values as needed or determined by the District Construction Manager. If there is a subcontractor substitution, new subcontractor must be incorporated into this Activity Code.

UNIF UNIFORMAT

A1010	Standard Foundations
A1020	Special Foundations
A1030	Slab On Grade
A2010	Basement Excavation
A2020	Basement Walls
B1010	Superstructure – Floor Construction
B1020	Superstructure – Roof Construction
B2010	Exterior Walls
B2020	Exterior Windows
B2030	Exterior Doors

B3010	Roof Coverings
B3020	Roof Openings
C1010	Interior Construction – Partitions
C1020	Interior Doors
C1030	Interior Construction – Fittings
C2010	Stair Construction
C2020	Stair Finishes
C3010	Wall Finishes
C3020	Floor Finishes
C3030	Ceiling Finishes
D1010	Elevators & Lifts
D1020	Escalators & Moving Walks
D1090	Other Conveying Systems
D2010	Plumbing Fixtures
D2020	Domestic Water Distribution
D2030	Sanitary Waste
D2040	Rain Water Drainage
D2090	Other Plumbing Systems
D3010	HVAC – Energy Supply
D3020	Heat Generating Systems
D3030	Cooling Generating Systems
D3040	HVAC – Distribution Systems
D3050	Terminal & Package Units
D3060	Controls & Instrumentation
D3070	Systems Testing & Balancing
D3090	Other HVAC Systems & Equipment
D4010	Fire Protection – Sprinklers
D4020	Fire Protection – Standpipes
D4030	Fire Protection Specialties
D4090	Other Fire Protection Systems
D5010	Electrical Service & Distribution
D5020	Lighting and Branch Wiring
D5030	Electrical – Communications & Security
D5090	Other Electrical Systems
D8020	Technology Electrical Infrastructure
D8021	Structured Cabling
D8022	Low Voltage – Main Distribution Frames
D8023	Wireless LAN Systems
D8024	Multimedia Technology Systems
D8041	Intrusion Detection and Access Control
D8042	Video Surveillance and Control Systems
D8060	Local Sound Systems
D8061	VoIP Systems
D8062	Campus-Wide Emergency Communications
D8063	Clock and Bell Systems
D8064	Video Communications / CATV Systems
E1010	Commercial Equipment
E1020	Institutional Equipment
E1030	Vehicular Equipment

E2010	Fixed Furnishings
E2020	Moveable Furnishings
F1010	Special Structures
F1020	Integrated Construction
F1030	Special Construction
F1040	Special Facilities
F1050	Special Controls and Instrumentation
F2010	Building Elements Demolition
F2020	Hazardous Components Abatement
G1010	Site Clearing
G1020	Site Demolition and Relocation
G1030	Earthwork
G1040	Hazardous Earth Remediation
G2010	Roads
G2020	Parking Lots
G2030	Pedestrian Paving
G2040	Site Development
G2050	Landscaping
G3010	Water Supply
G3020	Sanitary Sewer
G3030	Storm Sewer
G3040	Heating Distribution
G3050	Cooling System
G3060	Fuel Distribution
G3090	Other Site Mechanical Utilities
G4010	Electrical Distribution
G4020	Site Lighting
G4030	Site Communications and Security
G4090	Other Site Electrical Utilities
G9010	Service Tunnels
G9090	Other Site Systems
Z1010	Administration
Z1020	Quality Requirements
Z1030	Temporary Facilities
Z1040	Project Closeout
Z1050	Permit, Insurance and Bonds
Z9999	Allowances

Note: Only use Z9999 if an Allowance cannot be coded to a single Uniformat Level 3 code.

END OF SECTION 01 32 03

SECTION 01 32 16

PULL PLANNING PROCESS and PROCEDURES

PART 1 - GENERAL

1.1 COLLABORATIVE SCHEDULE OVERVIEW / BACKGROUND

A. The purpose of the Collaborative Schedule process is to build a reliable project Master Schedule (Project Schedule) within a collaborative team environment. The primary goal is to 1) establish, solidify and maintain the Milestones within the Project Schedule, and 2) support the teams and work flow improvements necessary to produce safe, reliable and construction-interruption-free project delivery increasing the reliability of project production planning and improving project performance.

B. The primary function of the Pull Planning and the Last Planner® System (LPS) is the collaborative planning process that involves Last Planners, the persons executing the work, for planning in greater detail as the team gets closer to doing the work. The LPS is an opposite way of thinking when compared to conventional push scheduling principles, where the work that *should* be done is planned in weekly meetings emphasizing adherence to the Project Schedule milestones. In contrast, the LPS incorporates pull planning principles where only the work that *can* and *will* be done is considered and promised by Last Planners themselves. Because at its core, LPS is a system view versus individual optimization, the Last Planners' active engagement in this systemic process is a fundamental requirement.

1.2 RELATED DOCUMENTS

A. Construction Drawings, Technical Specifications, Addenda, and general provisions of the Contract, including Contract General Conditions and RFP Documents and other Division 01 Specification Sections, apply to this Section.

B. Related Requirements:
   1. Section 01 14 00 "Work Constraints"
   2. Section 01 30 00 "Administrative Requirements "
   3. Section 01 32 03 "Construction Progress Documents".

1.3 DEFINITIONS

A. Constraint – In the context of the Pull Planning, an input, directive, resource or other requirement that will prevent a task or an assignment from starting, advancing or completing as planned.

B. Constraint Log – A list of constraints, each one with an identification of the individual or champion who promises to remove it by the agreed upon date.

C. Last Planner® System – A system for project production planning and control aimed at creating a work flow for reliable execution.

D. Last Planner – The person who conducts the final planning of a task or activity and makes the work resource assignments for those in production.

E. Milestone Plan – A master plan scheduled developed collaboratively by a project team that identifies major milestones in the project as well as each team members' milestones and their timing.

F. Pareto chart - A type of chart, named after Vilfredo Pareto, that contains both bars and a line graph, where individual values are represented in descending order by bars, and the cumulative total is represented by the line.

G. Percent Planned Complete (PPC) – Metric used in the Last Planner® System to gauge plan reliability. Defined as the ratio of the number of actual activities completed in a given time period over the number of actual activities planned (typically weekly).

PART 2 - PRODUCTS

2.1 SECTION INCLUDES

A. Section Includes:
1. Basic Requirements of Prime Contractor's Scheduling System
2. Last Planner® Facilitation/Coaching

2.2 BASIC REQUIREMENTS OF PRIME CONTRACTOR'S SCHEDULING SYSTEM

A. This Section specifies District expectations, administrative and procedural requirements for planning and scheduling, in addition to those defined in the General Conditions. The District requires that Lean Construction planning principles and techniques shall be utilized as described herein. This specification section requires the integrated and coordinated use of the Reliable Production plan based on the Last Planner® System and detailed conventional CPM scheduling. The District requires use of the Last Planner® system in concert with a detailed CPM schedule.

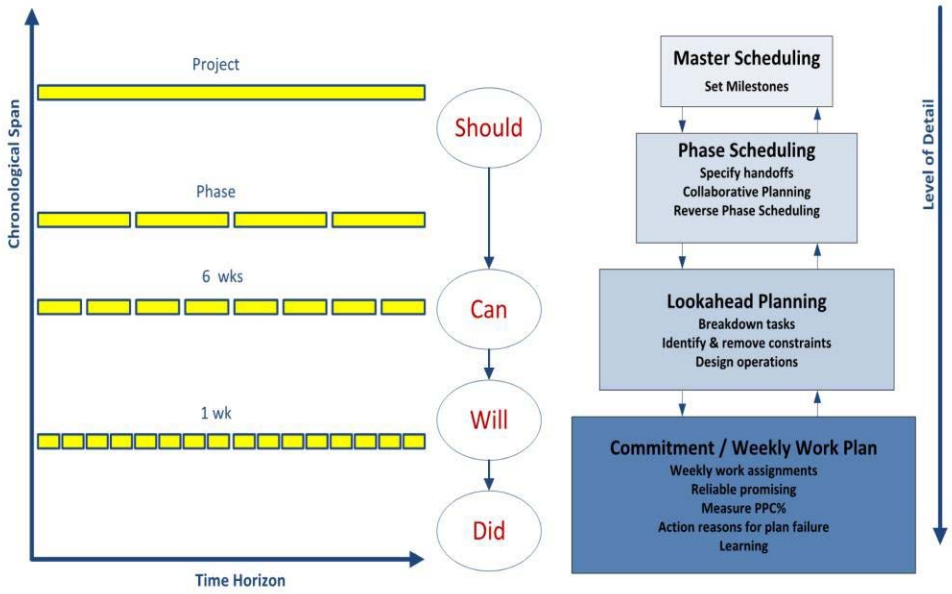
B. The overall detailed Project Schedule shall be prepared, updated and maintained using Primavera Project Planner, Microsoft Project, or other platform as approved by the District.

C. The Collaborative Schedule process is iterative and constantly measured with metrics against completed tasks. When executed successfully, Weekly Work Plans can be easily derived, and Monthly Schedule Updates are naturally produced.

D. The Collaborative Schedule process makes detailed plans by those whom execute and manage the work. The System promotes conversations between trade foremen and project management at appropriate levels of detail, and before issues become critical. It reviews the plan near its execution with collaborative planning to remove constraints as a team and verify that the promises made are tied to milestones, and that these commitments are firm, timely and without ambiguity.

E. Use planning procedures described herein to create a Project Schedule, a Look- Ahead Schedule, and a commitment-based Weekly Work Plan schedule through front- end planning using Last Planner® System (LPS) and Lean Construction Planning techniques.

F. LPS Planning Process Overview



The key elements of LPS are:

1) **Project Schedule Planning**: Setting milestones and strategy for the entire project including identification of long-lead items and major constraints. Incorporates critical path method (CPM) logic at a high level to determine overall project duration, what project work *should* be done. The milestone plan is used to develop the overall sequencing and flow of the work on the project. This will be a CPM based schedule.
2) **Phase Pull Planning**: Strategically planning segments of work (typically 3 to 4 months in duration) in order to produce progressively detailed Weekly Work Plans. Collaborative reverse phase (pull) scheduling planning by those who will be doing the work at sufficient level of detail to specify handoffs, and identify and resolve operational conflicts, schedule activity durations, what project work *can* be done. Phase pull planning often results in modifications to the CPM logic.
3) **6 Week Make-Ready Planning**: Look-ahead scheduling and constraint removal (roadblock removal process) in support of the progressively detailed planning process to assure that work is made ready for installation, what project work *will* be done. The plan is updated weekly where constraints that threaten reliable workflow are identified. Identifying responsibilities and making assignments ready follows by analyzing resource management information.
4) **Weekly Work Planning:** Team collaboration to plan each day's work, conditions for handoff and acceptance, sequencing and synchronizing next week's work. Commitments are made to perform work in a certain manner and a certain sequence. What project work are we to *do* this week. Weekly work planning is the point of maximum progressive detailing to create reliable work plans. Plan

reliability at this level is promoted by making only quality assignments and reliable promises so that the production unit will be shielded from upstream uncertainty.

5) **Daily Huddles**: Daily team check-ins, discussions based on the Weekly Work Plan. How are we doing? What do we need to maintain the plan in progress?
6) **Percent Plan Complete:** number of activities completed divided by the total number of planned activities. At the end of each week, assignments are reviewed for completeness in order to measure the reliability of the planning

7) **Learning** by measuring percent of promises complete (PPC), tracking reasons for variance, diving deep into reasons for plan failures, and developing/implementing lessons learned to improve future plan reliability. Analyzing reasons for plan failures and acting on these reasons is the basis of learning.
8) **Reliable Promising/Commitments**: Projects are essentially made up of an extensive set of reliable promises/commitments. LPS makes the planning processes and work flow highly reliable, and builds necessary trust within a collaborative team environment.

2.2 LAST PLANNER FACILITATION/COACHING

G. Pull Planning Facilitator/Coach Will be the On-site District Construction Manager
1. The DCM will provide training and coaching through the Pull Planning Process. All trade contractors and Prime Contractor personnel responsible for executing this specification shall attend the training. Initial training will be 6-8 hours
2. DCM shall facilitate the Pull Planning sessions as necessary to assure that all process and requirements detailed herein are fully understood by the Prime Contractor and Trade Contractors.
3. Experience indicates that (3-4) facilitated sessions (2-4 hrs) at the beginning of the project are typically required for the project team to develop competency.
4. Should the cumulative Percent Planned Complete (PPC) drop below 70 percent, The DCM will be readily available to assist the team in identifying why the plan is not reliable and assist in identifying and implementing appropriate countermeasures to improve reliability of the plan.

PART 3 - EXECUTION

3.1 SECTION INCLUDES

A. Section includes:
1. Collaborative Schedule Process
a. Required Participants
b. Last Planner® System Implementation Material and Tools
c. Preconstruction Meeting
d. Project Milestone Schedule
e. Phase Pull Scheduling
f. 6-Week Make Ready Planning
g. Weekly Work Plan

h. Workable Backlog
i. Daily Work Planning Huddles

2. Deliverables
3. Responsibility for Completion

3.2 COLLABORATIVE SCHEDULE PROCESS

A. Required Participants

1. Since LPS is a collaborative process, all those that have a planning role on the project need to participate in the in the scheduling process at the appropriate time. It is expected that there will be different participants required at different times in the project timeline depending on their respective scope of work and the timing of when it will be planned and performed. The right people need to participate at the right time for the plan to be informed and reliable. These individuals will be expected to participate in all phases of LPS as described in this section.
2. Required Project Stakeholders (the list is not exhaustive as there are others on a project whose participation may be required):
   a. The General Contractor
   b. All Subcontractors, and/or discipline-specific Trades
   c. Project Manager from each trade and/or subcontractor
   d. General Foremen and Superintendents from each trade subcontractor
   e. Key Project Engineers and/or Construction Coordinators
   f. Vendor and/or Suppliers with key materials
   g. Off Site Fabricators
   h. Third-Party Support (testing, inspection, Commissioning Agents, LEED Certification Specialists, etc.
   i. Architects and Engineers
   j. OMWD Staff
   k. District Construction Manager as Facilitator/Coach

B. Last Planner® System Implementation Materials and Tools

1. These forms are included by reference:
   a. Short-Term Production Plan
   b. Constraint Log
2. Large Meeting Room – Job Site Trailer, large enough for 30 individuals, ideally from one single location “The Big Room”
3. Standard conference room white board (20’ horizontal length)
4. Walls dedicated to visual system aids
5. Standard size “sticky notes,” dedicated color for each Trade Contractor and/or design discipline
6. Weekly work boards for the 6-week make work ready plan that are freestanding and contain columns and rows for “sticky notes”. Boards should have 7 columns, one for each day of the day, and approximately 20 rows.
7. Microsoft Office Suite, for creation of Weekly Work Plans and other necessary Last Planner® System elements. Primavera scheduling software, for creation and documentation milestone schedule, milestone relationships and 6-week Look-Ahead schedules.
8. Display well-maintained outputs for the group to use at Daily Huddles and Weekly Coordination Meetings in the Big Room.

9. The four primary Visual Output tools of Last Planner® System are:
    a. Weekly Work Plans (WWP) – see boards above
    b. Percent Plan Complete (PPC) trend over time
    c. Reasons for Variance Pareto, graph, or pie chart
    d. Constraint Log

C. Preconstruction Meeting
1. Submit a Draft Project Schedule and an initial 6 Week Look-ahead Schedule at the Pre-construction Meeting which will include mobilization activities, fencing, first collaborative pull planning session, etc.

D. Project Schedule Milestone Schedule
1. Prior to the first pull planning Milestone session, the Prime Contractor will prepare a detailed Project milestone CPM schedule in advance of the session for the entire project to identify major project milestones and general sequence of how the project may be executed. These milestones should include required delivery dates for major long-lead equipment items like switch gear, transformers, chillers, etc.
2. As part of the Milestone Plan pull planning session, the major project milestones (e.g., foundation poured, topping out, weathered in, permanent power) developed through the CPM schedule will serve as the dates to work the Milestone Plan.
3. Milestones have zero duration and represent the completion or start of a particular activity or action.
4. Milestones used in the development of the Milestone Plan should be completion milestones for the most part. Select start milestones for critical activities may also be appropriate to include in the plan.
5. Milestones for trade contractors should represent completion of major trade activities and for completion of trade work in a specific area of the project (e.g., floor, gridline or elevation).
6. Each trade should have multiple milestones and with sufficient detail to identify interim trade milestones at least every 6 weeks to help develop more reliable make work ready planning.
    a. The team works backward from the final project milestone to pull towards the milestone plan.
7. The collaboratively developed milestone plan is used to validate the required CPM schedule, and collaboratively inform necessary changes to the CPM schedule.
8. Include milestones for each trade contractor, each phase, key submittal approvals, key release dates for long-lead equipment and material, shipment/arrival of key materials and/or equipment, key inspections, occupancy, commissioning, project completion, etc.
9. Any constraints that are identified that will prevent a task or an assignment from starting, advancing, or completing as planned need to be captured in a Constraint Log. The log should clearly identify the constraint, by what date it needs to be removed to not impact project production, and the member of the project team that has been assigned responsibility to lead the efforts to remove the constraint. The constraint log should be maintained and updated throughout the project and displayed visually in the project Big Room so that all project team members can see it.
10. Project Schedule CPM Format
    a. Activities shall be coded in a logical manner to allow for sorting and grouping of like characteristics, including but not limited to such items as: phase, work

shift, project area, activity type (e.g., submittal, agency review, construction activity), trade, etc.

b. Include activities and milestones as requested for work completed by District under separate contract, District-furnished materials, move-in, etc.

c. The schedule duration shall be calculated using Critical Path Method for the Initial Construction Schedule, Contract Construction Schedule, and subsequent schedule updates.

d. Prime Contractor's Superintendent shall be integrally involved in production of the Initial Project Schedule and each subsequent update.

e. Failure by Prime Contractor to include any element of the work required for performance of the Contract shall not relieve Prime Contractor of the obligation to complete the entire Work of the Contract in accordance with the Contract Completion Date.

E. Phase Pull Scheduling

1. Phase Scheduling generates a detailed schedule magnifying the Project Schedule into more detailed project components strategically planning segments of work and activities in order to produce progressively detailed Weekly Work Plans.

2. The purpose of Phase Pull Scheduling is to produce a plan for completing a phase of work that everyone involved understands and supports; to produce a plan from which scheduled activities are drawn into the look-ahead process to be exploded into operational detail and made ready for assignment in weekly work plans.

a. The project milestones shall be placed at the top of the visual phase plan being developed at the wall.

b. The level of detail in the Phase Schedule is determined by the requirement that the Phase Schedule specify the handoffs between trade contractors involved in doing the work.

1) The phase plan will consist of activity tags completed for each trade by the Last Planner for that trade.

c. Activities should be no longer than 10 days in duration. Any task longer than 10 days can be broken down into smaller discrete activities which allow for better planning.

d. Identify the specific task to be completed with action verb, identify what is required to release the work (predecessor or constraint), location, crew size, and duration.

e. Each discipline or trade is responsible for completing and placing their own tags on the plan.

f. The phase will use pull starting from the completion of the interim milestone associated with the end of the phase and working backwards (right to left). After the pull backwards, then a forward pass (left to right) needs to be conducted to ensure the plan demonstrates a logical building sequence, the sum of the total activity durations is within the allowable time to meet the project milestone(s), and identify opportunities to resolve conflict and improve production flow. Do not double count durations for concurrent tasks.

g. The completion of a "phase" should be sequenced so that the "phase" completion releases new work.

h. Participants: All Team members involved in planning and execution of work during the Phase Schedule.

i. A Phase Pull schedule is produced for a typical duration of approximately 3 months using an appropriate interim milestone as the completion point of the

phase.

j. After the initial Phase Pull plan, subsequent Phase Pull plans should be developed every 6 weeks to reflect the next 3 months of project production. This will allow for a fully informed rolling 6-week Make-Work Ready Plan on the project.

k. The Phase Pull plan should be visually displayed in the Big Room for all to see and to inform subsequent 6-week Make-Work Ready Plans.

3. Phase Pull Schedule Format

a. Activities shall be organized in a logical manner to allow for grouping of like characteristics, including but not limited to such items as: phase, work shift, project area, activity work stream. This may include the use of swim lanes on the Phase Pull plan to designate different work areas, phases, or work streams.

b. An appropriate number of interim milestones will be used to help develop the Phase Pull schedule activities.

c. Identify work days and non-work days on the Phase Pull production schedule.

d. Prime Contractor shall work in conjunction with each trade contractor and supplier to ensure that all relevant submittal, procurement, delivery and installation dates for the various trades are accurately represented in the Phase Pull schedule

e. Include activities related to critical project submittals and approvals.

F. 6-Week Make Ready Planning

1. The 6-Week Make Ready / Look Ahead Plan is a visual plan of activities that need to be accomplished over the upcoming six weeks. Sticky notes placed on 6 weekly activity boards are used to establish the rolling 6-week Make-Work Ready Plan.

a. Once an activity has entered into the Look Ahead Plan, it is the team's task to make that activity ready for execution by the scheduled time, remove constraints, and execute the work within the expected duration.

b. Lookahead week activities should be planned as a whole identifying operations to be planned jointly by multiple trades with respect to hand-offs and work areas.

c. The Last Planners create the make-work ready plan that consists of weekly work plans with daily tags for each crew on site identifying what and where they will be working for the next 6 weeks and the size of the respective crew.

d. The quality of the work assignments/activities needs to be in greater detail and accuracy for the upcoming two weeks of work.

e. After the initial 6-Week Make Ready Plan has been developed, the next 6th week of work is planned as part of the weekly schedule meeting in the Big Room to provide a rolling 6-week plan.

f. Any new constraints that are identified during the 6-Week Make Ready planning are identified need to be captured in the constraint log with an assigned champion to remove them and required completion date.

g. Participants: All Team members involved in planning and execution of work during the next 6 weeks.

G. Weekly Work Plan

1. Weekly Work Planning is tactical team collaboration to plan each day's work during

the next week including defining work areas and zones, conditions for handoff and acceptance between trades and disciplines, and crew sizing.

a. Weekly Work Plan updates shall occur 1 day prior to the Weekly Owners Meeting.
b. The Weekly Work Plan needs to be highly reliable to produce effective work flow and production on the project.
c. Specify tasks planned to be done next week and on which days.
d. The five minimum requirements to control quality of input into the Weekly Work Plan are:
    1) What is the Task?
    2) What will be done (e.g. install electrical raceways sections 1, 2, 3)?
    3) Where it will be done (e.g. Column A/1, above AC Box)?
    4) When it will be done (e.g. Tuesday and Wednesday)?
    5) Who will do it (e.g., company, crew size)?
e. Identify make ready actions by assessing their feasibility prior to making assignments in the weekly work plan so as to shield production workers from uncertainty.
f. Synchronize tasks made ready relative to the promises of the team members.
g. The conditions for hand off and acceptance are clearly communicated within the team and all constraints removed.
h. Optimization of the team capabilities to plan, synchronize, execute, learn and improve.
i. At the end of each week, assignments are reviewed for completeness in order to measure the reliability of the planning system. Analyzing reasons for plan failures and acting on these reasons is the basis of learning.
j. Participants: All Team members involved in planning and execution of work during the next 6 weeks.

2. Weekly Work Plan Meeting Typical Agenda.
    a. Review constraint log and note any overdue constraints and impact (5 minutes)
    b. Review 6-week look-ahead plan (15 minutes)
    c. Review the new week – Note activities that are starting up in week 6.
    d. Review weeks 2-5 only by new exceptions that pop up. (Team should have been looking at weeks 2-5 for the last 5 weeks.)
    e. Review last week's performance (5 min.)
    f. Last week's PPC: The number of activities completed since the last weekly meeting divided by the total number of planned activities which were supposed to occur.
    g. Current week's PPC
    h. The Percent Plan Complete Statistic shall be kept on a Project Log showing each weeks Percent Plan Complete Statistic for each week of the project schedule until completion.
    i. Trend chart
    j. Variance chart, and reasons for variance: charted in Pareto or pie charts to see trends and facilitate learning, knowing what needs to be fixed in order to improve next week's PPC
    k. Finalize next week's Weekly Work Plan (30 minutes)
    l. Plus/Delta (2 minutes)

H. Workable Backlog

1. Capacity limitations of a production unit may prevent the Last Planner from assigning all work shown in the first week of the Look-ahead that satisfy the definition, soundness, and sequence criteria.
2. There may be more work made ready than a production unit can reasonably be expected to complete in any week.
3. Overloading a production unit is held against the performance of the Last Planner as assigned work that remains incomplete counts against the plan reliability measure.
4. Ready work that cannot be assigned is recorded as Workable Backlog on the Weekly Work Plan.
5. Should a production unit for any reason not be able to complete an assignment on their Weekly Work Plan, or should they complete assignments sooner than expected, the Workable Backlog will provide them with other work, so they need not be idle or wind up doing out-of-sequence work
6. Items in workable backlog must meet the same quality criteria as do priority assignments for the week.

I. Daily Work Planning Huddles
   1. Daily Huddles are meetings where team members quickly give the status of the previous shift's accomplishments and failures, plus the current shift's plan of work for that day.
   2. Daily Huddle discussions must be directly connected to the team's Weekly Work Plan.
   3. Transparency and reliable commitments are measured in the Daily Huddles for the Last Planners themselves to see and interact with directly.
   4. This is the rallying point for "our plan," which has "my input" accurately reflected. This is the heart of LPS, it is of utmost importance for the team to establish and drive healthy Daily Huddle discipline.

3.3 DELIVERABLES

A. Schedule Deliverables:
   1. Project Milestone Schedule / Baseline schedule – Due within 10 days after Notice to Proceed (NTP)
   2. Initial Phase Pull Plan – Due within 30 days after NTP
   3. Updated 6-Week Make Work Ready Look Ahead Schedule – Due every week
   4. Weekly Metric Report (Percent Plan Complete for week, variance analysis for week's missed commitments, Current Constraint Log)
      a. If weekly PPC is less than 70%, specify what specific efforts the Prime Contractor will undertake to improve its weekly work plan reliability.
   5. Monthly Project Schedule Updates – Due Every Month
      a. The updated Contract Construction Schedule shall accurately represent the as-built condition of all completed and in-progress work activities as of the schedule data date.
      b. The level of detail shall be sufficient to describe and forecast the scheduled completion dates for the phase milestones used in the Phase Pull Planning.
      c. Planned percent complete (PPC) for the month and cumulative to date for the project on a weekly basis displayed in a graphical format.
      d. If the average weekly PPC is less than 70%, specify what specific efforts the Prime Contractor will undertake to improve its weekly work plan reliability.
      e. Variance analysis for missed commitments with bar chart, Pareto chart or

pie chart that visually shows trends for the month and trends for the project-to-date.

f. The current status of the phase milestones as established in the Milestone Plan.

g. The reason phase milestones may not have been accomplished and their delaying factors.

h. What mitigation efforts the Prime Contractor will undertake to complete the phase milestones without adversely impacting the overall project milestones leading to successful completion of the project by the finish milestone.

i. Any changes made to the sequencing, durations, working time, etc. made to accomplish the phase milestones.

j. Current Constraint Log with items that may impact the production plan clearly identified with a required date for the constraint to be removed and a team member assigned to champion removal of the constraint.

B. All schedule submittals including the updated progress schedules will be reviewed jointly by the District and the Prime Contractor. Review of the Prime Contractor schedules shall not constitute approval or acceptance of the Prime Contractor construction means, methods, or sequencing, or a positive determination by the District of the Prime Contractor's ability to complete the Work in a timely manner.

3.4 RESPONSIBILITY FOR COMPLETION

A. Should any monthly or weekly update of the Contract Construction Schedule indicate that the Contract Completion Date has extended, Prime Contractor shall submit a written action plan to meet the Contract Completion Date. Prime Contractor shall initiate corrective actions, as approved by the Construction Administrator, at no additional cost. These actions shall include, but not be limited to, one or more of the following:

1. Identify and remove constraints and barriers to flow of the project work flow production.
2. Identify root causes for missed commitments and develop and implement countermeasures to address these.
3. Resequence activities in order to improve work flow production and subsequent completion of these activities.
4. Increase construction manpower in certain or all trades in order to bring the completion date into compliance with Contract requirements.
5. Increase the number of labor shifts, working hours per shift, or working days per week as required to bring the completion date into compliance with Contract requirements.
6. Arrange and pay for acceleration of fabrication schedules for long lead material items.
7. Arrange and pay for alternate shipping or delivery methods in order to expedite material procurement.

C. Comments provided by the Construction Administrator concerning the Initial Construction Schedule, Contract Construction Schedule, or any schedule update shall not relieve Prime Contractor from the responsibility for compliance with the entire requirements of the Contract Documents.

END OF SECTION 01 32 16

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 013240

PROGRESS SCHEDULES AND REPORTS

PART 1- GENERAL

1.1 REFERENCES

A. PROJECT TIMES, LIQUIDATED DAMAGES & PROSECUTION OF THE WORK: Supplement to General Conditions.

B. DEFINITIONS: General Conditions & Supplement to General Conditions.

C. DISTRICT OBSERVED HOLIDAYS: Supplement to General Conditions.

D. STARTING THE WORK, CONTINUING THE WORK: General Conditions.

E. CHANGE OF CONTRACT TIMES: General Conditions.

F. SUBMITTALS: Section 013300

1.2 TIME IS OF THE ESSENCE

A. It is expressly understood and agreed that the time of beginning, the rate of progress, and the time of completion of the WORK are of the essence of this Contract.

1.3 PRE-CONSTRUCTION

A. The CONTRACTOR shall bring a draft schedule to the pre-construction meeting.

B. Parts and material submittals required for the Project should be delivered as soon as can be prepared.

1.4 SCHEDULE SUBMITTAL

A. The Schedule shall show the start and end of the Project. The duration of the Project shall match the Contract calendar days specified for the Project.

B. The CONTRACTOR's schedule of values shall be included with the schedule submittal.

C. Work items of less than $25,000 value shall not be included in the schedule, unless they are critical to the Project.

D. Three (3) week look-ahead schedules that show upcoming work are required at the progress meetings.

1.5 THE CITY DOES NOT WARRANT THE SCHEDULE

A. The CONTRACTOR's means and methods that make up the schedule are the responsibility of the CONTRACTOR. Provided the schedule reflects all constraints that are part of the WORK, INCLUDING SPECIAL PERMIT PROVISIONS SUCH AS EXCLUSIONS BECAUSE OF BIRD BREEDING SEASONS, the District will accept the schedule; however, the District does not warrant the schedule. The schedule submittal is intended as a tool to assist the CONTRACTOR and the District with the planning of the WORK, and to bring any issues to light that might be in conflict with Project requirements. The schedule is also used to keep the neighborhood informed about upcoming work.

1.6 SCHEDULE UPDATES

A. The project will require a schedule update submittal every month.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

End of Section 013240

SECTION 013300

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

Related Sections:

1. Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including CONTRACTOR's construction schedule.
2. Division 1 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
3. Division 1 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
4. Division 1 Section "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

A. Submittals: Written and graphic information and physical samples that require Architect's responsive action.

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as informational submittals.

1.4 SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time

required for making corrections or modifications to submittals noted by the Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and CONTRACTOR's construction schedule.
2. Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of CONTRACTOR's construction schedule.

    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal category: Informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.
    g. Scheduled dates for purchasing.
    h. Scheduled dates for installation.
    i. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Processing Time: Allow time for submittal review, including time for re-submittals, as follows. Time for review shall commence on Architect's receipt of submittal. No

extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including re-submittals.

1. Initial Review: Allow 14 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise CONTRACTOR when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Re-submittal Review: Allow 14 days for review of each re-submittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 14 days for review of each submittal.

    a. Submittals may be transmitted simultaneously to Architect and to Architect's consultants, for review. Submittal will be returned to Architect before being returned to CONTRACTOR.

C. Identification and Information: Place a permanent label or title block on each paper copy submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record CONTRACTOR's review and approval markings and action taken by Architect.
3. Include the following information for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of DCM member.
    e. Name of Contractor.
    f. Name of subcontractor.
    g. Name of supplier.
    h. Name of manufacturer.
    i. Submittal number or other unique identifier, including revision identifier.

        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Re-submittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).

    j. Number and title of appropriate Specification Section.
    k. Drawing number and detail references, as appropriate.
    l. Location(s) where product is to be installed, as appropriate.
    m. Other necessary identification.

D. Options: Identify options requiring selection by the Architect.

E. Deviations: Identify deviations from the Contract Documents on submittals.

F. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.

G. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. The CM will return submittals, without review, or discard submittals received from sources other than CONTRACTOR.

1. Transmittal Form: Use AIA Document G810, CSI Form 12.1A, or CONTRACTOR's comparable form. Provide locations on form for the following information:

   a. Project name.
   b. Date.
   c. Destination (To:).
   d. Source (From:).
   e. Names of subcontractor, manufacturer, and supplier.
   f. Category and type of submittal.
   g. Submittal purpose and description.
   h. Specification Section number and title.
   i. Indication of full or partial submittal.
   j. Drawing number and detail references, as appropriate.
   k. Transmittal number (number transmittals consecutively).
   l. Submittal and transmittal distribution record.
   m. Remarks.
   n. Signature of transmitter.

2. On an attached separate sheet, prepared on CONTRACTOR's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

H. Re-submittals: Make re-submittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Use only final submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Submittals: Electronic copies of each submittal, unless otherwise indicated. Electronic marked-up submittals will be returned to the CONTRACTOR.
2. Informational Submittals: Submit Electronic copies of each submittal, unless otherwise indicated. Electronic marked-up submittals will be returned to the CONTRACTOR.
3. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 1 Section "Closeout Procedures."
4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

    a. Provide a notarized statement on original paper copy certificates and certifications where indicated.

5. Test and Inspection Reports Submittals: Comply with requirements specified in Division 1 Section "Quality Requirements."

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams showing factory-installed wiring.
b. Printed performance curves.
c. Operational range diagrams.
d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:

a. Submit Electronic copies of product data, unless otherwise indicated. Electronic submittals will be returned to the CONTRACTOR.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches.
3. Submit Shop Drawings in the following format:

a. Six opaque copies and one reproducible copy of each submittal. Architect will return one reproducible copy. Mark up and retain one copy as a Project Record Document.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

a. Project name.
b. Name of Architect and DCM member.
c. Name of subcontractor.
d. Name of supplier.
e. Name of manufacturer.

f. Submittal number or other unique identifier, including revision identifier.
g. Generic description of Sample.
h. Product name.
i. Sample source.
j. Number and title of applicable Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of CONTRACTOR.

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

   a. Number of Samples: Submit two full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

   a. Number of Samples: Submit three (3) full sets of available choice where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. One (1) marked-up sample will be returned with options selected.

      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.
5. Submit product schedule in the following format:

    a. PDF electronic file.
    b. Five paper copies of product schedule or list, unless otherwise indicated. Architect will return three copies. Mark up and retain one returned copy as a Project Record Document.

F. CONTRACTOR's Construction Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."

G. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A or CONTRACTOR's comparable form. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.
4. Submit subcontract list in the following format:

    a. Number of Copies: Seven (7) paper copies of subcontractor list, unless otherwise indicated. Architect will return (3) copies to the DCM and two (2) copies will be returned to the CONTRACTOR. Mark-up and retain one returned copy as a Project Record Document.

H. Coordination Drawings: Comply with requirements specified in Division 1 Section "Project Management and Coordination."

I. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

J. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on American Welding Society (AWS) forms. Include names of firms and personnel certified.

K. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

L. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

M. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

N. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

O. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

P. Product Test Reports: Submit written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

Q. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

R. Schedule of Tests and Inspections: Comply with requirements specified in Division 1 Section "Quality Requirements."

S. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

T. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

U. Field Test Reports: Submit reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

V. Maintenance Data: Comply with requirements specified in Division 1 Section "Operation and Maintenance Data."

W. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and

a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of CONTRACTOR by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit five paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to CONTRACTOR to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance/Material Submittals: Refer to requirements in Division 1 Section "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of CONTRACTOR's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear CONTRACTOR's approval stamp and will return them without action.

B. Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:

1. REVIEWED: Fabrication / installation may be undertaken. Review does not authorize changes to the contract sum or contract time.
2. FURNISH AS CORRECTED: Fabrication / installation may be undertaken. Review does not authorize changes to the contract sum or contract time.
3. REVISE AND RESUBMIT: Fabrication / installation may not be undertaken. In Resubmitting, limited corrections to items marked.
4. REJECTED: Fabrication / installation may not be undertaken. In Resubmitting, limited corrections to items marked.
5. SUBMIT SPECIFIED ITEM: Proposed substitution not accepted.

C. Informational Submittals: The DCM and the Architect will review each submittal and will return it, unless otherwise indicated. Architect will forward each submittal to appropriate party.

D. Partial submittals are not acceptable, will be considered nonresponsive, will not be reviewed, and will be returned or discarded. Partial submittals prepared for a portion of the Work may be reviewed when approval in advance by the DCM and Architect.

E. Incomplete submittals are not acceptable, will be considered nonresponsive, will not be reviewed, and will be returned or discarded.

F. Submittals not required by the Contract Documents will not be reviewed, and will be returned or discarded.

END OF SECTION 013300

This page left intentionally blank.

SECTION 013523
PROJET SAFETY REQUIREMENTS

1. GENERAL

1.1 The Contractor shall bear overall responsibility for all aspects of safety at the project.

1.2 The Contractor shall, at all times, provide adequate resources, equipment, training and documentation to:

1.2.1 Assure compliance with all applicable regulatory and contract requirements.

1.2.2 Assure a safe work environment at the Project.

1.2.3 Instill a culture for safe behavior in all supervisors and workers.

1.2.4 Ensure a universal understanding that safety and health issues take precedence over all other considerations at the Project.

1.3 The Contractor and every subcontractor shall comply with the requirements of this section and all Federal, State, and local statures, standards, and regulations. In any circumstance where this Section differs from, or is in conflict with any statutory requirement, the more stringent shall apply.

1.4 The Owner reserves the right to have any manager, supervisor or worker removed from the project for disregarding the Project's safety requirements.

1.5 The Owner reserves the right to deduct from the contract any safety related expenses that the Owner incurs as a result of the Contractor's, or any subcontractor's, failure to comply with the requirements of this section.

1.6 The Owner will deny requests for time extensions and/or monetary considerations whenever the Owner intercedes on behalf of safety compliance as a result of Contractor failure to act as required by the contract.

2. Contractor's Project Safety Coordinator (PSC)

2.1 The Contractor shall provide a Project Safety Coordinator, who shall be responsible for safety training, inspections, investigations, record keeping, reporting, incident response, and claims management, and shall serve as the technical advisor to the Contractor's Project staff for all safety issues.

2.2 If the contract value is less than $3,000,000 the Contractor's project superintendent may perform these duties. If the contract value exceeds $3,000,000 the Contractor shall furnish a construction safety specialist.

3. Subcontractors' Project Safety Representative (PSR)

Every subcontractor shall identify one employee to be its Project Safety Representative who will be on-site during all the subcontractor's activities and will participate in all training activities, audits, etc. related to the safety program.

3.1 The PSR shall attend all safety meetings while the company is actively performing work at the project and shall be responsible for reporting all incidents to the PSC.

3.2 The PSR shall transport or accompany any injured co-worker that

requires medical attention at facilities outside the project.

3.3 The PSR shall be responsible for either conducting or making arrangements for all training, equipment and materials that workers need to perform their duties in the safest possible manner.

4. Project Safety Program

4.1 The Contractor shall develop a written, site specific, safety program. It shall be printed in English and an initial draft shall be submitted to the Owner for review and comment as a prerequisite to issuance of the Notice to Proceed with construction services'

4.2 The Contractor shall incorporate Owner comments into a final draft which shall be resubmitted to the Owner for concurrence.

5. Personal Protective Equipment (PPE)

5.1 PPE shall be required for all workers in construction areas. The followings items shall be furnished, inspected, and maintained by the employer. The Contractor shall maintain an adequate inventory to furnish these items for five Owner representatives who may visit the project from time to time:

5.1.2 Hard Hats (safety helmets): shall be ANSI stamped (Z89.1-1997, Type I, Class E, G and C and be worn at all times while in the construction areas.

5.1.3 Eye protection (safety glasses): shall be ANSI stamped Z87. If a worker wears prescription glasses (plastic lenses only) that are marked Z87, the employer shall furnish goggles or safety glasses that are designed to fit over another pair of glasses and be worn at all times while in the construction areas.

5.1.4 Vests shall be at a minimum a Class II reflective traffic vests and be worn at all times while in the construction areas.

5.1.5 Hand protection, Hearing Protection, Respiratory Protection, Fall Arrest Equipment, Other PPE: shall all be furnished as required to comply with OSHA Standards.

6. Medical Equipment -

The Contractor shall maintain at least one first aid kit on the project site at all times per ANSI Z308.1.

7. Certifications

Supervisors, Competent Persons, Equipment and Crane Operators, and Emergency Responders shall all be identified in lists submitted by employers to the PSC prior to commencement of work. In addition to lists, the employers shall include copies of all available training certificates or formal documentation to support the declared positions. For all operations that require a "competent person" (per OSHA definition), the PSC shall maintain a project file containing the transmittals from each employer naming each person declared to be competent for each operation. For operations requiring independent certification, a copy of the certificates shall be attached.

8. Project Safety Signs and Posters

8.1 The Contractor shall post safety regulation signs at every point of entry to the project in English and Spanish. The content of the sign should at a minimum indicate that visitors are required to check in at the project office, persons entering the construction area must be appropriately attired, no weapons, tobacco, alcohol, controlled substances and related paraphernalia may be brought onto the premises, a posted speed limit will be identified and copies of the MSDS sheets are available at the project office.

8.2 The Contractor shall post emergency contacts and notification, including phone numbers, notification of insurance carrier for Worker's Compensation Coverage and any and all other required State and Federal postings.

9. Project Safety Training and Meetings

9.1 Within fifteen days of the issuance of the Notice to Proceed the Contractor shall hold the initial safety meeting and all Project Team members are strongly encouraged to participate.

9.2 The PSC shall present orientation training to every person who is to be allowed into the construction area without an escort. A translator shall be present when there are workers in attendance who do not speak English.

9.3 The PSC shall maintain a site safety orientation log signed by all persons receiving safety training.

9.4 Project safety meetings will be held on a weekly basis and will be chaired by the PSC and attended by all companies' PSRs who are currently on site. The topics of discussion should focus on safety and loss control issues.

9.5 "Tool Box Talks" shall be conducted on a weekly basis by each PSR and will cover safety issues related to upcoming work, current site conditions and review of any recent incidents.

9.6 Special task training should occur when new equipment or non-routine activities are scheduled.

10. Safety Inspections

10.1 Daily – The PSC shall observe work operations in all areas of the project and note any violations in the daily progress reports.

10.2 Weekly – A comprehensive safety inspection shall be conducted by the PSC and each PSR for their respective work areas. A written record of the observations and recommended corrections should be made and placed in the project files.

10.3 Quarterly – The PSC shall facilitate an inspection which shall include, but not be limited to the following: fall arrest equipment, fire extinguishers, rigging, ladders, hand tools, power tools, cords, welding leads, hoses, alarms, respirators, ground fault circuit interrupters, first aid stations, eye wash stations, and emergency rescue equipment.

10.4 Semi-annually – The PSC shall facilitate an inspection of all hoists, cranes, mobile equipment, motorized lift platforms, stages, generators and compressors to assure proper operational condition.

10.5 The PSC shall notify the Owner within one hour of the arrival at the project site by any representative of a regulatory agency and provide the Owner with a copy of any published findings or citations issued to any employer and shall ensure that statutory posting requirements are met.

11. Records and Reports - The PSC shall prepare a written report for each incident that involves any injury that may not be resolved by first aid response and/or each incident that involves damage to property or Equipment. The report should contain a list of factual details that created the incident, the responsive actions that occurred during and immediately following the incident and recommendations for modifications to prevent repetition of the incident. A copy of the report should be submitted to the Owner within 24 hours of the incident.

12. Construction Operations

12.1 Cranes

12.1.1 Tower cranes and related power supply equipment shall be surrounded by at least an eight foot high, 5/8" plywood enclosure with lock controlled entrance.

12.1.2 Operators of cranes, derricks and/or hoisting equipment shall possess certification from a nationally accredited training organization.

12.2 Demolition - Safe egress paths and barrier isolation of impacted areas shall be monitored and maintained to prevent entry by other trades and members of the public. This includes removal of materials and trash from elevated locations.

12.3 Electrical Power

12.3.1 Ground fault circuit interruption (GFCI) shall be the primary protection from exposure to electrical current for all workers on the project. Only exit lighting and medium-high (greater than 240) voltage service will not be GFCI protected.

12.3.2 All strings of temporary lights shall be fully lamped and guarded regardless of height, and shall be continuously maintained. Adequate levels of illumination for the work operations must be maintained at all times.

12.3.3 All receptacles and switches shall have trim plates installed before they are energized.

12.3.4 All power distribution panels shall have full covers installed before primary power is brought into the panel.

12.4 Excavations

12.4.1 Prior to starting, each excavation shall be reviewed with the Owner to obtain any historical knowledge about existing utilities in the area. Where applicable, "utility locates" will be called for seventy-two hours in advance of commencement of the excavation. Potholing and/or hand excavation shall be required within two horizontal feet of located centerlines and in areas where knowledge is lacking.

12.4.2 When a trench excavations cannot be backfilled in the same day as it is created, a highly visible barricade shall be erected no less than six feet from all approachable edges. All portable means of access shall be removed at the end of each workday.

12.4.3 Earth ramps that are to be used for walking access shall

not exceed twenty percent in grade slope. Steeper slopes shall be gated and used for equipment only.

12.5 Fall Protection and Prevention

12.5.1 Any walking/working surface shall be defined to have a fall exposure that has one or more sides, ends or edges without a guardrail system attached or a solid continuous wall of at least forty-two inches in height above the walking/working surface, and within twelve horizontal inches from the edge. The Contractor shall require engineered or conventional fall protection measures for each and every fall exposure that involves vertical distances equal to or greater than six feet. The recognized exemptions/exceptions are as follows:

- Portable step ladders
- Extension and straight ladders
- Erection and dismantling of scaffolding
- Limited exposure for engaging and disengaging a hook
- Vertical fall exposure protected by a warning line and six foot setback

12.5.2 Provide covers over holes which are secured and clearly marked as covers.

12.5.3 Job built ramps and bridges must be covered with non-skid materials.

12.5.4 Materials, scraps, waste and tools shall never be allowed to free-fall from a height greater than twenty feet, unless it is contained within a chute or controlled by a hoist.

12.6 Fire Protection

12.6.1 The Contractor shall review fire prevention needs and procedures with the Owner and shall post appropriate information and warnings.

12.6.2 The Contractor shall maintain unobstructed access to fire extinguishers, temporary fire protection facilities, stairways and other access routes.

12.6.3 The Contractor shall provide supervision of welding operations, combustion type temporary heating units and similar sources of ignition.

12.6.4 All floors that have combustible materials present shall be accessible from ground level by a usable stair system. For structures greater than three stories in height shall have a fire sprinkler stand pipe installed and it shall be charged to within two stories (or thirty vertical feet) of all floors containing combustible materials. A Siamese connection shall be installed at every second level to provide access for fire hoses.

12.6.5 All fire extinguishers that are not task-specific shall be adequate in number and description to comply with OSHA declared limits for egress points, floor area and travel distances. They shall be situated in highly visible locations.

12.6.6 All fire extinguisher that are task specific shall be inspected and furnished in advance by the employer that will be conducting the work that requires such fire fighting provisions. Such extinguishers shall be located with twenty-five feet from the

perimeter of the task operation.

12.7 Housekeeping - The Contractor shall ensure that all subcontractors effectively clean the project site continuously throughout each workday. Effective cleanup shall address all of the following housekeeping issues:

12.7.1 All construction waste, trash, and debris shall be placed in designated receptacles. No glass bottles will be permitted on the project site.

12.7.2 Stack all whole and scrap materials in locations that do not obstruct a clear pathway nor create a risk of toppling causing injury or damage to the work.

12.7.3 Place all hoses, cords, cables and wires in locations that prevent them from being damaged by tires, sharp edges, or pinch points and from creating trip or hook hazards.

12.7.4 Secure and effectively cover all materials on roofs and elevated levels to prevent displacement by wind.

12.7.5 All materials and equipment shall be protected from the elements while staged on the project site.

12.7.6 All signs, barricades, fire extinguishers, guardrails, gates, etc. are to be restored to their proper locations in sound condition after they have been moved for work purposes.

12.7.7 Properly store and secure all flammable and combustible liquids and gases.

12.7.8 Collect and place all cut-off or waste pieces of rolling stock into waste and scrape containers as they are created.

12.7.9 Live rounds ejected from powder-actuated tools shall be immediately placed in designated containers and periodically returned to the tool dealer or law enforcement agency for proper disposal.

12.7.10 All puncture and impalement exposures shall be covered or eliminated as soon as they are created.

12.8 Ladders

12.8.1 Portable aluminum ladders are prohibited.

12.8.2 Extension, straight and job built ladders shall be secured from movement at the top and bottom.

12.8.3 Manufactured portable ladders shall display ANSI heavy duty rating (Class 1-A) and be inspected daily.

12.9 Medical Assistance and Screening

12.9.1 The PSC shall maintain a First Aid Log for all treatment administered on the project.

12.9.2 Drug and alcohol screening shall be mandatory for every supervisor and/or worker who sustains or contributes to the cause of any injury (beyond first aid) or property damage incident.

12.9.3 Minimum requirements for chemical screening shall at least match the threshold limits for a NIDA 5-panel protocol and for alcohol screening shall at least match the Texas DOT vehicle operator's limit for blood alcohol content.

12.9.4 Any supervisor or worker who tests positive shall be ejected and excluded from return to work at the project. Successful

completion of an acceptable rehabilitation program may be considered by the Owner for restoring a person's ability to return to the project. The final decision rest solely with the Owner.

12.10 Petroleum Fuel Operated Equipment

12.10.1 Where possible, equipment operator cabs shall be locked during non-working hours. Only equipment operators and direct supervisors shall have access to keys.

12.10.2 Any combustion engine equipment with less than ninety-eight percent clean air exhaust shall not be operated in enclosed spaces unless the exhaust is piped to outside air, and fresh air is brought into the space to replace the amount being consumed. This includes generators/welders and compressors as well as mobile equipment.

12.10.3 For hose and termination fittings on air compressors, whip checks shall be used at all connection points. Emergency shut off valves shall be installed on every discharge fitting of all air compressors.

12.11 Public Protection - The public boundary perimeter shall be secured from public intrusion. Attractive nuisance items such as tower cranes, tall ladders, fire escapes, large excavations, etc. shall require additional and separate security measures

12.12 Project Service Water

12.12.1 Potable water: comply with city health requirements.

12.12.2 Non-potable water: Water storage containers, hose bibs and faucet shall be posted in English and Spanish "Danger – Do Not Drink"

12.13 Welding and Burning

12.13.1 Oxygen and fuel gas cylinders shall not be stored together, including on bottle carts. At the end of any workday bottles must be moved to OSHA prescribed storage arrangements.

12.13.2 Anti-flashback arrestors shall be installed at the pressure regulator gauges of all Oxy-Acetylene cutting rigs.

12.13.3 Welding operations shall not be allowed to present an opportunity for flash burn exposures to the eyes of any workers in the vicinity. All welding operations shall provide appropriate screening measures, erected in advance to contain the high energy light.

END OF SECTION 013523

THIS PAGE LEFT INTENTIONALLY BLANK

SECTION 013700

SCHEDULE OF VALUES

PART 1 – GENERAL

1.1 DESCRIPTION

A. The Schedule of Values is an itemized list of the value or cost of each Bid Item of work and the associated time of expenditures. It shall be used as the basis for submitting progress payments and projecting future payment schedule.

1.2 RELATED WORK SPECIFED ELSEWHERE

A. Section 013240 – Progress Schedules and Reports

1.3 PREPARATION

A. Schedule of Values shall be based on bid items and anticipated units completed each month.

B. The sum of the individual values shown on the Schedule of Values must equal the total Contract Price.

C. Lump Sum Bid Items shall be taken out into items as required by the General Provisions.

D. Coordinate the Schedule of Values with the Construction Schedule in accordance with Section 013240.

1.4 CONTRACTOR SUBMITTAL

A. A Schedule of Values shall be submitted per the requirements of the General Provisions.

B. The CONTRACTOR, DCM and Architect shall meet and jointly review the preliminary schedule of values and make any adjustments in value allocation if, in the opinion of the Architect, these are necessary to establish fair and reasonable allocation of values for the major work components. Front end loading will not be permitted. This review and any necessary revisions or reallocation of the schedule of values shall be completed within 10 working days from the date of the Notice to Proceed.

C. Submit three (3) copies of monthly updates to the schedule of values to the Architect with request for progress payments.

PART 2 – MATERIALS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 013700

This page left intentionally blank.

SECTION 014000

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and control services required by authorities having jurisdiction by provisions of this Section.

C. Related Sections:

1. Section 019113 - General Commissioning.
2. Divisions 02 through 32 Sections for specific test and inspection requirements.

1.3 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated

numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 SUBMITTALS

A. Concrete Slab Moisture Tests: Test results of testing for moisture content in concrete floor slabs. Submit copies to the Architect, Project Inspector, and Contractor prior to the installation of floor covering materials.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Description of test and inspection.
3. Time schedule or time span for tests and inspections.
4. Entity responsible for performing tests and inspections.
5. Requirements for obtaining samples.

1.5 QUALITY ASSURANCE

A. Testing and inspections required by governing authorities will be performed by an independent testing laboratory selected and employed by the Owner and approved by the Division of the State Architect (DSA). Qualification of a testing agency or laboratory will be under the jurisdiction of the DSA Office of Regulations (ORS) Structural Safety Section (SSS). Procedural and acceptance criteria are set forth in CBC Sections 108 and 1701, and California Code of Regulations (CCR) Title 24 Part 1, Administrative Code, and the DSA Interpretation of Regulations.

B. Testing and inspection services which are performed shall be in accordance with requirements of CCR Title 24 Part 1, Administrative Code, and as specified herein. Testing and inspection services shall verify that work meets the requirements of the Contract Documents.

C. In general, tests and inspections for structural materials shall include all items enumerated on the Structural Tests and Inspections list for this project as prepared and distributed by the Architect.

D. Test reports shall be signed by a Registered Civil Engineer licensed in the State of California.

E. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect and Project Inspector, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

1. Notify Architect, Project Inspector and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. Submit a certified written report of each test, inspection, and similar quality-control service to Architect and Project Inspector, with copy to Contractor and to authorities having jurisdiction.

3. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
4. Retest and re-inspect corrected work.
5. Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
6. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
7. Do not perform any duties of Contractor.

F. Testing Laboratory shall distribute one copy of each test and inspection report to each of the following:

1. Inspector
2. Architect
3. Structural Engineer
4. Contractor

G. Test reports shall include all tests made, regardless of whether such tests indicate that the material is satisfactory or unsatisfactory. Samples taken but not tested shall also be reported. Records of special sampling operations as required shall also be reported. The reports shall show that the material or materials were sampled and tested in accordance with the requirements of CCR Title 24 Part 1 Administrative Code, Part 2 California Building Code, and with the approved specifications. They shall also state definitely whether or not the material or materials tested comply with requirements.

H. Reporting Test Failures

1. Immediately upon Testing Laboratory determination of a test failure, the Laboratory will telephone the results of test to Architect. On the same day, Laboratory will send written test results to those named on the above distribution list.

1.6 PAYMENTS

A. Costs of initial testing and inspection, except as specifically modified herein, or specified otherwise in technical sections, will be paid for by the Owner. Initial tests and inspections are defined as the first tests and inspections as herein specified.

B. In the event a test or inspection indicates failure of a material or procedure to meet requirements of Contract Documents, costs for retesting and reinsertion will be paid by the Owner and back charged to the Contractor.

C. Additional tests and inspections not herein specified but requested by Owner or Architect, will be paid for by Owner, unless results of such tests and inspections are found to be not in compliance with Contract Documents, in which case the Owner will pay all costs for initial testing as well as retesting and re-inspection, and back charge the Contractor.

D. Costs for additional tests or inspections required because of change in materials being provided or change of source or supply will be paid by Owner and back charged to the Contractor.

E. Costs for tests or inspections which are required to correct deficiencies will be paid by the Owner and back charged to the Contractor.

F. Cost of testing which is required solely for the convenience of Contractor in his scheduling and performance of work will be paid by the Owner and back charged to the Contractor.

G. Overtime costs for testing and inspections performed outside the regular work day hours, including weekends and holidays, will be paid for by the Owner and back charged to the Contractor. Such costs include overtime costs for the DCM.

H. Testing Laboratory will separate and identify on the invoices, the costs covering all testing and inspections which are to be back charged to the Contractor as specified above.

a. Testing Laboratory will furnish to Owner a cost estimate breakdown covering initial tests and inspections required by Contract Documents. Estimate will include number of tests, man-hours required for tests, field and plant inspections, travel time, and costs.

I. Should it be considered necessary or advisable by the Owner at any time before final acceptance of the entire work to make an examination of work already completed by removing or tearing out the completed work, the Contractor shall, on request, promptly furnish necessary facilities, labor and materials. If such work is found to be defective in any respect due to fault of the Contractor or his subcontractor, he shall be responsible for all expenses of such examinations and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract, the additional cost of labor and material necessarily involved in the examination and replacement shall be reimbursed to the Contractor.

1.7 QUALITY CONTROL

A. Contractor Responsibilities:

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

B. Contractor shall not employ the same entity engaged by Owner.

1. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or inspecting will be performed.
2. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
3. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
4. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will

be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

C. Contractor Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field-curing of test samples.
5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
6. Security and protection for samples and for testing and inspecting equipment at Project site.
7. Selection of the material required to be tested will be by the laboratory or the DCM and not by the Contractor.

D. Contractor shall notify the Testing Agency a minimum of 3 working days in advance of the manufacture of material to be supplied by him under the Contract Documents, which must by terms of the Contract be tested, in order that the Agency may arrange for the testing of such material at the source of supply.

1. Material shipped by the Contractor from the source of supply before having satisfactorily passed such testing and inspection or before the receipt of notice from the DCM that such testing and inspection will not be required, shall not be incorporated in the Project.

E. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

F. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for the Notice to Proceed.

1. Distribution: Distribute schedule to Architect and testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.
2. Unless otherwise specified, Contractor shall notify Testing Laboratory a minimum of 10 working days in advance of all required tests, and a minimum of 2 working days in advance of all required inspections. Extra laboratory expenses resulting from a failure to notify the Laboratory will be paid by the Owner and back charged to the Contractor.

3. Contractor shall give sufficient advance notice to Testing Laboratory in the event of cancellation or time extension of a scheduled test or inspection. Charges due to insufficient advance notice of cancellations or time extension will be paid for by the Owner and back charged to the Contractor.

PROJECT INSPECTOR

A. An Inspector employed by the Owner in accordance with the requirements of CCR Title 24 Part 1, Administrative Code, will be assigned to the work. His duties are specifically defined in CCR Title 24 Part 1, Sec. 4-342.

B. The Contractor shall notify the Inspector a minimum of two working days in advance of execution of all work that requires inspection.

C. The work of construction in all stages of progress shall be subject to the personal continuous observation of the Inspector. Inspector shall have free access to any or all parts of the work at any time. The Contractor shall furnish the Inspector reasonable facilities for obtaining such information as may be necessary to be fully informed respecting the progress and manner of the work and the character of the materials. Inspection of the work shall not relieve the Contractor from any obligation to comply with the Contract requirements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

1.1 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Comply with the Contract Document requirements for Section 017329 - Cutting and Patching.

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

1.2 TESTS AND INSPECTIONS

A. Perform tests and inspections for the following in conformance with the California Building Code, Title 24, Part 2, of the California Code of Regulations.

B. Structural Test and Special Inspections (Chapter 17)

D. Soils and Foundations (Chapter 18)

1. Earth fill compaction

2. Excavation and fill for foundations

A. Concrete (Chapter 19A)

1. Materials

a. Portland Cement Tests
b. Concrete Aggregates
c. Reinforcing Bars
d. Batch Plant Inspection
e. Waiver of Batch Plant Inspection

2. Concrete Quality

a. Proportions of Concrete
b. Strength Tests of Concrete
c. Splitting Tensile Strength
d. Gunite/Shotcrete Cores
e. Shotcrete

3. Concrete Inspection

a. Job Site Inspection
b. Reinforcing Bar Welding Inspection

4. Anchors in Concrete

a. Drilled-In-Expansion Bolts or Epoxy-Type Anchors in Concrete

B. Masonry (Chapter 21)

1. Materials

a. Masonry Units
b. Portland Cement
c. Mortar & Grout Aggregates
d. Reinforcing Bars
e. Admixtures

2. Masonry Quality

a. Portland Cement Tests
b. Mortar & Grout Tests
c. Masonry Prism Tests
d. Masonry Core Tests
e. Masonry Unit Tests
f. Reinforcing Bar Tests

3. Masonry Inspection

a. Reinforced Masonry

b. Reinforcing Bar Welding Inspection

C. Structural Steel and Cold Formed Steel (Chapter 22)

a. Materials

i. Structural Steel and Cold Formed Steel
ii. Material Identification

b. Inspection and Tests of Structural Steel

i. Tests of Structural & Cold Formed Steel
ii. Tests of High Strength Bolts, Nuts and Washers
iii. Tests of End Welded Stud
iv. Shop Fabrication Inspection
v. Welding Inspection
vi. High Strength Bolt Inspection
vii. Non-Destructive Weld Testing

D. Wood (Chapter 23)

a. Materials

i. Lumber and Plywood Grading
ii. Wood Construction

E. Perform additional test that may be required by individual Specification Sections.

F. Perform structural tests and inspections in accordance with CBC Chapter 17.

END OF SECTION 014000

SECTION 014200

REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete in place and ready for the intended use.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

D. For complete titles of individual Industry Standards, see United Master Reference List (UMRL) at https://www.wbdg.org/FFC/DOD/UMRL/UMRL.pdf.

1. For titles of standards not included in the UMRL, see supplemental listing immediately following this section.

1.4 ABBREVIATIONS AND ACRONYMS

A. The lists in this article are provided for the reader's convenience. This information is believed to be accurate as of the District Guide Specifications Section Version date at the end of this section, however, it is subject to change without notice.

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Where duplicates occur, use according to appropriate context and subject matter. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; (Formerly: ACI International); www.abma.com.
9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
11. AF&PA - American Forest & Paper Association; www.afandpa.org.
12. AGA - American Gas Association; www.aga.org.
13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.

15. AI - Asphalt Institute; www.asphaltinstitute.org.
16. AIA - American Institute of Architects (The); www.aia.org.
17. AISC - American Institute of Steel Construction; www.aisc.org.
18. AISI - American Iron and Steel Institute; www.steel.org.
19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
21. ANSI - American National Standards Institute; www.ansi.org.
22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
23. APA - APA - The Engineered Wood Association; www.apawood.org.
24. APA - Architectural Precast Association; www.archprecast.org.
25. API - American Petroleum Institute; www.api.org.
26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASCE - American Society of Civil Engineers; www.asce.org.
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Safety Engineers (The); www.asse.org.
34. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AWEA - American Wind Energy Association; www.awea.org.
38. AWI - Architectural Woodwork Institute; www.awinet.org.
39. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
40. AWPA - American Wood Protection Association; www.awpa.com.
41. AWS - American Welding Society; www.aws.org.
42. AWWA - American Water Works Association; www.awwa.org.
43. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
44. BIA - Brick Industry Association (The); www.gobrick.com.
45. BICSI - BICSI, Inc.; www.bicsi.org.
46. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
47. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
48. BS - British Standard
49. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
50. CBC - California Building Code; www.bsc.ca.gov/Home/Current2013Codes.aspx.
51. CDA - Copper Development Association; www.copper.org.
52. CEA - Canadian Electricity Association; www.electricity.ca.
53. CEA - Consumer Electronics Association; www.ce.org.

54. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
55. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
56. CGA - Compressed Gas Association; www.cganet.com.
57. CIF – California Interscholastic Federation
58. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
59. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
60. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
61. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
62. CPA - Composite Panel Association; www.pbmdf.com.
63. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
64. CRRC - Cool Roof Rating Council; www.coolroofs.org.
65. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
66. CSA - Canadian Standards Association; www.csa.ca.
67. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
68. CSI - Construction Specifications Institute (The); www.csinet.org.
69. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
70. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
71. CWC - Composite Wood Council; (See CPA).
72. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
73. DHI - Door and Hardware Institute; www.dhi.org.
74. ECA - Electronic Components Association; (See ECIA).
75. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
76. ECIA - Electronic Components Industry Association; www.eciaonline.org.
77. EIA - Electronic Industries Alliance; (See TIA).
78. EIMA - EIFS Industry Members Association; www.eima.com.
79. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
80. EN - European Standard
81. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
82. ESTA - Entertainment Services and Technology Association; (See PLASA).
83. EVO - Efficiency Valuation Organization; www.evo-world.org.
84. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
85. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
86. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
87. FM Approvals - FM Approvals LLC; www.fmglobal.com.
88. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
89. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridaroof.com.
90. FSA - Fluid Sealing Association; www.fluidsealing.com.
91. FSC - Forest Stewardship Council U.S.; www.fscus.org.
92. GA - Gypsum Association; www.gypsum.org.
93. GANA - Glass Association of North America; www.glasswebsite.com.
94. GRI – Geosynthetic Institute

95. GS - Green Seal; www.greenseal.org.
96. HI - Hydraulic Institute; www.pumps.org.
97. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
98. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
99. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
100. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
101. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
102. IAS - International Accreditation Service; www.iasonline.org.
103. IAS - International Approval Services; (See CSA).
104. ICBO - International Conference of Building Officials; (See ICC).
105. ICC - International Code Council; www.iccsafe.org.
106. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
107. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
108. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
109. IEC - International Electrotechnical Commission; www.iec.ch.
110. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
111. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
112. IESNA - Illuminating Engineering Society of North America; (See IES).
113. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
114. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
115. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
116. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
117. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
118. IPEMA - International Playground Equipment Manufacturers Association
119. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
120. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
121. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
122. ISO - International Organization for Standardization; www.iso.org.
123. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
124. ITU - International Telecommunication Union; www.itu.int/home.
125. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
126. LMA - Laminating Materials Association; (See CPA).
127. LPI - Lightning Protection Institute; www.lightning.org.
128. MBMA - Metal Building Manufacturers Association; www.mbma.com.
129. MCA - Metal Construction Association; www.metalconstruction.org.
130. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
131. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
132. MHIA - Material Handling Industry of America; www.mhia.org.
133. MIA - Marble Institute of America; www.marble-institute.com.
134. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
135. MPEG - Moving Picture Experts Group

136. MPI - Master Painters Institute; www.paintinfo.com.
137. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
138. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
139. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
140. NADCA - National Air Duct Cleaners Association; www.nadca.com.
141. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
142. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
143. NBI - New Buildings Institute; www.newbuildings.org.
144. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
145. NCMA - National Concrete Masonry Association; www.ncma.org.
146. NEBB - National Environmental Balancing Bureau; www.nebb.org.
147. NECA - National Electrical Contractors Association; www.necanet.org.
148. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
149. NEMA - National Electrical Manufacturers Association; www.nema.org.
150. NETA - InterNational Electrical Testing Association; www.netaworld.org.
151. NFHS - National Federation of State High School Associations; www.nfhs.org.
152. NFPA - National Fire Protection Association; www.nfpa.org.
153. NFPA - NFPA International; (See NFPA).
154. NFRC - National Fenestration Rating Council; www.nfrc.org.
155. NHLA - National Hardwood Lumber Association; www.nhla.com.
156. NICET - National Institute for Certification in Engineering Technologies
157. NLGA - National Lumber Grades Authority; www.nlga.org.
158. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
159. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
160. NRCA - National Roofing Contractors Association; www.nrca.net.
161. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
162. NRTL - Nationally Recognized Testing Laboratory
163. NSF - NSF International; www.nsf.org.
164. NSPE - National Society of Professional Engineers; www.nspe.org.
165. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
166. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
167. NWFA - National Wood Flooring Association; www.nwfa.org.
168. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
169. PDI - Plumbing & Drainage Institute; www.pdionline.org.
170. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
171. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
172. RFCI - Resilient Floor Covering Institute; www.rfci.com.
173. RIS - Redwood Inspection Service; www.redwoodinspection.com.
174. SAE - SAE International; www.sae.org.
175. SATA-IO - Serial ATA International Organization
176. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
177. SDI - Steel Deck Institute; www.sdi.org.
178. SDI - Steel Door Institute; www.steeldoor.org.

179. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
180. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
181. SHRP – Strategic Highway Research Program
182. SIA - Security Industry Association; www.siaonline.org.
183. SJI - Steel Joist Institute; www.steeljoist.org.
184. SMA - Screen Manufacturers Association; www.smainfo.org.
185. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
186. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
187. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
188. SPIB - Southern Pine Inspection Bureau; www.spib.org.
189. SPRI - Single Ply Roofing Industry; www.spri.org.
190. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
191. SSINA - Specialty Steel Industry of North America; www.ssina.com.
192. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
193. STI - Steel Tank Institute; www.steeltank.com.
194. SWI - Steel Window Institute; www.steelwindows.com.
195. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
196. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
197. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
198. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
199. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
200. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
201. TMS - The Masonry Society; www.masonrysociety.org.
202. TPI - Truss Plate Institute; www.tpinst.org.
203. TPI - Turfgrass Producers International; www.turfgrasssod.org.
204. TRI - Tile Roofing Institute; www.tileroofing.org.
205. UL - Underwriters Laboratories Inc.; www.ul.com.
206. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
207. USAV - USA Volleyball; www.usavolleyball.org.
208. USGBC - U.S. Green Building Council; www.usgbc.org.
209. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
210. WASTEC - Waste Equipment Technology Association; www.wastec.org.
211. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
212. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
213. WDMA - Window & Door Manufacturers Association; www.wdma.com.
214. WI - Woodwork Institute; www.wicnet.org.
215. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
216. WWPA - Western Wood Products Association; www.wwpa.org.

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
2. ICC - International Code Council; www.iccsafe.org.
3. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeial Convention; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.

a. Available from Defense Standardization Program; www.dsp.dla.mil.
b. Available from General Services Administration; www.gsa.gov.
c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.

6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CALTRANS; State of California; Department of Transportation; www.dot.ca.gov
2. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
3. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
4. CDHS; California Department of Health Services; (See CDPH).
5. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
6. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
7. DSA; Division of the State Architect; www.dgs.ca.gov.
8. SDAPCD; San Diego Air Pollution Control district; www.sdapcd.org.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SUPPLEMENTAL LISTING OF INDUSTRY STANDARDS

A. The list immediately following this section is provided for the reader's convenience. It is intended to be reasonably thorough, however, it does not purport to be comprehensive.

END OF SECTION 014200

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 014219

REFERENCE STANDARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Throughout the Contract Documents, reference is made to codes and standards which establish qualities and types of workmanship and materials, and methods for testing and reporting on the pertinent characteristics.

B. Provide materials and workmanship which meet or exceed the specifically named code or standard.

C. Deliver to the Architect required proof that the materials or workmanship, or both, meet or exceed the requirements of the specifically named code or standard. Such proof shall be in the form requested by the Architect and will generally be required to be copies of a certified report of tests conducted by a testing agency acceptable for that purpose to the Architect.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Specific naming of codes or standards occurs on the Drawings and in other Sections of these Specifications. Comply with laws, ordinances, and regulations of authorities having jurisdiction. Proof of compliance shall be signed approval by the respective authorities having jurisdiction. Costs relative thereto shall be borne by the Contractor.

1.3 QUALITY ASSURANCE

A. Familiarity with Pertinent Codes and Standards: Verify the requirements of the specifically named codes and standards as well as requirements mandated by law, ordinance and authority. Verify that the items procured and installed in this Work meet or exceed the specified requirements.

B. Rejection of Noncomplying Items: The Architect reserves the right to reject items incorporated into the Work which fail to meet such minimum requirements.

1.4 APPLICABLE CODES

A. Work of the project shall conform to the following codes, copies of which will be kept at the jobsite by each trade contractor for their applicable scope of work, for the duration of the project. Code books to be made available for Construction Manager/Inspector of Record/Architect's review at all times:

1. Title 19, Public Safety, of the California Code of Regulations;
2. Title 24, Part 1, Public Works, Chapter 1, Department of General Services.
3. Title 24, State Building Standards, of California Code of Regulations:
   - Part 1 Administrative Regulations (formerly Title 21)
   - Part 2 - State Building Code (includes complete IBC and State adopted amendments), 2013 Edition.
   - Part 3 - State Electrical Code (includes NEC and State adopted amendments), 2013 Edition.
   - Part 4 - State Mechanical Code (includes IMC and State adopted amendments), 2013 Edition.
   - Part 5 - State Plumbing Code (includes IPC and State adopted amendments), 2013 Editions.
   - Part 6 - Special Building Standards.
4. California Building Code, 2013 Edition, as adopted by: California State Fire Marshal

1.5 APPLICABLE REFERENCE STANDARDS

A. Standards referenced in the Specifications are usually referred to by the abbreviation of the organization's name and the designation of the document (e.g., ASTM A 36). Documents in common use may be referred to by their own designation (e.g., the National Electrical Code is published by the National Fire Protection Association as NFPA-70 but is referred to as NEC and is part of a series of documents or standards referred to as the National Fire Code). References are to the latest issue of the publication available on the date stipulated for the receipt of bids.

STANDARDS ORGANIZATIONS:

AA	Aluminum Association
AAMA	American Architectural Manufacturer's Association
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AGA	American Gas Association
AISC	American Institute of Steel Construction
AITC	American Institute of Timber Construction
AMCA	Air Movement and Control Association, Inc.
ANSI	American National Standards Institute, Inc.

APA	American Plywood Association
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Material
AWPA	American Wood Preservers' Association
AWPB	American Wood Preservers' Bureau
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders' Hardware Manufacturers Association
CDA	Copper Development Association
CGA	Compressed Gas Association
CISPI	Cast Iron Soil Pipe Institute
CPSC	Consumer Product Safety Commission
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standard of U.S. Dept. of Commerce
CTI	Ceramic Tile Institute
CSMA	Chemical Specialties Manufacturing Association
FGMA	Flat Glass Marketing Council
FM	Factory Mutual System
FS	Federal Specification
GA	Gypsum Association
HI	Hydraulic Institute, Hydraulics Institute
IAPMO	International Association of Plumbing and Mechanical Officials
ICC	International Code Council
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
MIL	Military Specifications
ML/SFA	Metal Lath/Steel Framing Association
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry
NAAMM	National Association of Architectural Metal Manufacturers
NBS	National Bureau of Standards
NEBB	National Environmental Balancing Bureau
CEC	California Electric Code (NFPA)
NEMA	National Electric Manufacturers Association
N FLUID PA	National Fluid Power Association
NFPA	National Fire Protection Association
NRCA	National Roofing Contractors Association
NSF	National Sanitation Foundation
NWWDA	National Wood Window and Door Association
PS	Product Standard (of NBS)
SMACNA	Sheet Metal and Air Conditioning Contractors National

	Association
SDI	Steel Deck Institute, Steel Door Institute
SJI	Steel Joist Institute
SSPC	Steel Structures Painting Council
TCA	Tile Council of America
CBC	California Building Code - 2016
UL	Underwriters' Laboratories
WIC	Woodwork Institute of California
WLPDIA	Western Lath Plaster Drywall Industries Association
CMC	California Mechanical Code - See IAPMO
CPC	California Plumbing Code - See IAPMO

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 014219

SECTION 014500

TEST AND BALANCE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section specifies the requirements for test and balance of HVAC and related systems.

1.02 RELATED SECTIONS

A. Section 011000: Summary

B. Section 013300: Submittal Procedures

C. Section 013240: Progress Schedules and Reports

D. Section 017000: Closeout Procedures

E. Section 230593: Testing, Adjusting, and Balancing for HVAC

F. Section 233423: HVAC Power Ventilators

G. Section 233713.13: Air Diffusers

H. Section 236313: VFR Air-Cooled Refrigerant Condensers

I. Section 238219: Fan Coil Units

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 DEFINITIONS AND APPLICABLE PUBLICATIONS

A. For the purposes of this Section definitions are as indicated in applicable publications of AABC, NEBB, TABB, ASHRAE, ANSI and SMACNA.

1. TAB: Testing, Adjusting and Balancing.

2. TABB: Testing, Adjusting and Balancing Bureau.

3. AABC: Associated Air Balance Council

4. NEBB: National Environmental Balancing Bureau.

5. DCM: District Construction Manager

3.02 QUALITY ASSURANCE

A. The test and balance agency shall be directly subcontracted to CONTRACTOR. The qualifications of the agency shall comply with Section 3.02, Quality Assurance. The agency shall be responsible for furnishing labor, instruments, and tools required to test, adjust and balance the heating, ventilating and air conditioning (HVAC) systems and related plumbing systems, as described and/or as indicated in the Contract Documents.

B. CONTRACTOR shall obtain services of an independent, qualified testing agency acceptable to Architect to perform testing and balancing Work as specified and as follows:

1. Agency shall be currently certified by either The Associated Air Balance Council (AABC), The National Environmental Balancing Bureau (NEBB) or Testing, Adjusting and Balancing Bureau (TABB). NEBB or TABB certification shall be for Air and Hydronic Testing, Adjusting and Balancing and Sound and Vibration Measurement.

2. Work shall be in accordance with the latest edition of the AABC, NEBB or TABB National Standards. Where the requirements of the two standards are different, the more stringent requirements shall prevail. Also, if the Contract Documents impose a more stringent standard then the Contract Documents shall prevail.

C. Performance Criteria: Work of this Section shall be performed in accordance with approved Testing, Adjusting and Balancing agenda.

D. Test Equipment Criteria: Basic instrumentation requirements and accuracy/calibration required by Section Two of the AABC or Section II of the NEBB or TABB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems.

E. Verification: The Test and Balance Agency shall recheck ten percent (minimum ten) of the measurements listed in the report. The locations shall be selected by DCM. The recheck will be witnessed by DCM. If twenty percent of the measurements that are retested differ from the report and are also out of the specified range, an additional ten percent will be tested. If twenty percent fall outside the specified range, the report will be considered invalid and all test and balance work shall be repeated.

F. Due to more stringent acoustical requirements in the educational environment, the Test and Balance Agency shall recheck the air systems where the sound level is higher than the specified requirements and demonstrate compliance with the methodology specified in this document with emphasis on fan speed

adjustment and balancing for optimum acoustical performance. The recheck will be witnessed by DCM. When there are multiple air systems, a system selected by DCM shall be rechecked. If this system is found to be not in compliance, a second system shall be checked. If the second system if also found to be not in compliance, the report will be considered invalid and all test and balance work shall be repeated.

3.03 SUBMITTALS

A. Submit name of agency to perform the Work. Include in the submittal the certified qualifications of all persons responsible for supervising and performing actual Work of this Section. Agency shall submit a minimum of five (5) commercial or industrial HVAC system TAB projects of similar type, size, and degree of difficulty completed within the last two years. Agency shall provide name and telephone number of contact person for each listed project.

B. Submit, for approval, 6 copies of the Agenda as indicated in Section 3.06 to test and balance all mechanical and relevant plumbing systems.

C. Preliminary Report: Review the Contract Documents, examine Work installations and submit a written report to ARCHITECT and/or DCM indicating deficiencies in Work precluding proper testing and balancing of the Work.

D. Final TAB Report: Submit the final TAB report for review by ARCHITECT and/or DCM outlining the conditions and Work completed on each HVAC system. All outlets, devices, HVAC equipment, etc. shall be identified, along with a numbering system corresponding to report unit identification.

E. Submit an AABC “National Project Performance Guaranty” or “NEBB Quality Assurance Certification” assuring the Project systems were tested, adjusted and balanced in accordance with the Specifications and AABC, NEBB or TABB National Standards.

F. CADD drawings: Submit single line, multi-color CADD drawings indicating outside return and supply air, volume control boxes, each outlet and inlet, room numbers, duct sizes at traverse locations, temperatures and pressures, systems balanced, components changed and CONTRACTOR installed access points. In addition, drawings shall identify controls, equipment settings, including manual damper quadrant positions, manual valve indicators, fan speed control levers, and similar controls and devices shall be marked on the drawings to show final settings. CADD files shall be submitted on CD-ROM upon final submittal of TAB report. Reports shall identify discrepancies between completed Work and the Contract Documents affecting the performance and longevity of the system.

3.04 GENERAL SCOPE OF WORK

A. The general scope of Work shall include but not be limited to the following:

1. Measure airflow rates of HVAC systems and make adjustments to achieve design airflow rates, tabulate results and submit reports.

2. Measure water-flow rates of HVAC systems and make adjustments to achieve design water flow rates, tabulate results and submit reports.

3. Measure flow velocities, temperatures, static pressures or head, rotational speed, and electrical power demand of fans, pumps and other related HVAC system components, tabulate results and submit reports.

4. Measure sound levels in each conditioned space, tabulate results and submit reports.

5. Measure ambient sound levels of outdoor HVAC units and system components such as chillers and cooling towers, tabulate results and submit reports.

6. Reports shall contain sufficient data for the system designer to evaluate system performance and solve installation problems such as system pressure profiles and pressure drops across system components

3.05 SPECIFIC SCOPE OF WORK

A. The specific scope of Work shall include the following HVAC system components as indicated on the Drawings:

1. Air Handling Units

2. Air Conditioning Units

3. Heating and Ventilating Units

4. Heating and Cooling Coils

5. Supply, Return, Relief and Exhaust Fans

6. Outside Air and Return Air Plenums

7. Outside Air Intakes

8. All Supply and Return Ductwork

9. All associated Air Terminal Devices, i.e. Supply Diffusers, Return Registers, etc.

10. Exhaust Duct Systems

11. Fire and Fire/Smoke Dampers

3.06 TESTING, ADJUSTING AND BALANCING AGENDA

A. Provide proposed materials, methods, procedures, forms, diagrams and reports for test and balance Work.

B. Agenda to be completed by the test and balance agency and submitted to ARCHITECT and DCM for review and approval.

C. Agenda shall include one complete set of AABC, NEBB or TABB publications listed in Section 3.02, B, 2, applicable publications, or, in case of other test and balance agencies and or organizations, comparable publications to establish an approved, systematic and uniform set of procedures.

D. Agenda shall also include the following detailed narrative procedures, system diagrams and forms for test results:

1. Specific standard procedures required and proposed for each system of the Work.

2. Specified test forms for recording each procedure and for recording sound and vibration measurements.

3. Systems diagrams for each air, water and steam system. Diagrams may be single line.

E. In addition to information recorded for standard AABC, NEBB or TABB procedures, the following information is required:

1. Fan Data

2. System number, Location, Manufacturer, Model and Serial Number

3. Fan wheel type and size

4. Motor horse power, type and rpm

5. Drive size, type, number of grooves, and open turns on Variable Pitch Drives

6. Number and size of belts, motor and fan shaft sizes, center-to-center of shafts in inches, and adjustment available motor data, including nameplate data, actual amps, rated and actual motor rpm, volts, phase, hp, kW, starter heater size, and capacity

7. Fan design airflow and service (Supply, return, outdoor air or exhaust)

8. Fan static pressure, suction/discharge, static profile and static control point.

F. The following traverse data is required:

1. Traverse location, size of duct (inside dimensions), Area of duct in square feet

2. Column for each hole traversed/lines for each reading

3. Barometric pressure

4. Temperature/Static Pressure in the duct

5. Actual CFM corrected to SCFM

6. Notes

G. The following air distribution data is required:

1. Room identification

2. Outlet or intake balance sequence number

3. Size of outlet or inlet

4. AK Factor

5. Design and Actual FPM and CFM

6. Notes

9. Notes

7. Notes

H. The following electric heating coil data is required:

1. Heating coil identification number

2. Nameplate data; manufacturer, model and serial number

3. Amperage/Voltage on each phase

4. Phase, kW and Stages

5. Safety device installed

6. Air pressure drop across coil

7. Notes

8. Airflow across the tower within design rating according to fan curves

9. Notes

I. The following domestic water heater data is required:

1. Performance test results for rated capacity

2. Nameplate data; manufacturer, model and serial number

J. The following air-cooled split system heat pump data is required:

1. Performance test results for rated heating and cooling capacities

2. Unit identification number

3. Nameplate data, manufacturer, model and serial number.

4. Compressor nameplate and actual amps, volts, phase, and hertz

5. RPM of motors, where applicable

6. Refrigerant type

7. Suction/Discharge pressure for both heating and cooling modes when gauge installed

8. Number of stages

9. Low-pressure/High-pressure control setting

10. Condenser fan sequence stages

K. The following sound test data is required:

1. Area or location

2. Sound level in dB(A)

3. Sound level at the center band frequencies of eight non-weighted octaves with equipment on and off for 5 rooms selected by the DCM.

4. Plot corrected sound-level reading on Noise Criteria (NC) curve for the measurements in Q 3 above.

L. The following vibration test data is required:

1. Equipment identification number

2. Vibration levels at all accessible bearings, motors, fans, pumps, casings, and isolators

3. Measurements in mils defection and velocity in inches per second as specified per section XIV of this document

4. Each measurement taken in horizontal, vertical, and axial planes as accessible.

M. The following mixing damper leakage test data is required:

1. Equipment identification number (unit, box, zone, etc.)

2. Dry bulb temperature in the cold/hot (or bypass) deck

3. Dry bulb temperature in the mixed air stream

4. Calculated percent leakage

5. Data above taken in the full cool and full heat (or bypass) mode

6. Notes

N. The following airflow station data is required:

1. Station identification number

2. Nameplate data including effective area

3. Differential test pressure or velocity

4. Calculated CFM

5. Actual CFM (From Pitot tube traverse form)

6. Read out CFM

7. Notes

O. The following unit heater data is required:

1. Equipment identification number

2. Nameplate data; manufacturer, model and serial number

3. Test CFM (use manufacturer rated CFM if not ducted)

4. Heat test data per applicable procedure (hot water, electric, etc.)

5. Notes

P. The following fan coil and unit ventilator data is required:

1. Equipment identification number

2. Nameplate data; manufacturer, model and serial number

3. Tested supply CFM or manufacturer rated CFM if not ducted

4. Tested outside air in CFM

5. Motor data and actual amps and volts

6. Cooling/Heating test data

7. Static pressure

8. Notes

Q. The following pump data, including but not limited to, heating hot water, domestic hot water booster, and domestic hot water circulation is required:

1. Pump number

2. Nameplate data; manufacturer, model and serial number

3. Motor data including nameplate data, actual amps, volts, RPM, horsepower, starter heater size and capacity

4. Pump discharge and suction pressure along with total dynamic head in the following modes

5. Shut-off head FT, Wide open Head FT and Final operating Head FT

6. Final GPM Test plotted on a pump curve

7. Notes

3.07 PROCEDURES

A. Schedule the Work of this Section in order for test and balance activities to be completed prior to the date of Substantial Completion. CONTRACTOR shall place all heating, ventilating, and air conditioning equipment into operation during each day and until all HVAC adjusting, balancing, testing, demonstrations, and

instructions on systems are completed. Agency shall prepare and submit reports within ten (10) days from completion of the Work of this Section to allow sufficient time for corrective measures to be completed before Substantial Completion of the Work. When an individual building or portion thereof is ready for occupancy, all equipment relative to such portion of Work shall be put into service, tested and balanced.

B. Prior to the date of Substantial Completion, and upon completion of test and balance Work, place all exhaust fans in operation, force all air handling units and air conditioning units into a 100% outdoor air economizer mode with heating and cooling locked out and flush the building continuously for a period of fourteen (14) days.

C. Coordinate test and balance procedures with any phased Project requirements so test and balance procedures on each phased portion of the Work will be completed prior to completion of said designated phase.

3.08 FIELD EXAMINATION

A. Before the commencement of test and balance Work, CONTRACTOR shall ascertain that following conditions are fulfilled:

1. Ensure that all water heating and water cooling systems have been flushed, cleaned, filled and high points vented

2. Boilers, steam and hot water, are filled

3. Refrigerant systems are fully charged with specified refrigerant

4. Over-voltage and current protection have been provided for motors

5. Equipment has been labeled as required

6. Curves and descriptive data on each piece of equipment to be tested and adjusted are available as required

7. Operations and maintenance manuals have been supplied

8. Controls manufacturer and boiler-burner representatives shall be available for consultation and supervision of adjustments during tests

9. Verify that heating and cooling coil fins are cleaned and combed and air filters clean and installed

10. Verify that duct systems are clean of debris and leakage is minimized, access doors are closed and duct end caps are in place, fire and volume dampers are in place and open

11. Automatic control systems are completed and operating

12. Start up and initial commissioning of all HVAC equipment except fans shall be by the manufacturer.

B. In addition to the above, CONTRACTOR shall establish a specific, coordinated plan which details how each area of existing building will be balanced during the various phases of the Work. The evaluation shall address, at a minimum, the following concerns:

1. OWNER operations

2. Building safety and security policies. Prior to any fire safety or security systems shutdown at any time during the Work, CONTRACTOR shall first advise and coordinate with OWNER to ensure all concerned parties are notified.

3. Protecting furniture, computers, photocopiers, and other office equipment.

4. Protecting classroom fixtures and equipment.

5. Concerns specific and unique to building related issues.

6. Downtime required for each AHU including projected time to return each portion of the building back to its normal occupancy temperature and humidity.

7. Shutdown and reactivation of the fire alarm system to avoid accidental alarms during test and balance and related Work.

3.09 TEST AND BALANCE

A. For each heating, ventilating, or air conditioning system the following shall be performed, recorded and submitted in an approved format for review. Make, type, and model of unit, and location of each piece of equipment shall be included in the report. Readings shall include but not be limited to following:

1. Air Systems**:**

a. General

1) Verify all ductwork, dampers, grilles, registers, and diffusers have been installed per design and set in the full open position. Agency shall perform the following TAB procedures in accordance with AABC or NEBB National Standards. Where the requirements of the two standards are different, the more stringent requirements shall prevail. Also, if the Contract Documents impose a more stringent standard then the Contract Documents shall prevail.

b. Zone, Branch and Main Ducts:

1) Adjust ducts to within design CFM requirements by means of Pitot-tube duct traverse.

c. Supply Fans:

1) Fan speeds: Test and adjust fan RPM to achieve maximum or design CFM. CONTRACTOR shall provide new belt pulleys when required.

2) Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits. Ensure fan motor is not in or above the service factor as published by the motor manufacturer.

3) Pitot-Tube Traverse: Perform a Pitot-tube traverse of main supply and return ducts, record total CFM.

4) Outside Air: Test and adjust the outside air using Pitot-tube traverse.

5) Static Pressure: Test and record system static profile of each supply fan.

6) Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits. Ensure fan motor is not in or above the service factor as published by the motor manufacturer.

d. Return, Relief and Exhaust Fans:

1) Fan speeds: Test and adjust fan RPM to achieve maximum or design CFM. CONTRACTOR shall provide new belt pulleys where required.

2) Pitot-Tube Traverse: Perform a Pitot-tube traverse of the main return ducts to obtain total CFM.

3. Static Pressure: Test and record system static profile of each fan.

e. VAV Systems:

1) Set volume regulators on all terminal boxes to meet design maximum and minimum CFM requirements.

2) Identification: Identify the type, location, and size of each terminal box. This information shall be recorded on terminal box data sheets.

f. Diffusers, Registers and Grilles:

1) Tolerances: Test and balance each diffuser, grille, and register to within 5% of design requirements.

2) Identification: Identify the type, location, and size of each grille, diffuser, and register. This information shall be recorded on air outlet data sheets.

g. Coils: Air Temperature: Once airflow is set to acceptable limits, agency shall take wet bulb and dry bulb air temperatures on the entering and leaving side of each cooling coil. Dry-bulb temperature shall be taken on the entering and leaving side of each heating coil.

h. Duct Leakage Testing:

1) On existing ductwork, agency shall calculate duct leakage by traversing the unit and reading associated diffusers.

2) On new installations each and every section of the entire air distribution system (all supply, return, exhaust and relief ductwork) shall be tested at one and one-half times (1-1/2) design static pressure. All ducts shall demonstrate 5% leakage maximum (per CBC 2001 Sec 905.7.3.).

i. Air handling units:

1) Prepare pressure profile and show design and actual CFM (outside air, return air, and supply air).

2) Measure and record each mode (minimum OA and 100% OA) where economizer cycle is specified.

3) Record pressure drops of all components (coils, filters, sound attenuators, louvers, dampers, and fans) and compare with design values.

4) Pressure profile and component pressure drops are performance indicators and are not to be used for flow measurements.

j. System Pressure Profiles:

1) Prepare pressure profiles from fan (supply, return exhaust) or air handling unit to extremities of system.

2) As a minimum, show pressure at each floor, main branch, and airflow, measuring device.

3) Make pitot tube traverses of all trunk lines and major branch lines where required for analysis of distribution system. Airflow measuring devices installed in ductwork, if available, may be utilized.

4) Record residual pressures at inlets of volume controlled terminals at ends of system.

5) Show actual pressures at all static pressure control points utilized for constant or variable flow systems.

k. Fan speed adjustments and balancing for optimum acoustical performance:

1) As the very first step, the speed of all fans (supply, return, exhaust, inside packaged equipment or air handling units) shall be adjusted to deliver the required fan total air quantity with all volume dampers and other flow rate control devices fully open. Adjustments shall be made with the outdoor air intake dampers, return air dampers and relief air dampers in the minimum outdoor air position. The adjustments shall be made again in the100% outdoor air position in systems with 100% outdoor air economizers.

2) The above adjustment shall be done with wet cooling coils where cooling coils are provided.

3) The airflow rates at each branch duct shall be adjusted as the second step with air with all volume dampers and other flow rate control devices fully open.

4) The airflow rates at each air inlet and outlet shall be adjusted as the final step. The volume damper in the branch duct shall be used for balancing. Opposed blade dampers at air inlets and outlets where provided shall only be used for fine adjustments and shall not be closed beyond 60% open or when the dampers start to generate audible noise.

5) CONTRACTOR shall provide the labor and materials for all dampers, pulleys and belt changes required for

balancing. The design documents indicate the worst-case scenario with safety factors in fan static pressures for contingency. Properly coordinated and installed air systems may require a lower static pressure and a reduction in fan speed.

2. Water Systems: CONTRACTOR shall confirm all equipment, piping, and coils have been filled and purged, strainers are clean and all balancing valves (except bypass valves) are set full open. Agency shall perform the following TAB procedures in accordance with the AABC, TABB or NEBB National Standards:

B. Pumps:

1. Test and adjust chilled water, hot water, and condenser water pumps to achieve maximum or design GPM.

2. Measure and record suction and discharge pressures.

3. Check pumps for proper operation. Pumps shall be free of vibration and cavitation.

4. Current and Voltage: agency shall test and record motor voltage and amperage, and compare data with the nameplate limits. Ensure pump motor is not in or above the service factor as published by the motor manufacturer.

5. Adjust pump flow by adjusting and setting balancing valves, to obtain amperage reading on a clamp-on ammeter, to correspond to amperage indicated on pump's curves for required flow.

6. Verify that the motor is not drawing more current than indicated on motor plate rating. When actual flows of primary pumps are found by test to vary more than 5% from specified amount, system shall be re-balanced to regulate flow within this tolerance. When a flow indicating device(s) is in circuit, it shall be used to verify pump flows.

7. When testing is completed, a pump capacity chart with pump number and location indicated shall be marked indicating operating point of pump on the curve. Chart shall then be included in the report.

C. Steam Heating Systems:

1. Condensing and Refrigerating Units:

a. Suction pressure and temperature.

b. Discharge pressure and temperature.

c. Amps and volts.

d. Make, type, and model of unit, capacity rating.

e. Ambient temperature: WB, DB

f. Proper operation of controls: Temperature controllers and safety devices shall be tested during operating tests, with all other controls and devices, except one under test, being by-passed.

g. Upon completion of tests, controls and devices shall be returned to their normal operating condition and boiler shall remain in service.

2. Split System Heat Pump Units:

a. Suction pressure and temperature.

b. Discharge pressure and temperature.

c. Amps and volts.

d. Make, type, and model of unit, capacity rating.

e. Ambient temperature: WB, DB

f. Supply, return, relief and exhaust fans shall be balanced as indicated in Section 3.09. A. 1. Air Systems.

g. Proper operation of controls: Temperature controllers and safety devices shall be tested during operating tests, with all other controls and devices, except one under test, being by-passed.

h. Upon completion of tests, controls and devices shall be returned to their normal operating condition and boiler shall remain in service.

3. MISCELLANEOUS:

a. Electric Heaters:

1. Amperage.

2. Voltage.

3. Make, type, model, and name plate capacity rating.

3.10 VERIFICATION OF HVAC CONTROLS

A. Agency shall verify in conjunction with CONTRACTOR all control components are installed in accordance with the intent of the Contract Documents and are

functioning according to the design intent, including all electrical interlocks, damper sequences, air and water resets, fire stat's, and other safety devices.

B. CONTRACTOR shall verify all control components are calibrated and set for design operating conditions and intent.

3.11 TEMPERATURE TESTING

A. To verify system control and operation, agency shall perform a series of three temperature tests taken at approximately two-hour intervals in each separately controlled zone. The resulting temperatures shall not vary more than two (2) degrees Fahrenheit from the thermostat or control set point during the tests. Outside temperature and humidity shall also be recorded during the testing periods.

3.13 BUILDING/ZONE PRESSURIZATION

A. Agency shall test and adjust building/zone pressurization by setting the design flows to meet the required flow direction and pressure differentials. Positive/Negative area(s) supply air shall be set to design flow and exhaust air rates adjusted to obtain the required pressure differential(s).

3.14 FIRE AND SMOKE DAMPER TESTING

A. This work is to be performed by OWNER and State Fire Marshall. Do not include in agency scope of work.

3.15 LIFE SAFETY CONTROLS TESTING

A. This work is to be performed by OWNER and State Fire Marshall. Do not include in agency scope of Work.

3.16 FINAL TABULATION

A. After heating, ventilating, and air conditioning components are satisfactorily tested and balanced, entire system shall be put into operation and all pressures, temperatures, gpm, cfm, velocities, etc., shall be recorded and checked against design schedules. Design requirements shall be listed on reports and final tabulation shall be within a tolerance of plus or minus 5% of design requirements.

B. Readings at various locations as described herein will be made every hour for four (4) hours, during normal working hours for three (3) days. Boilers, forced air furnaces and chillers shall be started up far enough in advance to meet design conditions during period of testing.

3.17 VIBRATION TESTING

A. Furnish instruments and perform vibration measurements if specified in Division 15. Provide measurements for all rotating HVAC equipment half horsepower and

larger, including reciprocating/centrifugal/screw/scroll compressors, pumps, fans and motors.

B. Record initial and final measurements for each unit of equipment on test forms. Where vibration readings exceed allowable tolerance and efforts to make corrections have proved unsuccessful, forward a separate report to ARCHITECT.

3.18 SOUND TESTING

A. Perform and record sound measurements as specified in this section and if specified in Section 15070: Sound Vibration and Seismic Control. Take additional readings if required by ARCHITECT.

B. Take measurements with a calibrated Type 1 sound level meter and octave band analyzer.

C. Sound reference levels, formulae and coefficients shall be according to ASHRAE handbook, Current Systems Volume; Chapter: Sound and Vibration Control.

D. Determine compliance with the Contract Documents as follows:

1. Where sound pressure levels are specified as noise criteria or room criteria in Section 15070: Sound, Vibration and Seismic Control.

a. Reduce background noise as much as possible by shutting off unrelated audible equipment.

b. Measure octave band sound pressure levels with specified equipment "off".

c. Measure octave band sound pressure levels with specified equipment "on".

d. Use difference in corresponding readings to determine sound pressure due to equipment.

DIFF.:	0	1	2	3	4	5	9-10 or More
FACTOR:	10	7	4	3	2	1	0

Sound pressure level, due to equipment, equals sound pressure level with equipment "on" minus factor.

e. Plot octave bands of sound pressure level due to equipment for typical rooms, on a graph, which also shows, noise criteria (NC) curves.

2. When sound power levels are specified:

a. Perform steps in Section 3.19, D, 1.a. through 1.d.

b. For indoor equipment: Determine room attenuating effect; i.e., difference between sound power level and sound pressure level. Determine sound power level will be sum of sound pressure level due to equipment, plus room attenuating effect.

c. For outdoor equipment: Use directivity factor and distance from noise source to determine distance factor, i.e., difference between sound power level and sound pressure level. Measured sound power level will be sum of sound pressure level due to equipment, plus distance factor.

3. Where sound pressure levels are specified in terms of dbA, measure sound levels using the "A" scale of meter. Single value readings will be used instead of octave band analysis.

E. Where measured sound levels exceed specified level, CONTRACTOR shall take all remedial action and necessary sound tests shall be repeated.

F. Measure and record sound levels in decibels at each diffuser, grille or register in occupied areas. Sound levels shall be measured approximately 5'-0" above floor on a line approximately 45 degrees to center of opening, on the "A" and "C" scales of a General Radio Company sound level meter, or similar instrument.

G. Report shall also include ambient sound levels of rooms in which above openings are located, taken without air-handling equipment operating. A report shall also be made of any noise caused by mechanical vibration.

END OF SECTION 014500

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 015000

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities, construction facilities and controls to be provided, maintained, relocated, and removed by Contractor.

B. Temporary trailers for District personnel during construction are specified in Section 015001 Facilities for Onsite Owner Representation.

1.02 RELATED SECTIONS

A. Section 011000: Summary

B. Section 013700: Schedule of Values

C. Section 013240: Progress Schedules and Reports

D. Section 014500: Test and Balance

E. Section 017700: Closeout Procedures

1.03 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, District's construction forces, Architect, District Construction Manager (DDCM), testing agencies, and authorities having jurisdiction.

B. Sewer Service: Pay sewer service use charges for sewer usage by all entities for construction operations.

C. Water Service: Pay water service use charges for water used by all entities for construction operations.

D. Electric Power Service: Pay electric power service use charges for electricity used by all entities for construction operations.

1.04 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion and Sedimentation Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

1.05 QUALITY ASSURANCE

A. CONTRACTOR shall comply with applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
1. Building Code requirements
2. Division of State Architect
3. Health and safety regulations
4. Utility company regulations
5. Police, fire department and rescue squad requirements
6. Environmental protection regulations

B. CONTRACTOR shall arrange for the inspection and testing of each temporary utility prior to use. Obtain any required certifications and permits and transmit to DCM.

C. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with California Electrical Code (CEC).

D. Accessible Temporary Egress: Comply with applicable provisions in the California Building Code (CBC), the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines, and ICC/ANSI A117.1.

1.06 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before District's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 QUALITY ASSURANCE

A. CONTRACTOR provided facilities are to be in place and available for DCM use and occupancy within thirty (30) calendar days following the date of issue of the

Notice to Proceed and shall remain in place and available for DCM use and occupancy throughout the full term of the Contract.

B. Interior Air Quality (IAQ) During Construction:

1. Referenced Standards include:

i. ASHRAE 62.1 – 2004.

ii. ASHRAE 52.2 – 1999.

iii. CHPS Best Practices Manual – Volume III (2006 Edition).

2. Interior Air Quality (IAQ) During Construction Plan: CONTRACTOR is required to develop and submit to the DCM for review and approval a Construction Indoor Air Quality (IAQ) Plan. Plan shall be submitted within 120 days of NTP. Implementation of the approved (IAQ) Plan will be included in the project construction schedule.

3. Construction Photos Requirement: CONTRACTOR shall submit photographs that demonstrate the Construction Ventilation, Preconditioning, Sequencing, and Protection measures taken during the project for complying with the IAQ plan, applicable specifications and referenced standards.

3.02 TEMPORARY UTILITIES

A. CONTRACTOR shall submit to DCM reports of tests, inspections, meter readings and similar procedures performed on temporary utilities.

B. CONTRACTOR shall coordinate with the appropriate utility company to install temporary services. Where the utility company provides only partial service, CONTRACTOR shall provide and install the remainder with matching compatible materials and equipment.

C. Temporary Water:

1. CONTRACTOR shall furnish, install and pay for all necessary permits, inspections, move ins/out, temporary water lines, connections & fees, extensions and distribution, metering devices and use charges, deliveries/pick ups, rentals, storage, transportation, taxes, labor, insurance, bonds, material, equipment and all other miscellaneous items for the temporary water system, and upon Substantial Completion of the Work, removal of all such temporary water system devices and appurtenances.

2. CONTRACTOR shall provide and maintain temporary water service, including water distribution piping and outlet devices of the size and required flow rates in order to provide service to all areas of the Project site.

3. CONTRACTOR shall provide and pay for all potable water needed for construction and all other uses associated with the Work.

4. CONTRACTOR shall at their expense and without limitation, remove, extend and/or relocate temporary water systems as rapidly as required in order to provide for progress of the Work.

D. Temporary Electric:

1. CONTRACTOR shall furnish, install, maintain and pay for all necessary permits, inspections, temporary wiring, metering devices and use charges, move ins/outs, connections & fees, service, extension and distribution, deliveries/pickups, rentals, storage, transportation, taxes, labor, insurance, bonds, materials, equipment and all other required miscellaneous items for the temporary electric systems and upon Substantial Completion of Work, removal of all such temporary electric systems and appurtenances.

2. CONTRACTOR shall furnish, install, maintain, extend and distribute temporary electric area distribution boxes, so located that individual trades can obtain adequate power and artificial lighting, at all points required for the Work, for inspection and for safety.

3. CONTRACTOR shall provide temporary electric for construction, temporary facilities, and connections for construction equipment requiring power or lighting, at all points required for the Work, for inspection and safety.

4. CONTRACTOR shall provide 20 foot candles minimum lighting levels inside building(s) and 5 foot candles outside for safety and security.

5. CONTRACTOR shall ensure welding equipment is supplied by electrical generators.

6. CONTRACTOR shall at their expense and without limitation remove, extend and/or relocate temporary electric systems as rapidly as required in order to provide for progress of the Work.

E. Temporary Heating, Ventilation and Air Conditioning:

1. CONTRACTOR shall furnish, install, maintain, and pay for all necessary permits, inspections, move ins/out, extensions and distribution, connections and fees, use charges, metering devices and use charges, equipment, rentals, deliveries/pick ups, storage, transportation, taxes, labor, insurance, bonds, material, equipment and all other required miscellaneous items for temporary heat and ventilation needed for proper installation of the Work and to protect materials and finishes from damage due to weather. Upon Substantial Completion of the Work, CONTRACTOR shall remove all such temporary heating and ventilating system devices and appurtenances.

2. CONTRACTOR shall provide, maintain and pay for all temporary ventilation of enclosed Work areas to cure materials, disperse humidity, remove fumes, and to prevent accumulation of dust, irritants, or gases.

3. DISTRICT will not accept utilization of the permanent HVAC system for temporary HVAC until Substantial Completion.

4. CONTRACTOR shall maintain manufacturer required levels of room and/or space temperature, humidity and ventilation necessary to install products, materials and/or systems of the Work.

5. CONTRACTOR shall at their expense and without limitation, remove, extend and/or relocate temporary heating and ventilating systems as rapidly as required in order to provide for progress of the Work.

F. Temporary Telephone and Data:

1. CONTRACTOR shall furnish, install, maintain and pay for all necessary permits, inspections, move ins/outs, extensions and distribution, devices, connections and fees, use charges, rentals, deliveries/pickups, storage, transportation, taxes, labor, insurance, bonds, material, equipment and all other required miscellaneous items for temporary phone, data service and distribution to Project site temporary offices as required by this Section and Section 01500, 3.03.

2. CONTRACTOR shall at their expense and without limitation, remove, extend and/or relocate temporary phone service and distribution as rapidly as required in order to provide for progress of the Work.

3. Upon Substantial Completion of the Work, CONTRACTOR shall remove all such temporary phone service, distribution, devices and appurtenances.

3.03 CONTRACTOR PROVIDED FACILITIES

A. CONTRACTOR shall provide temporary offices, utilities, storage units, fencing, barricades, chutes, elevators, hoists, scaffolds, railings and other facilities or services as required. CONTRACTOR shall be responsible for providing, installation, maintenance, supplying, and all use charges for the items provided under Section 01500.

B. Temporary Offices:

1. Field Office for CONTRACTOR: Prefabricated or mobile trailer unit(s) with serviceable finishes, temperature controls, and foundations adequate for

normal loading. Furnish and equip office as necessary for CONTRACTOR' s field staff.

2. Provide and maintain Construction Management office:

   a. Size: 10' x 20' minimum

   b. Furniture: 2 desks and 2 chairs

   c. Number of Offices: 2

   d. Utilities: Electrical, phone & data

   e. Parking Stalls: 2

C. CONTRACTOR shall be responsible for maintaining all transmission lines, equipment and related devices.

D. Trailer, furniture, equipment, and related ancillary devices shall remain property of CONTRACTOR. CONTRACTOR shall remove such property upon Substantial Completion of Work or as otherwise determined in writing by DCM.

E. At CONTRACTOR'S expense and without limitation remove and/or relocate temporary office(s) and related facilities as rapidly as required in order to provide for progress of the Work.

F. Temporary Sanitary Facilities:

1. CONTRACTOR shall provide portable chemical toilet and handwashing facilities. Quantity of portable chemical toilet facilities shall be based on total number of workers and shall be in accordance with CAL/OSHA standards.

2. Portable chemical toilet facilities shall be maintained with adequate supplies and in a clean and sanitary condition and shall be removed from the Project site upon Substantial Completion of the Work.

3. At CONTRACTOR'S expense and without limitation remove and/or relocate portable chemical toilet facilities as rapidly as required in order to provide for progress of the Work.

4. CONTRACTOR will contain their breaks and lunch periods to the areas designated by DCM or any public area outside the Project site. CONTRACTOR shall provide a suitable container within the break/lunch area for the placement of trash. Areas used for break/lunch must be maintained clean and orderly. Once finish flooring has been installed in a particular area, no food or beverages will be permitted in that area.

G. Temporary Security Fence/Barricade:

1. CONTRACTOR shall install temporary Project site security barricade(s) indicated on Drawings or as required for safety and as specified herein. New or used material may be furnished. Security of Project site and contents is a continuous obligation of CONTRACTOR.

2. Unless otherwise indicated or specified, security fence shall be constructed of 8'-0" high chain link fencing with a 8'-0" high windscreen. Space posts not to exceed 10'-0" on centers. Posts shall be of following nominal pipe dimensions: terminal, corner, and gatepost 2-1/2", line posts 2". Chain link fence shall be not less than #13 gage, 2" mesh, and in one width. Posts, fence and accessories shall be galvanized and as follows:

   a. Shall be set in the earth a depth of 30" with soil firmly compacted around post, unless required otherwise in writing by DCM.

   b. Fence fabric shall be attached to posts with #14 gage tie wire at 16" on centers. A #6 gage steel tension wire with turnbuckles shall be installed at top and bottom of barricade fencing. Wire tie fabric to tension wires at 18" centers.

   c. Windscreen shall be attached to fence fabric and steel tension wires at 18" centers with a minimum of #14 gage tie wire. Windscreen shall be maintained and all rips, tears, missing sections shall be corrected upon notification by DCM.

   d. Chain link fencing shall be free from barbs, icicles or other projections resulting from galvanizing process. Fence having such defects will be replaced even if it has been installed.

   e. Gates shall be fabricated of steel pipe with welded corners, and bracing as required. Fence and fabric to be attached to frame at 12" centers. Provide all gate hardware of a strength and quality to perform satisfactorily until barricade is removed upon Substantial Completion of the Work. Each gate shall have a chain and padlock. Provide two (2) gate keys to DCM. At Substantial Completion of the Work, remove barricade from Project site, backfill and compact fence footing holes. Existing surface paving that is cut into or removed shall be patched and sealed to match surrounding areas.

   f. At CONTRACTOR'S expense and without limitation remove and/or relocate fencing, fabric and barricades or other security and protection facilities as rapidly as required in order to provide for progress of the Work.

H. Other Temporary Enclosures & Barricades:

1. Provide lockable, temporary weather-tight enclosures at openings in exterior walls to create acceptable working conditions, to allow for temporary heating and for security.

2. Provide protective barriers around trees, plants and other improvements designated to remain. Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

3. Since the Work of this Project may be immediately adjacent to existing occupied structures and vehicular and pedestrian right of ways, CONTRACTOR shall, in his sole judgment and in accordance with applicable safety standards, provide all temporary facilities, additional barricades, protection and care to protect existing structures, occupants, property, pedestrians and vehicular traffic. CONTRACTOR is responsible for any damage, which may occur to the property and occupants of the property of DISTRICT or adjacent private or public properties which in any way results from the acts or neglect of CONTRACTOR.

4. CONTRACTOR shall be responsible for cleaning up all areas adjacent to the construction site which have been affected by the construction; and for restoring them to at least their original condition- including landscaping; planting of trees, sod, and shrubs damaged by construction; and raking and disposal of debris such as roofing shingles, paper, nails, glass sheet metal, bricks, and waste concrete. Construction debris shall be removed and properly disposed of. Culverts and drainage ditches with sediment from the construction area shall be cleared routinely to maintain proper drainage and re-cleaned prior to completion of the contract.

5. CONTRACTOR shall ensure sediment does not block storm drains. CONTRACTOR shall be responsible for cleaning storm drains blocked due to erosion or sediment from the work area.

I. Temporary Storage Yards:

1. CONTRACTOR shall fence and maintain storage yards in an orderly manner.

2. Provide storage units for materials that cannot be stored outside.

3. At CONTRACTOR'S expense and without limitation remove and/or relocate storage yards and units as rapidly as required in order to provide for progress of the Work.

J. Temporary De-watering Facilities & Drainage: Comply with requirements of authorities having jurisdiction. Maintain project site, excavations, and construction free of water.

1. For temporary drainage and de-watering facilities and operations not directly associated with construction activities included under individual sections, comply with de-watering requirements of applicable Division 01 sections. CONTRACTOR shall maintain the Work, Project site and related areas free of water.

2. For temporary drainage and de-watering facilities and operations directly associated with new buildings, additions or other construction activities, comply with Division 01 & 02 Sections. CONTRACTOR shall be responsible for, but not limited to, de-watering of excavations, trenches & below grade areas of buildings, structures, the Project site and related areas.

3. Dispose of rainwater in a lawful manner and will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.

K. Temporary Protection Facilities Installation:

1. CONTRACTOR shall not change over from using temporary facilities and controls to permanent facilities until Substantial Completion, except as permitted by DCM

2. Until permanent fire protection needs are supplied and approved by authorities having jurisdiction, CONTRACTOR shall provide, install and maintain temporary fire protection facilities of the types needed in order to adequately protect against fire loss. Comply with NFPA 241.

   a. CONTRACTOR shall prohibit smoking in construction areas.
   b. CONTRACTOR shall supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
   c. CONTRACTOR shall develop and supervise an overall fire-prevention and protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
   d. When required, provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3. CONTRACTOR shall provide, install and maintain substantial temporary enclosures of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft and

similar violations of security. Where materials, tools and equipment are stored within the Work area, CONTRACTOR shall provide secure lock up to protect against vandalism, theft and similar violations of security. DISTRICT accepts no financial responsibility for loss, damage, vandalism or theft.

4. CONTRACTOR operations shall not block, hinder, impede or otherwise inhibit the use of required exits and/or emergency exits to the public way, except as approved by DCM. CONTACTOR shall maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fire fighting equipment and/or personnel.

5. With approval of DCM and at the earliest feasible date in each area of the Work, complete installation of the permanent fire protection facilities including connected services and place into operation and use. Instruct DISTRICT personnel in use of permanent fire protection facilities.

6. In the event of an emergency drill or an actual emergency, designated by the sounding of the fire alarm and/or other sounding device, all construction activities must cease. CONTRACTOR shall evacuate the Work area and remain outside the Work area until permitted to return. No Work shall be conducted during the evacuation of a building or during an emergency.

L. Temporary Security and Safety Measures:

1. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
   a. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

2. During performance of the Work, CONTRACTOR shall provide, install and maintain substantial temporary barriers and/or partitions separating all Work areas from areas occupied by District staff.

3. CONTRACTOR shall employ and maintain sufficient security and safety measures to effectively prevent vandalism, vagrancy, theft, arson, and all other such negative impacts to the Work. Any impacts to the progress of the Work of CONTRACTOR, DISTRICT, or DISTRICT'S forces, due to loss from inadequate security, will be the responsibility of CONTRACTOR.

4. Lifts and Hoists: Provide equipment necessary for hoisting materials and personnel.
   a. Truck cranes and similar devices for hoisting materials are considered "tools and equipment" and not temporary facilities.

5. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

6. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

7. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site where hazardous operations may occur overhead. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings.

   a. Construct covered walkways using scaffold or shoring framing.
   b. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
   c. Paint and maintain appearance of walkway for duration of the Work.

M. Temporary Access Roads and Staging Areas:

1. Traffic Controls: Comply with requirements of authorities having jurisdiction.
   a. Protect existing site improvements to remain including curbs, pavement, and utilities.
   b. Maintain access for fire-fighting equipment and access to fire hydrants.

2. Due to the limited amount of on and off Project site space for the parking of staff and school visitor's vehicles there will be no parking of CONTRACTOR vehicles in areas designated for District use only. CONTRACTOR shall provide legal access to and maintain CONTRACTOR designated areas for the legal parking, loading, off-loading & delivery of all vehicles associated with the Work. CONTRACTOR will be solely responsible for providing and maintaining these requirements whether on or off the Project site. CONTRACTOR shall provide and maintain ample on-site parking spaces designated for the exclusive use of Construction Manager per paragraph 3.03.B.2.

3. Temporary access roads are to be installed and maintained by CONTRACTOR to all areas of the Project site.

4. CONTRACTOR shall maintain roads and walkways in a clean condition including removal of debris and/or other deleterious material on a daily basis.

N. MOISTURE AND MOLD CONTROL

1. CONTRACTOR's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

2. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

    a. Protect porous materials from water damage.
    b. Protect stored and installed material from flowing or standing water.
    c. Keep porous and organic materials from coming into prolonged contact with concrete.
    d. Remove standing water from decks.
    e. Keep deck openings covered or dammed.

3. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

    a. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
    b. Keep interior spaces reasonably clean and protected from water damage.
    c. Periodically collect and remove waste containing cellulose or other organic matter.
    d. Discard or replace water-damaged material.
    e. Do not install material that is wet.
    f. Discard, replace or clean stored or installed material that begins to grow mold.
    g. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

4. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
    a. Control moisture and humidity inside building by maintaining effective dry-in conditions.
    b. Do not use permanent HVAC system to control humidity.
    c. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
        1. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
        2. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record daily readings over a forty-eight hour period. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.

3. Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

3.04 PROJECT SIGNAGE

A. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

a. Identification Signs: Provide Project identification signs..

b. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

c. Maintain and touchup signs so they are legible at all times.

B. No other signs shall be displayed without approval of DCM. At CONTRACTOR'S expense and without limitation, remove and/or relocate Project signage and related facilities as rapidly as required in order to provide for progress of the Work.

C. CONTRACTOR shall remove Project signage at Substantial Completion of the Work.

D. Until Substantial Completion of the Work, CONTRACTOR shall employ appropriate means to remove all graffiti from buildings, equipment, fences and all other temporary and/or permanent improvements on the Project site within twenty-four (24) hours from the date of report or forty-eight (48) hours of each occurrence.

E. CONTRACTOR shall provide and install signage to provide directional, identification, and contact information to construction personnel and visitors as follows and as reviewed by DCM.

1. For construction traffic control/flow at entrances/exits, and as designated by DCM.

2. To direct visitors.

3. For construction parking.

4. To direct deliveries.

5. For Warning Signs as required.

6. In accordance with CAL/OSHA standards as necessary.

7. For trailer identification and Project site address.

8. For "No Smoking" safe work site at designated locations.

9. Emergency contact information and phone number of CONTRACTOR.

10. Emergency contact information and phone number of local police, fire, and emergency personnel.

11. For Labor Compliance Program (LCP) as required under the General Conditions (Prevailing wage rates and Notice of LCP)

3.05 TRENCHES

A. Open trenches for installation of utility lines (water, gas, electrical and similar utilities) and open pits outside barricaded working areas shall be barricaded at all times in a legal manner determined by CONTRACTOR. Trenches shall be backfilled and patch-paved within twenty-four (24) hours after approval of installation by authorities having jurisdiction or shall have "trench plates" installed. Required access to buildings shall be provided and maintained. CONTRACTOR shall comply with all applicable statutes, codes & regulations regarding trenching and trenching operations. Open trenches deeper than 3'-6", and not located within a public street access, shall be enclosed within an 8'-0" high chain-link fence.

3.06 DUST CONTROL

A. CONTRACTOR is responsible for dust control on and off the Project site. When Work operations produce dust the Project site and/or streets shall be sprinkled with water to minimize the generation of dust. CONTRACTOR shall clean all soils and debris from construction vehicles and cover both earth and debris loads prior to leaving the Project site. CONTRACTOR shall, on a daily basis, clean all streets and/or public improvements within the right of way of any and all debris, dirt, mud and/or other materials attributable to operations of CONTRACTOR.

3.07 WASH OUT

A. CONTRACTOR shall provide and maintain an adequate quantity of wash out boxes of sufficient size and strength to provide for concrete mixer wash out. CONTRACTOR shall locate and relocate both the wash out boxes and wash out areas in order to accommodate the progression of the Work. The wash out area shall be located as to minimize the amount of potential run off onto adjacent private and/or public property. CONTRACTOR shall legally dispose of the contents of the wash out boxes and area on an as needed basis or as required by DCM.

3.08 WASTE DISPOSAL

A. Comply with requirements specified in Division 1 Section “Construction Waste Management”.

B. CONTRACTOR shall provide and maintain trash bins on the Project site. Trash bins shall be serviced on an as needed basis and CONTRACTOR is responsible for the transportation of and the legal disposal of all contents.

3.09 ADVERSE WEATHER CONDITIONS

A. Should warnings of adverse weather conditions such as heavy rain and/or high winds be forecasted, CONTRACTOR shall provide every practical precaution to prevent damage to the Work, Project site and adjacent property. CONTRACTOR precautions shall include, but not be limited to, enclosing all openings, removing and/or securing loose materials, tools, equipment and scaffolding.

B. CONTRACTOR shall provide and maintain drainage away from buildings and structures.

C. CONTRACTOR shall implement all required storm water mitigation measures as required under related Division 01 Sections.

3.10 DAILY AND MONTHLY REPORTS

A. CONTRACTOR shall provide and maintain in the Project site office of CONTRACTOR, a daily sign in sheet for use by all employees of CONTRACTOR and all Subcontractors at whatever tier. At the beginning of each work day, the foreman, project manager, superintendent of CONTRACTOR and/or Subcontractors shall visit the site office of CONTRACTOR and shall enter onto the daily sign in sheet: all employee names; trade classification; and represented company. The completed sign in sheet shall serve as the basis of and shall be submitted with the daily construction report as set forth in Section 3.10 B.

B. By the end of each workday, CONTRACTOR shall submit to DCM and IOR a daily construction report denoting the daily manpower counts and a brief description/location of the workday activities. Manpower shall be broken down by trade classification such as foreman, journeyman or apprentice. The report shall also note the date, day of the week, weather conditions, deliveries, equipment on the Project site whether active and/or idle, visitors, inspections, accidents and unusual events, meetings, stoppages, losses, delays, shortages, strikes, orders and requests of governing agencies, Construction Directive and/or Change Orders received and implemented, services disconnected and/or connected, equipment start up or tests and partial use and/or occupancies. CONTRACTOR shall also include on the daily construction report the above information for all Subcontractors at whatever tier.

C. CONTRACTOR shall submit on a monthly basis the forms found in Sections 01020 and 01330 certifying CEQA Mitigations and Storm Water Pollution Prevention (SWPP) compliances.

3.11 FIELD OFFICE SUPPLIES

A. CONTRACTOR shall provide the initial supply of field office supplies to DCM in the quantities to be identified. CONTRACTOR shall deliver all of the initial field office supplies to DCM Field Offices within fourteen (14) days from the date established in the Notice to Proceed.

B. CONTRACTOR may utilize different suppliers as the specified information is only to establish the required quantities and minimum levels of quality.

C. Postage & Delivery Costs: Postage and delivery costs for CONTRACTOR generated materials are the responsibility of the CONTRACTOR and shall not be charged to DISTRICT, regardless of whether the postage and/or delivery of CONTRACTOR generated materials resulted from a request and/or direction from DISTRICT.

D. All other expendable field office support items specified elsewhere, including, but not limited to, furnishing toner cartridges, equipment maintenance, and bottled water, are to be supplied and paid for by CONTRACTOR.

3.12 CEQA MITIGATIONS – CONTRACTOR RESPONSIBILITIES

A. Air Quality

MMIII-1. CONTRACTOR shall comply with and implement the applicable provisions of the most recently adopted South Coast Air Quality Management District Rule 403 and Rule 403 Implementation Handbook.

B. Cultural Resources

CR-1 . CONTRACTOR shall notify DISTRICT in the event that an archaeological find or a potential archaeological find is discovered and shall cease construction activities in affected area. CONTRACTOR may resume construction activities only after receiving written notice from DISTRICT. For work cessation on the critical path, CONTRACTOR will be entitled to additional days.

CR-2 CONTRACTOR shall notify DISTRICT in the event that human remains or possible human remains are discovered and shall cease construction activities in affected area. CONTRACTOR may resume construction activities only after receiving written notice from DISTRICT. For work cessation on the critical path, CONTRACTOR will be entitled to additional days.

C. Noise

Noise-1. During construction, CONTRACTOR shall ensure that all construction is performed in accordance with City of Carlsbad noise standards. No noise intensive construction or repair work shall be performed between the hours of 5:00 pm and 7:00 am on any

weekday, nor before 8 am or after 6 pm on any Saturday, or at any time on Sundays or federal holidays.

Noise-2. CONTRACTOR shall ensure that all internal combustion powered equipment shall be equipped with properly operating mufflers and kept properly tuned to alleviate noise and pollution.

Noise-3. During construction, CONTRACTOR shall locate portable equipment as far as possible from nearby residents.

Noise-4. CONTRACTOR shall store and maintain equipment as far as possible from nearby residents.

END OF SECTION 015000

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 015001

FACILITIES FOR ONSITE OWNER REPRESENTATION

PART 1 – GENERAL

1.1 All facilities provided for Owner's Representative shall be at suitable locations approved by OMWD. Such facilities must be in a trailer provided for this purpose with acceptable means for locking.

1.2 Class "A" Field Office in accordance with Section 1-2.1 shall be provided. All facilities shall conform to the applicable codes, ordinances, and regulations of the local jurisdiction and State of California, and shall conform to current practice. The interior shall be paneled or suitably lined to provide a facility of good appearance.

1.3 The Contractor shall provide janitorial and other maintenance services in all types of facilities provided. Such services shall include the supply of the appropriate paper products and dispensers. Trash receptacles shall be provided and emptied by the Contractor at weekly intervals or sooner as required. The trash shall be removed from the project site.

1.4 All costs to furnish, maintain, service, and remove the specified facilities at the project site shall be included in the price bid for such facilities. If no bid item is provided in the proposal, costs shall be included in other items for which bids are entered.

1.5 The first progress payment will not be approved until all facilities are in place and fully comply with the Specifications.

PART 2 – FIELD OFFICE FACILITIES

2.1 Class "A" Field Office. Contractor shall furnish the Owner's Representative one Class "A" Field Office located at 1966 Olivenhain Rd., Encinitas. The field office shall be for the exclusive use of the Owner's Representative and such other individuals the Owner's Representative/OMWD may designate. The field office shall be a separate structure from any office facility. The Contractor shall maintain the field office throughout the entire duration of the contract unless the Owner's Representative/OMWD shall otherwise direct. This office shall have a minimum floor space of 600 feet.

A. All doors and windows shall be provided with screens, window blinds, and security bars. Furniture shall be provided as follows: one plan table, one eight foot long conference table and chairs with seating for ten, one standard five foot long double-pedestal desk with a drawer suitable for holding files, two chairs, one drafting stool, and one plan rack.

Electric power shall be provided to include a minimum of four duplex convenience outlets. The office shall be illuminated at the tables and desk. An outdoor lighting fixture with a 300-watt bulb or equivalent shall be installed at each entry door. Heating

and air conditioning of sufficient capacity shall be provided at no expense to the OMWD. The Contractor shall provide drinking water within the office.

Additionally, the Class “A” Filed Office shall be provided with: one (1) additional standard five foot double pedestal desk with two chairs, one (1) multi-function device and supplies; multi-function device shall be one Richoh 2503 with print/scan/fax/copy capabilities including fax line out, or equal, unlimited high speed internet, one (1) mini refrigerator, one (1) microwave oven, and two (2) additional plan racks shall be provided. Water cooler to have hot and chilled water. A chemical toilet facility shall be provided adjacent to the office.

Furnishings are subject to OMWD approval. The field office shall be located at a site satisfactory to OMWD/Owner’s Representative and within or immediately adjacent to the limits of work. Access and three parking spaces for the exclusive use of the Owner’s Representative and his/hers designees that are convenient and satisfactory to the Owner’s Representative/OMWD shall be provided by the Contractor. The field office shall have at 24 inch by 36 inch sign affixed near the entry door. The sign text shall have Olivenhain Water District’s emblem and state OMWD Construction Management and Inspection.

PART 3 – REMOVAL OF FACILITIES

3.1 Field offices, laboratories, and bathhouse facilities at the project site shall be removed upon completion of the Work. Project site shall be returned to original working condition at the approval of the Owner’s Representative/OMWD. Buildings and equipment furnished by the Contractor at the project site under the provisions of this section are the property of the Contractor.

PART 4 - BASIS OF PAYMENT

4.1 All costs incurred in furnishing, maintaining, servicing, and removing field office(s) required at the project site shall be included in the bid item for furnishing such facilities.

END OF SECTION

SECTION 015002

TEMPORARY FACILITIES FOR OMWD STAFF

TO BE ISSUED AS AN ADDENDUM

END OF SECTION 015002

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 016000

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and “or equal” products.

B. Related Requirements:

1. Section 012100 "Allowances" for products selected under an allowance.
2. Section 012300 "Alternates" for products selected under an alternate.
3. Section 012500 "Substitution Procedures" for requests for substitutions.
4. Section 014200 "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. “or equal” Product: Product that is demonstrated and approved through the substitution request process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance,

physical properties, appearance, and other characteristics for purposes of evaluating "or equal" products of additional manufacturers.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and

limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to District.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for District.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCTS NOT ALLOWED

A. Do not provide products that contain asbestos, lead, or coal tar.

2.2 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. District reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. For products specified by name and accompanied by the term "or equal," comply with requirements of Section 012500 “Substitution Procedures” to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Where Specifications name a single manufacture's product and indicate "no substitution", provide the named product that complies with requirements. "or equal" products (substitutions) will not be considered.
2. Where Specifications name a single manufacturer or source and indicate "no substitution", provide a product by the named manufacturer or source that complies with requirements. "or equal" products (substitutions) will not be considered.
3. Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. "or equal" products (substitutions) will be considered.
4. Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. "or equal" products (substitutions) will be considered.

5. Basis-of-Design Product: Where Specifications name a product as the basis-of-design product, or refer to a product indicated on Drawings as the basis-of-design product, provide the specified or indicated product. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. "or equal" products (substitutions) will be considered.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300

EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of District-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.
9. Correction of the Work.

B. Related Requirements:

1. Section 011000 "Summary" for limits on use of Project site.
2. Section 013300 "Submittal Procedures" for submitting surveys.
3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of District-accepted deviations from indicated lines and levels, and final cleaning.
4. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

B. Qualification Data: For franchise utility project manager.

C. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

D. Cutting and Patching Notification: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
    a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

E. Landfill Receipts: Submit copies of waste hauler slips indicating the amount of waste hauled in tons and the amount of waste in tons diverted from landfill and recycled, composted or salvaged.

F. Certified Surveys: Submit two copies signed by land surveyor.

G. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.5 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in California and who is experienced in providing land-surveying services of the kind indicated.

B. Franchise Utility Project Manager Qualifications: A qualified franchise utility project manager/coordinator with a minimum of 10 years' experience in project management with utility agencies (SDG&E, SBC Global, Cox Cable, Time Warner, etc.). Duties shall include administering and coordinating all aspects of the administration of the franchise utility work including contractor self-performed work.

C. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify the DCM of locations and details of cutting and await directions from the DCM before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include but are not limited to the following:
    a. Primary operational systems and equipment.
    b. Fire separation assemblies.
    c. Air or smoke barriers.
    d. Fire-suppression systems.
    e. Mechanical systems piping and ducts.
    f. Control systems.
    g. Communication systems.
    h. Fire-detection and -alarm systems.
    i. Conveying systems.
    j. Electrical wiring systems.
    k. Operating systems of special construction.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
    a. Water, moisture, or vapor barriers.
    b. Membranes and flashings.
    c. Exterior curtain-wall construction.
    d. Sprayed fire-resistive material.
    e. Equipment supports.
    f. Piping, ductwork, vessels, and equipment.
    g. Noise- and vibration-control elements and systems.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in the DCM's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site to DCM 10 days prior to start of work.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.

3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility and/or District that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 31 00 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify the DCM promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify the DCM when deviations from required lines and levels exceed allowable tolerances.

7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and project Inspector.

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of the DCM. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to the DCM before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

D. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
    a. For utility lines, show, without limitation, elevations of drain/plumbing lines, plugged tees, capped ends, catch basins/drainage structures and the flow line elevations from these points.

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by the DCM.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor

bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 DISTRICT-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for District's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by District's construction personnel.

1. Construction Schedule: Inform District of Contractor's preferred construction schedule for District's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify District if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include District's construction personnel at preinstallation conferences covering portions of the Work that are to receive District's work. Attend preinstallation conferences conducted by District's construction personnel if portions of the Work depend on District's construction.

3.8 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 014002 "Quality Requirements / Contractor laboratory."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.11 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017329

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. See Section 012100 for allowance for all cutting and patching.

C. Related Sections include the following:

1. Section 012100 - Allowances.

1.3 DEFINITIONS

A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SPECIFIC CUTTING AND PATCHING

A. Utility tie-ins per civil construction documents shall include but not limited to:
1. Electrical
2. Natural gas
3. Water
4. Sewer

1.5 SUBMITTALS

A. Cutting and Patching Request: Submit information, describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.

2. Changes to Existing Construction: Describe anticipated results. Include changes to operating components as well as changes in building's appearance and other significant visual elements.
3. Products: List products to be used and firms or entities that will perform the patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate how long services and systems will be disrupted.
6. Request shall include Contractor's stamp or certification, Contractor's name, project Architect's name, project location and name, and Contractor's signature acknowledging review of submittal.
7. Architect's Approval: Obtain approval of cutting and patching request before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.6 QUALITY ASSURANCE

A. Structural Elements: Do not modify structural elements. Notify Construction Manager of locations where existing structural elements will interfere with new work.

B. Operational Elements: Do not cut and patch the following operating elements and related components in a manner that results in reducing their capacity to perform as intended or that result in increased maintenance or decreased operational life or safety. Operational elements include but are not limited to the following:

1. Primary operational systems and equipment.
2. Air or smoke barriers.
3. Fire-protection systems.
4. Control systems.
5. Communication systems.
6. Conveying systems.
7. Electrical wiring systems.
8. Fire separation assemblies.
9. Mechanical systems piping and ducts.

C. Other Construction Elements: Do not cut and patch the following construction elements or related components in a manner that could change their load-carrying capacity, that result in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Equipment supports.
4. Piping, ductwork, vessels, and equipment.

5. Noise- and vibration-control elements and systems.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1.7 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. For record only, submit product data and sketches or cut sheets deemed necessary by Architect for replacement materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Notify Project Inspector 48 hours before closing openings. Allow Inspector to view existing conditions.

B. Temporary Support: Provide temporary support of Work to be cut.

C. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

D. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with work sequence requirements in Section 011000 - Summary.

E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Cut or form holes for penetrations accurately to allow for proper sealing.
5. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
6. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
7. Proceed with patching after construction operations requiring cutting are complete and Project Inspector has approved the conditions.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or re-hang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather tight condition.
6. Fire-rated construction: patch and seal through-penetrations to maintain UL rating required.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

END OF SECTION 017329

This page left intentionally blank.

SECTION 017419

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

1. Section 024116 "Structure Demolition" for disposition of waste resulting from demolition of buildings, structures, and site improvements.
2. Section 024119 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.
3. Section 042200 "Unit Masonry" for disposal requirements for masonry waste.

1.3 DEFINITIONS

A. Source Separated Recycling Facility (SSRF): A facility that exclusively accepts separated individual commodities for the purpose of recycling; such as metals, paper, wood, and/or inerts such as asphalt and concrete.

B. Mixed Debris: Includes solid items such as building materials, packaging, and rubble resulting from construction, remodeling, repair, and demolition operations, herein referred to as the EDCO Mixed Debris Recycling Facility.

C. Class III Landfill: A landfill that accepts non-hazardous waste such as household, commercial, and industrial waste.

D. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

E. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

F. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

G. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

H. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

I. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS

A. General: Use best management practices for salvage/recycling of non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Clearly label all recycling containers and list acceptable and unacceptable materials. Deliver recyclable materials to source separated recycling facilities. Facilitate recycling and salvage of materials, including the following as applicable:

1. Demolition Waste:

a. Asphalt paving.
b. Concrete.
c. Concrete reinforcing steel.
d. Brick.
e. Concrete masonry units.
f. Wood studs.
g. Wood joists.
h. Plywood and oriented strand board.
i. Wood paneling.
j. Wood trim.
k. Structural and miscellaneous steel.
l. Rough hardware.
m. Roofing.
n. Insulation.
o. Doors and frames.
p. Door hardware.
q. Windows.
r. Glazing.
s. Metal studs.
t. Gypsum board.
u. Acoustical tile and panels.
v. Carpet.
w. Carpet pad.
x. Demountable partitions.
y. Equipment.

z. Cabinets.
aa. Plumbing fixtures.
bb. Piping.
cc. Supports and hangers.
dd. Valves.
ee. Sprinklers.
ff. Mechanical equipment.
gg. Refrigerants.
hh. Electrical conduit.
ii. Copper wiring.
jj. Lighting fixtures.
kk. Lamps.
ll. Ballasts.
mm. Electrical devices.
nn. Switchgear and panelboards.
oo. Transformers.

2. Construction Waste:

a. Masonry and CMU.
b. Lumber.
c. Wood sheet materials.
d. Wood trim.
e. Metals.
f. Roofing.
g. Insulation.
h. Carpet and pad.
i. Gypsum board.
j. Piping.
k. Electrical conduit.
l. Packaging: Salvage or recycle the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
6) Wood crates.
7) Plastic pails.

B. Co-mingled Debris: Direct all co-mingled site tonnage to the EDCO Mixed Debris Processing Facility.

1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 10 days of date established for the Notice to Proceed.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

1.7 SITE DEBRIS MANAGEMENT PLAN

A. General: Develop a site debris management plan.

B. Post approved plan in a prominent location at the Project site and distribute copies to superintendent and all subcontractors.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 015000 "Construction Facilities and Temporary Controls."

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Comply with Section 01 50 00 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

END OF SECTION 017419

SECTION 017700

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Project record documents submittal
4. Operation and maintenance manual submittal
5. Warranties.
6. OWNER orientation and instruction
7. Final cleaning.

B. Related Sections:

1. Section 017300 “Execution”
2. Section 017823 “Operation and Maintenance Data”
3. Section 017839 “Project Record Documents”
4. Section 017900 “Demonstration and Training”
5. Divisions 2 through 12 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete with request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, the DCM will either proceed with inspection or notify CONTRACTOR of unfulfilled requirements. DCM will prepare the Certificate of Substantial Completion after inspection or will notify CONTRACTOR of items, either on CONTRACTOR's list or additional items identified by DCM, that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.4 PROJECT RECORD DOCUMENT SUBMITTAL

A. General: Do not use project record documents for construction purposes. Protect record documents from deterioration and loss. Provide access to record documents for ARCHITECT, DCM reference during normal working hours. Project record document shall be updated on a weekly basis. Prior to submitting each application for payment, secure DCM approval of project record documents.

B. Record Drawings: Maintain a clean, undamaged set of blue or black line white prints of Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark which Drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Drawings. Provide detailed and accurate field dimensions for concealed elements that would be difficult to measure and record at a later date.

1. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work. Date and number entries in the same format as submitted. Call attention to entry by a “cloud” around the affected areas.

2. Mark new information important to OWNER but was not shown on Drawings or Shop Drawings.

3. Utility location and depth below finished grade and above ceilings and attic spaces shall be fully dimensioned and indicated on record drawings. Dimensions shall be measured from building lines or permanent landmarks and shall be triangulated to those features.

4. Note related Change Order or Construction Directive numbers where applicable. RFI submissions shall be referenced on each affected sheet, Drawing and Shop Drawing.

5. Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.

6. Prior to Contract Completion of the Work, review of the project record drawings by ARCHITECT, prepare a final set of project record drawings using reproducible vellum. Submit final set of transparencies to ARCHITECT.

C. Record Specifications: Maintain two complete copies of the Specifications, including Addenda. Include with the Specifications two copies of other written Contract Documents, such as Change Orders or Construction Directives issued during construction.

1. Mark these record documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.

2. Give particular attention to substitutions and selection of options and information on concealed Work that cannot otherwise be readily discerned later by direct observation.

3. Note related record document information with Product Data.

4. Prior to Contract Completion of the Work, submit record Specifications to ARCHITECT for OWNER records.

D. Record Product Data: Maintain two copies of each Product Data submittal. Note related Change Orders and Construction Directives and mark-up of record drawings and Specifications.

1. Mark these documents to illustrate significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the Project site and from the manufacturer's installation instructions and recommendations.

2. Provide detailed and accurate information regarding concealed products and portions of Work that cannot otherwise be readily discerned later by direct observation.

3. Prior to Contract Completion, submit complete set of record Product Data to ARCHITECT for OWNER records.

E. Record Samples: Immediately prior to Substantial Completion, CONTRACTOR shall meet with ARCHITECT and DCM at the Project site to determine which Samples are to be transmitted to OWNER for record purposes. Comply with DCM instructions regarding delivery to OWNER storage area.

F. Miscellaneous Records: Refer to other Specification sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Prior to the date of Contract Completion, complete and compile miscellaneous records and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to DCM for OWNER records.

G. Maintenance Manuals: Prior to Substantial Completion, organize operation and maintenance data into suitable two sets of manageable size. Bind properly indexed data in individual, heavy-duty, 2-3", 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Submit to DCM for OWNER records. Include the following types of information.

1. Emergency instructions

2. Spare parts list

3. Copies of warranties

4. Wiring diagrams

5. Recommended "turn-around" cycles

6. Inspection procedures

7. Shop Drawings and Product Data

8. Fixture lamping schedule

1.6 OPERATION AND MAINTENANCE:

A. Operation and Maintenance Instructions: Prior to Substantial Completion, arrange for each installer of equipment that requires regular operation and maintenance to meet with designated OWNER personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:

1. Maintenance manuals
2. Spare parts and materials
3. Tools
4. Lubricants
5. Fuels
6. Identification systems
7. Control sequences
8. Hazards
9. Cleaning
10. Warranties and bonds
11. Maintenance agreements and similar continuing commitments

B. As part of instruction for operating equipment, demonstrate the following procedures:

1. Start-up
2. Shutdown
3. Emergency operations
4. Noise and vibration adjustments
5. Safety procedures
6. Economy and efficiency adjustments
7. Effective energy utilization

C. Notice Of Termination: CONTRACTOR shall submit a Notice of Termination (NOT) to the local Regional Water Quality Control Board, RWQCB. Provide a copy of NOT to DCM.

1.7 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:

1. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
2. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
3. Submit pest-control final inspection report and warranty.
4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify CONTRACTOR of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify CONTRACTOR of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by CONTRACTOR that are outside the limits of construction. Use CSI Form 14.1A or CONTRACTOR's comparable form.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

a. Project name.
b. Date.
c. Name of the DCM
d. Name of Architect.
e. Name of CONTRACTOR.

f. Page number.

4. Submit list of incomplete items in the following format:

a. Five paper copies of list, unless otherwise indicated. Architect will return two copies.

1.9 WARRANTIES

A. Submittal Time: Submit written warranties for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with CONTRACTOR.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of CONTRACTOR.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with maximum allowable VOC levels of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
g. Sweep concrete floors broom clean in unoccupied spaces.
h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
j. Remove labels that are not permanent.
k. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

1) Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates.

l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter upon inspection.

1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report upon completion of cleaning.

q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
r. Leave Project clean and ready for occupancy.

C. Final Cleaning: The Owner will install its furnishings and equipment following cleaning included in Section B above and before Final Acceptance. The CONTRACTOR shall include an additional final cleaning of all surfaces of furnishing, equipment, and the balance of the Project interior following installation of furnishings, equipment, etc. by Owner's vendor.

D. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

E. Construction Waste Disposal: Comply with waste disposal requirements in Division 1 Section "Construction Waste Management."

END OF SECTION 017700

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 017823

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Section 019113 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Owner.

   a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
   b. Enable inserted reviewer comments on draft submittals.

2. One paper copy. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.

C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.

1. Correct or revise each manual to comply with and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a

designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Architect.
7. Name and contact information for Commissioning Authority.
8. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
9. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and

equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.
9. Earthquake.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.

2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.

5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

    1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

    1. Do not use original project record documents as part of operation and maintenance manuals.
    2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."

G. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

This page intentionally left blank.

SECTION 017839

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Miscellaneous record submittals.

B. Related Requirements:

1. Section 017300 "Execution" for final property survey.
2. Section 017700 "Closeout Procedures" for general closeout procedures.
3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Submit one paper copy of marked-up record prints.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued, depicting the current status of the Work.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations below first floor.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order, Construction Change Directive, or Field Work Order.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.
o. Changes made by responses to Requests for Information (RFI's).

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction.

Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's, Project Inspector's, and Construction Manager's reference during normal working hours.

C. Upon completion of the Work assemble and promptly transmit to the Architect all documents maintained at the Site by the Contractor pursuant to the foregoing.

D. Incorporate an index into the Record Drawing set. The index shall reflect the following information obtained from the drawing title block: drawing number, drawing date of issue and drawing last date of revision.

E. Review Record Documents weekly with Project Inspector. Indicate to Project Inspector the items incorporated in Project Record Documents concurrent with progress of the Work, including modifications, concealed conditions, field changes, product selections, and other notations incorporated.

END OF SECTION 017839

This page left intentionally blank.

SECTION 017900

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing District's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.

B. Related Requirements:

1. Divisions 02 through 32 Sections for specific requirements for demonstration and training of products and systems in those Sections.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For facilitator.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

    a. Name of Project.
    b. Name and address of videographer.
    c. Name of Architect.
    d. Name of DCM.
    e. Name of Contractor.
    f. Date of video recording.

2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
3. At completion of training, submit complete training manual(s) for District's use in PDF electronic file format.

1.5 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative experienced in operation and maintenance procedures and training.

C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

    1. Inspect and discuss locations and other facilities required for instruction.
    2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
    3. Review required content of instruction.
    4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

A. Coordinate instruction schedule with District's operations. Adjust schedule as required to minimize disrupting District's operations and to ensure availability of District's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.
2. Documentation: Review the following items in detail:
    a. Emergency manuals.
    b. Operations manuals.
    c. Maintenance manuals.
    d. Project record documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and District for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct District's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. District will furnish an instructor to describe District's operational philosophy.
2. District will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with District, through DCM, with at least seven days' advance notice.

D. Training Location: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. When necessary, provide classroom training.

1. Webinar training is not acceptable.

E. Reference Material: Conduct training using final operation and maintenance data submittals.

F. Cleanup: Collect used and leftover educational materials and give to District. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to District, on electronic media.

1. Electronic Media: Read-only format compact disc acceptable to District, with commercial-grade graphic label.
2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.

3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:
    a. Name of Contractor/Installer.
    b. Business address.
    c. Business phone number.
    d. Point of contact.
    e. E-mail address.

C. Narration: Describe scenes on video recording by audio narration. Include description of items being viewed.

D. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

E. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 017900

SECTION 019113

GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Owner's Project Requirements and Basis-of-Design documentation are included by reference for information only.

1.2 SUMMARY

A. Section Includes:

1. General requirements for coordinating and scheduling commissioning.
2. Commissioning Team duties.
3. Commissioning meetings.
4. Commissioning scheduling.
5. Test equipment, instrumentation, and tools for commissioning.
6. Construction verification.
7. Functional performance testing.
8. Commissioning tests and commissioning test demonstration.
9. Commissioning Report.

B. Related Requirements:

1. Section 01 33 00 "Submittal Procedures" for submittal procedures requirements for commissioning.
2. Section 01 77 00 "Closeout Procedures" for certificate of Construction Phase Commissioning Completion submittal requirements.
3. Section 01 78 23 "Operation and Maintenance Data" for preliminary operation and maintenance data submittal.
4. Section 23 08 00 "Commissioning of HVAC" for technical commissioning requirements for HVAC.

1.3 DEFINITIONS

A. Acceptance Criteria: Threshold of acceptable work quality or performance specified for a commissioning activity, including, but not limited to, construction checklists, performance tests, performance test demonstrations, commissioning tests and commissioning test demonstrations.

B. Basis-of-Design: A detailed description of building Design criteria, parameters, set-points, concepts, decisions and selections used to meet the Owner's Project Requirements that serves as a basis for review, approval and documentation of the Design process used for all building systems.

C. Commissioning Agent: An Owner appointed entity that plans and coordinates all activities that implement commissioning as outlined by Owner's Basis of Design.

D. Commissioning Plan: A document, prepared by Commissioning Agent, that outlines the organization, schedule, allocation of resources, and documentation requirements of commissioning.

E. Commissioning Report: A document, prepared by the Commissioning Agent, that records the activities and results of the Commissioning process.

F. Commissioning: The process of ensuring that systems are designed, installed, functionally tested and performing in conformity with the Owner's Requirements and that the Owner has received complete equipment/systems documentation and training.

G. Construction Verification: A quality control verification process performed by the installer as building assemblies, components, equipment and systems are being installed that documents that the materials, installation procedures, interfaces with other trades, start-up, testing and operations are correct, complete, in compliance with Contract Documents and manufacturer's recommendations and are ready for Functional Performance Testing.

H. Owner's Project Requirements: A narrative of the program, use and functional requirements of the building with a description of the Project goals and criteria in general categories (e.g.: flexibility of use, ease of maintenance, future expansion, etc.) and specific categories (e.g.: specialized environments, specific sustainable features, quality of materials, etc.).

I. Functional Performance Tests: Contractor testing of installed building assemblies, components, equipment, systems and interfaces which confirms correct performance through all operating modes and compliance with Contract Documents, manufacturer's recommendations and the Owner's Project Requirements.

J. Retro-Commissioning: A systematic process for improving and optimizing a building's operations and supporting those improvements with enhanced documentation and operator training.

K. Test: Performance tests, performance test demonstrations, commissioning tests, and commissioning test demonstrations.

1.4 ABBREVIATIONS

A. The following abbreviations are used in this Section:

1. A/E Architect / Engineer.

2. BAS: Building Automation System.
3. Cx: Commissioning.
4. CxA: Commissioning Agent.
5. DPR: Owner's Project Requirements.
6. FPT: Functional Performance Tests.
7. O&M: Operations and Maintenance.
8. PI: Project Inspector.
9. PPO: Physical Plant Operations
10. P/T: Pressure / Temperature.
11. TAB: Testing, Adjusting, and Balancing.

1.5 COMMISSIONING TEAM DUTIES

Cx TASK	Provided By					Provided To					Planning	Design	Construction	Turnover	Operation
	OWNER	PI	A/E	CxA	CONTRACTOR	PPO	PI	A/E	CxA	CONTRACTOR					
Owner's Project Requirements				X		X	X	X		X	PPO Narrative	Update	Update	Update, Include in Cx Report	
	X	X	X						X		Review Comments on PPO	Additional Comments on PPO	Additional Comments on PPO	Additional Comments on PPO	
Basis of Design			X			X	X		X		Basis of Design	Update	Update	Update	
	X	X		X				X			Review Comments	Additional Comments	Additional Comments	Additional Comments	
				X		X	X	X		X				Include in Cx Report	
Cx Plan				X		X	X	X		X	Cx Plan	Update	Update	Update, Include in Cx Report	Update, Include in Cx Report
	X	X			X				X		Review Comments	Additional Comments	Additional Comments	Additional Comments	Additional Comments
Construction Verification Checklists and Checklist Tracking Report					X	X			X				Edit and Develop		
					X	X			X				Perform and Submit as Work is Installed	Include in O&M Manuals	
	X			X						X			Review Comments		
Functional Performance Tests and FPT Tracking Report					X	X			X				Develop & Update Test Forms, Schedule and Direct Tests	Include in Cx Report	
					X	X			X				Perform and Submit		
	X			X						X			Review Comments		
Cx Report				X		X	X	X		X				Draft Report	Final Report
Cx Issues, Site Visit				X		X	X	X		X	Cx Issues, Site Visit &	Update	Update	Update	

Cx TASK	Provided By					Provided To					Planning	Design	Construc-tion	Turnover	Operation
	OWNER	PI	A/E	CxA	CONTRACTOR	PPO	PI	A/E	CxA	CONTRACTOR					
and Close-out Items Log											Closeout Log				
					X				X				Actions Taken	Actions Taken	
PPO Train-ing					X	X	X	X	X				O&M Data, Training Plan and Training		
		X		X						X			Evaluate O&M Data & Training		

1.6 INFORMATIONAL SUBMITTALS

A. Comply with requirements in Section 01 33 00 "Submittal Procedures" for submittal procedures general requirements for commissioning.

B. Lists:

1. Construction Verification List.
   a. Select appropriate lists from Appendix A.
2. Function Performance Tests List.
   a. Select appropriate lists from Appendix C.

C. Forms:

1. Construct Verification Tracking Report.
   a. See Appendix B.
2. Functional Performance Test Tracking Report.
   a. See Appendix D.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

A. Provide equipment required to perform startup, checkout and testing. Provide equipment that has been calibrated per the manufacturer's recommendations within the past year.

PART 3 - EXECUTION

3.1 COMMISSIONING PLAN

A. Assist Owner's Commissioning Agent in development of a complete commissioning plan detailing the following information at a minimum:

1. Contact information for key members of commissioning team.
2. Description of procedures to be utilized for each commissioning task.
3. List of commissioning systems and associated equipment.
4. Functional Performance Test sampling approach to be utilized for repeat equipment items.
5. List of responsibilities for each party involved in the commissioning process.
6. Commissioning milestones and schedule.

B. Commissioning Meetings:

1. Attend commissioning meetings with involved subcontractors and other personnel requested by CxA. Each party is responsible for providing a review of Project progress, commissioning issues and scheduling for future commissioning tasks.

C. Communication:

1. Relay communications resulting from or in relation to commissioning activities directly to the responsible party whenever possible, with copies to Construction Manager and Project Inspector.

D. Responsibilities:

1. All parties are to follow the Commissioning Plan and are responsible for commissioning activities as outlined in Article "Commissioning Team Duties."

E. Scheduling:

1. Provide CxA and involved subcontractors with a copy of the Project Schedule and regular monthly updates. CxA will provide Contractor with a detailed schedule of commissioning tasks for incorporation into project schedule.

F. Construction Verification:

1. The purpose of the Construction Verification List is to have a formal means of providing individual workers the key criteria for a successful installation and to easily track construction progress.
2. Notify CxA five days prior to construction verification so that CxA may witness, as deemed necessary, each assembly, component, equipment, system start up and testing.

3. If CxA identifies more than a 10 percent discrepancy rate, revalidate all items covered by that checklist and resubmit new checklists.

G. Functional Performance Testing:

1. Assist CxA in establishing a schedule for Functional Performance Testing.
2. Ensure all subcontractors involved with specific assemblies, components, equipment, systems and interfaces have qualified installers and technicians present at the same time working together to perform testing and demonstrate correct performance through all operating and failure modes and compliance with Contract Documents, manufacturer's recommendations and the Owner's Project Requirements.
3. Ensure completion and coordination of the Work prior to testing. Preplan testing procedures, and ensure necessary staff and resources are on hand for expediting testing. Failure to complete or coordinate work, preplan, or have staff and resources available to carry out testing will result in retesting.
4. CxA will establish sampling protocol and, at the time of testing, select sample test locations for identical pieces of equipment. Receive CxA approval where simulation of conditions or altering of set points or values is required to achieve an opening or failure mode for testing.
5. Correct minor deficiencies during testing. Deficiencies that cannot be corrected during testing will be documented and subject to retest. Retesting will continue until no deficiencies remain.
6. The cost of retesting is the responsibility of the Contractor and subject to deductive change order. Deficiencies and retesting are the responsibility of the Contractor and are not subject to time extensions or delay claims. Review preliminary construction checklists and preliminary test procedures and data forms.

3.2 OPERATION AND MAINTENANCE DATA

A. Provide as specified in Section 017823 "Operation and Maintenance Data."

3.3 DEMONSTRATION AND TRAINING

A. Provide as specified in Section 017900 "Demonstration and Training."

3.4 COMMISSIONING REPORT

A. CxA will provide Contractor, Architect, and Owner a Commissioning Report for the Project upon Substantial Completion. This report will include contact information for key members of the commissioning team; description of commissioned systems, commissioning activities, sampling protocol and results. The report will also include the Owner's Project Requirements, Basis-of-Design, Construction Verification Checklist Tracking Report, and Functional Performance Test Tracking Report.

END OF SECTION 019113

APPENDIX A – CONSTRUCTION VERIFICATION LIST

Choose from the following Construction verification checklists and provide additional items as needed to reflect the verification Requirements of assemblies, components, equipment and systems to be commissioned on this Project and used on the Construction Verification Tracking Report.

CV-22 05 14 – Backflow Preventers
CV-22 05 14 – Trap Primer Values
CV-22 07 00 – Plumbing Insulation
CV-22 11 00 – Water Distribution
CV-22 13 00 – Sanitary Sewage
CV-22 14 00 – Storm Drainage
CV-22 30 00 – Expansion Tanks
CV-22 30 00 – In-line Centrifugal Pumps
CV-22 30 00 – Water Heaters (Electric)
CV-22 30 00 – Water Heaters (Gas)
CV-22 42 00 – Plumbing Fixtures
CV-22 60 00 – Air Compressors
CV-23 05 14 – Variable Frequency Drives
CV-23 05 15 – Air Separators
CV-23 05 15 – Expansion Tanks
CV-23 05 15 – Suction Diffusers
CV-23 07 00 – HVAC Ductwork Insulation
CV-23 07 00 – HVAC Piping Insulation
CV-23 09 14 - Air Compressors
CV-23 09 14 - Control Wiring and Devices
CV-23 11 00 - Gas Piping
CV-23 21 13 - Hydronic Piping
CV-23 21 13 - Pumps
CV-23 23 00 - Refrigerant Piping / VRF, VRV
CV-23 25 00 - HVAC Water Treatment
CV-23 31 00 - Ductwork and Casings
CV-23 34 00 - Ceiling Exhaust Fans
CV-23 34 00 - Centrifugal Fans
CV-23 34 00 - Destratification Fans
CV-23 34 00 - Vaneaxial Fans
CV-23 36 00 - Air Terminal Units
CV-23 37 13 - Diffusers, Grilles and Registers
CV-23 41 00 - Filter Racks
CV-23 52 00 - Cast Iron or Modular Cast Iron Boiler
CV-23 52 00 - Fire Box, Fire Tube, Flexible Water Tube or Vertical Tubeless Boilers
CV-23 54 00 - Gas Fired Furnaces
CV-23 55 00 - Direct Fired MUA Units
CV-23 55 00 - Gas Fired Unit Heaters
CV-23 55 00 - Indirect Fired MUA Units
CV-23 62 13 - Air Cooled Chillers

CV-23 64 15 - Water Cooled Chillers
CV-23 73 12 - Refrigerant Coils
CV-23 82 00 - Fan Coil Units
CV-23 82 00 - Reheat Coils
CV-23 82 00 - Unit Heaters
CV-23 82 00 - Unit Ventilators
CV-26 05 13 - Medium Voltage Cables
CV-26 05 26 - Grounding and Bonding
CV-26 05 33 - Conduit, Raceway & Boxes for Electrical Systems
CV-26 05 36 - Cable Trays
CV-26 18 23 - Medium Voltage Surge Arrestor
CV-26 22 00 - Low Voltage Transformer
CV-26 24 13 - Switchboard
CV-26 24 16 - Panelboards
CV-26 27 13 - Electrical Meter
CV-26 27 28 - Non-Fusible Disconnect Switches
CV-26 28 16 - Enclosed Switches and Circuit Breakers
CV-26 29 00 - Magnetic Motor Starters
CV-26 29 00 - Manual Motor Starters
CV-26 29 00 - Motor Control Centers
CV-26 36 00 - Automatic Transfer Switches
CV-26 43 13 - Transient Voltage Suppression
CV-26 51 13 - Interior Light Fixtures, Lamps & Ballasts
CV-26 51 15 - Lighting Control Panels
CV-26 56 29 - Site Lighting
CV-27 00 00 - Communications Cabling
CV-28 31 00 - Fire Alarm Control Panels
CV-28 31 00 - Fire Alarm Wiring & Devices

APPENDIX B – CONSTRUCTION VERIFICATION TRACKING REPORT

Fill out the following tracking report using Construction Verification List for this Project.

Construction Verification Checklist No.	Equipment/System Type	No. of Equip., Areas (floors, etc.) or Groups	Checklists Tracking	
			Total Checklists	Complete to Date

APPENDIX C – FUNCTIONAL PERFORMANCE TEST LIST

Choose from the following Functional Performance Test list and provide additional items needed to reflect the Testing Requirements of assemblies, components, equipment and systems to be commissioned on this Project and used on Functional Performance Test Tracking Report.

FPT-22 30 00 - Domestic Booster Pumps
FPT-22 30 00 - Inline Centrifugal Pumps
FPT-22 30 00 - Water Heaters
FPT-23 05 14 - Variable Frequency Drives
FPT-23 09 23 - EMS Communication/Calibration
FPT-23 21 13 - Pumps
FPT-23 34 00 - HVAC Fans
FPT-23 36 00 - Air Terminal Units
FPT-23 52 00 - Boiler
FPT-23 54 00 - Gas Fired Furnaces
FPT-23 55 00 - Direct Fired MUA Units
FPT-23 55 00 - Gas Fired Unit Heaters
FPT-23 62 13 - Air-Cooled Chillers
FPT-23 64 15 - Water Cooled Chillers
FPT-23 73 13 - Air Handling Units/VRF, VRV
FPT-23 82 00 - Cabinet Heaters
FPT-23 82 00 - Fan Coil Units
FPT-23 82 00 - Re-Heat Coils
FPT-23 82 00 - Unit Heaters
FPT-26 51 15 - Lighting Controls

APPENDIX D – FUNCTIONAL PERFORMANCE TEST TRACKING REPORT

Fill out the following tracking report using the Functional Performance Test List for this Project.

Functional Performance Test No.	Equipment/System Type	No. of Equip., Areas (floors, etc.) or Groups	Test Tracking	
			Total Tests	Complete to Date

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 024116

STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of buildings and site improvements.
2. Abandoning in-place or removing below-grade construction.
3. Disconnecting, capping or sealing, and abandoning in-place or removing site utilities.
4. Salvaging items for reuse by District.

B. Related Requirements:

1. Section 011000 "Summary" for use of the premises and phasing requirements.
2. Section 013203 "Construction Progress Documentation".
3. Section 017419 “Construction Waste Management and Disposal”.
4. Section 024119 "Selective Demolition" for partial demolition of buildings, structures, and site improvements.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to the District ready for reuse. Include fasteners or brackets needed for reattachment elsewhere.

1.4 MATERIALS DISPOSITION

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items

of interest or value to the District that may be uncovered during demolition remain the property of the District.

1. Carefully salvage in a manner to prevent damage and promptly return to the District.

1.5 PRE-INSTALLATION MEETINGS

A. Pre-demolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be demolished.
2. Review structural load limitations of existing structures.
3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review and finalize protection requirements.
5. Review procedures for noise control and dust control.
6. Review procedures for protection of adjacent buildings.
7. Review items to be salvaged and returned to the District.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Engineering Survey: Submit engineering survey of condition of building.

C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

1. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings to remain including means of egress from those buildings.

D. Schedule of Building Demolition Activities: Indicate the following:

1. Detailed sequence of demolition work, with starting and ending dates for each activity.
2. Temporary interruption of utility services.
3. Shutoff and capping or re-routing of utility services.

E. Pre-demolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by demolition operations. Comply with Section 1.32 of Supplement to General Provisions “Audio Visual Documentation of Project Site”. Submit before the Work begins.

F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.8 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

1.9 FIELD CONDITIONS

A. Building(s) to be demolished will be vacated and their use discontinued before start of the Work.

B. Building(s) immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.

1. Do not affect operations of adjacent occupied buildings. Coordinate with DCM for planned shutdowns.
2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.

a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.

C. Conditions existing at time of inspection for bidding purpose will be maintained by the District as far as practical.

D. [Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify the DCM.

E. On-site storage or sale of removed items or materials is not permitted.

1.10 COORDINATION

A. Arrange demolition schedule so as not to interfere with The District's on-site operations or operations of adjacent occupied buildings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI / ASSE A10.6 and NFPA 241.

2.2 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in the Greenbook.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting demolition operations.

B. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.

C. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations. Comply with Section 1.32 of Supplement to General Provisions, “Audio Visual Documentation of Project Site”.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

B. Salvaged Items: Comply with the following:

1. Clean salvaged items of dirt and demolition debris.
2. Pack or crate items after cleaning. Identify contents of containers.

3. Store items in a secure area until delivery to the District.
4. Transport items to storage area designated by the District.
5. Protect items from damage during transport and storage.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Utilities to be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.

1. Arrange to shut off utilities with utility companies.
2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
3. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
4. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.4 PROTECTION

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.

B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of demolition.

C. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations.

1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by the District and authorities having jurisdiction.
2. Provide temporary services during interruptions to existing utilities, as acceptable to the District and authorities having jurisdiction.

a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.

D. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 015000 "Temporary Facilities and Controls."

1. Protect adjacent buildings and facilities from damage due to demolition activities.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.

E. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.5 DEMOLITION, GENERAL

A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
2. Maintain fire watch during and for at least one hour after flame-cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from the District and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

C. Explosives: Use of explosives is not permitted.

3.6 DEMOLITION BY MECHANICAL MEANS

A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.

C. Below-Grade Construction: Demolish foundation walls and other below-grade construction.

1. Remove below-grade construction, including basements, foundation walls, and footings, completely.

D. Existing Utilities: Abandon existing utilities and below-grade utility structures. Cut utilities flush with grade.

E. Existing Utilities: Demolish existing utilities and below-grade utility structures that are within 5 feet outside footprint indicated for new construction. Abandon utilities outside this area.

1. Fill abandoned utility structures with satisfactory soil materials according to backfill requirements in the Greenbook.

F. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.

3.7 SITE RESTORATION

A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.

B. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in the Greenbook.

C. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.8 REPAIRS

A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.9 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Do not burn demolished materials.

3.10 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

1. Clean roadways of debris caused by debris transport.

END OF SECTION 024116

SECTION 024119

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises, District-occupancy requirements, and phasing requirements.
2. Section 013203 "Construction Progress Documentation".
3. Section 017419 “Construction Waste Management and Disposal”.
4. Section 017300 "Execution" for cutting and patching procedures.

1.3 ALLOWANCES

A. Not Used.

1.4 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

C. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.5 MATERIALS DISTRICTSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to the District that may be uncovered during demolition remain the property of the District.

1. Carefully salvage in a manner to prevent damage and promptly return to the District.

1.6 PRE-INSTALLATION MEETINGS

A. Pre-demolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Engineering Survey: Submit engineering survey of condition of building.

C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and for noise control. Indicate proposed locations and construction of barriers.

D. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure District's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of District's continuing occupancy of portions of existing building and of District's partial occupancy of completed Work.
6. Locations of proposed dust and noise control temporary partitions and means of egress.
7. Means of protection for items to remain and items in path of waste removal from building.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

F. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.8 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.9 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.10 FIELD CONDITIONS

A. The District will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so the District's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by the District as far as practical.

C. Notify the Construction Manager of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Storage or sale of removed items or materials on-site is not permitted.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.11 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.12 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with the District’s operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI / ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by the District. The District does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

D. Survey of Existing Conditions: Record existing conditions by use of measured drawings, preconstruction photographs or video.

1. Comply with requirements specified in Section 013223 "Preconstruction Photographic Documentation."
2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

E. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Construction Manager.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off utilities with utility companies.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to the District.
f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

4. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

    a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling.

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch and portable fire-suppression devices during and for at least two hours after flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to the District.
4. Transport items to the District's storage area designated by District.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Construction Manager, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI (Resilient Floor Covering Institute).

F. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Section 075113 for new roofing requirements.

1. Remove existing roof membrane, flashings, copings, and roof accessories.
2. Remove existing roofing system down to substrate.

G. Air-Conditioning Equipment: Remove equipment without releasing refrigerants. Cap all ducts to remain, if new equipment is not immediately installed.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

3.8 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.9 SELECTIVE DEMOLITION SCHEDULE

A. Remove all items indicated on plans.

B. Remove and Salvage: To be coordinated with the District.

C. Remove and Reinstall all items indicated on plans.

D. Existing to Remain: As indicated on the plans.

E. Dismantle: As indicated on the plans.

END OF SECTION 024119

SECTION 030130

MAINTENANCE OF CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Surface preparation of existing concrete slabs indicated to receive new floor finishes.
2. Miscellaneous patching and repair.
3. Treatment of existing joints.
4. Treatment of existing stable cracks.
5. Moisture vapor control.

B. Specified Elsewhere:

1. Section 024119 – Selective Building Demolition, for demolition of areas of existing slabs.
2. Section 033000 – Cast-in-Place Concrete for new concrete work.
3. Division 09 Sections for interior floor finishes specifying miscellaneous leveling and patching compound.

1.2 REFERENCES

A. International Concrete Repair Institute, Technical Guideline No. 03732, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.

1.3 SYSTEM DESCRIPTION

A. General Performance Requirements: Provide work required to produce sound, clean and suitably roughened surfaces on existing concrete slab substrates, including removal of unsound concrete and bond-inhibiting films, verification of concrete strength, opening of pore structure, and establishing profiles suitable to receive new finishes.

1. Provide surface preparation of existing concrete slabs, miscellaneous patching and repair of deteriorated areas, treatment of existing joints, and treatment of existing stable cracks as required to accommodate new floor finishes indicated.
2. Containment and Safe Disposal: Take measures and use proper equipment to ensure controlled containment and safe disposal of concrete dust and other hazardous effects generated during operations.
3. Determine Substrate Conditions: Determine condition of existing slab, including surface porosity throughout; identify deteriorated areas requiring repair; locations, types and condition of joints; and locations and conditions of existing cracks.
4. Verify Material Requirements: Determine properties and application requirements of finishes indicated.

5. Methods: Select methods that optimize work results, make surfaces suitable for new finishes indicated, and do not damage or weaken the existing concrete, cause micro-cracking, nor expose or loosen reinforcing.

1.4 SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, chemical composition, physical properties, test data, and mixing, preparation, and application instructions.

B. Qualification Data: For installers.

C. Field quality-control reports.

D. Concrete Treatment Plan: Submit before work begins. Prepare a written plan for treatment of cast-in-place concrete, including each phase or process, protection of surrounding materials during operations, and control of debris and runoff during the Work. Describe in detail materials, methods, equipment, and sequence of operations to be used for each phase of the Work.

1.5 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

B. Manufacturer Qualifications: Each manufacturer shall employ factory-trained technical representatives who are available for consultation and Project-site inspection and assistance at no additional cost.

C. Installer Qualifications: A firm or individual experienced in performing work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance

1. An entity that employs installers and supervisors who are trained and approved by manufacturer to install products specified.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.

B. Store cementitious materials off the ground, under cover, and in a dry location.

C. Store aggregates covered and in a dry location; maintain grading and other required characteristics and prevent contamination.

1.7 FIELD CONDITIONS

A. Environmental Limitations for Epoxies and Other Products: Do not apply when air and substrate temperatures are outside limits permitted by manufacturer. During hot weather, cool epoxy components before mixing, store mixed products in shade, and cool unused mixed products to retard setting. Do not apply to wet substrates unless approved by manufacturer.

PART 2 PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations: Obtain each color, grade, finish, type, and variety of product from single source with resources to provide products of consistent quality in appearance and physical properties.

B. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

2.2 BONDING AGENTS

A. Bonding Agents, General: Only use bonding agents recommended by manufacturer for applications indicated.

B. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Manufactured product that consists of water-insensitive epoxy adhesive, portland cement, and water-based solution of corrosion-inhibiting chemicals that forms a protective film on steel reinforcement.

1. Acceptable Products: One of the following:
   a. BASF Construction Chemicals - Building Systems; Emaco P24.
   b. Euclid Chemical Company (The), an RPM company; Duralprep A.C.
   c. Sika Corporation, Construction Product Division; Armatec 110 EpoCem.
   d. Comparable product selected by Contractor, complying with specified requirements.

C. Epoxy Bonding Agent: ASTM C 881/C 881M, Type II, and free of VOCs.

1. Acceptable Manufacturers: One of the following:
   a. BASF Construction Chemicals - Building Systems.
   b. Dayton Superior Corporation.
   c. Euclid Chemical Company (The); an RPM company.
   d. Sika Corporation; Construction Product Division.
   e. W. R. Meadows, Inc.
   f. Comparable manufacturer selected by Contractor, complying with specified requirements.

D. Latex Bonding Agent: ASTM C 1059/C 1059M, Type I.

1. Acceptable Products: One of the following:

a. Dayton Superior Corporation; Superior Concrete Bonder (J-41); Conspec Weldtite, or Edoco PVA Bonding Agent.
b. Euclid Chemical Company (The), an RPM company; Euco Weld, or Tammsweld.
c. W. R. Meadows, Inc.; Intralok.
d. Comparable product selected by Contractor, complying with specified requirements.

2.3 PATCHING MORTAR

A. Patching Mortar, General: Only use patching mortars recommended by manufacturer for applications indicated.

B. Cementitious Patching Mortar: Packaged, dry mix for repair of concrete.

1. Acceptable Manufacturers: One of the following:
   a. BASF Construction Chemicals - Building Systems.
   b. Dayton Superior Corporation.
   c. Euclid Chemical Company (The); an RPM company.
   d. Fox Industries, Inc.
   e. Sika Corporation; Construction Product Division.
   f. Sto Corp.; Concrete Restoration Division.
   g. W. R. Meadows, Inc.
   h. Comparable manufacturer selected by Contractor, complying with specified requirements.
2. Compressive Strength: Not less than 4000 psi (27.6 MPa) at 28 days when tested according to ASTM C 109/C 109M.

C. Polymer-Modified, Cementitious Patching Mortar: Packaged, dry mix for repair of concrete and that contains a latex additive as either a dry powder or a separate liquid that is added during mixing.

1. Acceptable Manufacturers: One of the following:
   a. BASF Construction Chemicals - Building Systems.
   b. Dayton Superior Corporation.
   c. Euclid Chemical Company (The); an RPM company.
   d. Fox Industries, Inc.
   e. Sika Corporation; Construction Product Division.
   f. W. R. Meadows, Inc.
   g. Comparable manufacturer selected by Contractor, complying with specified requirements.
2. Compressive Strength: Not less than 4000 psi (27.6 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.4 JOINT FILLER

A. Joint Filler, General: Only use joint fillers recommended by manufacturer for applications indicated.

B. Epoxy Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A Shore durometer hardness of at least 80 according to ASTM D 2240.

1. Acceptable Manufacturers: One of the following:
    a. BASF Construction Chemicals - Building Systems; Masterfill 300i.
    b. Dayton Superior Corporation; PoxyFil (J-52).
    c. Euclid Chemical Company (The), an RPM company; Euco 700 or 800.
    d. Metzger/McGuire; MM-80 or Edge-Pro XL.
    e. Sika Corporation, Construction Product Division; Sikadur 51 NS or Sikadur 51 SL.
    f. W. R. Meadows, Inc.; Sealtight Rezi-Weld Flex.
    g. Comparable manufacturer selected by Contractor, complying with specified requirements.

C. Polyurea Joint Filler: Two-component, semirigid, 100 percent solids, polyurea resin with a Type A Shore durometer hardness of at least 80 according to ASTM D 2240.

1. Acceptable Manufacturers: One of the following:
    a. BASF Construction Chemicals - Building Systems; Masterfill 400 CT or TF-100.
    b. Dayton Superior Corporation; Joint Fill.
    c. Euclid Chemical Company (The), an RPM company; Euco Qwikjoint 200.
    d. Metzger/McGuire; Spal-Pro RS 88 or Spal-Pro 2000.
    e. Comparable manufacturer selected by Contractor, complying with specified requirements.

D. Color: As selected by Architect from full range of industry colors.

2.5 EPOXY CRACK-INJECTION MATERIALS

A. Epoxy Crack Injection Products, General: Only use products recommended by manufacturer for applications indicated.

B. Epoxy Crack-Injection Adhesive: ASTM C 881/C 881M, Type I, free of VOCs.

1. Acceptable Manufacturers: One of the following:
    a. BASF Construction Chemicals - Building Systems; Masterfill 400 CT or TF-100.
    b. Dayton Superior Corporation; Joint Fill.
    c. Euclid Chemical Company (The), an RPM company; Euco Qwikjoint 200.
    d. Sika Corporation; Construction Product Division.
    e. W. R. Meadows, Inc.
    f. Comparable manufacturer selected by Contractor, complying with specified requirements.
2. Capping Adhesive: Product manufactured for use with crack injection adhesive by same manufacturer.
3. Color: Color that will blend with existing, adjacent concrete and will not stain concrete surface.

2.6 MOISTURE VAPOR CONTROL

A. Liquid-Applied, Penetrating Moisture Vapor Control: Two-part, 100 percent solids, reactive epoxy moisture barrier formulation that penetrates into concrete substrates and produces a hard surface, and designed to reduce moisture vapor transmission rates from a maximum of 20 lb to below 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours when tested according to ASTM F 1869.

1. Acceptable Products: One of the following:
   a. Mapei, Planiseal.
   b. Ardex, MC Plus.
   c. HB Fuller TEC, Liquidam.

2.7 MIXES

A. General: Mix products, in clean containers, according to manufacturer's written instructions.

   1. Do not add water, thinners, or additives unless recommended by manufacturer.
   2. When practical, use manufacturer's premeasured packages to ensure that materials are mixed in proper proportions. When premeasured packages are not used, measure ingredients using graduated measuring containers; do not estimate quantities or use shovel or trowel as unit of measure.
   3. Do not mix more materials than can be used within time limits recommended by manufacturer. Discard materials that have begun to set.

PART 3 EXECUTION

3.1 EXAMINATION

A. Notify Architect seven days in advance of dates when areas of deteriorated or delaminated concrete and deteriorated reinforcing bars will be located.

B. Locate areas of deteriorated or delaminated concrete using hammer or chain-drag sounding and mark boundaries. Mark areas for removal by simplifying and squaring off boundaries. At columns and walls make boundaries level and plumb unless otherwise indicated.

C. Pachometer Testing: Locate at least three reinforcing bars using a pachometer, and drill test holes to determine depth of cover. Calibrate pachometer using depth of cover measurements, and verify depth of cover in removal areas using pachometer.

D. Perform surveys as the Work progresses to detect hazards resulting from concrete-maintenance work.

3.2 SUBSTRATE PREPARATION

A. Ensure that supervisory personnel are on-site and on duty when concrete maintenance work begins and during its progress.

B. Preparation for Removal of Deteriorated Concrete: Examine construction to be repaired to determine best methods to safely and effectively perform concrete maintenance work. Examine adjacent work to determine what protective measures will be necessary. Make explorations, probes, and inquiries as necessary to determine condition of construction to be removed in the course of repair.

   1. Verify that affected utilities have been disconnected and capped.

2. Inventory and record the condition of items to be removed for reinstallation or salvage.
3. Provide and maintain shoring, bracing, and temporary structural supports as required to preserve stability and prevent unexpected or uncontrolled movement, settlement, or collapse of construction being demolished and construction and finishes to remain.

C. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm resulting from concrete maintenance work.

1. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.
2. Use only proven protection methods appropriate to each area and surface being protected.
3. Provide barricades, barriers, and temporary directional signage to exclude public from areas where concrete maintenance work is being performed.
4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of concrete maintenance work.
5. Contain dust and debris generated by concrete maintenance work and prevent it from reaching the public or adjacent surfaces.
6. Protect floors and other surfaces along haul routes from damage, wear, and staining.
7. Provide supplemental sound-control treatment to isolate removal and dismantling work from other areas of the building.
8. Protect adjacent surfaces and equipment by covering them with heavy polyethylene film and waterproof masking tape or a liquid strippable masking agent. If practical, remove items, store, and reinstall after potentially damaging operations are complete.
9. Neutralize and collect alkaline and acid wastes for disposal off District's property.
10. Dispose of debris and runoff from operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

D. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is in working order.

1. Prevent solids such as aggregate or mortar residue from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from concrete maintenance work.
2. Protect drains from pollutants. Block drains or filter out sediments; allow only clean water to pass.

E. Concrete Removal:

1. Remove deteriorated and delaminated concrete by breaking up and dislodging from reinforcement.
2. Saw-cut perimeter of areas indicated for removal to a depth of at least 1/2 inch (13 mm). Make cuts perpendicular to concrete surfaces and no deeper than cover on reinforcement.
3. Remove additional concrete if necessary to provide a depth of removal of at least 1/2 inch (13 mm) over entire removal area.

4. Where half or more of the perimeter of reinforcing bar is exposed, bond between reinforcing bar and surrounding concrete is broken, or reinforcing bar is corroded, remove concrete from entire perimeter of bar and to provide at least a 3/4-inch (19-mm) clearance around bar.
5. Test areas where concrete has been removed by tapping with hammer, and remove additional concrete until unsound and disbonded concrete is completely removed.
6. Provide surfaces with a fractured profile of at least 1/8 inch (3 mm) that are approximately perpendicular or parallel to original concrete surfaces. At columns and walls, make top and bottom surfaces level unless otherwise directed.
7. Thoroughly clean removal areas of loose concrete, dust, and debris.

F. Reinforcing-Bar Preparation: Remove loose and flaking rust from reinforcing bars abrasive blast cleaning, needle scaling, or wire brushing until only tightly adhered light rust remains.

G. Preparation of Floor Joints for Repair: Saw-cut joints full width to edges and depth of spalls, but not less than 3/4 inch (19 mm) deep. Clean out debris and loose concrete; vacuum or blow clear with compressed air.

H. Surface Preparation for New Flooring:

1. Remove delaminated material and deteriorated concrete surface material.
2. Roughen surface of concrete to produce surface profile matching CSP 2 according to ICRI 03732.
3. Sweep and vacuum roughened surface to remove debris. Use additional methods required to prepare substrates suitable for new flooring.

3.3 MISCELLANEOUS PATCHING AND REPAIR

A. General: Comply with manufacturer's written instructions and recommendations for application of products, including surface preparation.

B. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Apply to reinforcing bars and concrete by stiff brush or hopper spray according to manufacturer's written instructions. Apply to reinforcing bars in two coats, allowing first coat to dry two to three hours before applying second coat. Allow to dry before placing patching mortar or concrete.

C. Epoxy Bonding Agent: Apply to reinforcing bars and concrete by brush, roller, or spray according to manufacturer's written instructions, leaving no pinholes or other uncoated areas. Place patching mortar or concrete while epoxy is still tacky. If epoxy dries, recoat before placing patching mortar or concrete.

D. Latex Bonding Agent, Type I: Apply to concrete by brush roller or spray. Allow to dry before placing patching mortar or concrete.

E. Placing Patching Mortar: Place as follows unless otherwise recommended in writing by manufacturer:

1. Apply in thin layers to minimize the effects of shrinkage during curing.
2. Provide forms where necessary to confine patch to required shape.

3. Wet substrate and forms thoroughly and then remove standing water.
4. Pretreatment: Apply specified bonding agent.
5. General Placement: Place patching mortar by troweling toward edges of patch to force intimate contact with edge surfaces. For large patches, fill edges first and then work toward center, always troweling toward edges of patch. At fully exposed reinforcing bars, force patching mortar to fill space behind bars by compacting with trowel from sides of bars.
6. Finishing: Allow surfaces of lifts that are to remain exposed to become firm and then finish to a surface matching adjacent concrete.
7. Curing: Wet-cure cementitious patching materials, including polymer-modified cementitious patching materials, for not less than seven days by water-fog spray or water-saturated absorptive cover.

3.4 TREATMENT OF EXISTING JOINTS

A. Floor-Joint Repair: Cut out deteriorated concrete and reconstruct sides of joint with patching mortar. Install joint filler in nonmoving floor joints where indicated and as follows:

1. Depth: Install joint filler to a depth of at least 3/4 inch (19 mm) for supported fillers; 2 inches (50 mm)] for unsupported fillers. Use fine silica sand no more than 1/4 inch (6 mm) deep to close base of joint. Do not use sealant backer rods or compressible fillers below joint filler.
2. Top Surface: Install joint filler so that when cured, it is flush at top surface of adjacent concrete. If necessary, overfill joint and remove excess when filler has cured.

3.5 TREATMENT OF EXISTING STABLE CRACKS

A. Epoxy Crack Injection:

1. Clean areas to receive capping adhesive of oil, dirt, and other substances that would interfere with bond, and clean cracks with oil-free compressed air or low-pressure water to remove loose particles.
2. Place injection ports as recommended by epoxy manufacturer, spacing no farther apart than thickness of member being injected. Seal injection ports in place with capping adhesive.
3. Seal cracks at exposed surfaces with a ribbon of capping adhesive at least 1/4 inch (6 mm) thick by 1 inch (25 mm) wider than crack.
4. Inject cracks wider than 0.003 inch (0.075 mm) to a depth of 8 inches (200 mm).
5. Inject epoxy adhesive, beginning at widest part of crack and working toward narrower parts. Inject adhesive into ports to refusal, capping adjacent ports when they extrude epoxy. Cap injected ports and inject through adjacent ports until crack is filled.
6. After epoxy adhesive has set, remove injection ports and grind surfaces smooth.

3.6 MOISTURE VAPOR CONTROL INSTALLATION

A. General: Comply with manufacturer's written application instructions.

B. Where mechanical surface preparation is required by moisture vapor control product manufacturer, prepare surfaces using mechanical methods specified in this Section.

C. Perform moisture testing as required to complete the application of products, including anhydrous calcium chloride test, ASTM F 1869, and relative humidity test using in situ probes.

D. Apply products in locations indicated and as required to accommodate resilient flooring, carpet tile, and and other adhered flooring materials indicated for this Project that requires a maximum vapor transmission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.

   1. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.

END OF SECTION 030130

SECTION 031000

CONCRETE FORMWORK

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Supply and installation or formwork required for cast-in-place concrete as indicated.

1.2 RELATED SECTIONS

A. Section 014000: Quality Requirements

B. Section 032000: Concrete Reinforcement.

C. Section 033000: Cast-In-Place Concrete.

D. Section 033010: Concrete Floors

1.3 QUALITY ASSURANCE

A. General: Conform to ACI 347 Chapter 1: Design and Chapter 3: Materials for Formwork.

B. Plywood: Conform to tables for form design and strength in APA Form V 345.

C. Except as otherwise specified herein, work of this Section shall be in accordance with Title 24, Party 2, Chapter 19A, “Concrete”, California Code of Regulations.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials shall be new except for reusable joist forms. Materials may be reused during progress of work, provided they are completely cleaned and reconditioned, recoated for each reuse, capable of producing formwork of required quality and are structurally sound.

2.2 MATERIALS

A. Footings, Foundations, Ramps, Landings, Steps and Floor Slabs: Douglas fir “Standard or Better” boards, wood or steel stakes.

B. Studs, Wales, Shoring, Bracing, Centering: “Standard” grade or “Better”, Douglas fir, adequate designed size, not less than 2x4.

C. Wall Forms: Wall forms shall be ¾" minimum, Douglas fir plywood, Grade B-B, Class I or II, Exterior, sanded both sides conforming to U.S. Product Standard 1-83. Plywood shall be edge-sealed and oiled both sides with colorless form oil.

D. Forms For Square or Rectangular Columns and Beam and Girder Bottoms: 2" thick Douglas fir planks or joists, S1S2E. Beam and girder sides may be constructed of plywood. Column forms shall be made with tight joints and shall be securely clamped together with steel clamps. Beam and girder sides shall be secured to prevent spreading.

E. Forms For Round Columns: Standard steel or fiber column forms. If columns are to be exposed, use seamless fiber tubes.

F. Concrete Joist Form: Adjustable type steel pans CRSI standard design or masonite "pres-pan" system.

G. Exposed Concrete Moldings and Ornamental Surfaces: Reverse molded soft pine mould properly placed and secured in forms. Molded surfaces shall be dressed to true, smooth surfaces and oiled. Projecting wood molds shall be constructed to allow proper removal, to avoid fracture of section.

H. Form Oil: Form oil shall be non-staining type, appropriate for use with forms specified and not detrimental to finished concrete surface or applied finish materials.

I. Chamfer Strips: Type CST ¾" diagonal face, PVC strips.

J. Ties: Carbon steel tie-rods with a breakback depth of 1", and a maximum cone diameter of 1-1/4", or approved equal.

K. Metal Construction Joints: "Keyed-Kold", by Burke Concrete Accessories or approved equal.

PART 3 – EXECUTION

3.1 GENERAL

A. Forms shall be constructed so as to form final concrete structure which conforms to shape, lines and dimensions of members required by Drawings and Specifications, and shall be substantial and sufficiently tight to prevent leakage of mortar. They shall be properly braced or tied together to maintain position and shape. Forms and their supports shall be designed so that previously placed structures will not be damaged. Forms shall be true to line within 1/250 of the span.

3.2 ERECTION

A. Plywood shall be laid out with horizontal joints level, vertical joints plumb and with all joints tight. Back all joints by studs or solid blocking, and fill where necessary for

smoothness. Reused plywood shall be thoroughly damaged edges or surfaces repaired and both sides and edges oiled with colorless form oil. Nail plywood along edges, and to intermediate supports, with common wire nails spaced as necessary to maintain alignment and prevent warping.

B. Openings For Cleaning: Provide temporary openings at all points in formwork deemed necessary by the District Inspector to facilitate cleaning and inspection. At base of walls and wide piers, bottom form board on one face for entire length shall be omitted until form has been cleaned, inspected and approved. Do not install board until after approval.

3.3 REMOVAL OF FORMS

A. Forms shall not be removed until concrete has hardened sufficiently to maintain its integrity and not be damaged by form removal operations. Columns and walls shall not be stripped in less than 5 days, floor slabs in less than 7 days, beams and girders in less than 15 days. Metal pan forms for joists may be removed after 3 days, but joist centering shall not be removed until after 15 days. Ramp, landing, steps and floor slab& shall not be stripped in teas than 7 days. Shoring shall not be removed until member has acquired sufficient strength to support its weight, load upon it, and added load of construction.

B. Compressive strength of in-place concrete shall be determined by testing field-cured specimens representative of concrete location or members, as specified in Section 03300: Cast-In-Place Concrete.

END OF SECTION 031000

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 032000

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Supply and install concrete steel reinforcement as indicated.

1.2 RELATED SECTIONS

A. Section 014000: Quality Requirements

B. Section 031000: Concrete Formwork.

C. Section 033000: Cast-In-Place Concrete.

D. Section 033010: Concrete Floors

1.3 SUBMITTALS

A. Submit in accordance with Section 013000: Collaboration Software

B. Shop Drawings: Submit steel reinforcement shop drawings in accordance with ACI 315. Include assembly diagrams, bending charts and slab plans. Show length and location of splices, and size and length of reinforcing steel.

1.4 QUALITY ASSURANCE

A. All materials for the work under this Section shall comply with the following standards:

1. American Society for Testing and Materials (ASTM).
2. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice.
3. American Welding Society (AWS).
4. American Concrete Institute (ACI).
5. Uniform Building Code, Chapter 19, “Concrete”, 1994 edition.
6. Fabrication and placement of reinforcing shall be in accordance with requirements of Title 24, Part 2, Chapter 19A, California Code of Regulations.

B. For testing and inspection requirements, see Section 01405: Testing and Inspection.

1.5 PRODUCT HANDLING

A. Reinforcing steel bars, wire, and wire fabric shall be stored on site to permit easy

access for proper examination and identification of each shipment. Material of each shipment shall be separated for size and shape in a manner approved by the District Inspector.

B. Protect reinforcing from excessive rusting or coating with grease, oil, dirt or other objectionable materials.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide reinforcing of sizes, gages and lengths indicated, bent to indicated shapes.

2.2 MATERIALS

A. Steel Reinforcing Bars: ASTM A615, or ASTM A706 deformed or smooth as indicated, grade 60 billet steel unless otherwise specified or indicated.

B. Bars or Rod Mats: ASTM A184.

C. Steel Wire For Concrete: ASTM A82 (smooth).

D. Wire Fabric For Reinforcement: ASTM A185.

E. Tie Wire: Fully annealed, copper-bearing steel wire, #16 gage minimum.

F. Chairs, Spacers, Supports and Other Accessories: Standard manufacture conforming to ACI-315 “Manual of Standard Practice,” made from steel wire of approved types and sizes. For reinforcement supported from grade, use properly sized dense precast blocks or concrete.

PART 3- EXECUTION

3.1 INSTALLATION

A. Bars shall be bent cold. Bars partially embedded in concrete shall not be field bent except as indicated on approved shop drawings. Before placing, clean reinforcing of loose scale, rust, oil, dirt and any coating that would destroy or reduce bond.

B. Accurately position and secure reinforcing in place as indicated and specified. Secure reinforcing so that it will not be displaced while placing concrete.

C. Use metal chairs to hold reinforcement the proper distance above form bottoms. In beams and slab construction, use chairs under top slab reinforcement as well as under bottom reinforcement. Space chairs so that reinforcement will not be displaced under a person’s weight. Use metal spacers to secure proper spacing. Stirrups shall be accurately and securely wired to bars at both top and bottom. At

slabs, footings, and beams in contact with earth, use concrete blocks to supports reinforcement at proper distance above earth.

D. Place and secure reinforcement to maintain proper clearance between parallel bars, and between bars and forms. Lapped splices shall be made wherever possible in a manner to provide proper clearance between sets of bars. Lapped splices shall in general be staggered. Dowels and bars extending through construction joints shall be secured in position against displacement before concrete is placed, and shall be cleaned of concrete adhering thereto immediately after completion of pour while concrete encrustations are still soft.

E. Do not place reinforcing in supported slabs and beams until walls and columns have been poured to underside of slabs and beams, nor until construction joints have been thoroughly cleaned.

F. Reinforcing shall be checked before concrete is place and cleaned again if required.

G. Use deformed bars everywhere except for spiral reinforcement and where Drawings or Specifications specifically call for plain or smooth reinforcement to be used.

END OF SECTION 032000

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 033000

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

2.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

2.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.

B. Related Sections include the following:

1. Section 321313 "Cement Concrete Pavement" for concrete pavement and walks.
2. Section 033010 "Concrete Floors" for concrete floor slabs on grade.

2.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

2.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Material Certificates: Signed by manufacturers certifying that each of the following items complies with ASTM requirements:

1. Cementitious materials and aggregates.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.

F. Concrete delivery tickets.

2.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

B. Regulatory Requirements: Concrete construction shall conform to the C California Building Code, Chapters 16, 17, 18, and 19, and the requirements specified herein.

C. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

D. ACI Publications: Comply with the following, unless more stringent provisions are indicated:

1. ACI 301, "Specification for Structural Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

2.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

3.1. FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. High-density overlay, Class 1, or better.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced

plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, unless otherwise shown.

E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of the exposed concrete surface.
2. Furnish ties that, when removed, will leave holes not larger than 1 inch in diameter in concrete surface.

3.2. STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed; ASTM A 706, Grade 60, deformed where bars are to be welded.

B. Plain-Steel Wire: ASTM A 82, as drawn.

C. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

3.3. REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.

3.4. CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type II.

1. Fly Ash: ASTM C 618, Class N or F.

B. Normal-Weight Aggregate: ASTM C 33, uniformly graded.

1. Fine Aggregate: Minimum sand equivalent (ASTM D2410) is 80.
2. Coarse Aggregate: Minimum cleanness value (Caltrans Test cv 227) is 80.
3. Do not use aggregates containing spalling-causing deleterious substances.

C. Lightweight Aggregate: ASTM C 330.

1. Use expanded shale only.

D. Water: Potable and complying with ASTM C 94.

3.5. ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

B. Air-Entraining Admixture: ASTM C 260.

C. Water-Reducing Admixture: ASTM C 494, Type A.

D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

3.6. WATERSTOPS

A. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
1. Profile: Flat, dumbbell without center bulb.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. PVC Waterstops:

a. Greenstreak.
b. Meadows: W. R. Meadows, Inc.
c. Vinylex Corporation.

C. Self-Expanding Strip Waterstops: Manufactured rectangular or trapezoidal strip, sodium bentonite or other hydrophylic material for adhesive bonding to concrete.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Volclay Waterstop-RX; Colloid Environmental Technologies Co.
b. Conseal CS-231; Concrete Sealants Inc.
c. Hydrotite; Greenstreak.
d. Mirastop; Mirafi Moisture Protection, Div. of Royal Ten Cate (USA), Inc.

3.7. CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

3.8. RELATED MATERIALS

A. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

B. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

C. Reglets: Fabricate reglets of not less than 0.0217-inch- thick galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

D. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

3.9. REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according

to ASTM C 109/C 109M.

3.10. CONCRETE MIXES

A. Mix designs shall be subject to approval by the Project Testing Laboratory of record. Contractor shall employ a testing laboratory to design mixes under the supervision of a California Registered Civil Engineer, who shall determine mix proportions to fulfill the specified requirements for strength, aggregate size, and workability. Mix designs shall bear the signature and seal of a California Registered Civil Engineer.

1. Design mixes in accordance with ACI 318 and CBC 1905, Method B.
2. Cost for the mix designs will be paid for by the Contractor.

B. Prepare design mixes for each type and strength of concrete determined by laboratory trial mix method, as follows:

1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
2. Proportion lightweight structural concrete according to ACI 211.2 and ACI 301.

C. Normal Weight Concrete: Proportion normal-weight concrete mix as follows:

1. Compressive Strength (28 Days): As indicated on drawings.
2. Maximum Slump: 4 inches.
3. Water-Cementitious Materials Ratio: 0.50 or less.
4. Minimum Cementitious Materials Content: 517 lb/cu. Yd.
5. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with 2- to 4-inch slump.

D. Maximum Size Aggregate: In no case shall the maximum aggregate size used exceed one third of the depth of slabs, nor three fourths of the minimum clear spacing between individual reinforcing bars or bundles of bars.

E. Lightweight Concrete: Proportion lightweight concrete mix as follows:

1. Compressive Strength (28 Days): As indicated on drawings.
2. Calculated Equilibrium Unit Weight: 110 lb/cu. ft. plus or minus 3 lb/cu. ft. as determined by ASTM C 567.
3. Maximum Slump: 5 inches.

F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 15 percent.
2. Combined Fly Ash and Pozzolan: 15 percent.

G. Maximum Size Aggregate: Maximum aggregate size shall not exceed 1-1/2 inch, nor one third of the depth of slabs, nor three fourths of the minimum clear spacing between individual reinforcing bars or bundles of bars.

H. Maximum Water-Cementitious Materials Ratio: 0.62 for exposed exterior concrete.

I. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus 1 or minus 1.5 percent, unless otherwise indicated:

1. Air Content: 3.0 percent for exposed exterior concrete.

J. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

K. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

3.11. FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

3.12. CONCRETE MIXING

A. Concrete shall be provided by certified automatic concrete batch plants only.

B. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

C. Waiver of Batch Plant Inspection: Batch plant inspection may be pursued by the IOR. Concrete plant shall comply with the requirements of UBC Standard 19-3, and be certified to comply with the requirements of the National Ready Mixed Concrete Association. Plant shall be equipped with an automatic batcher in which the total batching cycle, except for the measuring and introduction of an admixture, is completed by activating a single starter device.

PART 3 - EXECUTION

3.1. FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Surfaces exposed to view: Class A, 1/8 inch.
2. Surfaces not exposed to view: Class C, 1/2 inch.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

1. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2. EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor bolts, accurately located, to elevations required.
2. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.3. REMOVING AND REUSING FORMS

A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.

B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place for 14 days or until concrete has achieved the following:

1. At least 75 percent of 28-day design compressive strength.
2. Determine compressive strength of in-place concrete by testing representative field- or laboratory-cured test specimens according to ACI 301.
3. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4. SHORES AND RESHORES

A. Comply with ACI 318, ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or

deflection.

3.5. STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Shop- or field-weld reinforcement according to AWS D1.4 only where indicated or specifically approved.
2. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
3. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6. JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

3.7. WATERSTOPS

A. Flexible Waterstops: Install in construction joints as indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's written instructions.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, bonding or mechanically fastening and firmly pressing into place. Install in longest lengths practicable.

3.8. CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Architect.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

D. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Maximum length of wall pour shall be 60 feet. Place each layer while preceding layer is still plastic, to avoid cold joints. Do not allow concrete free-fall to exceed 10 feet.

1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.

3.9. FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch in height.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.

C. Rubbed Finish: Apply the following to smooth-formed finished concrete:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.10. MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.11. CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or

hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

B. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:

C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3.12. CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and

structural performance as determined by Architect.

D. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

3.13. FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform tests and submit test reports during concrete placement. Sampling and testing for quality control is specified in Division 1 Section “Quality Requirements”.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.
2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Delete unit weight test below if no structural lightweight concrete.

unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.

i. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
ii. Compressive-Strength Tests: ASTM C 39; test one laboratory-cured specimen at 7 days and two at 28 days. Keep one specimen in reserve.

(1).1 A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.

C. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, District inspector, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.

E. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying

with ASTM C 42 or by other methods as directed by Architect.

END OF SECTION 033000

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 033010

CONCRETE FLOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies six inch (6") minimum depth cast-in-place concrete floors on grade.

1. Comply with requirements specified in Division 3 Section "Cast-In-Place Concrete" for formwork and reinforcement.

B. Related Sections include the following:

1. Section 014000: "Quality Requirements" for concrete floor preparation and moisture vapor/alkalinity testing.
2. Section 321313: "Cement Concrete Pavement" for exterior concrete paving and flatwork.
3. Section 033000: "Cast-In-Place Concrete" for general concrete requirements.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and silica fume.

1.4 SUBMITTALS

A. In addition to submittals required in Division 3 Section "Cast-In-Place Concrete", submit the following:

B. Product Data: Submit manufacturers technical literature for the following:

C. Floor and slab treatments.

1. Vapor barriers.
2. Repair materials.

D. Minutes of preinstallation conference.

1. Cement Finisher's ACI certifications or equivalent (only if silica fume concrete is used).
2. Concrete mix design shrinkage test results.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Concrete construction shall conform to the California Building Code, Chapters 16, 17, 18, and 19 and the requirements specified herein.

B. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

C. ACI Publications: Comply with the following, unless more stringent provisions are indicated:

1. ACI 301, "Specification for Structural Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 REINFORCING STEEL

A. Where welded wire fabric is indicated in floors, comply with the following:

1. Deformed-Steel Welded Wire Fabric: ASTM A 497, flat sheet.

2.2 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type II or V, low alkali type, not contain more than 0.6 percent total alkali when calculated as sodium oxide as determined by the method given in ASTM C 114.

B. Fly Ash: ASTM C 618, Class F, except loss on ignition shall not exceed 2 percent..

C. Silica Fume: ASTM C 1240, amorphous silica.

D. Normal-Weight Aggregate: Use ASTM C 227 to determine alkali reactivity of the aggregates as specified therein; the alkali reactivity shall be "innocuous" as determined by ASTM C 289.

1. Fine Aggregate: ASTM C33. Washed clean, uniformly screen graded, and containing not more than 2 percent by weight of deleterious materials such as shale, schist, alkali,

clay lumps, earth, loam, mica or similar materials. Uniformly grade fine aggregate from fine to coarse.

2. Coarse Aggregate: ASTM C33. Clean, hard, crushed rock or washed gravel, free from organic materials or soft or friable materials, containing not more than 2 percent by weight of shale or cherty material and not more than 15 percent by weight of elongated fragments.
3. Maximum Size Aggregate: In no case shall the maximum aggregate size used exceed 1-1/2 inches, nor one third of the depth of slabs, nor three fourths of the minimum clear spacing between individual reinforcing bars or bundles of bars.

E. Lightweight Aggregate: ASTM C 330.

F. Water: Potable and complying with ASTM C 94.

2.3 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride. Water-reducing admixtures may be used provided maximum shrinkage limit specified is maintained.

B. Air-Entraining Admixture: ASTM C 260.

C. Water-Reducing Admixture: ASTM C 494, Type A.

D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

2.4 VAPOR BARRIERS

A. Vapor Barrier: Vapor barrier must meet or exceed the following properties:
   (1) Water-Vapor Permeance Rating: 0.00 grains/ft^2/hr.; ASTM E 94.
   (2) Membrane thickness of 10 mils.
   (3) Class B category per ASTM E 1745.
   (4) Tensile Strength: 45 lbf/in.; ASTM E 154.
   (5) Puncture Resistance: 1900 grams; ASTM E 1745.
   (6) Maximum Perm Deterioration: 0.004 gr./ft^2/hr., ASTM E 154.
   (7) Available Product: Subject to compliance with requirements, products that may be incorporated into the Work includes, but is not limited to, “Premoulded Membrane Vapor Seal” by W. R. Meadows, Inc., Stego Wrap (15 mil) Vapor Barrier by Stego Instrustries LLC, and Vaporguard by Reef Industries.

B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured sand; ASTM D 448, Size 10, with 100 percent passing a No. 4 sieve and 10 to 30 percent passing a No. 100 sieve; meeting deleterious substance limits of ASTM C 33 for fine aggregates.

C. Capillary Barrier: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 4 sieve.

2.5 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

B. Liquid Floor Treatment: Water-dispersed polyurethane polymers solution; odorless; colorless; that will cure to act as a barrier to solvents and moisture.

C. Products: Subject to compliance with requirements, provide one of the following:

1. Liquid Floor Treatment:

a. AAT 1185 Moisture Emission Sealer; Advanced Adhesive Technologies
b. Safecoat Hardseal; AFM Inc.
c. Eucothane VOX; Euclid Chemical Co.

2.6 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Products: Subject to compliance with requirements, provide one of the following:

1. Evaporation Retarder:

a. Spray-Film; ChemMasters.
b. Aquafilm; Conspec Marketing & Manufacturing Co., Inc.
c. Eucobar; Euclid Chemical Co.
d. E-Con; L&M Construction Chemicals, Inc.
e. Confilm; Master Builders, Inc.
f. SikaFilm; Sika Corporation.

2.7 RELATED MATERIALS

A. Isolation Joint Strips: 30 lb. asphalt-saturated felt building paper.

B. Epoxy Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Shore A hardness of 80 per ASTM D 2240.

2.8 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to ¼ inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

2.9 CONCRETE MIXES

A. Mix designs shall be subject to approval by the Project Testing Laboratory of record. Contractor shall employ a testing laboratory to design mixes under the supervision of a California Registered Civil Engineer, who shall determine mix proportions to fulfill the specified requirements for low alkalinity, optimum unit weight, strength, aggregate size, workability, water-cementitious material ratio, permeability and finishability of concrete. Mix designs shall bear the signature and seal of a California Registered Civil Engineer.

1. Design mixes in accordance with ACI 318 and CBC, Sec. 1905, Method B.
2. Cost for the mix designs will be paid for by the Contractor.

B. Prepare design mixes for each type and strength of concrete determined by laboratory trial mix basis, as follows:

1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

C. Floor Slabs: Proportion normal-weight concrete mix as follows:

1. Minimum compressive Strength (28 Days): As indicated on drawings.
2. Minimum Cementitious Materials Content: 611 lb/cu. yd.
3. Maximum Slump: 4 inches. (6 to 9 inches if silica fume is used).
4. Water-Cementitious Material Ratio: 0.40 or less.
5. Shrinkage: 0.05% maximum
6. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with 2- to 4-inch slump.

D. Lightweight Concrete: Proportion lightweight concrete mix as follows:

1. Compressive Strength (28 Days): As indicated on drawings.
2. Calculated Equilibrium Unit Weight: 110 lb/cu. ft. plus or minus 3 lb/cu. ft. as determined by ASTM C 567.
3. Maximum Slump: 5 inches.

E. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 35 percent.
3. Silica Fume or Silica Fume equivalent: 10 percent.
4. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume (or equivalent) not exceeding 10 percent.

F. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus 1 or minus 1 percent, unless otherwise indicated:

1. Air Content: 4.5 percent for 1-1/2-inch- nominal maximum aggregate size.
2. Air Content: 4 percent for 1-inch- nominal maximum aggregate size.
3. Increase specified air content by 2 percent if silica fume is used.

G. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

H. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.

2.10 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1. FORMWORK

A. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

3.2. EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3. VAPOR BARRIERS

A. Vapor Barrier: Place, protect, and repair vapor-barrier sheets according to ASTM E 1643 and manufacturer's written instructions.

1. Install vapor barrier over properly prepared capillary barrier specified in Section 02300.
2. Place and compact a ½-inch thick layer of fine-graded granular material over capillary barrier.
3. Have field representative of vapor barrier manufacturer inspect and approve vapor barrier installation prior to covering.
4. Place concrete slab-on-grade directly on vapor barrier without a granular material base.

3.4. STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor barrier. Repair damage and reseal vapor barrier before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Position temperature and shrinkage reinforcement in slabs on grade in the upper third of the slab thickness, or 2 inches below the slab surface, whichever is closer to the surface.
2. Extend reinforcement to within 2 inches of slab edges.

D. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

1. Fabric shall not be laid on ground and pulled up after concrete has been placed, nor shall the fabric be walked-in after placing concrete.

3.5. JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints of suspended slabs. Stop reinforcement at construction joints in slab-on-grade, install debonded dowels across joint as indicated. Do not continue reinforcement through sides of strip placements of floors and slabs on grade.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to one and one-fourth inch of concrete thickness (one inch minimum), as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
2. Saw-cut joints using early-entry dry-cut process. Waiting period typically varies from 1 hour in hot weather to 4 hours in cold weather after completion of the finishing operation.

D. Isolation Joints in Slabs-on-Grade: Install isolation joint strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

3.6. CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement.

C. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Consolidate concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.

3. Limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.
4. Maintain reinforcement in position on chairs during concrete placement.
5. Screed slab surfaces with a straightedge and strike off to correct elevations.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.7. FINISHING FLOORS AND SLABS

A. General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Silica-Fume Concrete: If silica-fume is used in concrete mix, comply with the following additional requirements:

1. Conduct finishing operations under the direction of an ACI Certified Flatwork Finisher or by personnel trained and experienced with silica-fume concrete finishing techniques.
2. Due to a lack of bleed water, the surface must be kept moist during finishing operations to prevent plastic shrinkage cracking. Keep surface continually moist (but not wet) during finishing operations by use of a pressure-fogger.

C. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes.

1. Apply scratch finish to surfaces indicated and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finishes.

D. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated to receive trowel finish

E. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system
2. Finish surfaces to the following tolerances, measured within 72 hours according to

ASTM E 1155/E 1155M for a randomly trafficked floor surface:

a. Specified overall values of flatness, F(F) 25; and levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and levelness, F(L) 15.
b. Contractor is responsible for testing for surface tolerances.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

G. Slip-Resistive Aggregate Finish: Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:

1. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive aggregate over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
2. After broadcasting and tamping, apply trowel finish.
3. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose slip-resistive aggregate.

3.8. CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Floor Surfaces: Begin curing immediately after finishing concrete. Cure by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than ten days with the following materials:

a. Water.
b. Continuous water-fog spray.
c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not

less than ten days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3.9. LIQUID FLOOR TREATMENTS

A. Liquid Floor Treatment: Prepare, apply, and finish liquid floor treatment according to manufacturer's written instructions.

1. Insure proper ventilation during application of liquid floor treatments.
2. Remove oil, dirt, laitance, and other contaminants and complete surface repairs.
3. Do not apply to concrete that is less than ten days old.
4. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.10. JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least two months. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid epoxy joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.11. CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing

operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least ¾ inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
6. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

3.12. FIELD QUALITY CONTROL

A. Comply with Section 033000 and the following.

B. Calcium Chloride Testing: Testing shall be witnessed by the Project IOR. Contractor shall provide calcium chloride dome testing in accordance with ASTM F1869 or E1907.7.7 to determine the level of water vapor transmitted through the concrete surface at time of testing. Test shall be performed for each 1000 s.f. of slab surface. Test kits shall be placed across the slab surface in a cross-diagonal grid arrangement. Test shall be performed after concrete has cured a minimum of 60 days.

1. If test results indicate a vapor transmission in excess of 5.0 lb. per 24 hours per 1000 sq. ft. of slab surface, the District may have coring and testing performed to evaluate the following:

    a. Evaluation of base and sub-base.
    b. Use of petrographic analysis to evaluate water-cementitious material ratio, and whether sufficient hydration has taken place

2. When test results indicate that specified requirements have not been met, Contractor shall be responsible for the cost of tests.
3. When test results indicate that specified requirements have not been met, Contractor shall be responsible for remedial work required to provide concrete that does not have a vapor transmission in excess of 5.0 lb. per 24 hours per 1000 sq. ft. of slab surface.

END OF SECTION 033010

SECTION 042200

CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes concrete unit masonry assemblies.

1.3 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 SUBMITTALS

A. Product Data: For each different masonry unit, accessory, and other manufactured product specified.

B. Shop Drawings: Show fabrication and installation details for the following:

1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."

C. Samples: For the following:

1. Integrally colored unit masonry samples in small-scale form showing the full range of colors and textures for each different exposed masonry unit required.
2. Colored mortar samples.

D. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:

1. Each type of masonry unit required.
2. Grout mixes complying with compressive strength requirements of ASTM C 476. Include description of type and proportions of grout ingredients.

E. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Each type of masonry unit required.
2. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.

3. Each material and grade indicated for reinforcing bars.

1.5 QUALITY ASSURANCE

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

C. Preconstruction Testing Service: Replace will engage a qualified independent testing agency to perform preconstruction testing as required by CBC Section 2105A.2.2.2. Prism testing shall be shall be carried out during construction per Section 2105A.2.2.2.2.

D. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Section 2104A.3 of the California Building Code.

E. Hot-Weather Requirements: Section 2104A.4 of the California Building Code. Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. General: Provide shapes indicated and as follows:

1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners, unless indicated as bullnose.

B. Concrete Masonry Units: As follows:

1. Unit Strength: Minimum individual unit strength as indicated on drawings.
2. Weight Classification: As indicated on drawings.
3. Size (Width): Manufactured to the following dimensions:
   a. 6 inches nominal; 5-5/8 inches actual.
4. Exposed Faces: Manufacturer's standard color and texture; Match existing adjacent units unless otherwise indicated.
   a. Precision (standard) face.

2.2 MORTAR AND GROUT MATERIALS

A. Mortar: Provide mortar of the type and color specified, and conforming with ASTM C 270.

B. Grout: Unless otherwise required, provide grout that conforms to the requirements of ASTM C 476.

C. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in mortar.

D. Water: Potable and free of dirt.

2.3 REINFORCING STEEL

A. Uncoated Steel Reinforcing Bars: ASTM A 615, Grade 60.

2.4 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

C. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Form units from 0.142-inch steel wire.

1. Provide units with loops as needed for number of bars indicated.

2.5 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium polyphosphate and 1/2-cup dry measure laundry detergent dissolved in 1 gal. of water.

2.6 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Provide minimum 28 day compressive strength as indicated on drawings.
2. Do not use calcium chloride in mortar or grout.

B. Mortar for Unit Masonry: Comply with Articles 2.1 and 2.6A of ACI 530.1/ASCE 6/TMS 602 (Property Specification) and ASTM C 270.

1. Limit cementitious materials in mortar to portland cement and lime.
2. For all reinforced masonry, use Type S mortar.
3. Mortar unused after 1-1/2 hours from initial mix time shall not be used.

C. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required. Limit pigments to the following percentages of cement content by weight:

1. For mineral-oxide pigments and portland cement-lime mortar, not more than 10 percent.
2. For carbon-black pigment and portland cement-lime mortar, not more than 2 percent.

D. Grout for Unit Masonry: Comply with Article 2.2 of ACI 530.1/ASCE 6/TMS 602 and ASTM C476.

1. Use coarse grout in grout spaces 2 inches or more in width and in all filled-cell masonry construction.
2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.
3. Grout shall be transit mixed, and shall not be used if more than 1-1/2 hours have elapsed since water was added.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

C. Continuous inspection of masonry construction shall be provided by the Replace's testing agency. Refer to Section 01 41 00 for testing and inspection requirements.

1. Additional testing is required when full allowable stresses are used in design.

3.2 INSTALLATION, GENERAL

A. Thickness: Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.

D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry where new units abut or are adjacent to existing units.

3.3 CONSTRUCTION TOLERANCES

A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:

B. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.

C. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, nor 1/2 inch maximum.

D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.

E. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.

F. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

1. One-half running bond with vertical joint in each course centered on units in courses above and below, unless otherwise indicated or required to match existing.

C. Lay concealed masonry with all units in a wythe in running bond. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow masonry units as follows:

1. With full mortar coverage on horizontal and vertical face shells.
2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.

3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.

1. For glazed masonry units, use a nonmetallic jointer 3/4 inch or more in width.

C. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.6 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joints in unit masonry where indicated. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

B. Form control joints in concrete masonry as follows:

1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake joints in exposed faces.

3.7 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.

1. Construct formwork to conform to shape, line, and dimensions shown. Make it sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements of Section 2104A.5.1.2 of the California Building Code.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

1. Comply with requirements of Section 2104A.5.1.2 of the California Building Code for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Low-Lift Grouting:

a. Use Low-Lift grouting technique in accordance with Section 2104A.5.1.2.2 of the California Building Code.

b. Construct low-lift masonry by placing reinforcement, laying masonry units and pouring grout as the work progresses.

c. Place vertical reinforcement bars and supports prior to laying of masonry units. Horizontal reinforcement bars may be placed progressively with laying of masonry units.

d. Limit grout pours as required to prevent displacement of masonry by grout pressures (blowout), but do not exceed 24" pour height.

e. Pour grout using container with spout and consolidate immediately by rodding or puddling; do not use trowels. Place grout continuously; do not interrupt pouring of grout for more than one hour. If poured in lifts, place from center-to-center of masonry courses. Terminate pour 1-1/2" below top of highest course in pour.

3. High-Lift Grouting:

a. High-lift grouting technique in accordance with Section 2104A.5.1.2.3 of the California Building Code may be used subject to the approval of the enforcement agency.

b. Place reinforcement and support in proper position, prior to laying of masonry units.

c. Construct high-lift masonry by laying masonry to full height and width prior to placing of grout. Provide cleanout holes in first course of masonry, and use high-pressure water jet stream to remove excess mortar from grout spaces, reinforcement bars and top surface of structural members which support wall. Clean grout spaces daily during construction of masonry.

d. Preparation of Grout Spaces: Prior to grouting, inspect and clean grout spaces. Remove dirt, dust, mortar droppings, loose pieces

of masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper positioning. Clean top surface of structural members supporting masonry to ensure bond. After cleaning and inspection, close cleanout holes with matching masonry units and brace closures to resist grout pressures.

e. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure, but not less than 3 days curing time. Install shores and bracing, if required, before starting grouting operations.

f. Place grout by pumping into grout spaces.

g. Use "Coarse Grout" per ASTM C 476. Rod or vibrate each grout lift during placing and again after excess moisture has been absorbed, but before plasticity is lost. Do not penetrate or damage grout placed in previous lifts or pours.

h. Limit grout pours to sections which can be completed in one working day with not more than one hour interruption of pouring operation. Limit pours so as not to exceed the capacity of masonry to resist displacement or loss of mortar bond due to grout pressures.

i. Where pour height exceeds 4', place grout in a series of lifts not exceeding 4' height. Place each lift as a continuous pouring operation. Allow not less than 30 minutes, or more than one hour between lifts of a given pour.

3.8 FIELD QUALITY CONTROL

A. Replace will engage a qualified independent testing agency to perform field quality-control testing indicated below.

1. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.

B. Testing Frequency: Tests and Evaluations listed in this Article will be performed during construction for each 5000 sq. ft. of wall area or portion thereof.

C. Mortar properties will be made and tested in accordance with ASTM C 780.

D. Grout will be sampled and tested for compressive strength in accordance with ASTM C1019.

E. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.

F. Prism-Test Method: For each type of wall construction indicated, masonry prisms will be tested per Section 2105A.2.2.2 of the California Building Code, and as follows:

1. Conform to Section 2105A.2.2.2.2 of the California Building Code. A set of three masonry prisms shall be built during construction in accordance

with ASTM C1314 for each 5,000 square feet of wall area, but not less than one set of three prisms for the project. Each set of prisms shall equal or exceed f'_m.

3.9 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.

END OF SECTION 042200

SECTION 051200

STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division I Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes structural steel.

B. This Section includes structural steel and architecturally exposed structural steel.

C. Related Work Specified Elsewhere:

1. Steel Deck field installation of shear connectors.
2. Loose steel bearing plates and miscellaneous steel framing.
3. Special Coatings of surface preparation and priming requirements.
4. Painting, surface preparation and priming requirements.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer structural steel connections required by the Contract Documents to be selected or completed by the fabricator to withstand design loadings indicated.

B. Engineering Responsibility: Engage a fabricator who utilizes a qualified professional engineer to prepare calculations, Shop Drawings, and other structural data for structural steel connections.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division I Specification Sections.

B. Product Data for each type of product specified.

C. Shop Drawings detailing fabrication of structural steel components.

1. Include details of cuts, connections, splices, camber, holes and other pertinent data.
2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length and type of each weld.
3. Indicate type, size, and length of bolts, distinguishing between shop and

field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.

4. Include Shop Drawings signed and sealed by a qualified professional engineer responsible for their preparation.

D. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and Districts, and other information specified.

E. Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.

1. Structural steel, including chemical and physical properties.
2. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
3. Direct-tension indicators.
4. Shear stud connectors.
5. Shop primers.
6. Nonshrink grout.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.

1. Fabricator must participate in the LA City Quality Certification Program and be designated a LA City-Certified Plant as follows:
   a. Category: Category I, conventional steel structures.
   b. Category: Category II, complex steel building structures.
   c. Fabricator shall be registered with and approved by authorities having jurisdiction.

C. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Specification for Structural Steel Buildings—Allowable Stress Design and Plastic Design."
2. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
3. AISC's "Specification for Load and Resistance Factor Design of Single-Angle Members."
4. AISC's "Seismic Provisions for Structural Steel Buildings."
5. ASTM A 6 (ASTM A 6M) "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."

6. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
7. Research Council on Structural Connections' (RCSC) "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material, design, and extent.

E. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code-Steel."
1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

F. Mockups: Prior to installing architecturally exposed structural steel, construct mockups for each form of construction and finish required to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.
1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect one week in advance of the dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship of steel surfaces and welded and bolted connections.
    a. Coordinate finish painting requirements of mockups with Division 9 Section "Painting."
4. Obtain Architect's approval of mockups before start of final unit of Work.
5. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
    a. When directed, demolish and remove mockups from Project site.
    b. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division I Section "Project Meetings."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.

2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.7 SEQUENCING

A. Supply anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Steel Shapes, Plates, and Bars: As follows:

1. ASTM A992 Fy=50ksi.
2. High Strength, Low-Alloy Structural Steel: ASTM A 992, Grade 50, corrosion resistant.

B. Plates, Angles, and Channels U.N.O. on the Drawings: ASTM A 36.

C. Cold-Formed Structural Steel Tubing: ASTM A 500, Grade B.

D. Hot Formed Structural Steel Tubing: ASTM A 501.

E. Steel Pipe: ASTM A 53, Type E or S, Grade B.

1. Weight Class: Standard.
2. Finish: Black.

F. Carbon-Steel Castings: ASTM A 27, Grade 65-35 (ASTMA 27M, Grade 450-240), medium strength carbon steel.

G. Shear Connectors: ASTM A 108, Grade 1015 through 1020, headed-stud type, cold-finished carbon steel, AWS D1.1, Type B.

H. Anchor Rods, Bolts, Nuts, and Washers: As follows:

1. Unheaded Rods: ASTM A 36 (ASTM A 36M).
2. Headed Bolts: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); carbon-steel, hex-head bolts; and carbon-steel nuts.
3. Headed Bolts: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.
4. Washers: ASTM A 36 (ASTM A 36M).

I. Nonhigh-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); carbon-steel, hex-head bolts: carbon-steel nuts: and

flat, unhardened steel washers.

1. Finish: Plain, uncoated.

J. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Plain, uncoated.

K. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type I, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers, uncoated.

1. Direct-Tension Indicators: ASTM F 959, Type 490, uncoated.

L. Welding Electrodes: Comply with AWS requirements.

2.2 PRIMER

A. Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer with good resistance to normal atmospheric corrosion, complying with performance requirements of FS TT-P-664.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application, and a 30-minute working time.

2.4 FABRICATION

A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.

1. Camber structural steel members where indicated.
2. Identity high-strength structural steel according to ASTM A 6 (ASTM A 6M) and maintain markings until steel has been erected.
3. Mark and match-mark materials for field assembly.
4. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
5. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
6. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

B. Fabricate architecturally exposed structural steel with exposed surfaces smooth,

square, and free of surface blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness.

1. Remove blemishes by filling, grinding, or by welding and grinding, prior to cleaning, treating, and shop priming.
2. Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for steel Buildings and Bridges" for architecturally exposed structural steel.

C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded.

D. Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.

E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D I.I and manufacturer's printed instructions.

F. Steel Wall Framing: Select true and straight members for fabricating steel wall framing to be attached to structural steel framing. Straighten as required to provide uniform, square, and true members in completed wall framing.

G. Welded Door Frames: Build up welded door frames attached to structural steel framing. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches (250 mm) o.c., unless otherwise indicated.

H. Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on Shop Drawings.

1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.
2. Weld threaded nuts to framing and other specialty items as indicated to receive other work.

2.5 SHOP CONNECTIONS

A. Shop install and tighten non high-strength bolts, except where high-strength bolts are indicated.

B. Shop install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Shop install and tighten high-strength bolts according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1. Bolts: ASTM A 325 (ASTM A 325M) high-strength bolts, unless otherwise indicated.

D. Weld Connections: Comply with A WS Dl.l for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds ½ inch (13mm) and larger. Grind flush butt welds. Dress exposed welds.

2.6 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed-on fireproofing.
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:

1. SSPC-SP 3 "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer1s instructions and at rate recommended by SSPC to provide a dry film thickness of not less than l.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint comers, crevices, bolts, welds, and sharp edges.
2. Apply 2 coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Apply a 1-coat, non asphaltic primer complying with SSPC's "Painting System Guide No. 7.00" to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.7 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel indicated for galvanizing according to ASTM A 123.

2.8 SOURCE QUALITY CONTROL

A. District will engage an independent testing and inspecting agency to perform shop inspections and tests and to prepare test reports.
   1. Testing agency will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirements.
   2. Provide testing agency with access to places where structural steel Work is being fabricated or produced so required inspection and testing can be accomplished.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

D. Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

E. Shop-bolted connections will be tested and inspected according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 35 or A 490 Bolts."

   1. Direct-tension indicator gaps will be verified to comply with ASTM F 959, Table 2.

F. In addition to visual inspection, shop-welded connections will be inspected and tested according to A WS D1.1 and the inspection procedures listed below, at testing agency's option.

   1. Liquid Penetrant Inspection: ASTM E 165.
   2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
   3. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."
   4. Ultrasonic Inspection: ASTM E 164.

G. In addition to visual inspection. shop-welded shear connectors will be inspected and tested according to requirements of A WS D1.1 for stud welding and as follows:

   1. Bend tests will be performed when visual inspections reveal either less than a continuous 360-degree flash or welding repairs to any shear connector.
   2. Tests will be conducted on additional shear connectors when weld fracture occurs on shear connectors already tested, according to requirements of AWS D1.1.

PART 3- EXECUTION

3.1 EXAMINATION

A. Before erection proceeds, and with the steel erector present, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.

B. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.

B. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
3. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
   a. Comply with manufacturer's instructions for proprietary grout materials.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

1. Maintain erection tolerances of architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection.

H. Finish sections thermally cut during erection equal to a sheared appearance.

I. Do net enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. Install and tighten non high-strength bolts, except where high-strength bolts are indicated.

B. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Install and tighten high-strength bolts according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1. Bolts: ASTM A 325 (ASTM A 325M) high-strength bolts, unless otherwise indicated.
2. Bolts: ASTM A 490 (ASTM A 490M) high-strength bolts, unless otherwise indicated.
3. Connection Type: Slip-critical, direct-tension, or tensioned shear/bearing connections as indicated.

D. Weld Connections: Comply with AWS Dl.l for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
3. Verity that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch (13 mm) and larger. Grind flush butt welds. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

A. District will engage an independent testing and inspecting agency to perform field inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and slate in each report whether tested Work complies with or deviates from requirements.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

D. Field-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

E. Field-bolted connections will be tested and inspected according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1. Direct-tension indicator gaps will be verified to comply with ASTM F 959, Table 2.

F. In addition to visual inspection, field-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2·2T."
4. Ultrasonic Inspection: ASTM E 164.

G. In addition to visual inspection, field-welded shear connectors will be inspected and tested according to requirements of AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed when visual inspections reveal either less than a continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors when weld fracture occurs on shear connectors already tested, according to requirements of AWS D1.1.

3.6 CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted

connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

1. Apply by brush or spray to provide a minimum dry film thickness of l.5 mils (0.038 mm).

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on structural steel are included in Division 9 Section "Painting."

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint according to ASTM A 780.

END OF SECTION 051200

SECTION 055000

METAL FABRICATIONS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Supply and install metal fabrications including but not limited to the following:

1. Steel pipe.
2. Square and rectangular steel tubing.
3. Pipe columns.
4. Steel ladders.
5. Gratings, frames and covers.
6. Steel stairs.

1.2 RELATED SECTIONS

A. Section 051200 - Structural Steel

1.3 SUBMITTALS

A. Submit in accordance with Section 014000: Quality Requuirements

1. Submit shop drawings indicating materials used, dimensions, anchoring details, and adjacent construction.

1.4 QUALITY ASSURANCE

A. Reference Specifications, Standards and Code:

1. Design, fabricate and erect miscellaneous metals in accordance with AISC'S Design, Fabrication and Erection of Structural Steel for Buildings.
2. AWS D-1.0 Code – Welding in Building Construction.

1.4 PRODUCT HANDLING

A. Store miscellaneous metal items above ground on platforms, skids or other approved supports.

B. Protect metals from corrosion.

PART 2 PRODUCTS

2.1 MATERIALS

A. Structural Steel Shapes: “Standard Specifications for Structural Steel”, ASTM A36.

B. Steel Pipe:

1. Steel pipe for pipe columns, and other structural purposes shall conform to “Standard Specification for Welded and Seamless Steel Pipe”, ASTM A53, Type E or S, Grade B, as required.

2. Steel pipe other than pipe used for structural purposes shall conform to “Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses”, ASTM A120, or ASTM A53.

C. Square and Rectangular Steel tubing:

1. Steel tubing for structural purposes shall be carbon steel conforming to “Standard Specification for Cold-Formed Welded and Seamless Carbon Structural Tubing in Rounds and Shapes” ASTM A500 or ASTM A346 steel.

2. Steel tubing other than tubing used for structural purposes shall be hot or cold rolled carbon steel electric welded tubing.

D. Cast Steel: “Standard Specification for Mild-to-Medium Strength Carbon-Steel Castings for General Application” ASTM A27, Grade 65-35.

E. Steel Bolts: “Standard Specification for Carbon Steel Externally and Internally Threaded Standard Fasteners”, ASTM A307, Grade A, with bolt head and nut dimensions conforming to ANSI B 18.2.1.

F. Rolled steel plates and shapes:

1. Shapes and plates shall conform to ASTM A36, except for plates to be bent or cold-formed.

2. Plates to be bent or cold-formed shall conform to ASTM A283, Grade C.

G. Chain: Chain shall be 4/0 double loop pattern coil chain.

2.2 FABRICATION

A. General:

1. For fabrication of items which will be exposed to view, use only materials which are smooth and free of blemishes. Remove blemishes by grinding or by welding and grinding, prior to cleaning, treating and application of surface finishes including zinc-coatings.

2. Form exposed work true to line and level with accurate angles and surfaces, and straight sharp edges.

3. Ease exposed edges to radius of approximately 1/32", unless otherwise indicated or specified.

4. Form bent metal corners to the smallest radius possible without causing grain separation or otherwise impairing work.

5. Form exposed connections with hairline joints which are flush and smooth, using concealed fasteners wherever possible.

6. Remove loose rust, mill scale, cutting and punching burrs.

7. Fabricate items in as large sections as practical to minimize field jointing.

B. Miscellaneous Framing and Supports:

1. Fabricate miscellaneous units to sizes, shapes and profiles indicated or, if not indicated, of necessary dimensions to receive adjacent work to be retained by framing.

2. Except as otherwise indicated, space anchors 2'-0"o.c., and provide minimum anchor units os 1-1/4" x ¼" x 8" steel straps.

3. Shelf angles for exterior construction shall be galvanized steel of sizes indicated.

C. Welding:

1. Weld shop connections and field connections unless, indicated or specified otherwise.

2. Weld corners and seams continuously and in accordance with requirements of AWS Code. Welds shall be inspected as required in Section 05129 Structural Steel.

3. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

D. Galvanizing:

1. Galvanizing shall conform to requirements of ASTM A123, "Standard Specification for Zinc (Hot-galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip".

2. Items to be galvanized shall be hot-dip galvanized in as large sections

as possible.

E. Shop Finish:

1. Miscellaneous metal fabrications, except those galvanized items, which will be exposed when building is completed, shall receive a coat of primer.

2. Primer specified shall be spray applied, covering surfaces with a smooth unbroken film. Minimum dry film thickness of primer shall be 2.0 mils.

3. Preparation for Painting: Miscellaneous ferrous metal, except items specified galvanized or shop primed, shall be thoroughly cleaned of all mill scale, grease, dirt or rust, by scraping, wirebrushing, or sandblasting and shall be delivered to job unpainted, but in proper condition for painting. Shipping oil or other protective coatings shall be removed.

PART 3 EXECUTION

3.1 INSTALLATION

A. Handrails and Guardrails:

1. Set standards into metal sleeves cast in concrete, and extending into same not less than 9". Wedge standards true and plumb and cement in place with expansive Portland cement grout such as "Por-Rok". Finish grout smooth and flush with floor surface.

2. Rails contacting a vertical surface shall be fitted with standard pipe rail flanges, secured to concrete or masonry surfaces with 3/8" 2-unti cinch anchor bolts and secured to wood frame surfaces with 3/8" lag screws, unless otherwise indicated.

3. Railings abutting pipe columns shall have shaped end caps to fit columns welded to rails and secured to columns with self-tapping machine screws.

B. Steel Thresholds: Fabricate channel or angle thresholds of rolled steel sections of size indicated, galvanized after fabrication. Anchor into concrete with countersunk 2-unit cinch anchor bolts, unless otherwise indicated.

C. Gratings, Frames and Covers:

1. Over areas indicated, provide steeling gratings and grating frames as detailed. Frames shall have mitered and welded corners, and be fitted with anchors.

2. Provide steel checked plate covers and steel frames for sumps, grease traps, and sand traps, and other covers for access where indicated. Frames shall have mitered and welded corners and be fitted with anchors as detailed. Cover shall be perforated. Each section of access cover shall be fitted with steel pull rings and tool operated fastening device. Screws to fasten covers shall be brass.

3.2 FINISH

A. Repair of Damaged Galvanized Surfaces: Galvanized finish which has been damaged or burned off in welding shall be repaired by coating surface with “Galvalloy” or “All-State Galvover” or approved equal. Clean surface of foreign matter, heat to approximately 600°F and rub alloy bar over heated surface, allowing a small amount to flow. Wire brush briskly, spreading material evenly over area to be covered.

END OF SECTION 055000

This page left intentionally blank

SECTION 055213

PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Stainless-steel pipe and tube railings, Type 304(18-8) - ornamental grade and 316L – ornamental grade.

B. Steel pipe and tube railings. Angles and channels to be carbon steel C1010.

1.2 QUALITY ASSURANCE

A. Fabricator to engineer and fabricate railings to withstand design loads.

1.3 FABRICATION

A. Changes in Direction of Members: By rotary bending or by inserting prefabricated fittings.

B. Connections: Welded (steel).

C. Infill Panels: As indicated on drawing.

D. Toe boards.

1.4 FINISHES

A. Stainless Steel: Ornamental grade with a smooth surface simple to polish. Polished and buffed or dull satin, No. 6 polish as selected by Architect.

B. Steel and Iron: Hot dipped galvanized after fabrication per ASTM A 123A/A123M & A153A/A153M, primed per recommendations for factory finish -2-coat fluoropolymer or Division 9 – Coatings for Exterior Steel as indicated.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Shop prime uncoated railings with primers specified in Division 9 Section "High-Performance Coatings".

1.5 SCHEDULE

A. Interior locations: Stainless Steel – Typical.

B. Exterior locations: Painted Steel – Typical (Stainless Steel with coating where indicated by Construction Documents)

END OF SECTION 055213

SECTION 061000

ROUGH CARPENTRY

PART 1 – GENERAL

1.1 DESCRIPTION:

Section specifies wood blocking, framing, sheathing, furring, nailers, sub-flooring, rough hardware, and light wood construction.

1.2 RELATED WORK:

A. Sheathing: Section 061600: SHEATHING.
B. Milled woodwork: Section 062023: INTERIOR FINISH CARPENTRY.
C. Gypsum sheathing: Section 092900: GYPSUM BOARD ASSEMBLIES.

1.3 SUMBITTALS:

A. Submit in accordance with Section 014000: QUALITY REQUIREMENTS
B. Shop Drawings showing framing connection details, fasteners, connections and dimensions.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Protect lumber and other products from dampness both during and after delivery at site.
B. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.
C. Stack plywood and other board products so as to prevent warping.
D. Locate stacks on well drained areas, supported at least 6 inches above grade and cover with well ventilated sheds having firmly constructed over hanging roof with sufficient end wall to protect lumber from driving rain.

1.5 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
B. American Forest and Paper Association (AFPA):

National Design Specification for Wood Construction

NDS-12.....Conventional Wood Frame Construction

C. American Institute of Timber Construction (AITC):

A190.1-07.....Structural Glued Laminated Timber

D. American Plywood Association (APA):

PDS-04.....Panel Design Specification

F. American Society for Testing And Materials (ASTM):

A47-99(R2009).....Ferritic Malleable Iron Castings

A48-03(R2008).....Gray Iron Castings

A653/A653M-07 .....Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process

C954-04 .....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 inch to 0.112-inch in thickness

C1002-04 .....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Metal Studs

D143-09 .....Small Clear Specimens of Timber, Method of Testing

D1760-01 .....Pressure Treatment of Timber Products

D2559-10 .....Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions

D3498-11 .....Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems

F844-07.....Washers, Steel, Plan (Flat) Unhardened for General Use

F1667-05.....Nails, Spikes, and Staples

PART 2 – PRODUCTS

2.1 LUMBER:

A. Unless otherwise specified, each piece of lumber bear grade mark, stamp, or other identifying marks indicating grades of material, and rules or standards under which produced.
   1. Identifying marks in accordance with rule or standard under which material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
   2. Inspection agency for lumber approved by the Board of Review, American Lumber Standards Committee, to grade species used.

B. Structural Members: Species and grade as listed in the AFPA, National Design Specification for Wood Construction having design stresses as shown.

C. Lumber Other Than Structural:
   1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.
   2. Framing lumber: Minimum extreme fiber stress in bending of 1100.
   3. Furring, blocking, nailers and similar items: Number 2 Grade.

D. Sizes:
   1. Conforming to Prod. Std., PS20.
   2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.

E. Moisture Content:
   1. At time of delivery and maintained at the site.
   2. Boards and lumber 2 inches and less in thickness: 19 percent or less.
   3. Lumber over 2 inches thick: 19 percent or less.

F. Fire Retardant Treatment:
   1. Mil Spec. MIL-L-19140 with piece of treated material bearing identification of testing agency and showing performance rating.
   2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.

G. Preservative Treatment:
    1. Do not treat Heat Redwood and Western Red Cedar.
    2. Treat wood members and plywood exposed to weather or in contact with plaster, masonry or concrete, including framing of open roofed structures; sills, sole plates, furring, and sleepers that are less than 8 inches from ground; nailers, edge strips, blocking, crickets, curbs, cant, vent strips and other members used in connection with roofing and flashing materials.
    3. Treat other members specified as preservative treated (PT).
    4. Preservative treat by the pressure method complying with ASTM D1760, except any process involving the use of Chromated Copper arsenate (CCA) for pressure treating wood is not permitted.

2.2 PLYWOOD

A. Comply with Prod. Std., PS 1.
B. Bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of plywood which identifies compliance by veneer grade, group number, span rating where applicable, and glue type.
C. Sheathing:
    1. APA rated Exposure 1 or Exterior; panel grade CDX or better.
    2. Wall sheathing:
        a. Minimum 11/32 inch thick with supports 16 inches on center and 15/32 inch thick with supports 24 inches on center unless specified otherwise.
        b. Minimum 48 inches wide at corners without corner bracing of framing.
    3. Roof sheathing:
        a. Minimum 11/32 inch thick with span rating 24/0 15/32 inch thick with span rating for supports 16 inches on center unless specified otherwise.
        b. Minimum 19/32 inch thick or span rating of 40/20 23/32 inch thick or span rating of 48/24 for supports 24 inches on center unless specified otherwise.
D. Subflooring:
    1. Under finish wood flooring or underlayment:
        a. APA Rated sheathing, Exposure 1. panel grade CD.
        b. Minimum 19/32 inch thick with span rating 32/16 or greater for supports at 16 inches on center and 23/32 inch thick with span rating 48/24 for supports at 24

inches on center.

2. Combination subflooring-underlayment under resilient flooring or carpet:
    a. APA Rated Stud-I-Floor Exterior or Exposure 1, T and G.
    b. Minimum 19/32 inch thick or greater, span rating 16, for supports at 16 inches on center; 23/32 inch thick or greater, span rating 24, for supports at 24 inches on center.

E. Underlayment:
1. APA rated Exposure 1 or Exterior, panel grade C-C Plugged.
2. Minimum 1/4 inch thick or greater over plywood subflooring unless otherwise shown.

2.3 STRUCTURAL-USE PANELS

A. Comply with APA.
B. Bearing the mark of a recognized association or independent agency that maintains continuing control over quality of panel which identifies compliance by end use, Span Rating, and exposure durability classification.
C. Wall and Roof Sheathing:
1. APA Rated sheathing panels, durability classification of Exposure 1 or Exterior Span Rating of 16/0 or greater for supports 16 inches on center and 24/0 or greater for supports 24 inches on center.
D. Subflooring:
1. Under finish wood flooring or underlayment:
    a. APA rated sheathing panels, durability classification of Exposure 1 or Exterior.
    b. Span Rating of 24/16 or greater for supports 16 inches on center.
2. Under resilient floor or carpet.
    a. APA rated combination subfloor-underlayment grade panels, durability classification of Exposure 1 or Exterior T and G.
    b. Span Rating of 16 or greater for supports 16 inches on center and 24 or greater for supports 24 inches on center.
E. Underlayment:
1. APA rated Exposure l.
2. Minimum 1/4 inch thick or greater over subfloor.

2.4 ROUGH HARDWARE AND ADHESIVES:

A. Anchor Bolts:
1. ASME B18.2.1 and ANSI B18.2.2 galvanized, 5/8 inch unless shown otherwise.

2. Extend at least 7 inches into masonry or concrete with ends bent 2 inches.

B. Washers
   1. ASTM F844.
   2. Use zinc or cadmium coated steel or cast iron for washers exposed to weather.

C. Screws:
   1. Wood to Wood: ANSI B18.6.1 or ASTM C1002.
   2. Wood to Steel: ASTM C954, or ASTM C1002.

D. Nails:
   1. Size and type best suited for purpose unless noted otherwise. Use aluminum-alloy nails, plated nails, or zinc-coated nails, for nailing wood work exposed to weather and on roof blocking.
   2. ASTM F1667:
      a. Common: Type I, Style 10.
      b. Concrete: Type I, Style 11.
      c. Barbed: Type I, Style 26.
      d. Underlayment: Type I, Style 25.
      e. Masonry: Type I, Style 27.
      f. Use special nails designed for use with ties, strap anchors, framing connectors, joists hangers, and similar items. Nails not less than 1-1/4 inches long, 8d and deformed or annular ring shank.

F. Framing and Timber Connectors:
   1. Fabricate of ASTM A446, Grade A; steel sheet not less than 0.052 inch thick unless specified otherwise. Apply standard plating to steel timber connectors after punching, forming and assembly of parts.
   2. Framing Angles: Angle designed with bendable legs to provide three way anchors.
   3. Straps:
      a. Designed to provide wind and seismic ties with sizes as shown or specified.
      b. Strap ties not less than 1-1/4 inches wide.
      c. Punched for fastener.
   4. Metal Bridging:
      a. Optional to wood bridging.
      b. V shape deformed strap with not less than 2 nail holes at ends, designed to nail to top and side of framing member and bottom and side of opposite member.

c. Not less than 3/4 by 5 inches bendable nailing flange on ends.
d. Fabricated of 0.04 inch minimum thick sheet.

5. Joist Hangers:
   a. Fabricated of 0.063 inch minimum thick sheet, U design unless shown otherwise.
   b. Heavy duty hangers fabricated of minimum 0.108 inch thick sheet, U design with bent top flange to lap over beam.
6. Timber Connectors: Fabricated of steel to shapes shown.
7. Joist Ties: Mild steel flats, 3/16 by 1-1/4 inch size with ends bent about 30 degrees from horizontal, and extending at least 16 inches onto framing. Punch each end for three spikes.
8. Wall Anchors for Joists and Rafters:
   a. Mild steel strap, 3/16 by 1-1/4 inch with wall ends bent 2 inches, or provide 3/8 by 5 inch pin through strap end built into masonry.
   b. Strap long enough to extend onto three joists or rafters, and punched for spiking at each bearing.
   c. Strap not less than 4 inches embedded end.
9. Joint Plates:
   a. Steel plate punched for nails.
   b. Steel plates formed with teeth or prongs for mechanically clamping plates to wood.
   c. Size for axial eccentricity, and fastener loads.

G. Adhesives:
   1. For field-gluing plywood to lumber framing floor or roof systems: ASTM D3498.
   2. For structural laminated Wood: ASTM D2559.

PART 3 – EXECUTION

3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS:

A. Conform to applicable requirements of the following:
   1. AFPA National Design Specification for Wood Construction for timber connectors.
   2. AITC Timber Construction Manual for heavy timber construction.
   3. AFPA WCD-number 1, Manual for House Framing for nailing and framing unless specified otherwise.

4. APA for installation of plywood or structural use panels.
5. ASTM F 499 for wood underlayment.
6. TPI for metal plate connected wood trusses.

B. Fasteners:
   1. Nails.
      a. Nail in accordance with the Recommended Nailing Schedule as specified in AFPA Manual for House Framing where detailed nailing requirements are not specified in nailing schedule. Select nail size and nail spacing sufficient to develop adequate strength for the connection without splitting the members.
      b. Use special nails with framing connectors.
      c. For sheathing and subflooring, select length of nails sufficient to extend 1 inch into supports, unless otherwise noted.
      d. Use eight penny or larger nails for nailing through 1 inch thick lumber and for toe nailing 2 inch thick lumber, unless otherwise noted.
      e. Use 16 penny or larger nails for nailing through 2 inch thick lumber, unless otherwise noted.
      f. Select the size and number of nails in accordance with the Nailing Schedule except for special nails with framing anchors.
      g. Nailing Schedule: Per plan.
   2. Bolts:
      a. Fit bolt heads and nuts bearing on wood with washers.
      b. Countersink bolt heads flush with the surface of nailers.
      c. Embed in concrete and solid masonry or use expansion bolts. Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.
      d. Use toggle bolts to hollow masonry or sheet metal.
      e. Use bolts to steel over 0.112 inch, 11 gage in thickness. Secure wood nailers to vertical structural steel members with bolts, placed one at ends of nailer and 24 inch intervals between end bolts. Use clips to beam flanges.
   3. Drill Screws to steel less than 0.112 inch thick.
      a. ASTM C1002 for steel less than 0.033 inch thick.
      b. ASTM C 954 for steel over 0.033 inch thick.
   4. Power actuated drive pins may be used where practical to anchor to solid masonry,

concrete, or steel.

5. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Use metal plugs, inserts or similar fastening.
6. Screws to Join Wood:
    a. Where shown or option to nails.
    b. ASTM C1002, sized to provide not less than 1 inch penetration into anchorage member.
    c. Spaced same as nails.
7. Installation of Timber Connectors:
    a. Conform to applicable requirements of the NFPA National Design Specification for Wood Construction.
    b. Fit wood to connectors and drill holes for fasteners so wood is not split.

C. Set sills or plates level in full bed of mortar on masonry or concrete walls.
    1. Space anchor bolts 4 feet on centers between ends and within 6 inches of end. Stagger bolts from side to side on plates over 7 inches in width.
    2. Use shims of slate, tile or similar approved material to level wood members resting on concrete or masonry. Do not use wood shims or wedges.
    3. Closely fit, and set to required lines.

D. Cut notch, or bore in accordance with NFPA Manual for House-Framing for passage of ducts wires, bolts, pipes, conduits and to accommodate other work. Repair or replace miscut, misfit or damaged work.

E. Blocking Nailers, and Furring:
    1. Install furring, blocking, nailers, and grounds where shown.
    2. Use longest lengths practicable.
    3. Use fire retardant treated wood blocking where shown at openings and where shown or specified.
    4. Layers of Blocking or Plates:
        a. Stagger end joints between upper and lower pieces.
        b. Nail at ends and not over 24 inches between ends.
        c. Stagger nails from side to side of wood member over 5 inches in width.

F. Roof Framing:
    1. Set rafters with crown edge up.
    2. Form a true plane at tops of rafters.

3. Valley, Ridge, and Hip Members:
    a. Size for depth of cut on rafters.
    b. Straight and true intersections of roof planes.
    c. Secure hip and valley rafters to wall plates by using framing connectors.
    d. Double valley rafters longer than the available lumber, with pieces lapped not less than 4 feet and spiked together.
    e. Butt joint and scab hip rafters longer than the available lumber.
4. Spike to wall plate and to ceiling joists except when secured with framing connectors.
5. Frame openings in roof with headers and trimmer rafters. Double headers carrying more than one rafter unless shown otherwise.
6. Install 2 inch by 4 inch strut between roof rafters and ceiling joists at 4 feet on center unless shown otherwise.

G. Framing of Dormers:
1. Frame as shown, with top edge of ridge beveled to pitch of roof header.
2. Set studs on doubled trimmer rafters.
3. Double studs at corners of dormers.
4. Double plate on studs and notch rafters over plate and bear at least 3 inches on plates.
5. Frame opening to receive window frame or louver frame.

H. Partition and Wall Framing:
1. Use 2 inch by 4 inch studs spaced 16 inches on centers; unless shown otherwise.
2. Install double studs at openings and triple studs at corners.
3. Installation of sole plate:
    a. Anchor plates of walls or partitions resting on concrete floors in place with expansion bolts, one near ends of piece and at intermediate intervals of not more than 4 feet or with power actuated drive pins with threaded ends of suitable type and size, spaced 2 feet on center unless shown otherwise.
    b. Nail plates to wood framing through subfloor as specified in nailing schedule.
4. Headers or Lintels:
    a. Make headers for openings of two pieces of 2 inches thick lumber of size shown with plywood filler to finish flush with face of studs or solid lumber of equivalent size.
    b. Support ends of headers on top of stud cut for height of opening. Spike cut stud

to adjacent stud. Spike adjacent stud to header.

5. Use double top plates, with members lapped at least 2-feet spiked together.
6. Install intermediate cut studs over headers and under sills to maintain uniformity of stud spacing.
7. Use single sill plates at bottom of opening unless shown otherwise. Toe nail to end stud, face nail to intermediate studs.
8. Install 2 inch blocking for firestopping so that maximum dimension of any concealed space is not over 8 feet in accordance with NFPA Manual for House Framing.
9. Install corner bracing when plywood or structured use panel sheathing is not used.
    a. Let corner bracing into exterior surfaces of studs at an angle of approximately 45 degrees, extended completely over walls plates, and secured at bearing with two nails.
    b. Use 1 inch by 4 inch corner bracing.

J. Rough Bucks:
1. Install rough wood bucks at opening in masonry or concrete where wood frames or trim occur.
2. Brace and maintain bucks plumb and true until masonry has been built around them or concrete cast in place.
3. Cut rough bucks from 2 inch thick stock, of same width as partitions in which they occur and of width shown in exterior walls.
4. Extend bucks full height of openings and across head of openings; fasten securely with anchors specified.

K. Subflooring:
1. Subflooring may be either boards, structural-use panels, or plywood.
2. Lay board subflooring diagonally, with close joints. Stagger end joints and make joints over supports. Bear each board on at least three supports.
3. Provide a clearance of approximately 1/2 inch at masonry or concrete at walls.
4. Apply plywood and structural-use panel subflooring with face grain or long dimension at right angles to the supports, with edges 1/4 inch apart at side joints, and 1/8 inch apart at end joints.
5. Combination subfloor-underlayment:
    a. Space edges 1/8 inch apart.
    b. Provide a clearance of 1/4 inch at masonry on concrete at walls.

6. Stagger panel end joints and make over support.

L. Underlayment:
   1. Where finish flooring of different thickness is used in adjoining areas, use underlayment of thickness required to bring finish flooring surfaces into same plane.
   2. Apply to dry, level, securely nailed, clean, wood subfloor without any projections.
   3. Fasten to subfloor as specified in ASTM F499.
   4. Plywood and particle underlayment may be glue-nailed to subfloor.
   5. Butt underlayment panels to a light contact with a 1/32 inch space between plywood or hardboard underlayment panels and walls, and approximately 3/8 inch between particleboard underlayment panels and walls.
   6. Stagger underlayment panel end joints with respect to each other and offset joints with respect to joints in the subfloor at least 2 inches.
   7. After installation, avoid traffic on underlayment and damage to its finish surface.

M. Sheathing:
   1. Use plywood or structural-use panels for sheathing.
   2. Lay panels with joints staggered, with edge and ends 1/8 inch apart and nailed over bearings as specified.
   3. Set nails not less than 3/8 inch from edges.
   4. Install 2 inch by 4 inch blocking spiked between joists, rafters and studs to support edge or end joints of panels.

END OF SECTION 061000

SECTION 061010

MICROLLAM LVL SPECIFICATIONS

PART 1 - GENERAL

1.1 Scope

This work includes the complete furnishings and installation of all Microllam® laminated veneer lumber (LVL) as shown on the drawings herein specified and necessary to complete the work.

1.2 Code Approvals

These products shall be designed and manufactured to the standards set forth in the ICC Evaluation Service, Inc. report ESR-1387.

1.3 Related Work Specified Elsewhere

A Section 061000: Rough Carpentry

B Section 062023: Interior Finish Carpentry

1.4 Design

A Products

Microllam® LVL shall be designed to fit the dimensions and loads indicated on the plans.

B Design Calculations

__ Member calculations shall be prepared by Weyerhaeuser. (Service Fees may apply)

_x_ Not required.

1.5 Submittals

A Drawings

__ Drawings showing layout and detail necessary for determining fit and placement in the building shall be provided by Weyerhaeuser.

_x_ Not required.

B Production

Fabrication and/or cutting shall not proceed until the architect and/or engineer have approved the submittal package.

PART 2 - PRODUCTS

2.1 Materials

A Code Reports

Materials shall comply with ICC ES ESR-1387.

B Adhesives

Adhesives shall be of the waterproof type conforming to the requirements of ASTM D-2559.

2.2 Fabrication

Microllam® LVL shall be manufactured by Weyerhaeuser in a plant listed in the reports referred to above and under the supervision of an approved third-party inspection agency. It shall be manufactured in a continuous process with all grain parallel with the length of the members. All members are to be free of finger or scarf joints or mechanical connections in full-length members.

2.3 Tolerances

Finished Length (as specified): ± 1/8"

Depth: ± 1/16"

Width: ± 1/16"

2.4 Identification

Microllam® LVL shall be identified by a stamp indicating the product type and grade and ICC ES evaluation report number, manufacturer's name, plant number and the independent inspection agency's logo.

2.5 Hardware

Not applicable.

PART 3 - EXECUTION

3.1 Installation

Microllam® LVL, if stored prior to installation, shall be protected from the weather. It shall be installed in accordance with the plans and any Weyerhaeuser drawings and installation suggestions. Temporary construction loads that cause stresses beyond design limits are not permitted. Safety bracing is to be provided by the installer to keep the Microllam® LVL straight and plumb as required and to assure adequate lateral support for the individual Microllam® LVL members and the entire system until the sheathing material has been applied.

3.2 Installation Review

The contractor shall give notification to the building inspector prior to enclosing product to provide opportunity for review of the installation within conformance of construction documents and/or manufacturer's literature.

3.3 Performance Standards

Products shall be proven by testing and evaluation in accordance with the

provisions of ASTM D-5456.

3.4 Fire Rating

Microllam® LVL is permitted as a substitute for conventional wood framing in fire-resistive assemblies. Microllam® LVL shall be sized for the same load-carrying capacity as the sawn lumber specified in the assembly, and its dimensions shall be equal to or greater than those specified for the sawn lumber.

3.5 Warranty

The products delivered shall be free from manufacturing errors or defects in workmanship and material. The products, when correctly installed and maintained, shall be warranted to perform as designed for the normal and expected life of the building.

4.0 ALTERNATES AND/OR EQUALS

4.1 Base Bid

Due to the customized detailing and engineering characteristics of the roof and/or floor framing assembly, it is a requirement that Microllam® LVL be used in the base bid.

4.2 Alternate Manufacturers

Other manufacturers' bids are to be listed in the alternate section of your proposal. All framing plans, detailing and calculations for the alternate bids will be reviewed by the owner, architect and engineer for structural performance, possible conflicts with related trades, and compatibility with the overall building requirements and building code.

4.3 Alternate Products

Alternate products will only be permitted if written approval and acceptance is obtained by both architect and owner at least _5_ days prior to the bid date.

4.4 Acceptable Alternates

At the discretion of the specifier of record, accepted alternates will be listed on the final addendum prior to the bid date.

END OF SECTION 061010

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 061020

PARALLAM PSL SPECIFICATIONS

PART 1 - GENERAL

1.1 Scope

This work includes the complete furnishings and installation of all Parallam® parallel strand lumber (PSL) as shown on the drawings herein specified and necessary to complete the work.

1.2 Code Approvals

These products shall be designed and manufactured to the standards set forth in the ICC Evaluation Service Report No. ESR-1387.

1.3 Related Work Specified Elsewhere

A Section 061000 – Rough Carpentry

B Section 062023 – Interior Finish Carpentry

1.4 Design

A Products

Parallam® PSL shall be designed to fit the dimensions and loads indicated on the plans.

B Design Calculations

__ Member calculations shall be prepared by Weyerhaeuser. (Service Fees may apply)

_x_ Not required.

1.5 Submittals

A Drawings

__ Drawings showing layout and detail necessary for determining fit and placement in the building shall be provided by Weyerhaeuser.

_x_ Not required.

B Production

Fabrication and/or cutting shall not proceed until the architect and/or engineer have approved the submittal package.

PART 2 - PRODUCTS

2.1 Materials

C Code Reports

Materials shall comply with ICC ES ESR-1387.

D Adhesives

Adhesives shall be of the waterproof type conforming to the requirements of ASTM D-2559.

2.2 Fabrication

Parallam® PSL shall be manufactured by Weyerhaeuser in a plant listed in the reports referred to above and under the supervision of an approved third-party inspection agency. It shall be manufactured from strands of wood fiber in a continuous process with all strands oriented to the length of the member and then fed into a press in the desired lay-up pattern. All members are to be free of finger or scarf joints or mechanical connections in full-length members.

2.3 Tolerances

Finished Length (as specified):	± 1/4"
Depth:	± 1/16"
Width:	± 1/16"

2.4 Identification

Parallam® PSL shall be identified by a stamp indicating the product type and grade and ICC-ES evaluation report number, manufacturer's name, plant number and the independent inspection agency's logo.

2.5 Hardware

Not applicable.

3.0 EXECUTION

3.1 Installation

Parallam® PSL, if stored prior to installation, shall be protected from the weather. It shall be installed in accordance with the plans and any Weyerhaeuser drawings and installation suggestions. Temporary construction loads that cause stresses beyond design limits are not permitted. Safety bracing is to be provided by the installer to keep the Parallam® PSL straight and plumb as required and to assure adequate lateral support for the individual Parallam® PSL members and the entire system until the sheathing material has been applied.

3.2 Installation Review

The contractor shall give notification to the building inspector prior to enclosing product to provide opportunity for review of the installation within conformance of construction documents and/or manufacturer's literature.

3.3 Performance Standards

Products shall be proven by testing and evaluation in accordance with the provisions of ASTM D-5456.

3.4 Fire Rating

Parallam® PSL is permitted as a substitute for conventional wood framing in fire-resistive assemblies. Parallam® PSL shall be sized for the same load-carrying capacity as the sawn lumber specified in the assembly, and its dimensions shall be equal to or greater than those specified for the sawn lumber. The fire-resistive design provisions for heavy-timber construction in all U.S. model building codes are applicable to Parallam® PSL.

3.5 Warranty

The products delivered shall be free from manufacturing errors or defects in workmanship and material. The products, when correctly installed and maintained, shall be warranted to perform as designed for the normal and expected life of the building.

4.0 ALTERNATES AND/OR EQUALS

4.1 Base Bid

Due to the customized detailing and engineering characteristics of the roof and/or floor framing assembly, it is a requirement that Parallam® PSL be used in the base bid.

4.2 Alternate Manufacturers

Other manufacturers' bids are to be listed in the alternate section of your proposal. All framing plans, detailing and calculations for the alternate bids will be reviewed by the owner, architect and engineer for structural performance, possible conflicts with related trades, and compatibility with the overall building requirements and building code.

4.3 Alternate Products

Alternate products will only be permitted if written approval and acceptance is obtained by both architect and owner at least _5_ days prior to the bid date.

4.4 Acceptable Alternates

At the discretion of the specifier of record, accepted alternates will be listed on the final addendum prior to the bid date.

END OF SECTION 061020

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 061053

MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Rooftop equipment bases and support curbs.
3. Wood blocking and nailers.
4. Wood furring and grounds.
5. Wood sleepers.
6. Wood backing panels.

B. Related Requirements:

1. Section 061000 "Rough Carpentry".
2. Section 062023 “Interior Finish Carpentry”

1.3 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.

2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Post-installed anchors.
5. Metal framing anchors.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

B. Inspection Agencies: Inspection agencies, and the reference abbreviations include the following:

1. RIS: Redwood Inspection Service.
2. WCLIB: West Coast Lumber Inspection Bureau.
3. WWPA: Western Woods Products Association.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b**.**

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

D. Application: Pressure treat above ground items with waterborne preservatives to a minimum retention of 0.25 lb./cu. ft. After treatment, kiln-dry lumber and plywood to a maximum moisture content of 19 and 15 percent, respectively. Treat items indicated on Drawings, and the following:

1. Wood nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2. Wood sills, sleepers, blocking, furring, stripping and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.For enclosed roof framing, framing in attic spaces, and where high-temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat all miscellaneous carpentry unless otherwise indicated.

1. Framing for raised platforms.
2. Concealed blocking.
3. Roof framing and blocking.
4. Wood nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
5. Wood backing panels.

2.4 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade of the following species:

1. Hem-fir; WCLIB or WWPA.
2. Western woods; WCLIB or WWPA.

B. Other Framing: Construction or No. 2 grade of species:

1. Douglas fir-larch; WCLIB or WWPA.
2. Douglas fir-south; WWPA.
3. Hem-fir; WCLIB or WWPA.

2.5 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Furring.
5. Grounds.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of the following species:

1. Hem-fir; WCLIB or WWPA.
2. Western woods; WCLIB or WWPA.

C. Concealed Boards: 15 percent maximum moisture content of any of the following species and grades:
1. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 WOOD BACKING PANELS

A. Equipment Backing Panels: Wood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 2 x inch nominal thickness.

2.7 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Screws for Fastening to Metal Framing: ASTM C 1002 length as recommended by screw manufacturer for material being fastened.

D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 as appropriate for the substrate.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat screws.

2.8 METAL FRAMING ANCHORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. KC Metals Products, Inc.

2. Simpson Strong-Tie Co., Inc.
3. USP Structural Connectors.
4. Or equal.

B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

1. Use for interior locations unless otherwise indicated.

2.9 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring**,** nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Install wood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.

D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Do not splice structural members between supports unless otherwise indicated.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
4. Fire block concealed spaces behind exterior trim at not more than 20 feet o.c.

H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

J. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

K. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in the California Building Code (CBC).
2. ICC-ES evaluation report for fastener.

L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal-size furring horizontally and vertically at 24 inches o.c.

C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal-size furring vertically at 16 inches o.c.

END OF SECTION 061053

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 061600

SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.
3. Parapet sheathing.
4. Subflooring.
5. Underlayment.

B. Related Requirements:

1. Section 061000 "Rough Carpentry"
2. Section 061053 "Miscellaneous Rough Carpentry"
3. Section 062023 “Interior Finish Carpentry”

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.

4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WOOD PANEL PRODUCTS

A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

B. Factory mark panels to indicate compliance with applicable standard.

C. Wood Structural Panels, when used structurally (including for siding, roof and wall sheathing, subflooring, diaphragms, and built-up members), shall conform to the

requirements for their type in DOC PS1, DOC PS2, or ANSI / APA PRP210. Each panel or member shall be identified for grade, bond classification, and performance category by the trademarks of an approved testing and grading agency.

2.3 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Pressure treat above ground items with waterborne preservatives to a minimum retention of 0.25 lb/cu. ft. After treatment, kiln-dry plywood to a maximum moisture content of 15 percent. Treat all plywood unless otherwise indicated. Treat items indicated on Drawings.

2.4 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201/D 3201M at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature

fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat all plywood unless otherwise indicated and the following:

1. Roof and wall sheathing within 48 inches of fire walls.
2. Roof sheathing.
3. Subflooring and underlayment for raised platforms.

2.5 WALL SHEATHING

A. Plywood Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 24/0.
2. Nominal Thickness: Not less than 1/2 inch.

2.6 ROOF SHEATHING

A. Plywood Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 32/16.
2. Nominal Thickness: Not less than 1/2 inch.

2.7 PARAPET SHEATHING

A. Plywood Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 24/0.
2. Nominal Thickness: Not less than 15/32 inch.

2.8 SUBFLOORING AND UNDERLAYMENT

A. Plywood Combination Subfloor-Underlayment: DOC PS 1, Exposure 1, Structural I, Underlayment single-floor panels.

1. Span Rating: Not less than 24.
2. Nominal Thickness: Not less than 23/32 inch.
3. Edge Detail: Tongue and groove.
4. Surface Finish: Fully sanded face.

B. Plywood Subflooring: DOC PS 1, Structural I -floor panels or sheathing.

1. Span Rating: Not less than 24.
2. Nominal Thickness: Not less than 23/32 inch.

C. Underlayment: Provide underlayment in nominal thicknesses indicated or, if not indicated, not less than 1/4 inch over smooth subfloors and not less than 3/8 inch over board or uneven subfloors.

1. Plywood Underlayment for Resilient Flooring: DOC PS 1, Exposure 1 Underlayment with fully sanded face.
2. Plywood Underlayment for Carpet: DOC PS 1, Exposure 1, Underlayment.

2.9 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For roof, parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Screws for Fastening Sheathing to Wood Framing: ASTM C 1002.

E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

2.10 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in the California Building Code.

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall, parapet and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Combination Subfloor-Underlayment:

Nail to wood framing.
a. Screw to cold-formed metal framing.
b. Space panels 1/8 inch apart at edges and ends.

2. Subflooring:

a. Glue and nail to wood framing.
b. Screw to cold-formed metal framing.
c. Space panels 1/8 inch apart at edges and ends.

3. Wall and Roof Sheathing:

a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
b. Screw to cold-formed metal framing.
c. Space panels 1/8 inch apart at edges and ends.

4. Underlayment:

    a. Nail to subflooring.
    b. Space panels 1/32 inch apart at edges and ends.
    c. Fill and sand edge joints of underlayment receiving resilient flooring immediately before installing flooring.

END OF SECTION 061600

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 062023

INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior trim, including non-fire-rated interior door and sidelight frames.
2. Interior plywood and particle board paneling.
3. Shelving and clothes rods.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view and for framing exposed to view.
2. Section 099123 "Interior Painting" for priming and backpriming of interior finish carpentry.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
2. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.
4. Include copies of warranties from chemical-treatment manufacturers for each type of treatment.

B. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

C. Samples for Verification:

1. For each species and cut of lumber and panel products with non-factory-applied finish, with 1/2 of exposed surface finished, 50 sq. in. for lumber and 8 by 10 inches for panels.
2. For each finish system and color of lumber and panel products with factory-applied finish, 50 sq. in. for lumber and 8 by 10 inches for panels.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For fire-retardant-treated wood, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

B. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and the following grading rules:

1. NHLA: National Hardwood Lumber Association, "Rules for the Measurement and Inspection of Hardwood & Cypress."
2. RIS: Redwood Inspection Service.
3. WCLIB: West Coast Lumber Inspection Bureau, Standard No. 17, "Grading Rules for West Coast Lumber."
4. WWPA: Western Wood Products Association, "Western Lumber Grading Rules."

B. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.

1. For exposed lumber, mark grade stamp on end or back of each piece.

C. Softwood Plywood: DOC PS 1.

D. Hardwood Plywood: HPVA HP-1.

1. Each batch shall be accompanied by the appropriate stamp, certifying that the urea formaldehyde emissions are below the voluntary level set by HPMA FE.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent respectively.
2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
3. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
4. Do not use material that is warped or does not comply with requirements for untreated material.
5. Mark lumber with treatment-quality mark of an inspection agency approved by the American Lumber Standard Committee's Board of Review.

a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

6. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

a. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.

7. Application: Where indicated

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: For applications indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction, and comply with testing requirements; testing by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent respectively.

C. For exposed items indicated to receive a stained or natural finish, use organic resin chemical formulations that do not contain colorants, and provide materials that do not have marks from spacer sticks on exposed face.

D. Do not use material that does not comply with requirements for untreated material or is warped or discolored.

E. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
2. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.

F. Application: Where indicated

2.4 INTERIOR TRIM

A. Softwood Lumber Trim for Transparent Finish (Stain or Clear Finish):

1. Species and Grade: Douglas fir-larch or Douglas fir south finish; WCLIB, or WWPA.
2. Maximum Moisture Content: 19 percent with at least 85 percent of shipment at 12 percent or less.
3. Finger Jointing: Not allowed.
4. Face Surface: Surfaced (smooth).

B. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish):

1. Species and Grade: Clear, kiln-dried White maple or Alder**:** NHLA.
2. Maximum Moisture Content: 9 percent.
3. Finger Jointing: Not allowed.
4. Gluing for Width: Not allowed.
5. Veneered Material: Not allowed.
6. Face Surface: Surfaced (smooth).
7. Matching: Selected for compatible grain and color.

C. Lumber Trim for Opaque Finish (Painted Finish):

1. Species and Grade: White maple or Alder; D Select Quality**;** WWPA.
2. Species and Grade: White woods, D Select; WWPA.
3. Species and Grade: Douglas fir-larch or Douglas fir south, Prime or D finish; WCLIB, or WWPA.
4. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less].
5. Maximum Moisture Content: 9 percent.
6. Finger Jointing: Not allowed.
7. Face Surface: Surfaced (smooth).

D. Softwood Moldings for Transparent Finish (Stain or Clear Finish): WMMPA WM 4, N-grade wood moldings. Made to patterns included in WMMPA WM 12.

1. Species: Douglas fir.
2. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
3. Finger Jointing: Not allowed.
4. Matching: Selected for compatible grain and color.

E. Hardwood Moldings for Transparent Finish (Stain or Clear Finish): WMMPA HWM 2, N-grade wood moldings made to patterns included in WMMPA HWM 1.

1. Species: Clear, kiln-dried White maple or Alder.
2. Maximum Moisture Content: 9 percent.
3. Finger Jointing: Not allowed.
4. Matching: Selected for compatible grain and color.

F. Moldings for Opaque Finish (Painted Finish): Made to patterns included in WMMPA WM 12.

1. Softwood Moldings: WMMPA WM 4, P grade.

    a. Species: kiln-dried White maple or Alder.
    b. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.

2. Hardwood Moldings: WMMPA HWM 2, P-grade.

a. Species: kiln-dried White maple or Alder.
b. Maximum Moisture Content: 9 percent.

3. Finger Jointing: Not allowed

G. Wood Molding Patterns: Provide stock moldings made to patterns included in WMMPA WM7 and graded under WMMPA WM4.

2.5 PANELING

A. Hardwood Veneer Plywood Paneling: Manufacturer's stock hardwood plywood panels complying with HPVA HP-1.

1. Face Veneer Species and Cut: Rotary-cut white birch
2. Veneer Matching: Selected for similar color and grain.
3. Backing Veneer Species: Any hardwood compatible with face species.
4. Construction: Veneer core.
5. Thickness: 5/16 inch
6. Panel Size: 48 by 96 inches
7. Glue Bond: Type II (interior).
8. Face Pattern: Manufacturer's standard pattern of V-grooves, with grooves at edges, center, and third points of panels, and at other locations to provide pattern resembling random-width boards.
9. Finish: As selected by Architect from manufacturer's full range.

B. Softwood Board Paneling: Interior wood-board paneling complying with WMMPA WM 9.

1. Species: Douglas Fir.
2. Grade: Clear No. 1
3. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
4. Pattern: As indicated.
5. Grain: Vertical grain.
6. Length: Uniform lengths of dimension indicated or required to provide full-length pieces without intermediate end joints.
7. Finish: Manufacturer’s standard sanded finish, ready for field application of transparent finish.
8. Net Coverage Width: Not less than 5-1/16 inches

2.6 SHELVING

A. Shelving: Made from the following material, 3/4 inch thick.

1. Melamine.

B. Shelf Cleats: 3/4-by-5-1/2-inch boards with hole and notch to receive clothes rods, as specified above.

C. Shelf Brackets with Rod Support: BHMA A156.16, B04051; prime-painted formed steel.

D. Shelf Brackets without Rod Support: BHMA A156.16, B04041; prime-painted formed steel.

E. Standards for Adjustable Shelf Brackets: BHMA A156.9, B04102; powder-coat-finished steel.

F. Adjustable Shelf Brackets: BHMA A156.9, B04112; powder-coat-finished steel

G. Standards for Adjustable Shelf Supports: BHMA A156.9, B04071; powder-coat-finished steel.

H. Adjustable Shelf Supports: BHMA A156.9, B04081 or B04091; powder-coat-finished steel.

I. Clothes Rods: 1-1/2-inch diameter, powder-coat-finished steel.

J. Clothes Rods: 1-5/16-inch-diameter, powder-coat-finished steel.

K. Rod Flanges: powder-coat-finished steel.

2.7 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.

C. Paneling Adhesive: Comply with paneling manufacturer's written recommendations for adhesives.

D. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.

2.8 FABRICATION

A. Back out or kerf backs of the following members except those with ends exposed in finished work:

1. Interior standing and running trim except shoe and crown molds.
2. Wood-board paneling.

B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, too small to fabricate with proper jointing arrangements, or with defective surfaces, sizes, or patterns.

B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
4. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.

1. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
2. Install trim after gypsum-board joint finishing operations are completed.
3. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 PANELING INSTALLATION

A. Plywood Paneling: Select and arrange panels on each wall to minimize noticeable variations in grain character and color between adjacent panels. Leave 1/4-inch gap to be covered with trim at top, bottom, and openings. Install with uniform tight joints between panels.

1. Attach panels to supports with manufacturer's recommended panel adhesive and fasteners. Space fasteners and adhesive as recommended by panel manufacturer.
2. Conceal fasteners to greatest practical extent.
3. Arrange panels with grooves and joints over supports. Fasten to supports with nails of type and at spacing recommended by panel manufacturer. Use fasteners with prefinished heads matching groove color.

B. Board Paneling: Install according to manufacturer's written instructions. Arrange in random-width pattern suggested by manufacturer unless boards or planks are of uniform width.

1. Install in full lengths without end joints.
2. Select and arrange boards on each wall to minimize noticeable variations in grain character and color between adjacent boards. Install with uniform tight joints between boards.
3. Fasten paneling by face nailing, setting nails, and filling over nail heads.
4. Fasten paneling with trim screws, set below face and filled.
5. Fasten paneling by blind nailing through tongues.
6. Fasten paneling with paneling system manufacturer's concealed clips.
7. Fasten paneling to gypsum wallboard with panel adhesive.

3.6 SHELVING INSTALLATION

A. Cut shelf cleats at ends of shelves about 1/2 inch less than width of shelves and sand exposed ends smooth.

B. Install shelf cleats by fastening to framing or backing with finish nails or trim screws, set below face and filled. Space fasteners not more than 16 inches o.c. Use 2 fasteners at each framing member or fastener location for cleats 4 inches nominal in width and wider.

1. Apply a bead of multipurpose construction adhesive to back of shelf cleats before installing. Remove adhesive that is squeezed out after fastening shelf cleats in place.

C. Install shelf brackets according to manufacturer's written instructions, spaced not more than 32 inches o.c. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

D. Install standards for adjustable shelf supports according to manufacturer's written instructions. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Space fasteners not more than 12 inches o.c.

E. Install standards for adjustable shelf brackets according to manufacturer's written instructions, spaced not more than 36 inches o.c. and within 6 inches of end of shelves. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

F. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled. Install shelves, fully seated on cleats, brackets, and supports.

1. Fasten shelves to cleats with finish nails or trim screws, set flush.
2. Fasten shelves to brackets to comply with bracket manufacturer's written instructions.

G. Install rod flanges for rods as indicated. Fasten to shelf cleats, framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Install rods in rod flanges.

3.7 ADJUSTING

A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.8 CLEANING

A. Clean interior finish carpentry on exposed and semi-exposed surfaces. Restore damaged or soiled areas and touch up factory-applied finishes, if any.

3.9 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 062023

This page intentionally left blank

SECTION 064116

PLASTIC LAMINATE FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Wood cabinets.
2. Plastic-laminate cabinets.
3. Plastic-laminate countertops.
4. Shop finishing interior woodwork.

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
2. Division 6 Section "Finish Carpentry" for interior carpentry exposed to view that is not specified in this Section.

1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items, unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

A. Product Data: For cabinet hardware and accessories.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections. Show locations and sizes of cutouts and holes for plumbing fixtures and other items installed in architectural woodwork. Apply WIC-certified compliance label to first page of Shop Drawings.

C. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.

1. Plastic laminates.

D. Samples for Verification: For the following:

1. Wood-veneer-faced panel products with transparent finish, 8 by 10 inches, for each species and cut. Include at least one face-veneer seam and finish as specified.

2. Plastic-laminate-clad panel products, 8 by 10 inches, for each type, color, pattern, and surface finish.

3. Exposed cabinet hardware and accessories, one unit for each type.

E. Product Certificates: Signed by manufacturers of woodwork certifying that products furnished comply with requirements.

1.5 QUALITY ASSURANCE

A. Quality Standard: Unless otherwise indicated, comply with WIC's "Manual of Millwork" for grades of interior architectural woodwork, construction, finishes, and other requirements.

1. Provide WIC-certified compliance certificate indicating that woodwork complies with requirements of grades specified.

2. Provide WIC-certified compliance certificate for installation.

3. Final product and installation shall be certified by a WIC inspector.

4. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with such selections and requirements in addition to the quality standard.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, and wet work is complete

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of the WIC quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Products: Comply with the following:

1. Softwood Plywood: DOC PS 1.

2. Hardwood Plywood and Face Veneers: HPVA HP-1.

C. Clear Float Glass for Doors: ASTM C 1036, Type I, Class 1, Quality q3, 6 mm thick, unless otherwise indicated.

E. Clear Tempered Float Glass for Doors: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality q3; manufactured by horizontal (roller hearth) process, with exposed edges seamed before tempering, 6 mm thick, unless otherwise indicated.

F. Mirror Glass for Doors: ASTM C 1036, Type I, Class 1, Quality q2; with second (back) surface coated with successive layers of chemically deposited silver, copper, and protective organic coating to produce coating system complying with performance requirements of FS DD-M-411.

1. Glass Thickness: 6 mm, unless otherwise indicated.

G. Clear Tempered Float Glass for Shelves: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality q3; with exposed edges seamed before tempering, 6 mm thick, unless otherwise indicated.
High-Pressure Decorative Laminate shall conform to NEMA LD 3, grades.

2.2 CABINET HARDWARE AND ACCESSORIES

A. Hinges: Stainless-steel, 5-knuckle hinges complying with BHMA 156.9, Grade 1, with antifriction bearings and rounded tips. Provide 2 for doors less than 48 inches high and 3 for doors more than 48 inches high. Hinges shall be notched.

B. Wire Pulls: Back mounted, 4 inches long, 5/16 inches in diameter.

C. Catches: Magnetic catches, equivalent to the following:

1. National Lock: No. 61-570.

2. Stanley Hardware; N0. 41.

D. Adjustable Shelf Standards and Supports:

1. Shall be 32 mm systems and 5 mm shelf supports.

E. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, equal to Accuride #100, and rated for the following loads:

1. Box Drawer Slides: 100 lbf.

2. File Drawer Slides: 150 lbf.

3. Pencil Drawer Slides: 45 lbf.

4. Keyboard Slide: 75 lbf.

F. Aluminum Slides for Sliding Glass Doors: BHMA A156.9, B07063.

G. Door Locks, Drawer Locks and Sliding Door Locks:

1. All cabinet door, drawer, and sliding door locks shall be easily re-keyable with a set screw cylinder release system or speed release cylinder removal system so as to afford easy access to the cylinder and cylinder housing by Owner facility personnel in servicing the locks. Cylinders to have a forwardly removable cylinder for easy access to lock pins. Locks to have passed ANSI Grade 1 testing. All cam locks must be keyed to same Owner R-1 keyway (5 or 6) Master Key System 47T97987.

2. Subject to compliance with the requirements, products that may be incorporated into the Work include, but are not limited to the following:
   a. Door Locks:
      (1) Olympus 500DR
      (2) Corbin 0737
   b. Drawer Locks:
      (1) Olympus 600DM
      (2) Corbin 0738
   c. Sliding Door Locks
      (1) Olympus 400SD
      (2) Corbin 02291

3. R-1 keyway (5 or 6 pin) to Owner Master Key 47T97987 standard as manufactured by Olympus Lock - 500DR (door), 600DW (drawer), 400SD (sliding door) or Corbin Cabinet Lock - 0737 (door), 0738 (drawer), 02291 (sliding door)

H. Grommets for Cable Passage through Countertops: 2-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.

I. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
   a. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

J. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.3 INSTALLATION MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 19 percent moisture content. Horizontal hanging strips shall be attached and continuous between wall framing members. Coordinate locations with millwork manufacturer.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.4 FABRICATION, GENERAL

A. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

B. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

C. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

D. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs. Seal edges of openings in countertops with water resistant material.

E. Install glass to comply with applicable requirements in Division 8 Section "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

2.5 WOOD CABINETS FOR TRANSPARENT FINISH

A. Quality Standard: Comply with WIC Section 14, except all cores shall be 13 ply Baltic Birch plywood.

B. Grade: Custom.

C. WIC Construction Style: Style A, Frameless.

D. WIC Construction Type: Type I, multiple self-supporting units rigidly joined together, or Type II, single-length sections to fit access openings.

E. WIC Door and Drawer Front Style: Flush overlay.

F. Wood Species and Cut for Exposed Surfaces: Red oak, rift sawn or cut

G. Semi exposed Surfaces: Provide surface materials indicated below:

1. Surfaces Other Than Drawer Bodies: Match species and cut indicated for exposed surfaces.

2. Drawer Sides and Backs: 1/2 inch thick 7 ply Baltic Birch plywood.

3. Drawer Bottoms: 1/4 inch thick plywood

2.6 PLASTIC-LAMINATE CABINETS

A. Quality Standard: Comply with WIC Section 15, except all plywood cores shall be 7 ply with void free core and a non-telegraphing face.

B. Grade: Custom.

C. WIC Construction Style: Style A, Frameless.

D. WIC Construction Type: Type I, multiple self-supporting units rigidly joined together, or Type II, single-length sections to fit access openings.

E. WIC Door and Drawer Front Style: Flush overlay.

F. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: HPL.

2. Post-formed Surfaces: HPL.

3. Vertical Surfaces: VGS.

4. Edge banding: Rigid PVC extrusions, bevel edges, through color with satin finish, 3 mm thick.

G. Materials for Semi exposed Surfaces: Provide surface materials indicated below:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS, or cabinet liner.

2. Drawer Sides and Backs: 1/2 inch thick 7 ply Baltic Birch plywood.

3. Drawer Bottoms: 1/4-inch thick sound plywood.

H. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. Match color, pattern, and finish as indicated by laminate manufacturer's designations for these characteristics.

2. Match Architect's sample.

3. Provide Architect's selections from laminate manufacturer's full range of colors and finishes in the following categories:
   a. Solid colors.
   b. Wood grains.

c. Patterns.

2.7 SOLID SURFACE COUNTERTOPS

A. Quality Standard: Comply with WIC Section 16 except use exterior grade plywood cores.

B. Grade: Custom.

C. High-Pressure Decorative Laminate Grade: HPL.

D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. Match color, pattern, and finish as indicated by manufacturer's designations for these characteristics.

2. Match Architect's sample.

3. Provide Architect's selections from manufacturer's full range of colors and finishes in the following categories:

a. Solid colors.
b. Wood grains.
c. Patterns.

E. Grain Direction: Horizontal.

F. Edge Treatment: Rolled raised front edge.

G. Core Material: Exterior-grade plywood.

H. Backsplash: Coved.

2.8 SHOP FINISHING

A. Quality Standard: Comply with WIC Section 25, unless otherwise indicated.

1. Grade: Provide finishes of same grades as items to be finished.

B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

C. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

D. Transparent Finish: Comply with requirements indicated below for grade, finish system, staining, and sheen, with sheen measured on 60-degree gloss meter per ASTM D 523:

1. WIC Finish System #1b.: Catalyzed lacquer.

2. Staining: Match Architect's sample.

3. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.

4. Filled Finish for Open-Grain Woods: After staining (if any), apply paste wood filler to open grain woods and wipe off excess. Tint filler to match stained wood.
   a. Apply vinyl wash coat sealer after staining and before filling.
5. Sheen: Satin, 30-50 gloss units.

PART 3 - EXECUTION

3.1. PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing.

3.2. INSTALLATION

A. Quality Standard: Install woodwork to comply with WIC Section 26 for the same grade specified in Part 2 of this Section for type of woodwork involved.

B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.

1. Anchor woodwork to anchors or blocking as specified by WIC.

D. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated. No visible anchoring in semi-exposed casework. Anchor screws shall be covered by anchor covers.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

E. Regulatory Requirements: Brace and anchor wall cabinets and base cabinets over 5 feet high in accordance with CBC requirements

F. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface. Joints shall not exceed 1/8 inch in width.

2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

3. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c..

4. Calk space between backsplash and wall with silicone sealant specified in Division 7 Section "Joint Sealants."

3.3. ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064116

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 071326

SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Modified bituminous sheet waterproofing for vertical applications.
2. Molded-sheet drainage panels.

B. Related Requirements:

1. Section 071413 “Hot-Fluid Applied Rubberized Asphalt Waterproofing” for horizontal waterproofing applications.

1.3 PRE-INSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

C. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Installer's Special Warranty: Signed by Installer, covering Work of this Section, for warranty period of five years.

1. Warranty includes removing and reinstalling protection board and drainage panels.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations for Waterproofing System: Obtain waterproofing materials, protection course, and molded-sheet drainage panels from single manufacturer.

2.2 MODIFIED BITUMINOUS SHEET WATERPROOFING

A. Modified Bituminous Sheet: Minimum 60-mil nominal thickness, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated on one side to a 4-mil-thick, polyethylene-film reinforcement, and with release liner on adhesive side**;** formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Carlisle Coatings & Waterproofing Inc.
    b. Grace Construction Products; W.R. Grace & Co. -- Conn.
    c. Polyguard Products, Inc.
    d. Or Equal.

2. Physical Properties:

    a. Tensile Strength, Membrane: 250 psi minimum; ASTM D 412, Die C, modified.
    b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
    c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
    d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
    e. Puncture Resistance: 40 lbf minimum; ASTM E 154.
    f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
    g. Water Vapor Permeance: 0.05 perms maximum; ASTM E 96/E 96M, Water Method.
    h. Hydrostatic-Head Resistance: 200 feet minimum; ASTM D 5385.

3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.3 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

B. Primer: Liquid waterborne primer recommended for substrate by sheet-waterproofing material manufacturer.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.

D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.

E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.

F. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.

G. Protection Course: ASTM D 6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:

1. Thickness: 1/8 inch, nominal.
2. Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for protection course type.

H. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

2.4 MOLDED-SHEET DRAINAGE PANELS

A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate of 9 to 15 gpm per ft.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carlisle Coatings & Waterproofing Inc.
b. Grace Construction Products; W.R. Grace & Co.
c. Polyguard Products.
d. Or Equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the waterproofing.

1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.

F. Bridge and cover expansion joints with overlapping sheet strips of widths according to manufacturer's written instructions.

1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.

G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:

a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.

H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch-minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.

1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.

D. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.

E. Seal edges of sheet-waterproofing terminations with mastic.

F. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.

G. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.

H. Immediately install protection course with butted joints over waterproofing membrane.

3.4 MOLDED-SHEET DRAINAGE-PANEL INSTALLATION

A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesives or other methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

1. For vertical applications, install protection course before installing drainage panels.

3.5 FIELD QUALITY CONTROL

A. Engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish daily reports to Construction Manager.

3.6 PROTECTION, REPAIR, AND CLEANING

A. Do not permit foot or vehicular traffic on unprotected membrane.

B. Protect waterproofing from damage and wear during remainder of construction period.

C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071326

This page left intentionally blank.

SECTION 071413

HOT-FLUID APPLIED RUBBERIZED ASPHALT WATERPROOFING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hot applied fabric-reinforced rubberized asphalt waterproofing system (WP-1) on vertical, horizontal and sloped concrete surfaces with the following systems applications.

B. Related Sections:

1. Section 033000 - Cast-in-Place Concrete
2. Section 072100 – Thermal Insulation
3. Section 076200 - Sheet Metal Flashing and Trim
4. Section 079200 - Joint Sealants.

1.2 SYSTEM DESCRIPTION

A. (WP-1) Horizontal Waterproofing System - Fabric Reinforced System: 215 mil thick hot applied rubberized asphalt system consists of the following:

1. Surface conditioner and neoprene flashing.
2. 215 mil membrane: Composite application consisting of 90 base layer of asphalt, embedded layer of polyester fabric, and 125 mil top layer of asphalt.
3. Protection sheet embedded in top surface.
4. Filter fabric layer over top of insulation

1.3 SUBMITTALS

A. Comply with Section 013300, unless otherwise indicated.

B. Product Data: Manufacturer's specifications and technical data including following.

1. Detailed specification of construction and fabrication.
2. Manufacturer's installation instructions, specifically written for this project including procedures and materials for flashing, splicing and bonding.

C. Shop Drawings: Indicate specific modifications of manufacturer's standard details to comply with project requirements plus the following specific requirements.

1. Indicate layout of sheets, location of field splices, type of splices, and termination details.

D. Quality Control Submittals: Comply with Section 014000.

1. Statement of qualifications for manufacturers and installers.
2. Statement of compliance with CGSB 37.50-M89.

E. Contract Closeout Submittals: Comply with Section 017700.
1. Special warranties.
2. Manufacturer's field reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Firm specializing in installation of types of waterproofing required for project for not less than 3 years and is acceptable to waterproofing manufacturer.

B. As applicable, assign work closely associated with waterproofing, including (but not limited to) waterproofing accessories, flashings in connection with waterproofing, expansion joints in membrane, insulation and protection course on membrane, to installer of waterproofing, for undivided responsibility.

C. Pre-installation Conference: Membrane waterproofing applicator, manufacturer's representative, Contractor and Architect shall meet at Site to review membrane waterproofing procedure, acceptance of substrate surfaces, and coordination with other trades.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to project site in original containers with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, shelf life, and directions for storing and mixing with other components.

B. Store materials in their original undamaged containers in clean, dry, protected location and within temperature range required by waterproofing manufacturer. Protect stored materials from direct sunlight.

C. Remove and replace material that cannot be applied within its stated shelf life.

1.6 PROJECT CONDITIONS

A. Substrate: Proceed with work of this section only after substrate construction and penetrating work have been completed.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not apply waterproofing membrane during inclement weather or when air temperature is below 40 degrees F.

B. Do not apply waterproofing membrane to damp, frozen, dirty, dusty, or unsuitable surfaces. Concrete surfaces shall be cured for 28 days.

C. Provide positive exhaust ventilation when waterproofing membrane is applied in enclosed areas, to remove toxic fumes.

D. At existing occupied buildings and at additions to existing occupied buildings, provide material with VOC (Volatile Organic Content) of 0.

1.8 WARRANTY

A. Contractor/manufacturer/installer shall warrant installed system for period of 5 years from Date of Substantial Completion against all the conditions indicated below. When notified in writing from Owner, Contractor/manufacturer/installer shall promptly, and without inconvenience and cost to Owner, correct said deficiencies.

1. Water-tight condition covered by Contractor/installer.
2. Faulty workmanship covered by Contractor/installer.
3. Defective material covered by manufacturer.
4. Correction includes responsibility for removal and reinstallation of other Work which conceals membrane waterproofing.
5. During special warranty period, repairs and replacements required because acts of God and other events beyond manufacturer's/installer's control shall be completed by manufacturer/installer and will be paid for by Owner at prevailing rates.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers and Products:

1. American Hydrotech Liquid Membrane 6125.
2. Carlisle Coatings and Waterproofing, CCW-500R
3. Tremproof 6100 by Tremco.
4. Ram Tough 250 by Barrett.

2.2 MATERIALS

A. Waterproofing Membrane (WP-1): Hot applied rubberized asphalt, cake form for field melting.

1. Comply with CGSB 37.50-M89.
2. Resistant to acids that will be encountered in fertilizers, building washes, and acid rain.
3. Fillers: Inert clay and not calcium carbonate.

B. Surface Conditioner: Cut-back asphalt conforming to ASTM D41 and specially modified as recommended by membrane manufacturer.

C. Reinforcing Sheet and Expansion Joint Flashing: 60 mil uncured neoprene.

D. Polyester Fabric Flashing: 0.09 pound spun-bonded polyester.

E. Neoprene Flashing: 45 mil uncured neoprene.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which Work is to be performed and identify conditions detrimental to proper or timely completion.

1. Ensure substrate is clean and free of depressions, waves or projections and is properly sloped to drainage locations.
   a. Finish texture of concrete substrate: Wood float finish.
2. Ensure curbs, pipes, sleeves, ducts, and vents through substrate are solidly set.
3. Ensure cant strips, reglets and nailing strips are properly located and installed.
4. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Form slight cove at vertical surfaces and fill cracks and joints with mastic or sealer in conformance with manufacturer's instructions.

B. Clean surfaces of foreign matter detrimental to installation of membrane. Sand areas to remove curing membrane if resin or other non-compatible type curing material was used.

1. Coordinate requirements with Work of Section 033000.

C. Moisture Content: Check moisture content of substrate to ensure current moisture content is within membrane manufacturer's requirements. Provide additional drying techniques or equipment to obtain compliance.

D. Apply surface conditioner at a rate recommended by manufacturer and allow to dry.

3.3 MEMBRANE INSTALLATION

A. Comply with manufacturer's recommendations.

B. Melt asphalt cakes to comply with manufacturer's recommendations to uniform temperature of 400 Degrees F (50 Degrees +/- maximum).

C. Apply hot asphalt over substrate at an average coating of 180 mils (3/16 inch) thickness and not less than 125 mils (1/8 inch) thickness.

D. Apply hot asphalt over substrate at average coating of 90 mils (3/32 inch) thickness, then embed layer of reinforcing fabric, followed by another coat of membrane at minimum 125 mils. Total minimum thickness of 215 mils.

1. Overlay process: While membrane is still warm and tacky, cover entire surface of membrane, including work at joints and cracks, with 60 mil uncured neoprene sheet, lapping seams 6 inches and sealing laps and joints hot asphalt.
2. Ensure neoprene overlay is free of bulges, fish-mouths or bubbles. Cut-out defective areas, patch, and recoat with hot asphalt while system is still warm.

E. Install protection sheet in accordance with Manufacturer’s instructions.

F. Construction Joints: At construction joints and cracks over 1/16 inch and less than 1/4 inch wide, embed 6 inch wide strip of polyester fabric flashing into hot asphalt along the joint.

1. Allow assembly to cool and apply second 1/8 inch of hot asphalt.
2. Extend second coat not less than 3 inches beyond each side of flashing.

G. Exterior Vertical Corners: Embed 6 inch wide strip of 60 mil uncured neoprene flashing into hot asphalt.

1. Allow assembly to cool and apply second coat of hot asphalt.
2. Extend second coat not less than 3 inches beyond each side of flashing.

H. Interior Vertical Corner: Similar to external, but use polyester fabric flashing.

I. Expansion Joints: At expansion joints and cracks over 1/4 inch, install 12 inch wide strip of 60 mil uncured neoprene flashing with looped down configuration or roll over large diameter backing material to allow free movement.

1. Embed edges of flashing in hot asphalt.
2. Allow assembly to cool and apply second 1/8 inch coat of hot asphalt.
3. Extend second coat not less than 6 inches beyond each side of flashing.

J. Flashings: At joints and transitions between horizontal and vertical surfaces, and at penetrations and drains, reinforce with 60 mil uncured neoprene to comply with expansion joint detailing specified above.

1. Corner reinforcement at concealed location of identical substrate: Use polyester fabric.

3.4 ACCESSORY INSTALLATION

A. Install protection board over membrane as soon as system will allow.

B. After water tests, specified under Field Quality Control below, are completed, install drainage board over membrane and protection board.

C. Install drainage board as indicated.

D. Installation of Horizontal Insulation Over Waterproof Membrane: Install insulation over protection and drainage board. Stagger locations of short joints. Butt panels tightly together. Fill voids over 1/4 inch wide with insulation.

1. Install rigid insulation with long joints continuous and short joints staggered. Offset joints between layers.
2. Cover insulation with filter fabric over lap joints not less than 12 inches.
3. Refer to Section 033000 for concrete above.

E. Cap Flashing: Over membrane along foundation wall at finish grade, install cap flashing to cover top edges of waterproofing that extends above grade. Anchor cap flashing securely in place to comply with the manufacturer's directions. Butt joints tightly and set in bed of sealant.

1. Close and seal ends to maintain weather-tightness and fill top trough with sealant to provide weather-tight, surface-mounted cap flashing.

3.5 FIELD QUALITY CONTROL

A. Water Tests at Horizontal Surfaces: On completion of installation of membrane, dam areas in preparation for flood testing. If entire area is too large to test at one time, divide into smaller pieces.

1. Flood area to a depth of not less than 3 inches with clean water. After not less than 24 hours, check for leaks.
2. If leaking is found, patch using same waterproofing materials; repeat flood test.
3. When the area is proved watertight, drain the water and remove dam.

B. Manufacturer's Field Services: Membrane manufacturer's technical representative shall provide following field services during installation.

1. Pre-form a pre-installation examination and acceptance of substrate and surface preparation for each stage. Issue report.
2. Be present at initial start-up for each process. Confirm application rates and techniques. Issue report.
3. Issue summary report at completion of installation indicating manufacturer's acceptance of installed system and warranty conditions.

3.6 PROTECTION

A. Institute procedures for protection of completed membrane during installation of work over membrane and throughout remainder of construction period. Do not allow traffic of any type on unprotected membrane.

B. Temporary Protection: Provide temporary protection if there are delays in Work or sequencing such that materials will not be properly protected. Remove temporary protection when Work is resumed.

END OF SECTION 071413

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 071900

WATER REPELLENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Division 01 applies to this Section. Provide a water repellent sealer treatment, complete.

B. Definition: The term "waterproof" shall mean resistant to penetration of water from driving rain under normal weather conditions of the area.

1.2 SUBMITTALS

A. Refer to Section 013300 for procedures.

B. Samples and Product Data: Submit Samples of sealer accompanied by sealer manufacturer's technical data, surface preparation and application instructions, recommended coverage rates for the types of surfaces to be treated, and evidence that sealer conforms to all requirements specified.

C. Test Reports: Submit written test reports for preliminary testing, both manufacturer's laboratory testing and testing at the site.

D. Submit material cost data for all materials required to construct the work in place. The cost data should be as marked up to the General Contractor. If the work is self-performed the material cost shall reflect the actual cost of material without mark up.

1.3 QUALITY ASSURANCE

A. Manufacturer's Supervision: Start sealer application under supervision of the sealer manufacturer. Notify the Architect and sealer manufacturer at least 72 hours prior to starting preliminary tests and application.

B. Preliminary Tests:

1. Tests by Manufacturer: Send following test samples, all as approved for use in the Work under other Sections, to sealer manufacturer for preliminary laboratory testing to verify sealer is adequately reacted by material or product constituents and that sealer is compatible with and does not affect the color or appearance of the material or product.

2. Preliminary Tests at Site: Sealer manufacturer and the Subcontractor for Work of this Section shall make tests on each kind of surface to be treated to establish the actual application rates required to fully waterproof involved surfaces and meet warranty requirements. Tests shall demonstrate sealer does not darken, mottle, or discolor treated surfaces and that surfaces to be treated are dry.

1.4 JOB CONDITIONS

A. Protection: Install temporary coverings and protection, and do not allow any sealer to contact plastic, planting soil, plants, asphaltic paving, roofing membranes, or other materials damaged by sealer.

B. Weather Conditions: Do not apply sealer during windy, wet, or excessively hot or dry weather conditions.

1.5 WARRANTY

A. Refer to Section 017870. The Contractor and Subcontractor shall jointly and severally warrant that repellent sealer treated surfaces will remain waterproof and free of water intrusion for at least 2 years, and that they will immediately repair and correct deficiencies or leaks that appear in the treated surfaces during warranty period at no cost to Owner. Sealer manufacturer shall warrant to furnish all sealer materials required to correct leakage that occurs in water repellent treated surfaces within 5 years from the Date of Substantial Completion at no further cost to Owner. Leakage caused by structural cracking or movement are excepted from the warranty.

PART 2 - PRODUCTS

2.1 SEALER MATERIALS

A. Furnish sealer materials conforming to the requirements as specified herein, "Deep Seal" manufactured by Pacific Coatings and Chemicals, 10040 Canoga Avenue, Chatsworth, Calif. 91311, 818/407-0224, or "Enviroseal 40" by Hydrozo; refer to Section 01600 regarding substitutions. Dilution of sealer at the site is not allowed. Provide a clear non-silicone non-acrylic wax-free sealer of organo-silane polymer solids and a water-base solvent, type that does not darken or discolor treated surfaces and non-toxic, compatible with standard product polymer type calking and sealing materials, meeting SCAQMD requirements, and certified by the sealer manufacturer as containing not less than 20% organo-silane solids by weight and suitable to receive oil, alkyd, or water based paint finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that surfaces to receive sealer are clean and free of dust, dirt, oil, grease, other deleterious substances and stains, and laitance or efflorescence; conform to Subparagraph "Preliminary Test Repeating" herein as required. Repair cracks or holes over 1/16" size. Spot prime cracks and holes 1/16" size and smaller and prime all horizontal surfaces other than soffits with heavy duty organo-silane sealer supplied by same sealer manufacturer. Mask and fully protect adjoining surfaces and glass unless sealer is harmless and easily removed.

3.2 APPLICATION

A. By experienced mechanics using methods and spray equipment recommended by sealer manufacturer (Hudson type sprayers are not permitted) and when surfaces to be treated are dry determined by moisture meter in accordance with sealer manufacturer's instructions.

B. Spray Application: Apply each sealer coat by airless spray using nominal 20 psi nozzle pressure. Obtain complete coverage of each coat. Indicate to the Architect or Owner areas that are coated when application is stopped for lunch or at end of the day.

END OF SECTION 071900

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 072100

THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Concealed building insulation.
2. Curtain Wall Insulation.
3. Sound attenuation insulation.

PART 2 - PRODUCTS

2.1 SLAG-WOOL-FIBER/ROCK-WOOL-FIBER BOARD INSULATION

A. Available Manufacturers:

1. Fibrex Insulations Inc.
2. Owens Corning.
3. Thermafiber.

B. Foil-Faced, Mineral-Wool-Fiber Board Insulation: ASTM C 612; faced on 1 side with foil-scrim or foil-scrim-polyethylene vapor retarder; with maximum flame-spread and smoke-developed indexes of 25 and 5, respectively; and of the following nominal density and thermal resistivity:

1. Nominal density of 8 lb/cu. ft. (128 kg/cu. m), Type III.

2.2 GLASS-FIBER BLANKET INSULATION

A. Available Manufacturers:

1. CertainTeed Corporation.
2. Guardian Fiberglass, Inc.
3. Johns Manville.
4. Knauf Fiber Glass.
5. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and

smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

C. Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft vapor-retarder membrane on 1 face.

D. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with no less than thermal resistances indicated:

1. 3-1/2 inches (89 mm) thick with a thermal resistance of R-13.
2. 5-1/2 inches (140 mm) thick with a thermal resistance of R-19.

2.3 OUTLET BOX PADS

A. Basis-of-Design Product: Harry A. Lowry & Associates, Inc.; Outlet Box Pads.

B. Composition: Grey, Polybutene-butyl, inert fillers (Positively no asbestos).

2.4 SPRAY POLYURETHANE FOAM INSULATION

A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, available manufacturers as follows:

a. BASF Corporation.
b. BaySystems NorthAmerica, LLC.
c. Dow Chemical Company (The).
d. ERSystems, Inc.
e. Gaco Western Inc.
f. Henry Company.
g. NCFI; Division of Barnhardt Mfg. Co.
h. SWD Urethane Company.
i. Volatile Free, Inc.

2. Minimum density of 1.5 lb/cu. ft. (24 kg/cu. m), thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F (43 K x m/W at 24 deg C).

PART 3 - EXECUTION

3.1 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements:

1. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for contact with insulation.
2. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

3.2 INSTALLATION OF CURTAINWALL INSULATION

A. Install 2 inches (50 mm) thick, foil-faced, mineral-wool-fiber board insulation where curtain wall insulation is indicated.

3.3 INSTALLATION OF INSULATION FOR SOUND ATTENUATION

A. Install minimum 3-1/2 inches thick, unfaced glass-fiber blanket insulation.

B. Install outlet box pads on all outlet boxes in walls that are not fire rated.

END OF SECTION 072100

This page left intentionally blank.

SECTION 072119

FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Closed-cell spray polyurethane foam.
2. Open-cell spray polyurethane foam.

B. Related Requirements:

1. Section 072100 "Thermal Insulation" for foam-plastic board insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Evaluation Reports: For spray-applied polyurethane foam-plastic insulation.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM

A. Closed-Cell Spray Polyurethane Foam: ASTM C 1029, Type II, minimum density of 1.5 lb/cu. ft**.** minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F.

1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

    a. Flame-Spread Index: 25 or less.
    b. Smoke-Developed Index: 450 or less.

2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 OPEN-CELL SPRAY POLYURETHANE FOAM

Open-Cell Spray Polyurethane Foam: Spray-applied polyurethane foam using water as a blowing agent. Minimum density of 0.4 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 3.4 deg F x h x sq. ft./Btu at 75 deg F.

1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

    a. Flame-Spread Index: 25 or less.
    b. Smoke-Developed Index: 450 or less.

2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.3 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.

B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Spray insulation to envelop entire area to be insulated and fill voids.

C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.

D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.

E. Cavity Walls: Install into cavities to fully fill void.

F. Miscellaneous Voids: Apply according to manufacturer's written instructions.

3.3 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION 072119

This page left intentionally blank.

SECTION 073210

CONCRETE ROOF TILE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete roof tiles and roof system components.

B. Metal roof flashing.

C. Underlayments and self-seal membrane.

D. Related roof accessories.

1.2 RELATED SECTIONS

A. Section 076200 - Flashing and Sheet Metal.

B. Section 077200 - Roof Accessories

C. Section 086223 - Tubular Skylights

D. Division 15 - Mechanical: Mechanical work projecting through roof.

E. Division 16: - Electrical: Electrical work projecting through roof.

1.3 REFERENCES

A. ASTM A 90 - Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings; 2001.

B. ASTM A 525 - Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process; 1993.

C. ASTM A 641 - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 1998.

D. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

E. ASTM C 1492 - Standard Specification for Concrete Roof Tile.

F. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt

Used in Roofing and Waterproofing; 1997a.

G. ASTM D 249 - Standard Specification for Asphalt Roll Roofing (Organic Felt) Surfaced with Mineral Granules; 1989 (reapproved 1996).

H. ASTM D 2626 - Standard Specification for Asphalt-Saturated and Coated Organic Felt Base Sheet Used in Roofing; 1997b.

I. AWPA C2 - Lumber, Timber, Bridge Ties and Mine Ties -- Preservative Treatment by Pressure Processes; 2001.

J. Tile Roofing Institute (TRI) - Concrete and Clay Design Criteria for Cold and Snow Regions.

K. FRSA/TRI - Concrete and Clay Roof Tile Installation Manual Fourth Edition (For Florida High Wind Applications, 150 mph). August 2005.

L. ICC ESR 1647 (ICC-ES) - International Code Council Evaluation Services.

M. ICBO ESR-2015P Concrete and Clay Roof Tile Installation Manual for Moderate Climate Regions.

N. ICC AC 180 - Acceptance Criteria for Clay and Concrete Roof Tiles. August, 2007.

O. Florida Building Code, Product Approval - FL 560, FL610, FL7781, FL7849.

P. City of Los Angles Research Report - LA RR 23700

Q. CAN/CSA-A220. Series-06 - Concrete Roof Tiles.

R. ICC AC 188 for underlayments.

S. AC 48 for underlayments in severe climates.

T. AC 148 for Wakaflex flashing and ridge venting products.

1.4 DESIGN REQUIREMENTS

A. Roofing tile materials and installation shall conform to the requirements of ICC ESR 1647 and LA RR 23700.

B. Roofing tile materials and installation shall conform to the requirements of San Diego County Notice of Acceptance (NOA) as follows:

1. NOA 07-00507.08 - Duralite Shake & Slate.
2. NOA 07-0710.04 - Duralite Villa.
3. NOA 07-1012.07 - Duralite Villa.

4. NOA 07-10123.06 - Espana.
5. NOA 06-0711.13 - Villa.
6. NOA 07-1023.07 - Vanguard Roll.
7. NOA 06-0524.02 - Villa 900.
8. NOA 07-0220.04 - Barcelona 900.
9. NOA 07-0228.03 - Saxony 900.
10. NOA 07-0710.05 - Saxony.
11. NOA 07-1023.09 - Spanish "S".
12. NOA 07-1023.10 - Cedarlite.
13. NOA 07-1023.11 - Mission Barrel.
14. NOA 04-0512.04 - Madera.
15. NOA 06-0711.12 - Tejas Espana.
16. NOA 07-0710.06 - Madera 700.
17. NOA 07-0710.07 - Saxony 700.
18. NOA 07-0710.08 - Saxony 600.
19. NOA 07-0711.03 - Saxony 900.
20. NOA 09-0331.10 - Spanish S Nuevo.
21. NOA 08-0107.02 - Boral TileSeal HT Underlayment.
22. NOA 08-0214.05 - RoofTopGuard II Underlayment.
23. NOA 09-0127.05 - Elevated Batten System.
24. NOA 08-1106.03 - Wakaflex Universal Flashing.
25. NOA 09-0512.03 - Zephyr Roll Vented Weather Block.
26. NOA 09-1001.04 - RidgeVent and Universal Water Dam.
27. NOA 09-0512.04 - Zip Clip Universal Wind Clip.
28. NOA 10-0301.04 - Brandguard Vents Dormer Style Field Vent.

C. Roofing tile materials and installation shall conform to the SBCCI Standard for Hurricane Resistant Residential Construction, SSTD10-99, the International Building Code for One and Two Family Dwelling Code and the Florida Building Code 2007.

D. Roofing tile materials and installation shall conform to the requirements of the applicable building code.

1.5 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Indicate metal flashing profiles, joint locations, fastening locations, and installation details. Indicate tile layout with location of cut and

special shaped tiles identified.

D. Selection Samples: For each finish product specified, two complete sets of tile colors representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two full size samples representing actual product, color, and patterns.

F. Certificates of Compliance: Submit to certify compliance with referenced standards.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum five years documented experience producing concrete roof tile and member of Tile Roof Institute.

B. Installer Qualifications: Minimum five years documented experience installing products specified in this section and/or supervision by a manufacturers authorized installation representative.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by Architect.
2. Mock-up shall be a minimum of a 10 foot (3.05 M) by 10 foot (3.05 M) area and include the edge, ridge, valley and other typical transition conditions anticipated.
3. Do not proceed with remaining work until installation workmanship and appearance is approved by Architect.
4. Mock-up may not remain as part of Work.
5. Accepted mock-up may remain as part of Work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Deliver products to project site in manufacturer's unopened pallets, labeled with data indicating compliance with specified requirements.

C. Maintain dry storage area for products of this section until installation of products.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation)

within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not overload the roof. Distribute stacks of tile uniformly on roof at not greater than 12 inches (305 mm) in height.

1.9 WARRANTY

A. Roof Tile: MonierLifetile's Limited Lifetime, Fully Transferable, Non-Prorated Product Warranty against defects in roof tile for the life of the structure.

B. Installation Warranty: Warrants products of this section, as installed, to be in accord with the Contract Documents and free from faults and defects in materials and workmanship for a period of 3 years after completion.

1.10 EXTRA MATERIALS

A. Provide an additional 1 percent of installed roof tiles, but not less than one full square, for District's use in roof maintenance.

B. Furnish extra materials packaged with protective covering for storage and identified with labels clearly describing contents.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Boral Roofing, which is located at: 7575 Irvine Center Dr. Suite 100 ; Irvine, CA 92618; Toll Free Tel: 800-571-TILE (8453); Tel: 949-585 8202 ; Fax: 949-756-2401; Email: Dave.Hager@boral.com; Web: www.boralroof.com

B. Manufacturing and Distribution Facility:

1. Southern California Region:
   a. Rialto Plant: 3511 North Riverside Avenue, Rialto, CA 92377. Tel: 909-822-4407. Tel: 800-769-8453.
2. Southern Nevada Region:
   a. Henderson Plant, 430 Eastgate, Henderson, NV 95020. Tel: 702-564-8453, Toll Free: 800-224-3560.

C. Substitutions: Not permitted.

D. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 CONCRETE ROOF TILE - SOUTHERN CALIFORNIA

A. Standard Weight Tile: Barcelona profile.

1. Finishing Tile: Provide Capri Trim, Hip Starter and Capri Apex 3-Way tiles.
2. Size: 17 inches (432 mm) by 12-3/8 inches (314 mm), nominal.
3. Coverage: 89 field tiles per 100 square feet (9.29 sm) of roof area.
4. Installed weight per square: Approximately 900 lbs (408 kg).
5. Color and Finish: To match existing tile.

2.3 ACCESSORY MATERIALS - SOUTHERN CALIFORNIA

A. Underlayment:

1. Boral TileSeal HT Self-Adhering Underlayment.
2. Boral TileSeal 50 HT Self-Adhering Underlayment.
3. GatorSeal Granular Heavy Duty Self-Adhering Underlayment
4. Alcazar Mechanically Fastened Underlayment.
5. HomeBase Granular Mechanically Fastened Underlayment.
6. RoofTopGuard II Synthetic Underlayment.

B. Fasteners: Sized to penetrate deck minimum 3/4 inch (19 mm) or through thickness of deck or batten.

1. Quik Drive Screws, Roofing Specific.

C. Wind Clips:

1. Zip-Clip, Adjustable Tile Clip.
2. Wind Clips, Galvanized.

D. Flashings:

1. Ribbed Tile Pan, 26 gauge Galvanized Sheet Steel side wall flashing.
2. Wakaflex universal flashing for abutments at chimneys, walls and other rising structures.
3. Terminal Bar metal flashing for chimneys and other roof to wall structures.
4. Ribbed Valley Metal 1 inch Center Diverter, 26 gauge, Galvanized Sheet Steel.
5. Plumbing Stacks and Other Pipes Penetrating Roof: Wakaflex Pipe Flashing.

E. Adhesive: Code approved adhesive suitable to bond to concrete roof tile.

F. Eave Closures:

1. Provide to match tile profile.
2. Vented Eave Riser - Metal.
3. Eave Riser - Metal.
4. Eave Closure "T" - Metal. For flat tiles only.

G. Battens:

1. Elevated Batten System 1 inch (25 mm) by 3 inches (76 mm) by 8 feet (2.44 m).
2. Elevated Batten System 1 inch (25 mm) by 2 inches (51 mm) by 8 feet (2.44 m).
3. Elevated Batten System 1 inch (25 mm) by 3 inches (76 mm) by 4 feet (1.22 m). Fire Retardant Treated.
4. Elevated Batten System 1 inch (25 mm) by 2 inches (51 mm) by 4 feet (1.22 m). Fire Retardant Treated
5. Batten Extenders 18 inches (457 mm) for use with standard battens.

H. Hip and Ridge

1. RidgeVent: Ridge vent and weather block for flat tiles only.
2. Figaroll: Ridge vent and weather block. for all profiles.
3. Zephyr Roll: Ridge Vent and Weather Block, 11 inch by 33 inch (279 by 838 mm). For flat tiles.
4. Zephyr Roll: Ridge Vent and Weather Block, 13.4 inch by 33 inch (340 by 839 mm). For medium and high profile tiles.
5. Ridge Riser: Elevates ridge board to proper height. For all profiles.
6. Universal Water Dam: Used with RidgeVent installed on hips.

I. Rake and Gable End

1. Rake and Ridge tile. Choose to match tile profile and color.
2. Metal Rake Trim.
3. Gable End Rubber Wedges.

J. Field Venting

1. Brandguard Vents, Dormer, Flame and Ember Resistant Vents.
2. Zephyr Vents.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Verify surfaces are uniform, smooth, clean and dry.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result under the project conditions.

3.3 INSTALLATION - GENERAL

A. Install in accordance with manufacturer's instructions and the following:

1. ICBO ESR-2015P Concrete and Clay Roof Tile Installation Manual for Moderate Climate Regions.
2. TRI/WSRCA Standard Installation Guides for Concrete and Clay Roof Tile in Cold Weather Applications.
3. FRSA/TRI Concrete and Clay Roof Tile Installation Manual Fourth Edition (For Florida High Wind Applications, 150 mph).
4. CAN/CSA-A220.1-Series-06 - Concrete Roof Tiles.

3.4 UNDERLAYMENT APPLICATION:

A. Underlayment: Install in accordance with the manufacturer's instructions.

B. Install ridge vents; follow vent manufacturer's installation recommendations.

C. Install nailer boards or ridge risers with 2 inch by 2 inch (51 mm by 51 mm) nailer boards at hips and ridges:

1. Use fasteners of sufficient length to penetrate minimum 3/4 inch (19 mm) into trusses.
2. Attach with No. 26 gage (0.018 inch) galvanized strapping minimum 24 inches (610 mm) on center.

3.5 FLASHING INSTALLATION

A. Install flashings to shed water and prevent water penetration under tiles.

B. Valleys: Install preformed metal flashing over underlayment.

1. Closed Valley: Miter tile to form straight border at center of valley.
2. Open Valley: Miter tile to form straight border a minimum of 2 inches (51 mm) back from the center of the valley on each side.

C. Side Wall Flashing:

1. Install preformed metal pan flashing at base of wall over underlayment starting at lower end and working up.
2. Vertical Flange: 4 inches (102 mm), minimum; nail vertical metal flange near top of metal edge.
3. Base Flange: 6 inches (152 mm), minimum.
4. Metal Edge Return: 1 inch (25 mm); secure to either deck or batten strip with roofing nail through metal strap.
5. Lap Joints: 6 inches (152 mm), minimum.

D. Counter Flashing:

1. Lap Top Flange of Base Flashing: 3 inches (76 mm), minimum.
2. Nail metal near edge 6 inches (152 mm) on center.
3. Set metal into reglets and seal thoroughly.
4. Lap Joints: 3 inches (76 mm), minimum.

E. Install batten extenders to support tile over flashing.

F. Install tiles so as not to inhibit water flow on flashings.

G. Head and Apron Flashing:

1. Nail near top edge of vertical flange with minimum 4 inches (102 mm) on tile surface.
2. Lap metal as required including flash bar 6 inches (152 mm) and seal laps with flashing cement. Seal wall juctions with flashing cement.

H. Flashing at Curb Mounted Skylights and Other Items:

1. Install curb high enough to exceed tile height. Curbing must be a minimum 2 inches by 6 inches (51 mm by 152 mm) to allow for proper flashing transition.
2. Turn up underlayment a minimum of 4 inches (102 mm) at all sides of curbing.
3. Install flashing as noted above for side wall.

I. Flashing at Plumbing Stacks, Pipes, Turbines, Vents, Etc:

1. Install base flashing sealed or lapped by underlayment.
2. Install second flashing interlaced with tile coursing.
3. Seal with sealant if not self-sealing.

J. Coatings: Apply color coordinated paint to all exposed metal flashings.

3.6 BATTEN INSTALLATION

A. Install battens in accordance with the manufacturer's instructions.

3.7 TILE INSTALLATION

A. Layout:

1. Overhang at Eave: 3/4 inch (19 mm) past drip edge, uniformly aligned.
2. Overhang at Eave: 2 inches (51 mm) past drip edge, uniformly aligned.
3. Minimum Head Lap: 3 inches (76 mm).
4. Coursing: Staggered/cross bond.
5. Coursing: Straight bond.

B. Set perimeter tiles in mortar; apply sealer to exposed mortar.

C. Secure field and perimeter tile in accordance with UBC Table 15-D-2.

D. Cut field tile to form straight edge at center of hip, ridge and valley.

E. Install eave closures.

F. Install storm clips.

G. Hips: Use prefabricated hip starter.

1. Hips: Use standard hip tiles as starter.
2. Miter tile as hip starter to match eave lines.
3. Form end with color coordinated mortar.

H. Hips and Ridges, Mechanically fastened:

1. Install nailer board of sufficient height to support trim tile.
2. Protect nailer board with Type 30 asphalt felt, pressure sensitive adhesive, mortar, or preformed metal closure.
3. Mechanically fasten trim to nailer board with minimum 3/4 inch (19 mm) penetration.
4. Use approved sealant or clips.
5. Point mortar and finish to match tile surfaces.
6. Install Trim-Lock Ridge Metal and hips and ridges. Install tiles with approved tile adhesive.

I. Rakes and Gables:

1. Use prefabricated gable metal in accordance with manufacturer's instructions.
2. Install tiles so as not to inhibit water flow on flashings.

J. Rakes and Gables: Use rake tile.

1. Adjust first course to match field tile.
2. Nail rake tile with minimum two corrosion resistant fasteners of sufficient length to penetrate:
    a. Framing minimum 3/4 inch (19 mm).
    b. Abut eave succeeding rake tile to nose of field tile above.

3.8 CLEANING

A. Remove all broken tile, debris and excess tile from roof.

B. Sweep cut tiles clean.

3.9 REPAIR AND REPLACEMENT

A. Damaged Tile:

1. Break out damaged roof tile.
2. Repair torn underlayment.
3. Drive fastener flush.
4. Apply minimum 3/8 inch (10 mm) by 2 inch (51 mm) bead of approved adhesive on tile in course below replacement tile.
5. Immediately set replacement tile in position assuring proper contact.

B. Damaged Small Valley and Hip Cuts:

1. Apply a minimum of 3/8 inch (10 mm) by 2 inch (51 mm) bead of approved adhesive at head of cut tile.
2. Immediately set tile in course above in position assuring proper contact.

3.10 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Completion.

END OF SECTION 073210

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 075590

BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Modified bituminous membrane roofing.
2. Roofing insulation.
3. Roof membrane surfacing material.

B. Related Sections include the following:

1. Section 061000 "Rough Carpentry" for wood blocking, curbs, cants, and nailers; and wood-based, structural-use roof deck panels.
2. Section 062023 "Interior Finish Carpentry" for wood blocking, curbs, cants, and nailers.
3. Section 076200 "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counter-flashings.
4. Section 077200 "Roof Accessories."
5. Section 079200 "Joint Sealants."

1.3 REFERENCE STANDARDS

A. ASTM D1079 - Roofing Terminology definitions of terms related to roofing work not otherwise defined in this Section.

1. ASTM D-312-84 Type 1V, Asphalt used in roofing.

2. ASTM D-6163 Type 1 Fiberglass reinforce, SBS modified bitumen membrane sheet.

3. ASTM D-6164 Polyester reinforce, SBS modified bitumen membrane.

4. ASTM C-728-89a Perlite Thermal Insulation Board.

5. ASTM D-4586 Type 1 Bitumen Flashing Cement asbestos free and compatible with SBS.

6. ASTM D-41 Asphalt Primer

B. Underwriters Laboratories, Inc – U.L. Class A Fire Rating for entire roof system. System shall be listed in the current U.L. Building Materials Directory.

C. Factory Mutual Engineering Corp, Class 1, Wind Rating, IA-90 Approve, as determined in accordance with FMRC Standard 4470.

1.4 PERFORMANCE REQUIREMENTS

A. General: Install a watertight, modified bituminous membrane roofing and base flashing system with compatible components that will not permit the passage of liquid water and will withstand wind loads, thermally induced movement, and exposure to weather without failure.

B. FM Listing: Provide modified bituminous membrane, base flashings, and component materials that meet requirements of FM 4450 and FM 4470 as part of a roofing system and that are listed in FM's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM markings.

1. Roofing system shall comply with the following:
   a. Fire/Windstorm Classification: Class 1A-90.

1.4 SUBMITTALS

A. Product Data: For each type of roofing product specified. Include data substantiating that materials comply with requirements.

B. Installer Certificates: Signed by roofing system manufacturer certifying that Installer has been approved, authorized, or licensed by manufacturer for a minimum of (5) years to install specified roofing system and is eligible to receive the standard roofing manufacturer's warranty.

C. Manufacturer Certificates: Signed by roofing system manufacturer certifying that the roofing system complies with requirements specified in the "Performance Requirements" Article. Upon request, submit evidence of complying with requirements.

D. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of components of roofing system with requirements based on comprehensive testing of current product compositions.

1. Indicate compliance of bulk roofing asphalt materials delivered to Project with requirements. Include quantity and statistical and descriptive data for each product. Submit certificate with each load before it is used.
2. Include continuous log showing time and temperature for each load of bulk bitumen, indicating date obtained from manufacturer, where held, and how transported before final heating and application on roof.

E. Research/Evaluation Reports: Evidence of roofing system's compliance with building code in effect for Project from ICBO.

F. Maintenance Data: For roofing system to include in the maintenance manuals specified in Division 1.

G. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roof installation.

H. Data sheets showing that submitted materials have been tested, and meet the current ASTM numbers listed in this specification.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to perform Work of this Section who has specialized in installing roofing similar to that required for this Project; who has been approved by the manufacturer for a minimum of (5) years and authorized, or licensed by the roofing system manufacturer to install manufacturer's product; and who is eligible to receive the standard roofing manufacturer's warranty.

B. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method indicated below by UL, FM, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A; complying with ASTM E 108, for application and slopes indicated.
2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing materials are a part.

C. Pre-installation Conference: Before installing roofing system, conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings." Notify participants at least 5 working days before conference and meet at project site not more than one week prior to beginning roofing.

1. Meet with District; Architect; District's inspector; roofing Installer; roofing system manufacturer's representative; deck Installer; and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.

2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and attachment to structural members.
4. Review loading limitations of deck during and after roofing.
5. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing.
6. Review temporary protection requirements for roofing system during and after installation.
7. Review roof observation and repair procedures after roofing installation.
8. Designate which areas on site will be available for use as storage and work areas.
9. Review procedures to be followed to provide proper protection of roof system during and after construction of roof.
10. Document proceedings, including corrective measures or actions required, and furnish copy of record to each participant.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store roofing materials in a dry, well-ventilated, weather-tight location to ensure no significant moisture pickup and maintain at a temperature exceeding roofing system manufacturer's written instructions. Store rolls of felt and other sheet materials on end on pallets or other raised surfaces. Do not double-stack rolls.

1. Handle and store roofing materials and place equipment in a manner to avoid significant or permanent damage to deck or structural supporting members.

B. Do not leave unused felts and other sheet materials on the roof overnight or when roofing work is not in progress unless protected from weather and moisture and unless maintained at a temperature exceeding 50 deg F.

C. Deliver and store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.

D. Protect roofing insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

E. Allow no unlabeled materials on site.

1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with roofing work only when existing and forecasted weather conditions permit roofing to be installed according to manufacturers' written instructions and warranty requirements.

B. Ensure that fumes do not enter building air handling systems or building doors/windows.

C. If rain occurs once roofing has started, protect deck, insulation, penetrations and membrane from water damage and intrusion.

D. Remove and replace all material that has been subject to moisture.

E. In event of damage, immediately make all repairs and replacement required by Architect or District Representative.

1.8 WARRANTY

A. General Warranty: The warranties specified in this Article shall not deprive the District of other rights the District may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Standard Roofing Manufacturer's Warranty: Submit a written warranty, without monetary limitation, signed by roofing system manufacturer agreeing to promptly repair leaks in the roof membrane and base flashings resulting from defects in materials or workmanship for the following warranty period:

1. Warranty Period: 10 years NDL.
2. Guarantee to run from date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. SBS-Modified Bituminous Sheet:
   a. US Intec
   b. GAF Building Materials Corp.
   c. Johns Manville.
   d. Soprema Inc

2. Polyisocyanurate Board Insulation:
   a. U.S. Intec
   b. Johns Manville

c. Celotex Corp. (The).
d. GAF Building Materials Corp.

3. Perlite Board Insulation:
   a. GAF Building Materials Corp.
   b. Johns Manville.
   c. U.S. Intec

2.2 SBS-MODIFIED BITUMINOUS SHEET

A. SBS-Modified Bituminous Sheet, Smooth Surfaced: SBS-modified asphalt-impregnated and -coated sheet complying with ASTM D 5147 and ASTM D6163 Type 1 grade S, with glass-fiber-reinforcing mat, dusted with fine parting agent on both sides, and averaging or exceeding the following weight:

1. Weight: 60 lb/100 sq. ft, minimum.
2. Use: Base and intermediate ply.
3. Thickness: 2.1 mm minimum

   a. GAF – Ruberiod 20
   b. Johns Manville – Dyna Base
   c. U.S. Intec – SBS Glass Base
   d. Soprema – Elastophen Sanded

B. SBS-Modified Bituminous Sheet, Smooth Surfaced: SBS-modified asphalt sheet complying with ASTM D 5147 and ASTM D6164 Type 1Grade S smooth surfaced, dusted with fine parting agent on both sides; suitable for application method specified; thickness as indicated; for use and of reinforcing type as follows:

1. Use: Finish sheet in gravel surfaced roof assemblies.
2. Use: Base flashing ply sheet.
3. Weight: 75lbs/100 sq.ft, minimum.
4. Thickness: 3.0 mm minimum.
5. Reinforcing: Non-woven polyester mat.
   a. GAF – Ruberiod Mop
   b. Johns Manville – DynaLastic 180 S
   c. U.S Intec – SBS Polysmooth
   d. Soprema – Sopraline 180 Sanded
6. SRI: 78 or better

C. General: Furnish auxiliary materials recommended by roofing system manufacturer for intended use and compatible with SBS-modified bituminous roofing.

1. Furnish liquid-type auxiliary materials that meet VOC limits of authorities having jurisdiction.

D. Asphalt Primer: ASTM D 41.

E. Roofing Asphalt: ASTM D-312 Type IV, as recommended by modified bituminous membrane manufacturer.

1. All roof slopes shall have Type 1V asphalt.

2. Label each container or provide certification with each load of bulk asphalt identifying type of roofing asphalt and indicating softening point, minimum flash point, equiviscous temperature, and finished blowing temperature.

F. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions of FM 4470; designed for fastening base sheets, base-ply felts, and base flashings and for backnailing modified bituminous membrane to substrate; tested by manufacturer for required pullout strength; and acceptable to roofing system manufacturer.

G. Cants: Perlite board, complying with ASTM C 728 (4x4 inches).

H. Aggregate Surfacing: Clean, dry, opaque, free of sharp edges, complying with ASTM D 1863.

I. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer for intended use.

2.3 BASE-SHEET MATERIALS

A. Sheathing Paper: Red-rosin (wood board deck only or Re-roofing), minimum 3 lb/100 sq. ft.

B. Base Sheet: SBS glass-fiber base sheet. Complying with ASTM D5147 and ASTM D-6163 Type 1

2.4 INSULATION MATERIALS (Tapered crickets/saddles only)

A. General: Provide preformed, roofing insulation boards that comply with requirements, selected from manufacturer's standard sizes and of thicknesses indicated.

1. Provide preformed, tapered insulation boards where indicated for sloping to drain. Fabricate with the following taper:
   a. 1/4 inch per 12 inches, unless otherwise indicated.

2. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

B. Polyisocyanurate Board Insulation: Rigid, cellular polyisocyanurate thermal insulation with core formed by using HCFC's as blowing agents complying with ASTM C 1289, classified by facer type as follows:

1. Facer Type: Type II, felt or glass-fiber mat on both major surfaces.

C. Perlite Board Insulation: Rigid, mineral-aggregate thermal insulation board consisting of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal-coated, complying with ASTM C 728.

2.5 INSULATION ACCESSORIES

A. General: Furnish roofing insulation accessories recommended by insulation manufacturer for intended use and compatible with sheet roofing material.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions of FM 4470, designed for fastening roofing insulation to substrate, tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.

2.7 WALKWAY

A. Preformed, Skid-resistant walk boards minimum ½ inch thick as provided by submitted manufacture.

2.8 ROOF PENETRATIONS

A. All roof penetrations shall have 2.5 lb. Lead roof jack of proper size to match roof penetration.

2.9 ROOF DRAINS

A. All roof drains shall be cast iron with clamping rings, and flashed into the roof system with 4lb Lead.

2.10 MATERIALS NOT SPECIFIED

A. All other materials not specifically described, but required for a complete and proper installation of the roof, shall be selected by an approved manufacturer and subject to approval of Architect/District.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions under which roofing will be applied, with Installer present, for compliance with requirements.

B. Verify that roof openings and penetrations are in place and set and braced and that roof drains are properly clamped into position.

C. Verify that wood curbs, and nailers are securely anchored to roof deck at roof penetrations and terminations and match the thicknesses of insulation required.

D. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch out of plane.

E. Do not proceed with installation until unsatisfactory conditions have been corrected.

F. By starting the application the installer has accepted the substrate.

3.2 PREPARATION

A. Clean substrate of dust, debris, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install modified bituminous membrane roofing system according to roofing system manufacturer's written instructions and applicable recommendations of NRCA/ARMA's "Quality Control Recommendations for Polymer Modified Bitumen Roofing."

1. Install roofing system according to applicable specification plates of NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Start installation of modified bituminous membrane roofing in presence of roofing system manufacturer's technical personnel.

C. Shingling Plies: Install modified bituminous membrane roofing system with ply sheets shingled uniformly to achieve required number of membrane plies throughout. Shingle in direction to shed water.

1. Where roof slope exceeds 1/2 inch per 12 inches, run sheets of modified bituminous membrane roofing parallel with slope. Backnail top ends of sheets to nailer strips or wood deck.

D. Cant Strips: Install and secure preformed 45-degree cant strips at junctures of modified bituminous membrane roofing system with vertical surfaces or angle changes greater than 45 degrees. Use (4) inch cant where allowed.

E. Coordinate installing roofing system components so insulation and roofing plies are not exposed to precipitation or left exposed at the end of the workday or when rain is forecast.

1. Provide cutoffs at end of each day's work to cover exposed ply sheets and insulation with a course of coated felt with joints and edges sealed.
2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
3. Remove and discard temporary seals before beginning work on adjoining roofing.

F. Asphalt Heating: Heat roofing asphalt and apply within plus or minus 25 deg F of equiviscous temperature, unless otherwise required by roofing system manufacturer. Do not raise roofing asphalt temperature above the equiviscous temperature range more than one hour before time of application. Do not exceed roofing asphalt manufacturer's recommended temperature limits during roofing asphalt heating. Do not heat roofing asphalt within 25 deg F of flash point. Discard roofing asphalt maintained at a temperature exceeding 500 deg F for more than 4 hours. Keep kettle lid closed, unless adding roofing asphalt.

1. Substrate-Joint Penetrations: Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction. If mopping is applied directly to substrate, tape substrate joints.

3.4 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Where tapered crickets or saddles are needed to provide positive drainage, form crickets and saddles by solidly adhering tapered insulation panels over the nailed base sheet using full 33lbs. per square mopping of asphalt. Board edges shall be butted tightly with no gaps of ¼ inch or larger between them.

3.5 BASE-SHEET INSTALLATION

A. Loosely lay one course of sheathing paper, lapping edges and ends a minimum of 2 inches and 6 inches, respectively (On wood board decks only or Re-Roofing).

B. Install one lapped course of base sheet according to roofing system manufacturer's written instructions, extending sheet over and terminating beyond cants. Attach base sheet as follows:

1. Mechanically fasten to substrate.

3.6 ROOF MEMBRANE INSTALLATION

A. General: Install modified bituminous membrane over area to receive roofing, according to manufacturer's written instructions. Extend modified bituminous membrane over and terminate beyond cants.

1. Unroll sheet and allow it to relax for the minimum time period required by manufacturer.

B. Three-Ply, Modified Bituminous Membrane: Install 2 plies of modified bituminous membrane over base sheet, consisting of one inner-ply and one Cap sheet. For roofs ½ in 12 and greater.

1. Inner-Ply Application: Adhere ply to base substrate in a solid mopping of hot roofing asphalt applied at rate required by roofing system manufacturer.
2. Add one additional ply in waterways.
3. Cap Sheet Application: Adhere cap sheet to inner ply in a solid mopping of hot asphalt applied at rate required by roofing system manufacturer.

C. Four-Ply, Modified Bituminous Membrane: Install 3 plies of modified bituminous membrane over base sheet, consisting of two inner plies and one Cap Sheet finish. For roofs less then ½ in 12.

1. Inner- Ply Application: Adhere each ply to base substrate in a solid mopping of hot asphalt applied at rate required by roofing manufacturer. In no areas should felt touch felt.
2. Cap Sheet Application: Adhere cap sheet to inner ply in a solid mopping of hot asphalt applied at a rate required by roofing systems manufacturer.

D. Laps: Accurately align sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.

1. Repair tears and voids in laps and lapped seams not completely sealed.

E. Install modified bituminous membranes with side laps shingled with slope of roof deck where possible.

1. Install modified bituminous membranes with side laps shingled in direction to shed water on each large area of roofing, where slope exceeds 1/2 inch per 12 inches.

F. Install all modified sheets with hot asphalt temperature of 400 deg F, or at equiviscous temperature + or- 25 deg whichever is higher.

G. Mop lead distance shall not exceed 6 feet from roll.

H. THE SURFACE MEMBRANE IS TO BE INSTALLED THE SAME DAY AS THE BASE PLIES. NO PHASING WILL BE PERMITTED WITHOUT THE EXPRESS WRITTEN PERMISSION OF THE MANUFACTURER.

I. Cap Sheet Surface: Install mineral surface cap in areas indicated on plans. Sheet to be installed per plans or as manufacturers recommendations. Maintain a minimum asphalt application temperature of 400 degrees.

1. All cap sheet will be fire rated.
2. Exposed asphalt will be covered with matching mineral granules.
3. Cap sheet must have a SRI of 78 or higher.

3.7 FLASHING AND STRIPPING INSTALLATION

A. Install modified bituminous membrane base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:

1. Prime substrates with asphalt primer if required by roofing system manufacturer.
2. Backer Sheet Application: Install base-sheet backer and adhere to substrate in a uniform mopping of hot roofing asphalt.
3. Base Flashing Application: Adhere modified bituminous membrane base flashing to substrate in asphalt roofing cement; apply cement at rate required by roofing system manufacturer.

B. Extend base flashing up the wall a minimum of 8 inches above roof membrane and 4 inches onto field of roof membrane.

C. Mechanically fasten top of modified bituminous membrane base flashing securely at terminations and perimeter of roofing.

1. Seal top termination of base flashing.

D. Install modified bituminous stripping where metal flanges and edgings are set on membrane roofing if recommended by manufacturer, according to roofing system manufacturer's written instructions.

E. Roof Drains: Set 30-by-30-inch metal flashing in bed of asphalt roofing cement on completed modified bituminous membrane roofing. Cover metal flashing with modified bituminous stripping extending a minimum of 4 inches beyond edge of metal flashing onto field of roof membrane. Clamp roof membrane, metal flashing, and stripping into roof-drain clamping ring.

3.8 FIELD QUALITY CONTROL

A. Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation prior to application, during application and on completion. Submit report to Architect.

1. Notify Architect and District 48 hours in advance of the date and time of inspection.

3.9 PROTECTING AND CLEANING

A. Protect modified bituminous membrane roofing from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and District.

B. Correct deficiencies in or remove modified bituminous roofing that does not comply with requirements, repair substrates, reinstall roofing, and repair base flashings to a condition free of damage and deterioration at the time of Substantial Completion and according to warranty requirements.

END OF SECTION 075590

This page left intentionally blank.

SECTION 076200

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes sheet metal flashing and trim in the following categories:

1. Roof-drainage systems.
2. Exposed trim, gravel stops, and fasciae.
3. Copings.
4. Metal flashing.
5. Reglets.
6. Roof expansion-joint covers.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
2. Section 079200 "Joint Sealants" for elastomeric sealants.

1.3 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Shop Drawings of each item specified showing layout, profiles, methods of joining, and anchorage details.

C. Samples of sheet metal flashing, trim, and accessory items, in the specified finish.

1. 8-inch- square Samples of specified sheet materials to be exposed as finished surfaces.

1.5 PROJECT CONDITIONS

A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.

PART 2 - PRODUCTS

2.1 METALS

A. Galvanized Steel Sheet: ASTM A 526, G 90, commercial quality, or ASTM A 527, G 90, lock-forming quality, hot-dip galvanized steel sheet with 0.20 percent copper, mill phosphatized where indicated for painting; not less than 0.0396 inch thick, unless otherwise indicated.

B. Coil-Coated Galvanized Steel Sheet: Zinc-coated, commercial-quality steel sheet conforming to ASTM A 755, G 90 coating designation, coil coated with high-performance fluoropolymer coating as specified in "Coil-Coated Galvanized Steel Sheet Finish" Article; not less than 0.0336 inch thick, unless otherwise indicated.

2.2 REGLETS

A. General: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces and compatible with flashing indicated.

B. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

C. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.

D. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.

E. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.

2.3 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Solder: ASTM B 32, Grade Sn50, used with rosin flux.

B. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer, except provide stainless steel screws with neoprene backed washers for exposed fasteners.

C. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil dry film thickness per coat.

D. Mastic Sealant: Polyisobutylene; non-hardening, non-skinning, nondrying, non-migrating sealant.

E. Elastomeric Sealant: Comply with joint sealants as specified in Division 7 Section "Joint Sealants."

F. Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of flashing sheet metal.

G. Paper Slip Sheet: 5-lb/square red rosin, sized building paper conforming to FS UU-B-790, Type I, Style 1b.

H. Polyethylene Underlayment: ASTM D 4397, minimum 6-mil- thick black polyethylene film, resistant to decay when tested according to ASTM E 154.

I. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.

J. Gutter Screen: 1/4-inch hardware cloth installed in sheet metal frames. Fabricate screen and frame of same basic material as gutters and downspouts.

K. Roofing Cement: ASTM D 4586, Type I, asbestos free, asphalt based.

2.4 FABRICATION, GENERAL

A. Sheet Metal Fabrication Standard: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.

B. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Form exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.

D. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.

E. Expansion Provisions: Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

F. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

G. Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.

H. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.

I. Fabricate cleats and attachment devices from same material as sheet metal component being anchored.

1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

2.5 SHEET METAL FABRICATIONS

A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.

B. Gutters: Fabricate from the following material:
1. Galvanized Steel: 0.0217 inch thick.
2. Coil-Coated Galvanized Steel: 0.0217 inch thick.

C. Downspouts: Fabricate from the following material:
1. Galvanized Steel: 0.0217 inch thick.
2. Coil-Coated Galvanized Steel: 0.0217 inch thick.

D. Conductor Heads: Fabricate from the following material:
1. Galvanized Steel: 0.0276 inch thick.
2. Coil-Coated Galvanized Steel: 0.0276 inch thick.

E. Scuppers: Fabricate from the following material:
1. Galvanized Steel: 0.0276 inch thick.
2. Coil-Coated Galvanized Steel: 0.0276 inch thick.

F. Exposed Trim, Gravel Stops, and Fasciae: Fabricate from the following material:
1. Galvanized Steel: 0.0276 inch thick.
2. Coil-Coated Galvanized Steel: 0.0276 inch thick.

G. Copings: Fabricate from the following material:

1. Galvanized Steel: 0.0396 inch thick.
2. Coil-Coated Galvanized Steel: 0.0396 inch thick.

H. Base Flashing: Fabricate from the following material:
1. Galvanized Steel: 0.0276 inch thick.
2. Coil-Coated Galvanized Steel: 0.0276 inch thick.

I. Counterflashing: Fabricate from the following material:
1. Galvanized Steel: 0.0217 inch thick.
2. Coil-Coated Galvanized Steel: 0.0217 inch thick.

J. Flashing Receivers: Fabricate from the following material:
1. Galvanized Steel: 0.0217 inch thick.
2. Coil-Coated Galvanized Steel: 0.0217 inch thick.

2.6 COIL-COATED GALVANIZED STEEL SHEET FINISH

A. High-Performance Organic Coating Finish: Apply the following system by coil-coating process on galvanized steel sheet as recommended by coating manufacturers and applicator.

1. Fluoropolymer 2-Coat Coating System: Manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2.

a. Color and Gloss: As indicated by manufacturer's color and gloss designations.
b. Color and Gloss: Match Architect's sample.
c. Color and Gloss: As selected by Architect from manufacturer's full range of choices for color and gloss.

2. Coil-Coated Steel Sheet Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Copper Sales, Inc.
b. MM Systems Corporation.
c. Petersen Aluminum Corporation.
d. Vincent Metals.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that Work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Anchor units of Work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Install exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

D. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches, except where pre-tinned surface would show in finished Work.

1. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

E. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant.

F. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.

G. Separations: Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.
1. Bed flanges of Work in a thick coat of roofing cement where required for waterproof performance.

H. Install reglets to receive counterflashing according to the following requirements:

1. Where reglets are shown in concrete, furnish reglets for installation under Division 3 Section "Cast-in-Place Concrete."
2. Where reglets are shown in masonry, furnish reglets for installation under Division 4 Section "Unit Masonry."

I. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant. Lap counterflashing joints a minimum of 2 inches and bed with sealant.

J. Roof-Drainage System: Install drainage items fabricated from sheet metal, with straps and anchors recommended by SMACNA's Manual, to drain roof in the most efficient manner. Coordinate roof-drain flashing installation with roof-drainage system installation. Coordinate flashing and sheet metal items for steep-sloped roofs with roofing installation.

K. Equipment Support Flashing: Coordinate equipment support flashing installation with roofing and equipment installation. Seal flashing to equipment support member.

L. Roof-Penetration Flashing: Coordinate roof-penetration flashing installation with roofing and installation of items penetrating roof. Install flashing as follows:

1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
2. Seal and clamp flashing to pipes penetrating roof, other than lead flashing on vent piping.

M. Splash Pans: Install where downspouts discharge on low-sloped roofs, unless otherwise shown. Set in roof cement or sealant compatible with roofing membrane.

N. Install continuous gutter screens on gutters with noncorrosive fasteners, arranged as hinged units to swing open for cleaning gutters.

3.3 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

B. Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Completion.

END OF SECTION 076200

This page left intentionally blank.

SECTION 077160

ROOF EXPANSION ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Metal-flanged, bellows-type roof expansion joint assemblies.

B. Related Sections include the following:
1. Section 061000: "Rough Carpentry" for wooden curbs for mounting roof expansion assemblies.
2. Section 073210: “Concrete Roof Tile”
3. Section 076200: "Sheet Metal Flashing and Trim" for shop- and field-fabricated sheet metal expansion joint systems, flashing, and other sheet metal items.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide roof expansion joint assemblies that, when installed, remain watertight within movement limitations specified by manufacturer.

1.4 SUBMITTALS

A. Shop Drawings: Include plans, elevations, sections, details, joints, splices, locations of joints and splices, anchorage details, intersections, transitions, fittings, and attachments to other Work. Where joint assemblies change planes, provide isometric drawings depicting how components interconnect to achieve continuity.

1.5 SCHEDULING

A. Coordinate delivery and installation of expansion joint assemblies to prevent damage and provide timely integration of units with roofing membranes and flashing.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Metal-Flanged, Bellows-Type Roof Expansion Joint Assemblies:
   a. Metalastic; BMCA Insulation Products, Inc./GAF.
   b. Expansion Joint Shield; Celotex Corporation.
   c. Expand-O-Flash; Johns Manville Corporation.

2.2 SHEET METALS

A. Galvanized Steel Sheet: ASTM A 653/A 653M, hot-dip zinc-coating designation G90, stretcher-leveled standard of flatness and either commercial steel or forming steel, minimum 0.019 inch thick.

2.3 MISCELLANEOUS MATERIALS

A. Roof Cement: ASTM D 4586, Type II.

B. Mineral-Fiber Blanket: ASTM C 665.

C. Flexible Cellular Sponge or Expanded Rubber: ASTM D 1056.

2.4 BELLOWS-TYPE ROOF EXPANSION JOINT ASSEMBLIES

A. General: Provide manufacturer's standard assemblies of sizes and types indicated, including prefabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints, splicing units, adhesives, coatings, and other components as recommended by joint unit manufacturer for complete installation. Fabricate assemblies specifically for roof-to-roof applications.

B. Metal-Flanged, Bellows-Type Roof Expansion Assemblies: Provide assemblies consisting of exposed polymeric sheet over foam bellows, securely anchored at both edges to 3- to 4-inch- wide sheet metal nailing flanges, either flat or angle formed to fit cant or curbs as required. Insulate bellows with closed-cell, flexible rubber or plastic foam not less than 5/16 inch thick; adhere bellows to underside of polymeric sheet.
1. Polymeric Sheet: Neoprene, 60 mils thick.
2. Metal Flanges: Zinc-coated (galvanized) steel, minimum 0.019 inch thick.
3. Moisture Barrier: Manufacturer's standard, flexible, continuous, polymeric moisture barrier looped under roof expansion assembly covers at locations indicated. Fill space with blanket-type, glass-fiber insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for handling and installing roof expansion assemblies and materials, unless more stringent requirements are indicated.

B. Coordinate installation of roof expansion joint assembly materials and associated work so complete assemblies comply with assembly performance requirements.

C. Extend roof expansion joint assemblies over curbs, fasciae, and other elements in the construction profile, with factory-fabricated transitions to provide continuous, uninterrupted, waterproof roof expansion assemblies.

1. Install factory-fabricated transitions between roof expansion joint assemblies and building expansion joint cover assemblies, specified in Division 5 Section "Expansion Joint Cover Assemblies," to provide continuous, uninterrupted, watertight construction.

D. Splice roof expansion joint assemblies with materials provided by roof expansion assembly manufacturer for this purpose, according to manufacturer's written instructions, to provide continuous, uninterrupted, waterproof roof expansion assemblies.

E. Provide uniform profile of expansion joint assembly throughout length of each installation; do not stretch polymeric sheets.

F. Install mineral-fiber blanket insulation to fill joint space within joint and moisture barrier.

G. Bed anchorage flanges in cement or sealant recommended by manufacturer and securely nail to curbs and cant strips as recommended by manufacturer, but not less than 6 inches o.c.

H. Anchor roof expansion joint assemblies complying with manufacturer's written instructions.

I. Provide not less than a 4-inch embedding of flanges in bituminous membranes, with hot bitumen or roof cement. Cover with stripping material and install according to requirements in Division 7 Section for roofing.

END OF SECTION 077160

This page left intentionally blank

SECTION 077200

ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Roof hatches.
   2. Heat-and-smoke vents.

B. Related Sections include the following:

   1. Section 055000 "Metal Fabrications" for ladders and miscellaneous metal framing and supports.
   2. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-fabricated metal flashing and counterflashing, scuppers, gutters and downspouts, fasciae, and miscellaneous sheet metal trim and accessories.
   3. Section 077160 "Roof Expansion Assemblies" for roof expansion-joint covers.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, materials, dimensions of individual components and profiles, and finishes.

1.4 QUALITY ASSURANCE

A. Standards: Comply with the following:

   1. SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.
   2. NRCA's "Roofing and Waterproofing Manual" details for installing units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Roof Hatches:

a. Babcock-Davis Hatchways, Inc.
b. Bilco Company.
c. Dur-Red Products, Inc.
d. J. L. Industries, Inc.
e. Milcor, Inc.
f. Nystrom Products Co.

2. Hatch-Type Heat-and-Smoke Roof Vents:

a. Babcock-Davis Hatchways, Inc.
b. Bilco Company.
c. Dur-Red Products, Inc.
d. Milcor, Inc.
e. Nystrom Products Co.

2.2 MATERIALS, GENERAL

A. Aluminum Sheet: ASTM B 209 for alclad alloy 3005H25 or alloy and temper required to suit forming operations, with mill finish, unless otherwise indicated.

B. Galvanized Steel Sheet: ASTM A 653/A 653M with G90 coating designation; commercial quality, unless otherwise indicated.

C. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M with Class AZ-50 coating, structural quality, Grade 40, or as required for strength.

D. Insulation: Manufacturer's standard rigid or semi-rigid glass-fiber board of thickness indicated.

E. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than 1-1/2 inches thick.

F. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by manufacturer. Match finish of exposed fasteners with finish of material being fastened.

1. Where removing exterior exposed fasteners affords access to building, provide non-removable fastener heads.

G. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

H. Bituminous Coating: SSPC-Paint 12, solvent-type bituminous mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil dry film thickness per coating.

I. Mastic Sealant: Polyisobutylene; non-hardening, non-skinning, nondrying, non-migrating sealant.

J. Elastomeric Sealant: Generic type recommended by unit manufacturer that is compatible with joint surfaces; ASTM C 920, Type S, Grade NS, Class 25, and Uses NT, G, A, and, as applicable to joint substrates indicated, O.

K. Roofing Cement: ASTM D 4586, non-asbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.3 ROOF HATCHES

A. General: Fabricate units to withstand 40-lbf/sq. ft. external and 20-lbf/sq. ft. internal loading pressure. Frame with minimum 9-inch- high, integral-curb, double-wall construction with 1-1/2-inch insulation, formed cants and cap flashing (roofing counter-flashing), with welded or sealed mechanical corner joints. Provide double-wall cover (lid) construction with 1- inch- thick insulation core. Provide gasketing and equip with corrosion-resistant or hot-dip galvanized hardware including pintle hinges, hold-open devices, interior padlock hasps, and both interior and exterior latch handles.

B. Type: Single-leaf personnel access.

1. For Ladder Access: 30 by 36 inches.
2. For Ship's Ladder Access: 30 by 54 inches.
3. For Stair Access: 30 by 102 inches.

C. Material: Aluminum or galvanized steel, or in combination, at Contractor's option.

1. Finish: Prime painted.

D. Safety Post: Provide Bilko Co. “Ladder-Up” safety post at roof hatches with ladder access.

2.4 HEAT-AND-SMOKE VENTS

A. General: Automatically operated roof vents for heat and smoke constructed to operate (open) without power source that could be interrupted during a fire. Custom fabricate units only to extent necessary to comply with indicated dimensions and other special requirements.

B. Live Load and Uplift: Unless otherwise indicated, fabricate to withstand a minimum 10-lbf/sq. ft. external live load and 30-lbf/sq. ft. uplift.

C. Regulatory Requirements: Comply with provisions of the following:

1. UL 793, for construction and performance of automatically operated roof vents for heat and smoke.
2. NFPA 204M, for heat-and-smoke vent design constraints, operation, size, and location.

D. Heat-and-Smoke Vent Compliance: Provide units that have been tested, listed, or approved as follows:

1. Construction/Operation: UL listed.

E. Framing: Fabricate from the following materials, with manufacturer's standard welded or sealed mechanical corner joints, including cap flashing (roofing counterflashing):
1. Material: Formed sheet or extruded aluminum or galvanized steel, at Contractor's option.

a. Finish: Prime painted.

2. Unit Support: Double-wall curb construction with 1-inch insulation, of height indicated or, if not indicated, for mounting with height minimum 9 inches above roof membrane.

a. Provide formed cants and base profile coordinated with roof type and insulation thickness.

F. Hatch-Type Units: Equip units with unit support, lid, lid gaskets, automatic self-lifting mechanisms, UL-listed fusible links rated at 160 deg F or other heat- or smoke-sensitive release devices, as indicated, and hardware including hinges, hold-open devices, and independent manual-release devices for inside operation of covers.

1. When release is actuated, cover will open against 10-lbf/sq. ft. snow or wind load and lock in position.
2. Lid: Single-leaf, galvanized or aluminum-zinc alloy-coated steel sheet covers with 1-inch integral insulation.
3. Lid: Double-leaf, galvanized or aluminum-zinc alloy-coated steel sheet covers with 1-inch integral insulation.

a. Finish: Prime painted.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written instructions. Coordinate installation of roof accessories with installation of roof deck, roof insulation, flashing, roofing membranes, penetrations, equipment, and other construction involving roof accessories to ensure that each element of the Work performs properly and that combined elements are waterproof and weather tight. Anchor roof accessories securely to supporting

structural substrates so they are capable of withstanding lateral and thermal stresses, and inward and outward loading pressures.

B. Install roof accessory items according to construction details of NRCA's "Roofing and Waterproofing Manual," unless otherwise indicated,

C. Separation: Separate metal from incompatible metal or corrosive substrates, including wood, by coating concealed surfaces, at locations of contact, with bituminous coating or providing other permanent separation.

D. Flange Seals: Unless otherwise indicated, set flanges of accessory units in a thick bed of roofing cement to form a seal.

E. Cap Flashing: Where required as component of accessory, install cap flashing to provide waterproof overlap with roofing or roof flashing (as counterflashing). Seal overlap with thick bead of mastic sealant.

F. Operational Units: Test-operate units with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.

G. Heat-and-Smoke Vents: Locate, install, and test according to NFPA 204M.

3.2 CLEANING AND PROTECTION

A. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

END OF SECTION 077200

This page left intentionally blank.

SECTION 078400

FIRESTOPPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Firestop joint sealant and backing, including intumescent elastomeric compounds and sealants.
   2. Rigid boards, forms, wraps and accessories.
   3. Fiber packing and fiber fill.
   4. Wool fiber insulation and fire-safing insulation.
   5. Other firestopping as indicated.

B. Related Sections:
   1. Section 072900 - Joint Protection: Other sealants.
   2. Section 092900 – Gypsum Board
   3. Division 21 – Fire Suppression: Firestopping of penetrations caused by fire suppression services.
   4. Division 22 – Plumbing: Firestopping of penetrations caused by plumbing services.
   5. Division 23 – Heating, Ventilating and Air Conditioning: Firestopping of penetrations caused by mechanical services.
   6. Division 26 - Electrical: Firestopping of penetrations caused by electrical services.

1.2 REFERENCES

A. IEEE #634: Institute of Electrical and Electronic Engineers, Inc., Standard Cable Penetration Fire Stop Qualification Test.

B. UL 1479: Underwriters' Laboratories, Inc. (UL), Fire Standard Test Used to Classify Products as Standard for Through-Penetration Fire Stops.

C. UL Systems: XHEZ Series; (Pipe, conduit, cable and bus penetrations). (Table Indexes firestop systems by construction features.)

D. UL Materials: XHHW Series; (Duct penetrations and building joints). (List of Fill, Void or Cavity materials for use in numbered firestop systems.)

E. UL Materials, XHKU Series; (Forms and dams) (List of Forming materials for use in numbered firestop systems.)

F. UL Assemblies: BXUV Series; (Structural floors, partitions and walls.)

G. NFPA 101: Life Safety Code.

H. NFPA 258: Standard Test Method for Measuring the Smoke Generated by Solid Materials.

1.3 DEFINITIONS

A. Assembly: Particular arrangement of materials specific to given type of construction described or detailed in referenced documents.

B. Barriers: Time rated fire walls, smoke barrier walls, time rated ceiling/floor assemblies and structural floors.

C. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gases, and smoke.

D. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.

E. Construction Gaps: Gaps between adjacent sections of walls, exterior walls, and structural floors or roof decks; and gaps between adjacent sections of structural floors and at wall tops between top of wall and ceiling.

F. System: Specific products and applications, classified and numbered by Underwriters Laboratories Inc., to close specific barrier penetrations.

G. Sleeve: Metal fabrication or pipe section extending through thickness of barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other Sections and may or may not be required.

H. Manufacturer's Engineering Judgments: Firestopping systems which are derived from other U.L. Systems/Designs or other tests, and acceptable to the code enforcing authorities.

1.4 SYSTEM DESCRIPTION

A. Provide fire stops and smoke seals to prevent the passage of fire, smoke, toxic gasses or water from one floor or area to another. Seal openings in floors, fire rated walls and permanent partitions penetrated by pipes, ducts, conduits and other items as shown, specified, and as required for the type of construction.

B. Mineral fiber insulation installed as fire safing at non-rated penetrations not containing pipes, ducts, conduits, and other items in floor slabs, wall partitions, construction-joint conditions between slabs and adjacent construction and where indicated or required.

C. Provide damming material, clips, and closures as required for support and containment of dams, and other insulation materials required for tested and rated fire stop systems

D. Fire Rated Construction Design Requirements: Maintain barrier fire resistance ratings including resistance to cold smoke at all penetrations, connections with other surfaces or types of construction, at separations required to permit building movement and sound or vibration absorption, and at other construction gaps.

E. Through-Penetration Fire Stopping Schedule: Assembly designs are specified generally under UL system categories by penetrating item. Manufacturers' product applications must have specific UL system designations. The schedules on the following page indicate which Series of UL Classified Through Penetration Fire Stopping (TPFS) assemblies are acceptable for this Project based on barrier type, construction and penetrant type. The TPFS Series listed are generic in nature; ex: Series C-AJ-2000 includes all designs from 2001 through 2999 from all manufacturers; note that each manufacturer has its own number for tested assemblies. The Contractor will select appropriate TPFS assemblies for each condition encountered.

F. Refer to Schedule at the end of this section.

1.5 SUBMITTALS

A. Product Data: Manufacturer's specifications and technical data for each material including the following.
   1. Composition and limitations.
   2. Manufacturer's installation instructions.
   3. Furnish sleeve size schedule indicating size of penetrating item, insulation thickness (where applicable), and minimum annular space requirements.
   4. Submit fire test reports from independent testing agency indicating the following:
      a. Fire test report of fire stop material installed to substrate and penetration materials similar to the Work of this section. Test to indicate both Flame (F) and Temperature (T) Ratings.
      b. Test reports of products to be installed shall indicate conformance to ASTM E 814, UL rating with UL classified system description, and UL classified system detail.

B. Proposed UL System Drawings - Special Installation Drawings: Prior to starting installation of firestopping, firestopping manufacturer and installer shall review specific conditions applicable for Project, and identify each condition for firestopping and prepare individual U.L. Designs or manufacturers engineering judgements identification numbers, and installation drawings for each condition.
   1. Submit 3 Special Installation Drawings for each condition, 1 set for Owner, 1 set for Architect’s File Copy, and 1 set for Building Official.
   2. Submit other information as may be requested by Building Official.

C. Submit installer qualifications for each person installing firestopping systems.

D. Manufacturer's Qualifications: Submit evidence of conformance with qualification requirements specified.

E. Field Samples: No less than 10 days before commencing the Work of this section, provide field installed Samples of fire stop materials and systems.
   1. Apply one Sample of fire stop material for each different penetration and related fire rating required for the Work.
   2. Sample areas shall comply with thickness, fire resistance ratings, and finished appearance.

F. LEED Submittals:

1. Product Data for Credit EQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1.6 QUALITY ASSURANCE

A. Installer's Qualifications: Firm experienced in installation or application of systems similar in complexity to those required for this Project, plus the following.
   1. Acceptable to or licensed by manufacturer, State or local authority where applicable.
   2. Not less than 5 years of experience with systems.
   3. Successfully completed not less than 5 comparable scale projects using this system.

B. Qualifications of Manufacturer: Products furnished for fire stopping and smoke seals shall be manufactured by a firm which has been continuously and regularly employed in the manufacture of these materials for a period of at least 5 years; and which can provide evidence of these materials being satisfactorily installed on at least 5 projects of similar size and type within such period.

C. Single Source Responsibility for Materials: Obtain firestopping materials from one manufacturer for entire project.
   1. This does not restrict Contractor from subcontracting installation of firestopping to multiple subcontracts, but does require all installers do use the same manufacturer throughout the Project and be licensed by that manufacturer for the installation of firestopping.

D. Field Samples: First two applications for each firestopping condition will be reviewed by Owner's Representative and the Architect, and when accepted by the local Building Official shall become a standard of performance for remaining Work.
   1. Correct areas, modify method of application/installation, or adjust as directed by local code official to comply with specified requirements.
   2. Maintain field samples accessible to serve as a standard of quality for this Section.

E. Fire-Test Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those of this specification Section:
   1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, ITS, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
   2. Through-penetration firestop systems are identical to those tested per ASTM E 814. Provide rated systems complying with the following requirements:
      a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
      b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:
         1) UL in "Fire Resistance Directory."
         2) ITS in "Directory of Listed Products."

F. Performance Criteria:

1. Provide materials and Work to conform to source quality control criteria specified herein and CBC requirements in fire resistant wall and floor assemblies to prevent the passage of fire, smoke, and toxic gases.
2. Installed fire stops shall be of sufficient thickness, width, and density to provide a fire resistance rating at least equal to the floor, wall, or partition construction into which it is installed.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle to prevent damage, staining and disfigurement in original, new, and unopened packages and containers bearing manufacturer's name and label identifying contents. Do not freeze.

B. Where limited shelf life of product is noted by date on container or packing list, take note and do not use out of date material.

C. Deliver products to the Project site in manufacturer's original, unopened containers bearing correct UL labeling.

D. Fire stop material shall be stored above grade in an area protected from detrimental weather and moisture conditions.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Store firestopping materials out of weather, in cool, dry place, out of direct sunlight, at temperatures below 90 degrees F, not less than 40 degrees F and as recommended by manufacturer.

B. Use of Foam Products: Store unmixed liquid components in original, unopened containers at temperature of 65 to 80 degrees F for 12 hours minimum before use. Use forced air ventilation in areas having less than 2 cubic feet of free air for each pound of liquid mixture being foamed.

1.9 PROJECT CONDITIONS

A. Environmental Requirements: Comply with fireproofing material manufacturer's recommendations for temperature and humidity conditions before, during, and after installation of fireproofing.

B. Ventilation Requirements: Comply with fireproofing material manufacturer's recommendations during and after installation of fireproofing by natural or mechanical means.

C. Sleeves: Unless otherwise called for, sleeves passing through walls, slabs, beams, bridging, columns, shall be minimum of 1/2 inch greater in inside diameter than external diameter of pipe passing through sleeves, or insulation diameter. Verify sleeve size required with manufacturer of firestopping used. Pipe insulation shall be continuous through sleeves. Space between sleeve and pipe or duct and annular opening space shall be provided with a firestop system. Notify Contractor immediately of deviation from above sleeving requirements.

D. Fire Dampers: Firestopping of annular spaces around fire dampers shall be placed before installation of damper's anchoring flanges.

1.10 SEQUENCING

A. Sequence and coordinate application of firestopping with other related work specified in other Sections to comply with the following requirements:
   1. Provide temporary enclosures to prevent deterioration of firestopping for interior applications due to exposure to unfavorable environmental conditions.
   2. Do not install enclosing or concealing construction until after firestopping has been applied, inspected, tested, and corrections have been made to any defective firestopping.

1.11 SYSTEM DESIGN

A. Design of firestopping described by this Section is responsibility of Contractor. Individual through-penetration systems, construction-gap firestopping, through-penetration smoke-stopping, and construction-gap smoke-stopping will be selected by Contractor to meet requirements of Contract Documents and governing codes. Actual selection of individual designs or systems is responsibility of Contractor, and 'Single Source Responsibility for Materials' is required.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers and products: Products listed in UL Fire Resistance Directory for UL System involved, that are manufactured by one of the following:
   1. 3M Fire Protection Products.
   2. Hilti Construction Chemicals, Inc.
   3. Grace Construction Products
   4. Nelson Firestop Products
   5. Rectorseal Company
   6. Specified Technologies Inc.
   7. Tremco
   8. US Gypsum Company

2.2 THROUGH-PENETRATION FIRESTOPPING OF FIRE RATED CONSTRUCTION

A. Systems or devices listed in the UL Fire Resistance Directory under categories XHCR and XHEZ may be used, providing that they conform to the construction type, penetrant type, annular space requirements, and fire rating involved in each separate instance, and that the system be symmetrical for wall applications. Systems or devices must be asbestos-free.
   1. Additional requirements: Withstand the passage of cold smoke either as an inherent property of the product, or by the use of a separate product included as a part of the UL system or device, and designed to perform this function.

2.3 FIRESTOPPING, GENERAL

A. Compatibility: Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
   1. Permanent forming/damming/backing materials, including the following:
      a. Slag-/rock-wool-fiber insulation.
      b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
      c. Fire-rated form board.
      d. Fillers for sealants.
   2. Temporary forming materials.
   3. Substrate primers.
   4. Collars.
   5. Steel sleeves.

C. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24
   1. Sealants: 250 g/L.
   2. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Sealant Primers for Porous Substrates: 775 g/L.

2.4 FILL MATERIALS

A. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 by reference to the types of materials described in this Article. Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.

B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.

D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.

F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

H. Mortars: Prepackaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

I. Pillows/Bags: Reusable, heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.

J. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

K. Silicone Sealants: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
2. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

2.5 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

2.6 SOURCE QUALITY CONTROL

A. Fire stop and smoke seal material shall be tested by an independent testing agency for conformance to Flame (F) and Temperature (T) requirements of ASTM E-814/UL 1479.

B. Conform to UL Fire Hazard Classification Requirements. Material shall be classified as a fill, void, or cavity material and system for UL Through Penetration Firestop System. Comply with CBC.

C. Material shall be tested and classified noncombustible per ASTM E 84.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with written recommendations of firestop system manufacturer and the following requirements:
   1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
   2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.
   4. Do not allow caulks containing solvents to come in direct contact with plastic pipe.

B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration firestop systems to comply with "Performance Requirements" Article and firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for firestop systems by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 INSTALLATION

A. Use methods and materials indicated in firestopping systems shown in Referenced Standards.

B. Install penetration seal materials in accordance with instructions in UL Building Materials Directory and in accordance with manufacturer's printed instructions.

C. Install sealant, including forming, packing and other accessory materials to fill opening around services penetrating floors and walls to provide firestops with fire resistance ratings indicated for floor or wall assembly in which penetration occurs.
   1. Use masking tape to protect finished substrates and products adjacent to sealant materials.
   2. Apply sealant as specified under Section 079200 - Joint Protection, and as recommended by sealant manufacturer; apply bead to depth of 1-1/2 inches to fill void above support, or if mineral wool support is used to depth of 1/2 inch thick. Tool sealant immediately after application and before skin forms.
   3. If using foam sealant, immediately after mixing, pour or inject liquid foam into penetration opening, not more than 1/3 full to compensate for expansion during cure or in strict accordance with sealant manufacturer's recommendations. Do not exceed measured snap time of foam sealant. Do not remove dams for 24 hours minimum to allow foam to fully cure.

D. At sleeved pipes or other sleeved penetration, firestop annular space between sleeve and its contained pipe or duct with resilient firestopping sealant system to permit movement of pipe or duct without damage to firestopping sealant.

E. Seal holes and voids made by penetrations to ensure effective fire and smoke barrier.

F. Patch penetrations caused by cutting or presence of unused or abandoned openings or boxes using materials compatible with barrier construction and with fire rating equal to or greater than barrier rating.

G. For plumbing sleeves, construct time rated walls after placement of penetrating materials if possible, and to fit rated construction materials tightly to or directly upon material of penetration.

H. Large Openings: Close unused portions of large openings (annular spaces) made for later installation of pipes and ducts with solid fill equal to barrier rating or with applicable firestopping sealant system.
   1. Where both horizontal dimensions exceed 4 inches in structural floor openings, firestop annular spaces with concrete, or other rated assembly. Provide dowels and reinforcement, within such fill, equal to that specified for slab.
   2. In rated concrete or masonry wall openings where both height and width exceed thickness of rated materials, firestop annular spaces with masonry or other solid fill.
   3. Use fiber fill, solid fill or fiber packing to make up remainder of barrier thickness where required width of firestopping sealant system is less than barrier.

I. Install firestopping materials capable of supporting same loading as floor at floor openings more than four inches in width without penetrating item and subject to traffic or loading.

J. Install firestopping at least equal to barrier fire rating in and around penetrations of floor structures, exterior walls and interior walls noted as time rated fire barriers or smoke barriers.

K. Unused or abandoned openings or boxes or penetrations caused by cutting shall be patched with materials compatible with barrier construction and with fire rating equal to or greater than barrier fire-rating.

L. Use firestopping sealant systems at narrow spaces and at spaces with dimensions less than barrier thickness.

M. Fill void spaces completely with firestopping material.

N. Protect materials from damage on surfaces subject to traffic. Provide firestopping in floors flush with top of slab, sleeve or housekeeping pad.

3.5 IDENTIFICATION

A. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:

Warning – Fire-stop System
DO NOT DISTURB
Notify Building Management of Any Damage

Manufacturer's System No. _____
UL System No: _____
Contractor: _____
Date Installed: _____
Manufacturer: _____

3.6 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified independent inspecting agency to inspect through-penetration firestop systems and to prepare test reports.
   1. Inspecting agency will state in each report whether inspected through-penetration firestop systems comply with or deviate from requirements.

B. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued.

C. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

D. Manufacturer's Field Services: Firestopping manufacturer's technical representative shall provide the following field services during application.
   1. Perform a pre-installation examination and acceptance of substrate and voids scheduled for firestopping. Issue report.
   2. Be present at initial start-up for each process. Confirm application techniques. Issue report.
   3. Issue a summary report at completion of installation indicating manufacturer's acceptance of installed system and compliance with UL Design requirements.

3.7 ADJUSTING AND CLEANING

A. Clean up spills of liquid components.

B. Neatly cut and trim materials.

C. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

3.8 SCHEDULE

A. See attached pages for schedule of firestopping systems

Firestopping Wall Systems

TYPE OF PENETRANT	WOOD STUDS & GYPSUM WALLBOARD UL DESIGN NO. U300 SERIES	METAL STUDS & GYPSUM WALLBOARD UL DESIGN NO. U400 SERIES	POURED CONCRETE, CONCRETE BLOCK OR MASONRY UL DESIGN NO. FOR CONCRETE BLOCK WALL U900 SERIES (ANY THICKNESS)	POURED CONRETE CONCRETE BLOCK OR MASONRY UL DESIGN NO. FOR CONCRETE BLOCK WALL U900 SERIES GREATER THAN 8 IN.
NO PENETRANTS				
UL System Single penetrant	W-L-0000 SERIES OR NOTE 4	W-L-0000 SERIES OR NOTE 4	W-J-0000 SERIES OR NOTE 4	NOTE 4
UL System Multiple penetrants	W-L-0000 SERIES OR NOTE 4	W-L-0000 SERIES OR NOTE 4	W-J-0000 SERIES OR NOTE 4	NOTE 4
F Rating	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING
T Rating	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)
Additional Requirements	NONE	NONE	NONE	NONE
METALLIC, UNINSULATED PIPE, CONDUIT, OR TUBING (EXAMPLES: COPPER, IRON, STEEL)				
UL System Single penetrant	W-L-1000 SERIES	W-L-1000 SERIES	C-AJ-1000 OR W-J-1000 SERIES	C-BK-1000 OR W-K-1000 SERIES
UL System Multiple penetrants	W-L-8000 SERIES NOTE 5	W-L-8000 SERIES NOTE 5	C-AJ-8000 OR W-J-8000 SERIES --	N/A

TYPE OF PENETRANT	WOOD STUDS & GYPSUM WALLBOARD UL DESIGN NO. U300 SERIES	METAL STUDS & GYPSUM WALLBOARD UL DESIGN NO. U400 SERIES	POURED CONCRETE, CONCRETE BLOCK OR MASONRY UL DESIGN NO. FOR CONCRETE BLOCK WALL U900 SERIES (ANY THICKNESS) NOTE 5	POURED CONRETE CONCRETE BLOCK OR MASONRY UL DESIGN NO. FOR CONCRETE BLOCK WALL U900 SERIES GREATER THAN 8 IN.
F Rating	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING
T Rating	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)
Additional Requirements	NONE	NONE	NONE	NONE
NONMETALLIC, UNINSULATED PIPE, CONDUIT, OR TUBING (EXAMPLES: PVC, CPVC, GLASS)				
UL System Single penetrant	W-L-2000 SERIES	W-L-2000 SERIES	C-AJ-2000 OR W-J-2000 SERIES	C-BK-1000 OR W-K-1000 SERIES
UL System Multiple penetrants	W-L-8000 SERIES NOTE 5	W-L-8000 SERIES NOTE 5	C-AJ-8000 OR W-J-8000 SERIES -- NOTE 5	N/A
F Rating	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING
T Rating	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)
Additional Requirements	NONE	NONE	NONE	NONE
ELECTRICAL CABLES				
UL System Single penetrant	W-L-3000 SERIES	W-L-3000 SERIES	C-AJ-3000 OR W-J-3000 SERIES	N/A
UL System Multiple penetrants	NONE	NONE	C-AJ-3000 OR W-J-3000 SERIES	NONE
F Rating	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING
T Rating	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)
Additional Requirements	NONE	NONE	NONE	NONE
CABLE TRAYS W/ELECTRICAL CABLES				
UL System Single penetrant	W-L-4000 SERIES	W-L-4000 SERIES	C-AJ-4000 OR W-J-4000 SERIES	W-K-4000 SERIES
UL System Multiple penetrants	NONE	NONE	C-AJ-4000 OR W-J-4000 SERIES	NONE
F Rating	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING

TYPE OF PENETRANT	WOOD STUDS & GYPSUM WALLBOARD UL DESIGN NO. U300 SERIES	METAL STUDS & GYPSUM WALLBOARD UL DESIGN NO. U400 SERIES	POURED CONCRETE, CONCRETE BLOCK OR MASONRY UL DESIGN NO. FOR CONCRETE BLOCK WALL U900 SERIES (ANY THICKNESS)	POURED CONRETE CONCRETE BLOCK OR MASONRY UL DESIGN NO. FOR CONCRETE BLOCK WALL U900 SERIES GREATER THAN 8 IN.
T Rating	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)
Additional Requirements	NONE	NONE	NONE	NONE
INSULATED PIPES (EXAMPLES: COPPER, GLASS, IRON, PLASTIC, STEEL) IN SYSTEMS OPERATING BETWEEN 32 DEGF (0 DEGC) AND 122 DEGF (50 DEGC) (NOTE 1)				
UL System Single penetrant	W-L-5000 SERIES	W-L-5000 SERIES	C-AJ-5000 OR W-J-5000 SERIES	N/A
UL System Multiple penetrants	W-L-8000 SERIES NOTE 5	W-L-8000 SERIES NOTE 5	C-AJ-8000 OR W-J-8000 SERIES - NOTE 5	NONE
F Rating	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING
T Rating	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)
Additional Requirements	NONE	NONE	NONE	NONE
INSULATED PIPES (EXAMPLES: COPPER, GLASS, IRON, PLASTIC, STEEL) IN SYSTEMS OPERATING BELOW 32 DEGF (0 DEGC) OR ABOVE 122 DEGF (50 DEGC) (NOTE 2)				
UL System Single penetrant	W-L-5000 SERIES	W-L-5000 SERIES	C-AJ-5000 OR W-J-5000 SERIES	N/A
UL System Multiple penetrants	W-L-8000 SERIES NOTE 5	W-L-8000 SERIES NOTE 5	C-AJ-5000 OR W-J-5000 SERIES	NONE
F Rating	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING
T Rating	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)
Additional	NOTE 6	NOTE 6	NOTE 6	NONE

TYPE OF PENETRANT	WOOD STUDS & GYPSUM WALLBOARD UL DESIGN NO. U300 SERIES	METAL STUDS & GYPSUM WALLBOARD UL DESIGN NO. U400 SERIES	POURED CONCRETE, CONCRETE BLOCK OR MASONRY UL DESIGN NO. FOR CONCRETE BLOCK WALL U900 SERIES (ANY THICKNESS)	POURED CONRETE CONCRETE BLOCK OR MASONRY UL DESIGN NO. FOR CONCRETE BLOCK WALL U900 SERIES GREATER THAN 8 IN.
Requirements				
MISC ELECTRICAL PENETRATIONS (EXAMPLES: BUS DUCTS)				
UL System Single penetrant	W-L-6000 SERIES	W-L-6000 SERIES	C-AJ-6000 SERIES	N/A
UL System Multiple penetrants	N/A	N/A	C-AJ-6000 SERIES	NONE
F Rating	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING
T Rating	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)
Additional Requirements	NONE	NONE	NONE	NONE
METAL DUCT				
UL System Single penetrant	W-L-7000 SERIES	W-L-7000 SERIES	C-AJ-7000 OR W-J-7000 SERIES	N/A
UL System Multiple penetrants	N/A	N/A	N/A	NONE
F Rating	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING
T Rating	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)
Additional Requirements	NOTE 7	NOTE 7	NOTE 7	NONE
UL LISTED ELECTRICAL BOXES				
UL System Single penetrant	CLIV OR NOTE 8	CLIV OR NOTE 8	??	N/A
UL System Multiple penetrants	N/A	N/A	N/A	NONE
F Rating	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING
T Rating	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)
Additional Requirements	NONE	NONE	NONE	NONE
OTHER RECESSED DEVICES (NOTE 3)				
UL System Single penetrant	NOTE 8	NOTE 8	NOTE 8	NOTE 8
UL System	NONE	NONE	NOTE 8	NONE

TYPE OF PENETRANT	WOOD STUDS & GYPSUM WALLBOARD UL DESIGN NO. U300 SERIES	METAL STUDS & GYPSUM WALLBOARD UL DESIGN NO. U400 SERIES	POURED CONCRETE, CONCRETE BLOCK OR MASONRY UL DESIGN NO. FOR CONCRETE BLOCK WALL U900 SERIES (ANY THICKNESS)	POURED CONRETE CONCRETE BLOCK OR MASONRY UL DESIGN NO. FOR CONCRETE BLOCK WALL U900 SERIES GREATER THAN 8 IN.
Multiple penetrants				
F Rating	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING
T Rating	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)
Additional Requirements	NONE	NONE	NONE	NONE

Floor Systems

TYPE OF PENETRANT	**WOOD FRAMED FLOOR**	**POURED CONCRETE FLOOR ANY THICKNESS**	**POURED CONCRETE FLOOR GREATER THAN 5 INCHES**
NO PENETRANTS			
UL System Single penetrant	W-L-000 SERIES OR NOTE 4	C-AJ-0000 SERIES, F-A-0000 SERIES OR NOTE 4	C-BJ-0000 SERIES OR NOTE 4
UL System Multiple penetrants	W-L-000 SERIES OR NOTE 4	NONE	NONE
F Rating	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING
T Rating	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)
Additional Requirements	NONE	NONE	NONE
METALLIC, UNINSULATED PIPE, CONDUIT, OR TUBING (EXAMPLES: COPPER, IRON, STEEL)			
UL System Single penetrant	F-C-1000 SERIES	C-AJ-1000 OR F-A-1000 SERIES	C-BJ-1000 OR F-B-1000 SERIES
UL System Multiple penetrants	F-C-8000 SERIES NOTE 5	C-AJ-8000 OR F-A-8000 SERIES -- NOTE 5	C-BJ-8000 OR F-B-8000 SERIES -- NOTE 5
F Rating	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING
T Rating	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)
Additional Requirements	NONE	NONE	NONE
NONMETALLIC, UNINSULATED PIPE, CONDUIT, OR TUBING (EXAMPLES: PVC, CPVC, GLASS)			
UL System Single penetrant	F-C-2000 SERIES	C-AJ-2000 OR F-A-2000 SERIES	C-BJ-2000 OR F-B-2000 SERIES

TYPE OF PENETRANT	WOOD FRAMED FLOOR	POURED CONCRETE FLOOR ANY THICKNESS	POURED CONCRETE FLOOR GREATER THAN 5 INCHES
UL System Multiple penetrants	NONE	C-AJ-8000 OR F-A-8000 SERIES -- NOTE 5	C-BJ-8000 OR F-B-8000 SERIES -- NOTE 5
F Rating	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING
T Rating	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)
Additional Requirements	NONE	NONE	NONE
ELECTRICAL CABLES			
UL System Single penetrant	F-C-3000 SERIES	C-AJ-3000 OR F-A-3000 SERIES	N/A
UL System Multiple penetrants	NONE	NONE	NONE
F Rating	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING
T Rating	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)
Additional Requirements	NONE	NONE	NONE
CABLE TRAYS W/ELECTRICAL CABLES			
UL System Single penetrant	N/A	C-AJ-4000 OR F-A-4000 SERIES	C-BJ-3000 OR F-B-3000 SERIES
UL System Multiple penetrants	NONE	NONE	NONE
F Rating	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING
T Rating	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)
Additional Requirements	NONE	NONE	NONE
INSULATED PIPES (EXAMPLES: COPPER, GLASS, IRON, PLASTIC, STEEL) IN SYSTEMS OPERATING BETWEEN 32 DEGF (0 DEGC) AND 122 DEGF (50 DEGC) (NOTE 1)			
UL System Single penetrant	F-C-5000 SERIES	C-AJ-5000 OR F-A-5000 SERIES	C-BJ-5000 OR F-B-5000 SERIES
UL System Multiple penetrants	F-C-8000 SERIES NOTE 5	C-AJ-8000 OR F-A-8000 SERIES - NOTE 5	C-AJ-8000 OR F-A-8000 SERIES - NOTE 5
F Rating	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING
T Rating	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)
Additional Requirements	NONE	NONE	NONE
INSULATED PIPES (EXAMPLES: COPPER, GLASS, IRON, PLASTIC, STEEL) IN SYSTEMS OPERATING BETWEEN			

TYPE OF PENETRANT	WOOD FRAMED FLOOR	POURED CONCRETE FLOOR ANY THICKNESS	POURED CONCRETE FLOOR GREATER THAN 5 INCHES
32 DEGF (0 DEGC) OR ABOVE 122 DEGF (50 DEGC) (NOTE 2)			
UL System Single penetrant	F-C-5000 SERIES	C-AJ-5000 OR F-A-5000 SERIES	C-AJ-5000 OR F-A-5000 SERIES
UL System Multiple penetrants	F-C-8000 SERIES NOTE 5	C-AJ-8000 OR F-A-8000 SERIES - NOTE 5	C-BJ-8000 OR F-B-8000 SERIES - NOTE 5
F Rating	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING
T Rating	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)
Additional Requirements	NOTE 6	NOTE 6	NOTE 6
MISC ELECTRICAL PENETRATIONS (EXAMPLES: BUS DUCTS)			
UL System Single penetrant	N/A	C-AJ-6000 SERIES	C-AJ-6000 SERIES
UL System Multiple penetrants	NONE	C-AJ-8000 OR F-A-8000 SERIES - NOTE 5	C-AJ-6000 SERIES
F Rating	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING
T Rating	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)
Additional Requirements	NONE	NONE	NONE
METAL DUCT			
UL System Single penetrant	F-C-7000 SERIES	C-AJ-7000 OR F-A-7000 SERIES	C-BJ-7000 OR F-B-7000 SERIES
UL System Multiple penetrants	N/A	N/A	N/A
F Rating	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING
T Rating	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)
Additional Requirements	NOTE 7	NOTE 7	NOTE 7
UL LISTED ELECTRICAL BOXES			
UL System Single penetrant	N/A	N/A	N/A
UL System Multiple penetrants	N/A	N/A	N/A
F Rating	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING
T Rating	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)
Additional Requirements	NONE	NONE	NONE
OTHER RECESSED DEVICES (NOTE 3)			
UL System Single penetrant	NOTE 8	NOTE 8	NOTE 8

TYPE OF PENETRANT	WOOD FRAMED FLOOR	POURED CONCRETE FLOOR ANY THICKNESS	POURED CONCRETE FLOOR GREATER THAN 5 INCHES
UL System Multiple penetrants	NONE	NONE	NONE
F Rating	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING	EQUAL TO BARRIER RATING
T Rating	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)	EQUAL TO F RATING (NOTE 9)
Additional Requirements	NONE	NONE	NONE

THIS SCHEDULE USES THE IDENTIFICATION SYSTEMS OF UNDERWRITERS LABORATORIES, INC. AS DEFINED IN THEIR "FIRE RESISTANCE DIRECTORY" AND AS USED BY MANUFACTURERS ON THEIR UL CLASSIFIED SYSTEM. INDICATED RATINGS MAY BE EXCEEDED. "N/A" = NOT APPLICABLE

NOTES

1. EXAMPLES OF SYSTEMS THAT OPERATE BETWEEN 32 DEG F (0 DEG C) AND 122 DEG F (50 DEG C):
   CHILLED WATER SUPPLY & RETURN
   DOMESTIC HOT WATER LESS THAN 122 DEG F (50 DEG C)
   HEAT PUMP WATER SUPPLY & RETURN
   DOMESTIC HOT WATER RECIRCULATION LESS THAN 122 DEG F (50 DEG C)
   DOMESTIC COLD WATER

2. EXAMPLES OF SYSTEMS OPERATING BELOW 32 DEG F (0 DEG C) OR ABOVE 122 DEG F (50 DEG C):
   STEAM SUPPLY & RETURN
   HEATING HOT WATER SUPPLY & RETURN
   STEAM VENT
   HOT-CHILLDED WATER SUPPLY & RETURN
   CONDENSATE PUMP DISCHARGE
   DOMESTIC HOT WATER SUPPLY 140 DEG F (60 DEG C)
   DOMESTIC HOT WATER RECIRCULATION 140 DEG F (60 DEG C)

3. EXAMPLES OF OTHER RECESSED DEVICES:
   UNIT HEATERS
   FIRE EXTINGUISHER CABINET
   FIRE HOSE CABINETS

4. SEAL OPENING USING BARRIER'S ORIGINAL CONSTRUCTION.

5. WHERE A SERIES 8000 CLASSIFIED SYSTEM IS NOT AVAILABLE, INSTALL PENETRANTS SINGLY, AND PROVIDE SINGLE-PENETRANT SYSTEMS.

6. FOR SYSTEMS THAT OPERATE BELOW 32 DEG F (0 DEG C) OR ABOVE 122 DEG F (50 DEG C), COMPLY WITH THE FOLLOWING ADDITIONAL REQUIREMENTS:
   A. PROVIDE TPFS SYSTEM USING INTUMESCENT ELASTOMERIC WRAP STRIP AS ITS FILL, VOID, OR CAVITY MATERIAL.
   B. DO NOT USE SERIES 8000 PENETRATIONS. PROVIDE ONLY SINGLE PENETRATIONS.

7. FOR PENETRATIONS PROTECTED WITH DAMPERS, PROVIDE TPFS SYSTEM

APPROVED BY DAMPER MANUFACTURER.

8. WHERE UL CLASSIFIED SYSTEMS ARE NOT AVAILABLE FOR OTHER RECESSED DEVICES, MAINTAIN CONTINUITY OF RATED BARRIER CONSTRUCTION AROUND RECESS.

9. WHERE PENETRANT EXITS PENETRATION ENTIRELY WITHIN A FLOOR, PROVIDE FIRESTOP SYSTEM WITH THE SAME LEVEL OF FIRE RESISTANCE AS THE FLOOR SYSTEM. ONE SIDED COMPOSITE PANEL SYSTEMS ARE NOT ALLOWED.

END OF SECTION 078400

SECTION 078413

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

B. Related Sections:

1. Section 079200 – Joint Sealants.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

C. Qualification Data: For qualified Installer.

D. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration

firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:

1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
   a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
   b. Classification markings on penetration firestopping correspond to designations listed by the following:
      1) UL in its "Fire Resistance Directory."
      2) FM Global in its "Building Materials Approval Guide."

C. Preinstallation Conference: Conduct conference at Project site.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.5 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

C. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until Inspector of Record has examined each installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. A/D Fire Protection Systems Inc.
2. Grace Construction Products.
3. Hilti, Inc.
4. Nelson Firestop Products.
5. RectorSeal Corporation.
6. Specified Technologies Inc.
7. 3M Fire Protection Products.
8. Tremco, Inc.; Tremco Fire Protection Systems Group.
9. USG Corporation.

2.2 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (water gage).

1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls and fire partitions.
2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (water gage).

1. Horizontal assemblies include floors, floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies.
2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

F. VOC Content: Provide penetration firestopping that complies with the following limits for VOC content in accordance with South Coast Air Quality Management District (SCAQMD) Rule 1168 and the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers" as follows:

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

1. Permanent forming/damming/backing materials, including the following:
   a. Slag-wool-fiber or rock-wool-fiber insulation.
   b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
   c. Fire-rated form board.
   d. Fillers for sealants.
2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

2.3 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

A. Owner may engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

C. Proceed with enclosing penetration firestopping with other construction only after inspection has been completed, inspection reports are issued and installations comply with requirements.

3.5 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

3.6 PENETRATION FIRESTOPPING SCHEDULE

A. See next pages:

PENETRATION FIRESTOPPING SCHEDULE
FIRESTOPPING SYSTEMS ARE LISTED USING THE ALPHA-ALPHA-NUMERIC IDENTIFICATION SYSTEM PUBLISHED IN UL'S FIRE RESISTANCE DIRECTORY, VOLS. 2A - 2B

TYPE OF PENETRANT	CONSTRUCTION							
	FLOOR PENETRATION SYSTEMS (FIRST ALPHA COMPONENT = C OR F)				WALL PENETRATION SYSTEMS (FIRST ALPHA COMPONENT = C OR W)			
	CONCRETE FLOORS WITH A MINIMUM THICKNESS LESS THAN OR EQUAL TO 5 INCHES (127 MM)	CONCRETE FLOORS WITH A MINIMUM THICKNESS OF MORE THAN 5 INCHES (127 MM)	FRAMED FLOORS	FLOOR-CEILING ASSEMBLIES CONSISTING OF CONCRETE WITH MEMBRANE PROTECTION	CONCRETE OR MASONRY WALLS WITH A MINIMUM THICKNESS LESS THAN OR EQUAL TO 8 INCHES (203 MM)	CONCRETE OR MASONRY WALLS WITH A MINIMUM THICKNESS OF MORE THAN 8 INCHES (203 MM)	FRAMED WALLS	COMPOSITE PANEL WALLS
NO PENETRATING ITEMS	C-AJ-0001-0999 or F-A-0001-0999	C-BJ-0001-0999 or F-B-0001-0999	F-C-1001-1999		C-AJ-0001-0999, C-BJ-0001-0999, or W-J-0001-0999		W-L-000-1-0999	
METALLIC PIPE, CONDUIT, OR TUBING	C-AJ-1001-1999 or F-A-1001-1999	C-BJ-1001-1999, C-BK-1001-1999, or F-B-1001-1999	F-C-1001-1999	F-E-1001-1999	C-AJ-1001-1999, C-BJ-1001-1999, or W-J-1001-1999	C-BK-1001-1999 or W-K-1001-1999	W-L-1001-1999	W-N-1001-1999
NONMETALLIC PIPE, CONDUIT, OR TUBING	C-AJ-2001-2999 or F-A-2001-2999	C-BJ-2001-2999, C-BK-2001-2999, or F-B-2001-2999	F-C-2001-2999	F-E-2001-2999	C-AJ-2001-2999, C-BJ-2001-2999, or W-J-2001-2999	C-BK-2001-2999 or W-K-2001-2999	W-L-2001-2999	W-N-2001-2999
ELECTRICAL CABLES	C-AJ-3001-3999 or F-A-3001-3999	C-BJ-3001-3999, C-BK-3001-3999, or F-B-3001-3999	F-C-3001-3999	F-E-3001-3999	C-AJ-3001-3999, C-BJ-3001-3999, or W-J-3001-3999	C-BK-3001-3999 or WK-3001-3999	W-L-3001-3999	
CABLE TRAYS WITH ELECTRICAL CABLES	C-AJ-4001-4999 or F-A-4001-4999	C-BJ-4001-4999 or F-B-4001-4999			C-AJ-4001-4999, C-BJ-4001-4999, or W-J-4001-4999	W-K-4001-4999	W-L-4001-4999	

PENETRATION FIRESTOPPING SCHEDULE FIRESTOPPING SYSTEMS ARE LISTED USING THE ALPHA-ALPHA-NUMERIC IDENTIFICATION SYSTEM PUBLISHED IN UL'S FIRE RESISTANCE DIRECTORY, VOLS. 2A - 2B								
TYPE OF PENETRANT	CONSTRUCTION							
	FLOOR PENETRATION SYSTEMS (FIRST ALPHA COMPONENT = C OR F)				WALL PENETRATION SYSTEMS (FIRST ALPHA COMPONENT = C OR W)			
	CONCRETE FLOORS WITH A MINIMUM THICKNESS LESS THAN OR EQUAL TO 5 INCHES (127 MM)	CONCRETE FLOORS WITH A MINIMUM THICKNESS OF MORE THAN 5 INCHES (127 MM)	FRAMED FLOORS	FLOOR-CEILING ASSEMBLIES CONSISTING OF CONCRETE WITH MEMBRANE PROTECTION	CONCRETE OR MASONRY WALLS WITH A MINIMUM THICKNESS LESS THAN OR EQUAL TO 8 INCHES (203 MM)	CONCRETE OR MASONRY WALLS WITH A MINIMUM THICKNESS OF MORE THAN 8 INCHES (203 MM)	FRAMED WALLS	COMPOSITE PANEL WALLS
INSULATED PIPES	C-AJ-5001-5999 or F-A-5001-5999	C-BJ-5001-5999, C-BK-5001-5999, or F-B-5001-5999	F-C-5001-5999	F-E-5001-5999	C-AJ-5001-5999, C-BJ-5001-5999, or W-J-5001-5999	C-BK-5001-5999	W-L-5001-5999	W-N-5001-5999
MISCELLANEOUS ELECTRICAL PENETRANTS	C-AJ-6001-6999 or F-A-6001-6999	C-BJ-6001-6999			C-AJ-6001-6999, C-BJ-6001-6999, or W-BJ-6001-6999		W-L-6001-6999	
MISCELLANEOUS MECHANICAL PENETRANTS	C-AJ-7001-7999 or F-A-7001-7999	C-BJ-7001-7999 or F-B-7001-7999	F-C-7001-7999	F-E-7001-7999	C-AJ-7001-7999, C-BJ-7001-7999, or W-J-7001-7999		W-L-7001-7999	W-N-7001-7999
GROUPINGS OF PENETRATIONS	C-AJ-8001-8999 or F-A-8001-8999	C-BJ-8001-8999 or F-B-8001-8999	F-C-8001-8999	F-E-8001-8999	C-AJ-8001-8999, C-BJ-8001-8999, or W-J-8001-8999		W-L-8001-8999	

Remarks: For each location where a fire-resistance-rated floor or wall assembly is penetrated, provide a UL-listed penetration firestopping system selected from the applicable UL number range listed above that complies with Section 078413 - Penetration Firestopping, and that is suitable for the penetration conditions indicated for the Project.

END OF SECTION 078413

SECTION 078443

FIRE-RESISTANT JOINT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes fire-resistant joint sealants for the following:

1. Head-of-wall joints.
2. Joints at cold formed exterior wall framing and floor slab.
3. Joints between perimeter edge of fire-resistance-rated floor assemblies and back of non-fire-resistance-rated, exterior, glazed aluminum curtain walls.

B. Related Sections:

1. Section 078400 - Firestopping: Through-Penetration Firestop Systems for systems installed in openings in walls and floors with and without penetrating items.
2. Section 079200 - Joint Sealants: Non-fire-resistant joint sealants.

1.2 PERFORMANCE REQUIREMENTS

A. General: For joints in the following constructions, provide fire-resistant joint sealants that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistant joint sealants are installed:

1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
2. Fire-resistance-rated non-load-bearing walls, including partitions with fire-protection-rated openings.
3. Exterior curtain-wall assemblies and fire-resistance-rated floor assemblies, and perimeter fire containment systems.
4. Exterior stud wall assemblies and fire-resistance-rated floor assemblies, and perimeter fire containment systems.

B. Fire Resistance of Joint Systems: Assembly ratings (and movement capabilities) indicated, but with assembly ratings not less than that equaling or exceeding fire-resistance rating of constructions in which joints are located, as determined by UL 2079.

C. Fire Resistance of Perimeter Fire-Containment Systems: Integrity and insulation ratings indicated as determined by UL 2079.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each fire-resistant joint sealant, show each kind of construction condition in which joints are installed and relationships to adjoining construction. Include fire-resistant joint sealant design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistant joint sealant configuration for construction and penetrating items.

C. Product Certificates: For each type of fire-resistant joint sealant, signed by product manufacturer.

D. Qualification Data: For Installer.

E. Compatibility and Adhesion Test Reports: From fire-resistant joint sealant manufacturer indicating the following:

1. Materials forming joint substrates have been tested for compatibility and adhesion with fill materials.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
3. Evaluation Reports: Evidence of fire-resistant joint sealants' compliance with ICBO ES AC30, from the ICBO Evaluation Service.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fire-resistant joint sealants for each kind of joint and construction condition indicated through one source from a single manufacturer.

B. Preconstruction Compatibility and Adhesion Testing: Submit to fire-resistant joint sealant manufacturers, for testing indicated below, samples of materials that will contact or affect fill materials.

1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of fill materials to joint substrates.
   a. Perform tests under environmental conditions replicating those that will exist during installation.
2. Submit no fewer than nine pieces of each type of material, including joint substrates, forming materials, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

4. For materials failing tests, obtain fire-resistant joint sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.

C. Fire-Test-Response Characteristics: Provide fire-resistant joint sealants that comply with the following requirements and those specified in "Performance Requirements" Article:

1. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for fire-resistant joint sealants acceptable to authorities having jurisdiction.
2. Fire-resistant joint sealants are identical to those tested per ICBO ES AC30 and are qualified for types of joints and joint movement capabilities indicated in a current Evaluation Report by the ICBO Evaluation Service.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver fire-resistant joint sealant products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for fire-resistant joint sealants to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistant joint sealants when ambient or substrate temperatures are outside limits permitted by fire-resistant joint sealant manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate fire-resistant joint sealants per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistant joint sealants are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistant joint sealants.

C. Notify Owner's inspecting agency at least 7 days in advance of fire-resistant joint sealant installations; confirm dates and times on days preceding each series of installations.

D. Do not cover up fire-resistant joint sealant installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Basis-of-Design Products: The design for each fire-resistant joint sealant is based on products named in Part 2 articles. Subject to compliance with requirements, provide either the named products or comparable products by one of the following:
   a. Fire-resistant joint sealants:
      1) 3M Fire Protection Products Systems,Inc.
      2) Specified Technologies, Inc.
      3) A/D Fire Protection Systems Inc.
      4) Hilti, Inc.
      5) RectorSeal Corporation (The)
      6) United States Gypsum Company.
   b. Perimeter Fire-Containment Systems:
      1) Specified Technologies Inc.
      2) United States Gypsum Company.

2.2 FIRE-RESISTANT JOINT SEALANTS, GENERAL

A. Compatibility: Provide fire-resistant joint sealants that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistant joint sealant manufacturer based on testing and field experience.

B. Accessories: Provide components of fire-resistant joint sealants, including forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistant joint sealant manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

2.3 FIRE-RESISTANT JOINT SEALANTS

A. Where UL-classified fire-resistant joint sealants are indicated, they refer to alphanumeric designations listed in UL's "Fire Resistance Directory" under product Category XHBN.

B. (FRJS-1) Head-of-Wall, Fire-resistant joint sealant at interior partitions:

1. Basis-of-Design UL-Classified Product: Provide HW-D type joint UL listed and approved for actual constructed condition and rating required, for each location. Submit proposed system for Architects acceptance.
2. Assembly Rating: As indicated on Drawings.
3. Nominal Joint Width: As indicated on Drawings.
4. Movement Capabilities: Class II, 18.75 percent compression or extension.

C. Fire Resistant Joint System at Rated Walls:

1. Basis-of-Design UL-Classified Product: Select joint material types UL listed and approved for U.L. assembly No. WW-D-0045. Submit proposed system for Architects acceptance.

2.4 PERIMETER FIRE-CONTAINMENT SYSTEMS

A. Where UL-classified perimeter fire-containment systems are indicated, they refer to alphanumeric designations listed in UL's "Fire Resistance Directory" under product Category XHDG.

B. (FRJS-2) Perimeter Fire-Containment System at Curtain walls:

1. Basis-of-Design UL-Classified Product: Select CW-S type joint UL listed and approved for U.L. assembly type No. CW-S-2061. Submit proposed system for Architects acceptance.
2. Integrity Rating: Matching ratings of adjacent construction, as indicated on Drawings.
3. Insulation Rating: Matching ratings of adjacent construction, as indicated on Drawings.
4. Linear Opening Width: As indicated, maximum.

C. (FRJS-3) Perimeter Fire-Containment System at Exterior Stud Walls:

1. Basis-of-Design UL-Classified Product: Select CW-S type joint UL listed and approved for U.L. assembly type No. CW-S-1010. Submit proposed system for Architects acceptance.
2. Integrity Rating: Matching ratings of adjacent construction, as indicated on Drawings.
3. Insulation Rating: Matching ratings of adjacent construction, as indicated on Drawings.
4. Linear Opening Width: As indicated, maximum.

D. Refer to Section 072100 – Thermal Insulation for safing insulation and curtain wall insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistant joint sealants to comply with fire-resistant joint sealant manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistant joint sealant manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistant joint sealant from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-resistant joint sealant materials.

1. Remove tape as soon as possible without disturbing fire-resistant joint sealant's seal with substrates.

3.3 INSTALLATION

A. General: Install fire-resistant joint sealants to comply with Part 1 "Performance Requirements" Article and fire-resistant joint sealant manufacturer's written installation instructions for products and applications indicated.

B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

C. Install fill materials for fire-resistant joint sealants by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
2. Apply fill materials so they contact and adhere to substrates formed by joints.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified independent inspecting agency to inspect fire-resistant joint sealants and to prepare inspection reports.

1. Inspecting agency will state in each report whether inspected fire-resistant joint sealants comply with or deviate from requirements.

B. Proceed with enclosing fire-resistant joint sealants with other construction only after inspection reports are issued and inspecting agency has approved installed fire-resistant joint sealants.

C. If deficiencies are found, repair or replace fire-resistant joint sealants so they comply with requirements.

3.5 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistant joint sealant manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistant joint sealants are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistant joint sealants immediately and install new materials to produce fire-resistant joint sealants complying with specified requirements.

END OF SECTION 078443

SECTION 079200

JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes sealants for the following applications, including those specified by reference to this Section:

1. Exterior joints in the following vertical surfaces and non-traffic horizontal surfaces:
   a. Control and expansion joints in cast-in-place concrete.
   b. Joints between architectural precast concrete units.
   c. Control and expansion joints in unit masonry.
   d. Joints between metal panels.
   e. Joints between different materials listed above.
   f. Perimeter joints between materials listed above and frames of doors and windows.
   g. Control and expansion joints in ceiling and overhead surfaces.
   h. Other joints as indicated.
2. Interior joints in the following vertical surfaces and horizontal non-traffic surfaces:
   a. Control and expansion joints on exposed interior surfaces of exterior walls.
   b. Perimeter joints of exterior openings.
   c. Tile control and expansion joints.
   d. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
   e. Joints between plumbing fixtures and adjoining walls, floors, and counters.
   f. Other joints as indicated.
3. Interior joints in the following horizontal traffic surfaces:
   a. Control and expansion joints in cast-in-place concrete slabs.
   b. Control and expansion joints in tile flooring.
   c. Other joints as indicated.

B. Related Sections include the following:

1. Section 078400 "Firestopping" for fire-resistant building joint-sealant systems.
2. Section 095110 "Acoustical Panel Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.

1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each type and color of joint sealant required. Install joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Product Certificates: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.

E. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.

F. Product Test Reports: From a qualified testing agency indicating sealants comply with requirements, based on comprehensive testing of current product formulations.

1.5 QUALITY ASSURANCE

A. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates as follows:

1. Conduct field tests for each application indicated below:
    a. Each type of elastomeric sealant and joint substrate indicated.
2. Test Method: Test joint sealants by hand-pull method described below:
    a. Install joint sealants in 60-inch- long joints using same materials and methods for joint preparation and joint-sealant installation required for the completed Work. Allow sealants to cure fully before testing.
    b. Make knife cuts from one side of joint to the other, followed by two cuts approximately 2 inches long at sides of joint and meeting cross cut at one end. Place a mark 1 inch from cross-cut end of 2-inch piece.
    c. Use fingers to grasp 2-inch piece of sealant between cross-cut end and 1-inch mark; pull firmly at a 90-degree angle or more in direction of side cuts while holding a ruler alongside of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
    d. For joints with dissimilar substrates, check adhesion to each substrate separately. Do this by extending cut along one side, checking adhesion to opposite side, and then repeating this procedure for opposite side.

3. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
4. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
2. When joint substrates are wet.

B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated for each type in the sealant schedules at the end of Part 3.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and

application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: Match Architect's samples.

C. Colors of Exposed Joint Sealants: As indicated by referencing manufacturer's designations.

D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Elastomeric Joint-Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.

B. Additional Movement Capability: Where additional movement capability is specified in the Elastomeric Joint-Sealant Schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at the time of installation and remain in compliance with other requirements of ASTM C 920 for uses indicated.

C. Stain-Test-Response Characteristics: Where elastomeric sealants are specified in the Elastomeric Joint-Sealant Schedule to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

D. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

2.4 LATEX JOINT SEALANTS

A. Latex Sealant Standard: Comply with ASTM C 834 for each product of this description indicated in the Latex Joint-Sealant Schedule at the end of Part 3.

2.5 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Type C: Closed-cell material with a surface skin.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.

C. Masking Tape: Non-staining, non-absorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1. EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2. PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   a. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning perations by vacuuming or blowing out joints with oil-free compressed air.

2. Remove laitance and form-release agents from concrete.

3. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3. INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.

2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.

E. Install sealants by proven techniques to comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses provided for each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to

form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.4. CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5. PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

3.6. ELASTOMERIC JOINT-SEALANT SCHEDULE

A. Low-Modulus Nonacid-Curing Silicone Sealant: Where joint sealants of this type are indicated, provide products complying with the following:

1. Products: Provide one of the following
   a. 790; Dow Corning.
   b. Silpruf; GE Silicones.
   c. 864; Pecora Corporation.
   d. 890; Pecora Corporation.
   e. Spectrem 1; Tremco.
2. Type and Grade: S (single component) and NS (non-sag).
3. Class: 25.
4. Additional Movement Capability: 50 percent movement in extension and 50 percent movement in compression for a total of 100 percent movement.
5. Use Related to Exposure: NT (non-traffic).
6. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
   a. Use O Joint Substrates: Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, masonry, ceramic tile, and wood.
7. Stain-Test-Response Characteristics: Non-staining to porous substrates per ASTM C 1248.
8. Applications:

a. Exterior vertical and non-traffic horizontal joints. Interior control and expansion joints.

B. Mildew-Resistant Silicone Sealant: Where joint sealants of this type are indicated, provide products formulated with fungicide that are intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and temperature extremes, and that comply with the following:

1. Products: Provide one of the following
   a. 786 Mildew Resistant; Dow Corning.
   b. Sanitary 1700; GE Silicones.
   c. 898 Silicone Sanitary Sealant; Pecora Corporation.
   d. Tremsil 600 White; Tremco.
2. Type and Grade: S (single component) and NS (non-sag).
3. Class: 25.
4. Use Related to Exposure: NT (non-traffic).
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.
6. Application: Ceramic wall tile.

C. Single-Component Non-sag Urethane Sealant: Where joint sealants of this type are indicated, provide products complying with the following:

1. Products: Provide one of the following
   a. Vulkem 116; Mameco International.
   b. Vulkem 230; Mameco International.
   c. Sikaflex - 1a; Sika Corporation.
   d. NP 1; Sonneborn Building Products Div., ChemRex Inc.
2. Type and Grade: S (single component) and NS (non-sag).
3. Class: 25.
4. Use Related to Exposure: T (traffic)
5. Uses Related to Joint Substrates:M, A, and, as applicable to joint substrates indicated, O.
   a. Use O Joint Substrates: Ceramic tile.
6. Applications: Ceramic and quarry tile flooring.

3.7. LATEX JOINT-SEALANT SCHEDULE

A. Latex Sealant: Where joint sealants of this type are indicated, provide products complying with the following:

1. Products: Provide one of the following
   a. Chem-Calk 600; Bostik Inc.
   b. AC-20; Pecora Corporation.
   c. Sonolac; Sonneborn Building Products Div., ChemRex, Inc.
   d. Tremflex 834; Tremco.
2. Applications:
   a. Interior non-moving vertical joints.

END OF SECTION 079200

SECTION 079219

ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes acoustical joint sealants.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for elastomeric, latex, and butyl-rubber-based joint sealants for nonacoustical applications.

1.3 ACTION SUBMITTALS

A. Product Data: For each acoustical joint sealant.

B. Sustainable Design Submittals:

C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

D. Samples for Verification: For each kind and color of acoustical joint sealant required, provide Samples with joint sealants in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

E. Acoustical-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each kind of acoustical joint sealant, for tests performed by a qualified testing agency.

B. Sample Warranties: For special warranties.

1.5 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace acoustical joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish acoustical joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E 90.

2.2 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C 834.

1. Colors of Exposed Acoustical Joint Sealants: As selected by Architect from manufacturer's full range of colors

B. Acoustical Sealant for Concealed Joints: Manufacturer's standard nonsag, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber acoustical sealant.

2.3 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by acoustical-joint-sealant manufacturer where required for adhesion of sealant to joint substrates.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where recommended by acoustical-joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.

B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C 919, ASTM C 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of acoustical joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect acoustical joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079219

SECTION 081113

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pressed steel hollow metal doors and frames.
2. Fire-rated hollow metal doors and frames.
3. Hollow metal window-walls, glazed openings, and other hollow metal frames for glass.
4. Metal louvers in hollow metal doors.
5. Rough bucks, frame reinforcing, door reinforcing, door insulation, closure panels, clip angles and anchorage.
6. Factory prime paint finish.

B. Related Sections:

1. Section 042200 - Unit Masonry and Related Materials: Grouting of frames.
2. Section 083113 - Access Doors and Panels.
3. Section 087100 - Door Hardware: Finish hardware, weather-stripping and sound-stripping.
4. Section 088000 - Glazing: Glass and glazing.
5. Section 102000 - Louvers.
6. Section 099113 - Exterior Painting
7. Section 099123 - Interior Painting

1.2 REFERENCES

A. ANSI/SDI A250.8 Recommended Specifications for Standard Steel Doors and Frames unless herein specified.

B. Underwriters' Laboratories Inc. (UL) UL63, Factory Mutual (FM), or Warnock Hersey as applicable to fire rated hollow metal assemblies and acceptable to authorities having jurisdiction.

C. NFPA No. 80 - Fire Doors and Windows.

D. ANSI A115.1-.17 - Specification for Door and Frame Preparation for Hardware.

E. ANSI A156.7 (Supersedes CS9-65) - Standard Template Hinge Dimensions.

1.3 SUBMITTALS

A. Shop Drawings: Indicate general construction, configurations, jointing methods, reinforcements, and location of hardware and cutouts for glass and louvers.

1.4 QUALITY ASSURANCE

A. Applicable Standards: Specifications and standards of ANSI/SDI A250.8.

B. Wind Load Performance Requirements: Comply with wind load requirements of Uniform Building Code. Deflection shall not exceed 1/175 of span.

C. Installer Qualification: Experience with installation of similar materials.

D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated or required, provide fire-rated door and frame assemblies that comply with NFPA 80 "Standard for Fire Doors and Windows", and have been tested, listed, and labeled in accordance with ASTM E152 "Standard Methods of Fire Tests of Door Assemblies" by nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.

1. Oversize Fire-Rated Door Assemblies: For door assemblies required to be fire-rated and exceeding sizes of tested assemblies, provide certificate or label from approved independent testing and inspection agency, indicating that door and frame assembly conforms to requirements of design, materials and construction as established by individual listings for tested assemblies.
2. Temperature Rise Rating: At stairwell enclosures, provide doors which have Temperature Rise Rating of 450 degrees F maximum in 30 minutes of fire exposure.

E. Design Requirements: Drawings indicate profile and general details of steel frame fabrication and installation.

F. Regulatory Requirements: Comply with CBC Standard 7-2 requirements for positive pressure smoke testing.

1.5 PRODUCT HANDLING

A. Deliver hollow metal doors in manufacturer's protective covering. Handle hollow metal with care to prevent damage.

B. Door Storage: Store doors in upright position, under cover. Place doors on at least 4 inch wood sills or on floors in manner that will prevent rust and damage. Do not use non-vented plastic or canvas shelters which create humidity chamber and promote rusting. If corrugated wrapper on door becomes wet, or moisture appears, remove wrapping immediately. Provide 1/4 inch space between doors to promote air circulation.

C. Frame Storage: Store frames under cover on 4 inch wood sills on floors in manner that will prevent rust and damage. Do not use non-vented plastic or canvas shelters which create humidity chamber and promote rusting. Store assembled frames in vertical position, 5 units maximum in stack. Provide 1/4 inch space between frames to promote air circulation.

PART 2 PRODUCTS

2.1 HOLLOW METAL

A. Acceptable Manufacturers: One of the following, or equal:

1. Overly Manufacturing Co., as a standard of quality.
2. Krieger Steel Products, Co.
3. Steelcraft Manufacturing Co.
4. Amweld Metal Doors and Frames.

B. Cold Rolled Steel Sheets: Cold formed, prime quality pickled, annealed stretcher level steel, free from scale, pitting or other surface defects, complying with ASTM A366.

C. Galvanized Steel Sheets: ASTM A526 or A527, G60 zinc coating. Use galvanized steel sheets for exterior hollow metal doors, door frames and door louvers.

D. Minimum gages of hollow metal are specified below. Provide heavier gage if required by details or specific condition. Entire frame and sidelight shall be of same gage.
1. 16 gage: Interior door frames, and glazed opening frames.
2. 16 gage: Labeled frames (or heavier if required by label).
3. 18 gage: Interior doors (or heavier if required by label).
4. 14 gage: Exterior door frames, window-wall and window frames, transom and sidelight frames.
5. 16 gage: Exterior doors.
6. 20 gage: Trim members.

2.2 RELATED MATERIALS

A. Steel Reinforcing: ASTM A36.

B. Door Bumpers or Silencers: GJ-64.

2.3 HOLLOW METAL FRAMES

A. General: Form to profiles indicated. Where necessary, alternate details will be considered provided design intent is maintained. Consider and provide for erection methods.

B. Typical Reinforcing: Provide minimum hinge reinforcement 3/16 inch by 1-1/2 inch by 9 inch and lock strike reinforcement 3/16 inch by 1-1/2 inch by 4 inch long. Provide similar reinforcement for hardware items as required to adequately withstand stresses, minimum 12 gage, including channel reinforcement for door closers and closer arms, door holders and similar items. Provide reinforcement and clearances for concealed in-head bar closers and for mortise locks.

C. Cover Plates: For hinge and strike plate cutouts, provide fully enclosed pressed steel cover boxes spot welded to frames behind mortises.

D. Hardware: Mortise, reinforce, drill and tap for mortise hardware, except drilling and tapping for surface door closers, door closer brackets and adjusters shall be done in field.

E. Anchorage: Provide standard and special anchorage items as required. Provide 12 gage angle clips at bottom of frames with punched holes for securing frames to floor, except where frames are secured entirely by rough bucks. Provide formed steel channel spreader at bottom of frames, removable without damaging frame. At masonry, provide anchors (about 2 inch by 10 inch) approximately 24 inches on center.

1. Furnish glazed openings in frames with steel glazing stops and moulding of sizes indicated for field installation with countersunk oval head sheet metal screws. Stops and mouldings shall be 16 gage material unless otherwise indicated or specified.
2. Anchors in Stud Partitions: Provide steel anchors, 16 gauge minimum sheet steel, of design to suit partition construction, securely welded inside each jamb.
3. Through Frame Anchors: At frames indicated to be anchored with bolts through the frame, provide countersunk holes for bolts with 16 gauge minimum sheet steel stiffeners full thickness of frame, and securely welded inside each frame at each hole.

F. Silencers: Provide specified silencers, except where stop does not occur and at smoke gasketed openings, 3 per jamb at single door and one for each door at double doors.

G. Extensions: Reinforce transom bars or mullions as necessary to provide rigid installation. Where required (as at multiple openings) to stabilize large frames, provide frame or mullion extensions to anchor to structure above, proper size to fit within overhead construction. Provide angle clips to fasten to structure.

H. Mullions: Provide mullions, continuously reinforced, straight and without twist, of tubular design. For removable mullions provide fastenings of non-ferrous bolts at bottom, with sleeves at head of frame for mullion to clip over.

I. Clearances: Provide and be responsible for proper clearances at metal frames, including for weatherstripping, soundstripping and smoke gasketing. Glass clearance shall be thickness of glass plus clearance each side (1/8 inch minimum exterior - 1/16 inch minimum interior), adjust for installation, glass thickness to allow for glazing and sealant. Where sealed double glazing is indicated, provide rebates minimum of 3/4 inch and provide 1/4 inch clearance at glass edges. Where units fit around concrete blocks (blocks built into frames) obtain actual dimensions of blocks being used to establish minimum clearances.

J. Drip Cap: Galvanized steel field painted per 099000. Secure to frame at exterior doors

K. Stops: Set with countersunk or Jackson head screws.

L. Labeled Frames: Construct in accordance with requirements for labeled work. Attach proper U.L. label, Warnok Hersey. "B" labeled frames shall be 1-1/2 hour construction.

M. Joinings: At frames with equal width jambs and head, neatly miter on face (except locations as at transom bars and at frames with large head members). Cope and butt stops. Weld length of entire joint, including face and flat intersections. Grind smooth, at other frames, provide same mitered joint wherever possible (at intersection of jamb-head or jamb-sill) and at other locations butt metal neatly and full weld. If tight butt joints are utilized, joints shall be neatly caulked smooth.

N. Workmanship: Fabricate so no grind marks, hollow or other out-of-plane areas are visible. At joints of intermediate members (as mullions and transom bars), provide tight joining, neatly accomplished without holes, burned out spots, weld build up or other defacing work. Fill to close cracks and to preserve shapes. Tightly fit loose stops, to hairline joints.

O. Finish: Clean frames by degreasing process and apply thorough coating of baked-on primer, covering inside as well as outside surfaces. At galvanized frames, coat welds and other disrupted surface with zinc-rich paint containing not less than 90 percent zinc dust by weight.

P. Inserts, Bolts, and Fasteners: Provide manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153 Class C or D as required.

Q. Head Reinforcing: Furnish reinforced heads of frames when wider than 42 inches with steel angles or channel of 12 gauge minimum, full width of frame and factory welded inside frame. Reinforcing shall not act as lintel or load-carrying member and shall comply with fire rating requirements.

R. Glass Lights: At glazed openings, furnish applied stops with mitered corners, of minimum 20 gauge galvanized steel, one-piece lengths, secured within 3 inches of ends and at 12 inch centers with flathead countersunk screws, tamper resistant. Corner joints shall be furnished with contact edges closed tight, with trim faces mitered and continuously welded. Frames for multiple openings shall be provided with mullion and/or rail members, fabricated of closed tubular shapes with no visible seams or joints. All joints between faces of abutting members shall be securely welded and finished smooth. Provide condensate weeps 4'-0" on centers, maximum.

S. Door Silencers: Except on weather-stripped frames, furnish stops to receive 3 silencers on strike jambs of single-door frames and 2 silencers on heads of double-door frames.

2.4 HOLLOW METAL DOORS

A. Provide to design indicated including: Flush panel doors, flush panel with cut-out as indicated, stile and rail type, stile and rail with door louver. Use galvanized steel at exterior doors.

B. Flush Doors: Reinforce, stiffen and sound deaden. Provide cut-outs for glass and louvers with stops as shown. Provide flush steel closure at top of exterior and interior doors and at bottom of exterior doors with drain holes in bottom closure. Provide seamless edge. Following door construction types are acceptable.

1. Exterior Doors (and Interior Reinforced Doors): 20 gage steel stiffener reinforced vertically 6 inches o.c. full height and width, spot welded 5 inches o.c. to both face sheets. Stiffeners welded together top and bottom. Insulate with 2-1/2 lb density mineral wool insulation.
2. Honeycomb Core Interior Doors (Typical): Impregnated Kraft honeycomb core completely filling inside of center panel and permanently laminated to inside face sheets.
3. Door Construction: Manufacturer's standard honeycomb, polyurethane foamed in place, unitized steel grid, vertical steel stiffeners, or rigid mineral fiber core with internal sound deadener on inside of face sheets where appropriate in accordance with SDI standards.

C. Stile and Rail Doors: Construct with equivalent reinforcing. Reinforce intersections of stiles and rails at stile type doors, to form rigid unit capable of withstanding severe abuse without racking or sagging.

D. Labeled Doors: Insulate as required by Underwriters Laboratories. Build in special hardware and provide astragals as indicated. At one hour and at 1-1/2 hour doors at enclosures, maximum transmitted temperature end point shall not exceed 450 degrees F above ambient at end of 30 minutes of fire exposure specified in NFPA 252 and UL10 ABC as applicable.

E. Seamless Vertical Edges: Construct doors with smooth flush surfaces, without visible joints or seams on exposed faces or stile edges. Interior and exterior door edge seams shall be full welded, except if polyurethane core is used for exterior, these doors shall have edges filled with body putty and ground smooth.

F. Exterior Hollow Metal Door Louvers: Fabricate louver units of 16-gage galvanized steel sheets with stationary, weatherproof Z-shaped blades and U-shaped frames, not less than 1-3/8 inch thick. Space louver blades not more than 1-1/2 inch o.c. Assemble units by welding. Provide insect screen on interior side of frame, consisting of 14 by 18 wire mesh in rigid, formed metal frame.

G. Interior Hollow Metal Door Louvers: Fabricate of 20-gage cold-rolled steel sheets with stationary sightproof inverted V-shaped blades and U-shaped frames. Space louver blades not more than 3 inches o.c. Assemble units by welding.

H. Typical Reinforcement: Provide as required for hardware items. For lock reinforcement, provide manufacturer's standard reinforcement. Provide 12 gage reinforcement for escutcheons or roses. centering clips to hold lock case in alignment. For door checks, provide 3/16 inch channel type reinforcements, 3-1/2 inch deep by 14 inches long, or as required. Hinge reinforcement minimum 7 gage by 1-1/2 inch by 9 inch bar. Weld reinforcing to door. Reinforce doors for surface items such as surface and semi-concealed closers, brackets, surface holders and door stops. Drilling and tapping installation of these surface items shall be done in field by hardware installer.

I. Special Reinforcing: At exterior doors, reinforce inside of door on hinge side with high frequency hinge preparation. Weld to door.

J. Hardware: Mortise, reinforce, drill and tap for hardware furnished under Section 087100 - Hardware, except drilling and tapping for surface door closers, door closer brackets and adjusters shall be done in field. Obtain templates from hardware supplier.

1. Provide conduit chases and other door preparations as needed for installation of electronic hardware.
2. For openings scheduled to have card readers installed in future (FCR), provide conduit chases and other provisions for installation of electronic hardware in doors.
   a. Refer to Division 01 Alternates specifications section.
3. Refer to Door Hardware Schedule and door hardware groups in Section 087100 – Door Hardware.

K. Finish: Provide prime coat finish on doors. Thoroughly clean off rust, grease and other impurities. Grind welds smooth, no marks shall show. Apply metallic filler as required to fill cracks and joints and to level any weld areas or similar imperfections. Sand filler coat smooth.

L. Glass Moulding and Stops: Furnish fixed mouldings of 18 gauge minimum sheet steel, integral with and welded to security side of door.

2.5 HOLLOW METAL PANELS

A. Same materials and constructed and finished in same way as specified for hollow metal doors.

2.6 FASTENINGS

A. Provide fastenings, anchors and clips as required to secure hollow metal work in place. Provide Jackson head screws, or flatter. Dimple metal work to receive screw heads. Set stops and other non-structural fastenings with #6 Jackson head self-tapping screws.

2.7 SHOP PRIMING

A. All exposed and concealed carbon steel metal surfaces of all hollow metal doors, frames and other hollow metal Work of this Section, not otherwise finished (galvanized) shall be shop primed.

B. All exposed metal Work shall be bonderized before shop priming.

C. All concealed surfaces shall be shop primed before assembly. All exposed surfaces shall be shop primed after assembly

D. Hollow metal work shall be shop prime painted by being completely immersed or coated. Items of hollow metal fabrication may be oven baked for fast dry conditions.

E. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

1. VOC Limits for Paints and Coatings: Provide products that comply with SCAQMD Rule 1113.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine supporting structure and conditions under which hollow metal is to be installed. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install hollow metal in accordance with reviewed shop drawings and manufacturer's printed instructions. Securely fasten and anchor work in place without twists, warps, bulges or other unsatisfactory or defacing workmanship. Set hollow metal plumb, level, square to proper elevations, true to line and eye. Set clips and other anchors with Ramset "shot" anchors or drill in anchors as approved. Units and trim shall be fastened tightly together, with neat, uniform and tight joints.

B. Placing Frames: Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
   1. In masonry construction, building-in of anchors and grouting of frames with mortar is specified in Section 042001 - Unit Masonry and Related Materials. At in-place concrete or masonry construction, set frames and secure in place with masonry anchorage devices with bolt heads neatly filled with metallic putty, ground smooth and primed.
   2. At exterior hollow metal door frames, grout frames solid with mortar as specified in section 042001 – Unit Masonry and Related Materials.
   3. At acoustic rated metal stud and gypsum board partitions, install insulation within frames.

C. Place fire-rated frames in accordance with NFPA Standard #80.

D. Door Installation: Fit hollow metal doors accurately in their respective frames, within following clearances: Jambs and head 3/32 inch, meeting edges pair of doors 1/8 inch, sill where no threshold or carpet 1/4 inch above finished floor, sill at threshold 3/4 inch maximum above finished floor, sill at carpet 1/4 inch above carpet. Place fire-rated doors with clearances as specified in NFPA Standard #80.

3.3 ADJUSTING AND CLEANING

A. Prime Coat Touch-Up: Immediately after installation, sand smooth rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 081113

This page left intentionally blank.

SECTION 081416

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.2 QUALITY ASSURANCE

A. Quality Standard: In addition to requirements specified, comply with WI's "Manual of Millwork."

1. Provide WI-Certified Compliance Certificate for door grades and installation.

B. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252, CBC Standard 7-2, or UL 10C.

1.3 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Solid-Core Interior Doors: Life of installation.

1.4 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Haley Brothers, Inc. (Basis-of-Design)
2. Algoma Hardwoods, Inc.
3. Ampco, Inc.
4. Buell Door Company Inc.
5. Chappell Door Co.

6. Eagle Plywood & Door Manufacturing, Inc.
7. Eggers Industries.
8. Graham; an Assa Abloy Group company.
9. Ideal Architectural Doors & Plywood.
10. Ipik Door Company.
11. Lambton Doors.
12. Marlite.
13. Marshfield Door Systems, Inc.
14. Mohawk Flush Doors, Inc.; a Masonite company.
15. Oshkosh Architectural Door Company.
16. Poncraft Door Company.
17. Vancouver Door Company.
18. VT Industries Inc.

1.5 DOOR CONSTRUCTION, GENERAL

A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

C. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-2.
2. Blocking: Provide wood blocking in particleboard-core doors as follows:
   a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
   b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have kick, mop, or armor plates.

D. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

1. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals.
2. Pairs: Provide formed-steel edges and astragals. Finish to match door hardware (locksets or exit devices).

E. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide 5 inch composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance.

1.6 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade AA faces.
2. Species: Select white birch, or Select white maple.
3. Cut: Rotary cut.
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Balance match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet (3 m) or more.
8. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
9. Core: Particleboard.
10. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.

1.7 LOUVERS AND LIGHT FRAMES

A. Metal Louvers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Air Louvers Inc.
   b. Anemostat; a Mestek company.
   c. Hiawatha Incorporated.
   d. L & L Louvers, Inc.
   e. LL Building Products, Inc.; a division of GAF Materials Corporation.
   f. Louvers & Dampers, Inc.; a Mestek company.
   g. McGill Architectural Products.
2. Blade Type: Vision-proof, inverted V or Vision-proof, inverted Y.
3. Metal and Finish: Hot-dip galvanized steel, 0.040 inch (1.0 mm) thick, factory baked-enamel or powder coated finish; custom color as selected.

B. Metal Frames for Light Openings in Wood Doors: Provide manufacturer's standard metal frame; factory baked-enamel or powder coated finish; custom color as selected.

C. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; factory baked-enamel or powder coated finish; custom color as selected, as approved for use in doors of fire-protection rating indicated.

1.8 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Openings: Cut and trim openings through doors in factory.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 8 Section "Glazing."
3. Louvers: Factory install louvers in prepared openings.

1.9 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

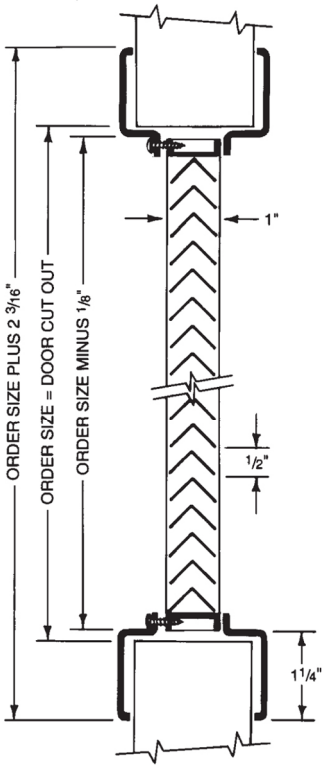
B. Finish doors at factory that are indicated to receive transparent finish..

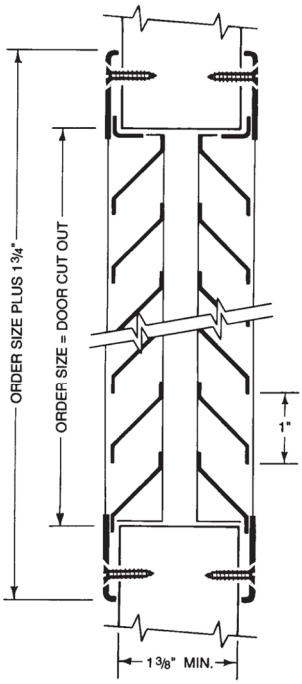
C. Transparent Finish:

1. Grade: Premium.
2. Finish: WI System 8 UV-curable coating.
3. Staining: As selected by Architect from manufacturer's full range.
4. Effect: Open-grain finish.
5. Sheen: Satin.

END OF SECTION 081416

Louvers


ORDER SIZE PLUS 2 3/16"
ORDER SIZE = DOOR CUT OUT
ORDER SIZE MINUS 1/8"
1"
1/2"
1 1/4"


ORDER SIZE PLUS 1 3/4"
ORDER SIZE = DOOR CUT OUT
1"
1 3/8" MIN.

This page left intentionally blank.

SECTION 083113

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Access doors and frames for walls and ceilings.

1.2 QUALITY ASSURANCE

A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80.

1. NFPA 252 or UL 10B for vertical access doors and frames.
2. ASTM E 119 or UL 263 for horizontal access doors and frames.

1.3 STEEL MATERIALS

A. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS) with A60 (ZF180) zinc-iron-alloy (galvannealed) coating or G60 (Z180) mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.

B. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation for Metallic-Coated Steel Sheet: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

2. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.

C. Drywall Beads: Edge trim formed from 0.0299-inch (0.76-mm) zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

D. Plaster Beads: Casing bead formed from 0.0299-inch (0.76-mm) zinc-coated steel sheet with flange formed out of expanded metal lath and in size to suit thickness of plaster.

1.4 STAINLESS-STEEL MATERIALS

A. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines or blend into finish.

1. Finish: Directional Satin Finish, No. 4.

1.5 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Acudor Products, Inc.
2. Babcock-Davis; A Cierra Products Co.
3. Bar-Co, Inc. Div.; Alfab, Inc.
4. Cendrex Inc.
5. Dur-Red Products.
6. Elmdor/Stoneman; Div. of Acorn Engineering Co.
7. Jensen Industries.
8. J. L. Industries, Inc.
9. Karp Associates, Inc.
10. Larsen's Manufacturing Company.
11. MIFAB, Inc.
12. Milcor Inc.
13. Nystrom, Inc.
14. Williams Bros. Corporation of America (The).

B. Flush Access Doors and Frames with Exposed Trim: Fabricated from stainless-steel sheet.

1. Locations: Interior wall and ceiling (except painted steel at single toilet room ceilings) surfaces in wet areas such as toilet, locker and shower rooms and on all ceramic tile surfaces.
2. Door: Minimum 0.060-inch- (1.5-mm-) thick sheet metal, set flush with exposed face flange of frame.
3. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with nominal 1 to 1-1/2 inches (25 to 38 mm) wide around perimeter of frame, surface-mounted trim.
4. Hinges: Spring-loaded, concealed-pin type.
5. Latch: Self-latching bolt operated by flush key with interior release.
6. Lock: Cylinder.

C. Flush Access Doors and Trimless Frames: Fabricated from metallic-coated steel sheet.

1. Locations: Interior wall and ceiling surfaces unless indicated otherwise.
2. Door: Minimum 0.060-inch- (1.5-mm-) thick sheet metal, set flush with surrounding finish surfaces.
3. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with drywall or plaster bead flange.
4. Hinges: Spring-loaded, concealed-pin type.
5. Latch: Self-latching bolt operated by flush key with interior release.
6. Lock: Cylinder.

D. Exterior Flush Access Doors and Frames with Exposed Trim: Fabricated from stainless-steel sheet. Weatherproof with extruded door gasket.

1. Locations: Exterior wall and ceiling (soffit) surfaces unless indicated otherwise.
2. Door: Minimum 0.060 inch (1.5 mm) thick sheet metal, set flush with exposed face flange of frame.
3. Frame: Minimum 0.060 inch (1.5 mm) thick sheet metal with nominal 1 to 1-1/2 inches (25 to 38 mm) wide around perimeter of frame, surface-mounted trim.
4. Hinges: Spring-loaded, concealed-pin type.
5. Latch: Self-latching bolt operated by flush key with interior release.
6. Lock: Cylinder.

E. Exterior Flush Access Doors and Trimless Frames: Fabricated from stainless-steel sheet. Weatherproof with extruded door gasket.

1. Locations: Plaster exterior wall and ceiling (soffit) surfaces.
2. Door: Minimum 0.060 inch (1.5 mm) thick sheet metal, set flush with surrounding finish surfaces.
3. Frame: Minimum 0.060 inch (1.5 mm) thick sheet metal with plaster bead flange.
4. Hinges: Spring-loaded, concealed-pin type.
5. Latch: Self-latching bolt operated by flush key with interior release.
6. Lock: Cylinder.

F. Fire-Rated, Insulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from stainless-steel sheet.

1. Locations: Interior wall and ceiling surfaces in wet areas such as toilet rooms and on all ceramic tile surfaces.
2. Fire-Resistance Rating: Not less than that of adjacent construction.
3. Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch (0.9 mm).
5. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with nominal 1 to 1-1/2 inches (25 to 38 mm) wide around perimeter of frame, surface-mounted trim.
6. Hinges: Concealed-pin type.

7. Automatic Closer: Spring type.
8. Latch: Self-latching device operated by flush key with interior release.
9. Lock: Self-latching device with cylinder lock.

G. Fire-Rated, Insulated, Flush Access Doors and Trimless Frames: Fabricated from metallic-coated steel sheet.

1. Locations: Interior wall and ceiling surfaces unless indicated otherwise.
2. Fire-Resistance Rating: Not less than that of adjacent construction.
3. Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch (0.9 mm).
5. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with drywall or plaster bead.
6. Hinges: Concealed-pin type.
7. Automatic Closer: Spring type.
8. Latch: Self-latching device operated by flush key with interior release.
9. Lock: Self-latching device with cylinder lock.

1.6 FABRICATION

A. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

B. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. Exposed Flanges: Nominal 1 to 1-1/2 inches (25 to 38 mm) wide around perimeter of frame.
2. For trimless frames with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.

C. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed. For cylinder lock, furnish two keys per lock and key all locks alike.

1.7 INSTALLATION

A. Install doors flush with adjacent finish surfaces.

END OF SECTION 083113

SECTION 084113

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Aluminum-framed entrances and storefronts

B. Exterior and interior storefront framing.

C. Storefront framing for punched openings.

D. Exterior and interior manual-swing entrance doors and door-frame units.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Contractor to design aluminum-framed systems.

B. Structural Performance:

1. Wind Loads: As indicated on Drawings and AHJ.
2. Seismic Loads: As indicated on Drawings and AHJ.

C. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to L/175.
2. Deflection Parallel to Glazing Plane: Limited to L/360 or 1/8 inch (3.2 mm), whichever is smaller.

D. Windborne-Debris-Impact-Resistance Performance: As recommended by Manufacturer and AHJ.

1.3 QUALITY ASSURANCE

A. Quality-control program for structural-sealant-glazed system.

B. Preconstruction sealant testing.

C. Mockups for each form of construction and finish.

1.4 WARRANTY

A. Materials and Workmanship: 10 years.

B. Finish: 20 years.

1.5 MAINTENANCE SERVICE

A. Entrance Door Hardware: Six months.

B. Structural Sealants: 12 months.

1.6 MANUFACTURERS – FLUSH GLAZED STOREFRONT

A. Basis-of-Design Product for Center or Outside Set, Flush Glazed Storefront: EFCO® System 433 Center or Outside Set Flush-Glazed, screw spline, Storefront, 2 by 4-1/2 inches,(custom color match to be selected) or comparable product by one of the following:
   1. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.
   2. Kawneer North America; an Alcoa company.

1.7 MANUFACTURERS – CENTER GLAZED STOREFRONT

A. Basis-of-Design Product for Center Glazed Storefront: EFCO® System 401 Center-Glazed Storefront, 1-3/4 by 4-1/2 inches, (custom color to be selected) or comparable product by one of the following:
   1. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.
   2. Kawneer North America; an Alcoa company.

1.8 MANUFACTURERS – ENTRANCE DOORS

A. Basis-of-Design Product for Entrance Doors: EFCO® System D300 – Medium Stile Doors (custom color to be selected) or comparable product by one of the following:
   1. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.
   2. Kawneer North America; an Alcoa company.

1.9 MATERIALS

1. Aluminum: Alloy and temper recommended by manufacturer. Extruded aluminum shall be 6063-T6 alloy and temper.

B. Steel reinforcement.

1.10 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members.

1. Construction: Non-thermal – 401 Series and Thermally Improved – 433 Series
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: As indicated.

B. Brackets and reinforcements.

C. Fasteners and accessories.

D. Concrete and masonry inserts.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing or 0.018-inch- (0.457-mm-) thick stainless steel.

F. Framing system gaskets and sealants.

G. Framing System Subframe and Subsill: Provide manufacturer’s standard to establish a substrate to seal against.

1.11 GLAZING SYSTEMS

A. Glazing: As specified in Division 8 Section "Glazing."

B. Glazing gaskets.

C. Spacers and setting blocks.

D. Bond-breaker tape.

E. Glazing Sealants:

1. Structural sealant.
2. Weatherseal sealant.

1.12 ENTRANCE DOOR SYSTEMS

A. Entrance Doors:

1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness.
2. Door Design: As indicated Medium stile.
3. Glazing stops and gaskets.

B. Entrance Door Hardware: Division 8 Section "Door Hardware."

1.13 ALUMINUM FINISHES

A. Interior Locations - Anodized Finish: Class I, clear anodic.

B. Exterior Locations - High-Performance Organic Finish: Fluoropolymer complying with AAMA 2605 and containing 70 percent PVDF resin (three coats).

C. Color: As reviewed and approved by District.

1.14 SOURCE QUALITY CONTROL

A. Testing Agency: Contractor engaged.

B. Structural-Sealant-Glazed Systems: Tested and inspected according to ASTM C 1401 recommendations.

1.15 FIELD QUALITY CONTROL

A. Testing: By Owner-engaged agency.

END OF SECTION 084113

SECTION 084123

SLIDING GLASS DOORS

TO BE ISSUED AS AN ADDENDUM

END OF SECTION 084123

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 085113

ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. The general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. Section includes:

1. Horizontal-sliding windows.
2. Projected windows.
3. Fixed windows.

C. Insect Screens: Provide insect screens at operable windows.

1.2 DEFINITIONS

A. Combination Windows: Where two different types of operating sash or ventilators are included in the same window unit and share a common frame, the unit is considered a "combination window."

B. Performance class number, included as part of the window designation system, is the actual design pressure in pounds force per square foot used to determine structural test pressure and water test pressure.

1. Structural test pressure, wind load test, is equivalent to 150 percent of the design pressure.
2. Water-leakage-resistance test pressure is equivalent to 15 percent of the design pressure with 2.86 lbf/sq. ft. as a minimum.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum windows engineered, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading without failure, as demonstrated by testing manufacturer's standard window assemblies representing types, grades, classes, and sizes required for Project according to test methods indicated.

B. Test Criteria: Testing shall be performed by a qualified independent testing agency based on the following criteria:

1. Design wind velocity at Project site is 70 mi./h.
2. Test Procedures: Test window units according to ASTM E 283 for air infiltration, both ASTM E 331 and ASTM E 547 for water penetration, and ASTM E 330 for structural performance.

C. Performance Requirements: Testing shall demonstrate compliance with requirements indicated in AAMA 101 for air infiltration, water penetration, and structural performance for type, grade, and performance class of window units required. Where required design pressure exceeds the minimum for the specified window grade, comply with requirements of AAMA 101, Section 3, "Optional Performance Classes," for higher than minimum performance class.

1. Air-Infiltration Rate for Operating Units: Not more than 0.37 cfm/ft. of operable sash joint for an inward test pressure of 6.24 lbf/sq. ft.
2. Air-Infiltration Rate for Fixed Windows: Not more than 0.15 cfm/ft. of area for an inward test pressure of 6.24 lbf/sq. ft.
3. Water Penetration: No water penetration as defined in the test method at an inward test pressure of 15 percent of the design pressure.
4. Structural Performance: No failure or permanent deflection in excess of 0.4 percent of any member's span after removing the imposed load, for a positive (inward) and negative (outward) test pressure of 30 lbf/sq. ft..
5. Forced-Entry Resistance: Comply with Performance Level 10 requirements when tested according to ASTM F 588.
6. Thermal Movements: Provide window units that allow thermal movement resulting from the following maximum change (range) in ambient temperature when engineering, fabricating, and installing aluminum windows to prevent buckling, opening of joints, and overstressing of components, connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to solar heat gain and nighttime sky heat loss.

    a. Temperature Change (Range): 100 deg F, ambient; 140 deg F material surfaces.

1.4 SUBMITTALS

A. Product Data for each type of window required, including the following:

1. Construction details and fabrication methods.
2. Profiles and dimensions of individual components.
3. Data on hardware, accessories, and finishes.
4. Recommendations for maintaining and cleaning exterior surfaces.

B. Shop Drawings showing fabrication and installation of each type of window required including information not fully detailed in manufacturer's standard Product Data and the following:

C. Test reports from a qualified independent testing agency indicating that each type, grade, and size of window unit complies with performance requirements indicated based on comprehensive testing of current window units within the last 5 years. Test results based on use of down-sized test units will not be accepted.

1.5 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain aluminum windows from one source and by a single manufacturer.

B. Product Options: Indicate sizes, profiles, dimensional requirements, and aesthetic effects of aluminum windows based on the specific window types and models. Other aluminum window manufacturers whose products have equal performance characteristics may be considered provided deviations in size, profile, and dimensions are minor and do not alter the aesthetic effect.

C. Provide AAMA -certified aluminum windows with an attached label.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength and not less than 0.062 inch thick at any location for main frame and sash members.

B. Fasteners: Provide aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components of window units.

1. Reinforcement: Where fasteners screw anchor into aluminum less than 0.125 inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads or provide standard, noncorrosive, pressed-in, splined grommet nuts.
2. Exposed Fasteners: Except where unavoidable for application of hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

C. Anchors, Clips, and Window Accessories: Fabricate anchors, clips, and window accessories of aluminum, nonmagnetic stainless steel, or hot-dip zinc-coated steel or iron complying with requirements of ASTM B 633; provide sufficient strength to withstand design pressure indicated.

D. Compression-Type Glazing Strips and Weatherstripping: Provide compressible stripping for glazing and weatherstripping such as molded EPDM or neoprene gaskets complying with ASTM D 2000 Designation 2BC415 to 3BC620, or molded PVC gaskets complying with ASTM D 2287, or molded expanded EPDM or neoprene gaskets complying with ASTM C 509, Grade 4.

E. Sliding-Type Weatherstripping: Provide woven-pile weatherstripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701.2.

F. Sealant: For sealants required within fabricated window units, provide type recommended by manufacturer for joint size and movement.

G. Wire-Fabric Insect Screen: 18-by-18, 18-by-16, or 18-by-14 mesh of 0.013-inch- diameter, coated aluminum wire, complying with FS RR-W-365, Type VII.

2.2 HARDWARE

A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum and of sufficient strength to perform the function for which it is intended.

2.3 ACCESSORIES

A. General: Provide manufacturer's standard accessories that comply with indicated standards.

B. Insect Screens: Provide insect screens at operable windows. Locate screens on inside or outside of window sash or ventilator, depending on window type. Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches.

1. Screen Frames: Fabricate frames of tubular-shaped, extruded- or formed-aluminum members of 0.040-inch- minimum wall thickness, with mitered or coped joints and concealed mechanical fasteners. Finish frames to match window units.

a. Provide removable PVC spline-anchor concealing edge of screen frame.

C. Weatherstripping: Provide sliding-type weatherstripping where sash rails slide horizontally or vertically along unit frame. Provide compression-type weatherstripping at perimeter of each operating sash where sliding type is inappropriate.

1. Provide weatherstripping locked into extruded grooves in sash.

2.4 HORIZONTAL-SLIDING WINDOWS

A. Window Grade and Class: Comply with requirements of AAMA Grade and Performance Class HS-HC40. Window units shall successfully pass operating force test performance requirements specified in AAMA 101. Provide thermal break.

1. Provide window units with sash that can be removed from inside for cleaning.

B. Hardware: Provide the following operating hardware:

1. Sash Rollers: Steel, lubricated ball-bearing rollers with nylon tires.
2. Lock: Cam-action sweep sash lock and keeper at meeting rails.

2.5 PROJECTED WINDOWS

A. Window Grade and Class: Comply with requirements of AAMA Grade and Performance Class P-HC40. Window units shall successfully pass the following test requirements as specified in AAMA 101. Provide thermal break.

1. Torsion test on an unglazed ventilator.
2. Horizontal and vertical concentrated load tests on latch rail of each ventilator.
3. Torsion load test on intermediate frame rails.
4. Vertical concentrated load test on intermediate frame rails over each ventilator.
5. Balance arm load test.

B. Hardware: Provide the following equipment and operating hardware:

1. Operating Device: Crank-operated, pivot-shoe-type, underscreen ventilator operator.
2. Hinges: 5-knuckle butt hinges (2 per ventilator).

3. Lock: Cam-action, sweep lock handle with surface-mounted strike.
4. Lock: Pole-operated, spring-catch lock where units are more than 72” above floor.
5. Limit Device: Stay bar with adjustable hold-open device.

2.6 FIXED WINDOWS

A. Window Grade and Class: Comply with requirements of AAMA Grade and Performance Class F-HC40. Provide thermal break.

2.7 FABRICATION

A. General: Fabricate aluminum window units to comply with indicated standards. Include a complete system for assembly of components and anchorage of window units.

1. Provide units that are reglazable without dismantling sash or ventilator framing.
2. Prepare window sash or ventilators for glazing, except where preglazing at the factory is indicated.
3. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
4. Provide water-shed members above side-hinged ventilators and similar lines of natural water penetration.
5. Subframes: Provide subframes with anchors for window units not less than 0.062-inch- thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Finish to match window units.
6. Mullions: Provide mullions and cover plates matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections.

B. Preglazed Fabrication: Preglaze window units at the factory where possible and practical for applications indicated. Comply with glass and glazing requirements of Division 8 Section "Glazing" of these Specifications and AAMA 101.

2.8 FINISHES

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.

B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 607.1.

D. Aluminum High-Performance Organic Finish: Three-coat thermocured system with fluoropolymer coats containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605. Color to be selected from manufacturer's full range of colors.

END OF SECTION 085113

This page left intentionally blank.

SECTION 086223

TUBULAR DAYLIGHTING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Tubular daylighting devices and accessories.

1.2 REFERENCES

A. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

C. ASTM A 463/A 463M - Standard Specification for Steel Sheet, Aluminum Coated, by the Hot Dip Process.

D. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc Coated (Galvanized), by the Hot Dip Process.

E. ASTM A 792/A 792M – Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

F. ASTM E 108 - Standard Test Methods for Fire Tests of Roof Coverings.

G. ASTM E 283 - Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

H. ASTM E 308 - Standard Practice for Computing the Colors of Objects by Using the CIE System.

I. ASTM E 330 - Structural Performance of Exterior Windows, Curtain Walls and Doors.

J. ASTM E 547 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain walls by Cyclic Air Pressure Difference.

K. ASTM E 1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.

L. ASTM E 1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricane.

M. ASTM D 635 - Test Method for Rate of Burning and/or Extent of Time of Burning of Self-Supporting Plastics in a Horizontal Position.

N. ASTM D 1929 - Test Method for Ignition Properties of Plastics.

O. ASTM D 2843 – Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.

P. ASTM F 1642 – Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loading.

Q. ASTM F 2912 – Standard Specification for Glazing and Glazing Systems Subject to Airblast Loading.

R. AAMA/WDMA/CSA 101/I.S.2/A440 - Standard/Specification for Windows, Doors, and Unit Skylights; 2011

S. FM Standard 4431 - The Approval Standard for Skylights

T. ICC-ES AC-16 - Acceptance Criteria for Plastic Skylights; 2008.

U. IBC Section 1710 - Load Test Procedure for Wind Load Testing on Rooftop Daylight Collecting System - Structural Performance Testing - Devised by ATI PE); 2012

V. IBC Section 2606.7.2 – Installation – Diffuser Fall Out Test (Devised by PE); 2012

W. OSHA 29 CFR - 1910.23 (e)(8) (Guarding Requirements for Skylights); 1926 Subpart M (Fall Protection); 1926.501(b)(4)(i); 1926.501(i)(2); 1926.501(b)(4)(ii)

X. California State OSHA Fall Protection Code of Regulations, Title 8, Section 3212 (e)(1)

1.3 PERFORMANCE REQUIREMENTS

A. Daylight Reflective Tubes: Spectralight Infinity with Cool Tube Technology combines ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance. Patented spectrally-selective optical surface yields an average total- and specular-reflectance greater than 99.5% percent for the Visible Light spectrum (400 nm to 700 nm) providing maximized visible light transmission and less than 25% reflectance for Infrared (IR) heat wavelengths (750 nm to 2500 nm) for minimized heat transmission, resulting in a spectrally-selective Total Solar Spectrum (250 nm to 2500 nm) reflectance less than 37 percent, as measured using a Perkin Elmer Lambda 1050 spectrophotometer with a Universal Reflectance Accessory. Color: a* and b* (defined by CIE L*a*b* color model) shall not exceed plus 2 or be less than minus 2 as determined in accordance to ASTM E 308.

B. SOLAMASTER 750 DS-C and 300 DS (CLOSED CEILING)
   1. AAMA/WDMA/CSA 101/IS2/A440, Class CW-PG70, size tested 14 inch (356 mm) and 21 inch (533 mm) diameter, Type TDDCC.
      a. Air Infiltration Test:

1) Air infiltration will not exceed 0.30 cfm/sf aperture with a pressure delta of 1.57 psf across the tube when tested in accordance with ASTM E 283.

b. Water Resistance Test:
1) Passes water resistance; no uncontrolled water leakage with a pressure differential of 10.7 psf (512 Pa) or 15 percent of the design load (whichever is greater) and a water spray rate of 5 gallons/hour/sf for 24 minutes when tested in accordance with ASTM E 547 and ASTM E 331.

c. Uniform Load Test: All units tested with a safety factor of (3) for positive pressure and (2) for negative pressure, acting normal to plane of roof in accordance with ASTM E 330.
1) No breakage, permanent damage to fasteners, hardware parts, or damage to make daylighting system inoperable or cause excessive permanent deflection of any section when tested at a Positive Load of 150 psf (7.18 kPa) or Negative Load of 70 psf (3.35 kPa).

2. Fire Testing:
a. Fire Rated Roof Assemblies:
1) When used with the Dome Edge Protection Band, all domes meet fire rating requirements as described in the International Building Code for Class A, B, and C roof assemblies.

b. When used with the Dome Edge Protection Band, all domes meet fire rating requirements as described in the International Building Code.

c. Self-Ignition Temperature - Greater than 650 degrees F per ASTM D-1929.

d. Smoke Density: Rating no greater than 450 per ASTM Standard E 84 in way intended for use. Classification C.

e. Rate of Burn and/or Extent: Maximum Burning Rate: 2.5 inches/min (62 mm/min) Classification CC-2 per ASTM D 635.

f. Rate of Burn and/or Extent: Maximum Burn Extent: 1 inch (25 mm) Classification CC-1 per ASTM D 635.

3. Fall Protection Performance:
a. Passes fall protection test: No penetration of dome or curb cap when subject to 400 lb (160 Kg)/42 inch (1066 mm) impact drop test when tested in accordance with OSHA 29 CFR 1926.506(c) Safety Net Systems.

b. Passes fall protection test: California State OSHA Fall Protection Code of Regulations, Title 8, Section 3212 (e)(1) Skylight Screens.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Data sheets showing roof dome assembly, flashing base, reflective tubes, diffuser assembly, and accessories.
4. Installation requirements.

C. Drawings. Submit standard drawings showing layout, profiles and product components, including rough opening and framing dimensions, anchorage, roof flashings and accessories.

D. Verification Samples: As requested by Architect.

E. Test Reports: Independent testing agency or evaluation service reports verifying compliance with specified performance requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Engaged in manufacture of tubular daylighting devices for minimum 20 years.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original containers, dry, undamaged, seals and labels intact.

B. Store products in manufacturer's unopened packaging until ready for installation.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

A. Daylighting Device: Manufacturer's standard warranty for 10 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Solatube International, Inc., which is located at: 2210 Oak Ridge Way; Vista, CA 92081; Toll Free Tel: 888-765-2882; www.solatube.com Contact Sun West Distributors; 760-432-0729; www.sunwestdistributors.com.

B. Substitutions: Not permitted.

2.2 TUBULAR DAYLIGHTING DEVICES

A. Tubular Daylighting Devices General: Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICC AC-16.

B. SolaMaster Series: Solatube Model 750 DS, 21 inch (530 mm) Daylighting System:
   1. Model:

a. Solatube Model 750 DS-C Closed (Penetrating) Ceiling. AAMA Type TDDCC.

2. Capture Zone:
   a. Roof Dome Assembly: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.
      1) Outer Dome Glazing: Type DA, 0.125 inch (3.2 mm) minimum thickness injection molded acrylic classified as CC2 material; UV inhibiting (100 percent UV C, 100 percent UV B and 98.5 percent UV A), impact modified acrylic blend.
         (a) Raybender 3000: Variable prism optic molded into outer dome to capture low angle sunlight and limit high angle sunlight.
   b. Tube Ring: 0.090 inch (2.3 mm) nominal thickness injection molded high impact PVC. Prevents thermal bridging between base flashing and tubing and channel condensed moisture. Attached to base of dome ring with butyl glazing rope 0.24 inch (6 mm) diameter; to minimize air infiltration.
   c. Dome Seal: Adhesive backed weatherstrip, 0.63 inch (16 mm) tall by 0.28 inch (7 mm) wide.
3. Flashings:
   a. Roof Flashing Base:
      1) One Piece: One piece, seamless, leak-proof flashing functioning as base support for dome and top of tube. Sheet steel, corrosion resistant conforming to ASTM A 653/A 653M or ASTM A 463/A 463M or ASTM A792/A 792M, 0.028 inch (0.7 mm) plus or minus .006 inch (.015 mm) thick.
         (a) Base Style: Type FC, Curb cap, with inside dimensions of 27 inches by 27 inches (685 mm by 685 mm) to cover curb as specified in Section 07600.
4. Transfer Zone:
   a. Extension Tubes: Aluminum sheet, thickness 0.018 inch (0.5 mm) conforming to ASTM B 209.
      1) Reflective Tubes:
         (a) Reflective extension tube, Type EXX and Type EL with total length of run as indicated on the Drawings.
         (b) Interior Finish: Spectralight Infinity with Cool Tube Technology combining ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance.
      2) Tube Options
         (a) Top Tube Angle Adapter and Bottom Tube Angle Adapter Kit: Type AK, Reflective 45 degree adjustable top and bottom angle adapters (one each), 16 inches (406 mm) long
         (b) Reflective extension tube, Type EL: 48 inches (1220 mm) long, replaces two normal 24-inch (610mm) extension tubes when long tube runs are required.
5. Delivery Zone:
   a. Diffuser Assemblies for Tubes Penetrating Ceilings: Solatube Model 750 DS-C. Ceiling mounted box transitioning from round tube to square ceiling assembly, supporting light transmitting surface at bottom

termination of tube; 23.8 inches by 23.8 inches (605 mm by 605 mm) square frame to fit standard suspended ceiling grids or hard ceilings.

1) Polymeric Transition Box: Type TP, round-to-square transition box made of opaque polymeric material, classified as CC2, Class C, 0.110 inch (2.8 mm) thick.
2) Lens: Type L1, OptiView Fresnel lens design to maximize light output and diffusion with extruded aluminum frame and EPDM foam seal to minimize condensation and bug, dirt and air infiltration per ASTM E 283. Visible Light Transmission shall be greater than 90 percent at 0.022 inch (0.6 mm) thick. Classified as CC2.
3) Supplemental Natural Effect Lens Type LN, Lens made of acrylic, classified as CC2, Class C, 0.060 inch (1.5 mm) thick, with open cell foam seal to minimize condensation and bug, dirt and air infiltration per ASTM E 283.

C. SolaMaster Series: Solatube Model 300 DS: 14 Inch (350 mm) Daylighting System:
   1. Model:
      a. Solatube Model 300 DS-C Closed (Penetrating) Ceiling, AAMA Type TDDCC.
   2. Capture Zone:
      a. Roof Dome Assembly: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.
         1) Outer Dome Glazing: Type DA, 0.125 inch (3.25 mm) minimum thickness impact resistant injection molded acrylic classified as CC2 material; UV inhibiting (100 percent UV C, 100 percent UV B and 98.5 percent UV A), impact modified acrylic blend.
            (a) Raybender 3000: Variable prism optic molded into outer dome to capture low angle sunlight and limit high angle sunlight.
         2) Tube Ring: Attached to top of base section; 0.090 inch (2.3 mm) nominal thickness injection molded high impact acrylic; to prevent thermal bridging between base flashing and tubing and channel condensed moisture out of tubing.
         3) Dome Seal: Polyethylene foam seal, black, 0.13 inch (3.2 mm) thick by 14.62 (371 mm) diameter, 2 PCF polyethylene foam.
         4) LightTracker Reflector, made of aluminum sheet, thickness 0.015 inch (0.4 mm) with Spectralight Infinity. Positioned in the dome to capture low angle sunlight.
      b. Dome Options:
      c. Flashings:
         1) Roof Flashing Base:
            (a) One Piece: One piece, seamless, leak-proof flashing functioning as base support for dome and top of tube. Sheet steel, corrosion resistant conforming to ASTM A 653/A 653M or ASTM A 463/A 463M or ASTM A792/A 792M, 0.028 inch (0.7 mm) plus or minus .006 inch (.015 mm) thick.
               (1) Base Style: Type FC, Curb Cap, with inside dimensions of 27 inches by 27 inches (685 mm by

685 mm) to cover curb as specified in Section 07600.

3. Transfer Zone:
   a. Extension Tubes: Aluminum sheet, thickness 0.015 inch (0.4 mm).
      1) Reflective Tubes:
         (a) Reflective Extension Tubes: Type EXX, extension tubes with total length of run as indicated on the Drawings.
         (b) Reflective angle adapter tube (standard top and bottom tubes), providing up to a 30-degree angle adjustment.
         (c) Interior Finish: Spectralight Infinity with Cool Tube Technology combining ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance.
4. Delivery Zone:
   a. Ceiling Ring: Injection molded impact resistant acrylic. Nominal thickness is 0.110 inches (2.8 mm).
   b. Ceiling Ring Seal: Polyethylene foam seal, white, 0.25 inch (6.4 mm) wide by 0.19 inch (4.8 mm) high, 2 PCF polyethylene foam with low-tack pressure sensitive adhesive. Upper glazing: PET GAG plastic with EPDM low density sponge seal to minimize condensation and bug, dirt, and air infiltration per ASTM E283. The nominal thickness is 0.039 inches (0.99 mm).
      1) Natural Effect Lens: Type LN.
   c. Diffuser Assemblies for Tubes Penetrating Ceilings: Ceiling mounted box transitioning from round tube to square ceiling assembly, supporting light transmitting surface at bottom termination of tube 23.8 inches by 23.8 inches (605 mm by 605 mm) square frame to fit standard suspended ceiling grids or hard ceilings.
      1) Metal Transition Box: Type TM, Round to Square transition box comprised of Spectralight Infinity SoftLight material with structured finish on exposed reflective surface, .015in (0.4mm) thick. Color: a* and b* (defined by CIE L*a*b* color model) shall not exceed plus 2 or be less than minus 2 as determined in accordance to ASTM E 308.
      2) Lens: Type L1 OptiView Fresnel lens design to maximize light output and diffusion with extruded aluminum frame and EPDM foam seal to minimize condensation and bug, dirt and air infiltration per ASTM E 283. Visible Light Transmission shall be greater than 90 percent at 0.022 inch (0.6 mm) thick. Classified as CC2.
      3)

2.3 ACCESSORIES

A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.

B. Sealant: Polyurethane or copolymer based elastomeric sealant as provided or recommended by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Examine openings, substrates, structural support, anchorage, and conditions for compliance with requirements for installation tolerances and other conditions.

C. If substrate and rough opening preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Coordinate requirements for power supply, conduit and wiring.

C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's printed instructions.

B.

C. Installer shall be factory trained and certified by the manufacturer prior to commencement of installation.

D.

E. Coordinate installation with substrates, air and vapor retarders, roof insulation, roofing membrane, and flashing to ensure that each element of the Work performs properly and that finished installation is weather tight.
   1. Install flashing to produce weatherproof seal with curb and overlap with roofing system termination at top of curb.
   2. Provide thermal isolation when components penetrate or disrupt building insulation. Pack fibrous insulation in rough opening to maintain continuity of thermal barriers.
   3. Coordinate attachment and seal of perimeter air and vapor barrier material.

F. Where metal surfaces of tubular unit skylights will contact incompatible metal or corrosive substrates, including preservative-treated wood, provide permanent separation as recommended by manufacturer.

G. Align device free of warp or twist, maintain dimensional tolerances.

H. Inspect installation to verify secure and proper mounting. Test each fixture to verify operation, control functions, and performance. Correct deficiencies.

3.4 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

This page left intentionally blank.

Section 087100

DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes: Finish Hardware for door openings, except as otherwise specified herein.

1. Door hardware for metal doors & frames
2. Door hardware for wood doors
3. Door hardware for other doors indicated
4. Keyed cylinders specified in other Sections

B. Related Sections:

1. Division 6: Rough Carpentry.
2. Division 8: Aluminum Doors and Frames
3. Division 8: Hollow Metal Doors and Frames.
4. Division 8: Wood Doors.
5. Division 26: Electrical
6. Division 28: Electronic Security

C. References: Comply with applicable requirements of the following standards. Where these standards conflict with other specific requirements, the most restrictive shall govern.

1. Builders Hardware Manufacturing Association (BHMA)
2. NFPA 101 Life Safety Code
3. NFPA 80 -Fire Doors and Windows
4. ANSI-A156.xx- Various Performance Standards for Finish Hardware
5. UL10C – Positive Pressure Fire Test of Door Assemblies
6. ANSI-A117.1 – Accessible and Usable Buildings and Facilities
7. DHI /ANSI A115.IG – Installation Guide for Doors and Hardware
8. CBC California Building Code

D. Intent of Hardware Groups

1. Should items of hardware not definitely specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
2. Where items of hardware aren't definitely or correctly specified, are required for completion of the Work, a written statement of such omission, error, or other discrepancy to Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.

1.2 SUBSTITUTIONS:

A. Comply with Division 1.

1.3 SUBMITTALS:

A. Comply with Division 1.

B. Special Submittal Requirements: Combine submittals of this Section with related Sections to ensure the "design intent" of the system/assembly is understood and can be reviewed together.

C. Product Data: Manufacturer's specifications and technical data including the following:

1. Detailed specification of construction and fabrication.
2. Manufacturer's installation instructions.
3. Wiring diagrams for each electric product specified. Coordinate voltage with electrical before submitting.
4. Submit 5 copies of catalog cuts with hardware schedule.

D. Shop Drawings - Hardware Schedule: Submit 5 complete reproducible copy of detailed hardware schedule. Organize vertically formatted schedule into “Hardware Sets” with index of doors and headings, indicating complete designations of every item required for each door or opening. Include following information:

1. List groups and suffixes in proper sequence.
2. Completely describe door and list architectural door number.
3. Door and frame sizes and materials.
4. Degree of opening
5. Manufacturer, product name, and catalog number.
6. Function, type, and style.
7. Size and finish of each item.
8. Fastenings and other pertinent information
9. Mounting heights.
10. Explanation of abbreviations and symbols used within schedule.
11. Description of operation for each electro-mechanical hardware application.

E. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.

1. Templates, point to point wiring diagrams and "reviewed Hardware Schedule" including electrical terms to electrical and security contactor for coordination and verification of voltages and locations where electro-mechanical hardware is included.

F. Samples: (If requested by the Architect)

1. 1 sample of Lever and Rose/Escutcheon design, (pair).
2. 3 samples of metal finishes

G. Keying Schedule:

1. Arrange for a keying meeting with Architect, Owner, Hardware Supplier, and other involved parties to ensure locksets and locking hardware are functionally correct and keying complies with project requirements.

2. Submit keying schedule prepared by or under the supervision of supplier detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations. Furnish 3 typed copies of keying schedule to Architect.

H. Contract Closeout Submittals: Comply with Division 1 including specific requirements indicated.

1. Operating and maintenance manuals: Submit 3 sets containing the following.

   a. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
   b. Catalog pages for each product.
   c. Name, address, and phone number of local representative for each manufacturer.
   d. Parts list for each product.

2. Copy of final hardware schedule, edited to reflect, "As installed".
3. Copy of final keying schedule
4. As installed point to point “Wiring Diagrams” for each piece of hardware connected to power, both low voltage and 110 volts.
   One set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.4 QUALITY ASSURANCE

A. Comply with Division 1.

1. Statement of qualification for distributor and installers.
2. Statement of compliance with regulatory requirements and single source responsibility.
3. Distributor's Qualifications: Firm with 3 years’ experience in the distribution of commercial hardware.

   a. Distributor to employ full time Architectural Hardware Consultants (AHC) or similar with 3 years’ experience for the purpose of scheduling and coordinating hardware and establishing keying schedule.

4. Installer's Qualifications: Firm with 3 years experienced in installation of similar hardware to that required for this Project, including specific requirements indicated.
5. Regulatory Label Requirements: Provide testing agency label or stamp on hardware for labeled openings.

   a. Provide UL listed hardware for labeled and 20 minute openings in conformance with requirements for class of opening scheduled.
   b. Underwriters Laboratories requirements have precedence over this specification where conflict exists.

6. Single Source Responsibility: Except where specified in hardware schedule, furnish products of only one manufacturer for each type of hardware.

B. Fire Rated Openings:

1. NFPA 80 compliant and as required by local governing agencies.
2. Electric latch retraction: Provide power supplies with fire alarm relay.

3. Hardware: UL10C/ UBC Standard 7-2 (positive pressure) compliant.
4. Provide proper latching hardware, self-closing, approved bearing hinges, and seals.
5. Coordinate with wood door section on intumescent seals.
6. Provide approved gasketing at storage rooms over 100 sqft.

C. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

D. Review Project for extent of finish hardware required to complete the Work. Where there is a conflict between these Specifications and the existing hardware, notify the Architect in writing and furnish hardware in compliance with the Specification unless otherwise directed in writing by the Architect.

E. **Pre-Installation Meetings**: Initiate and conduct with supplier, installer and related trades, coordinate materials and techniques, and sequence complex hardware items and systems installation. Convene at least one week prior to commencement of related work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Comply with Division 1.

1. Deliver products in original unopened packaging with legible manufacturer's identification.
2. Package hardware to prevent damage during transit and storage.
3. Mark hardware to correspond with "reviewed hardware schedule".
4. Deliver hardware to door and frame manufacturer upon request.

B. Storage and Protection: Comply with manufacturer's recommendations.

1.6 PROJECT CONDITIONS:

A. Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.

B. Review Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

C. Coordinate conduit and raceways as needed for electrical, electronic and electro-pneumatic hardware items. Fire/life-safety system interfacing. Point-to-point wiring diagrams plus riser diagrams to related trades.

D. Verification of existing conditions: Examine doors, frames, related items and conditions under which Work is to be performed such that specified hardware will accommodate these conditions.

E. Reinforce walls for wall-mounted hardware, including wall stops and stainless steel guard rails.

F. Coordinate finish floor materials and floor-mounted hardware.

1.7 WARRANTY:

A. Refer to Conditions of the Contract

B. Manufacturer's Warranty:

1. Closers: Ten years
2. Exit Devices: Three Years
3. Locksets & Cylinders: Three years
4. All other Hardware: One year

1.8 OWNER'S INSTRUCTION:

A. Instruct Owner's personnel in operation and maintenance of hardware units.

1.9 MAINTENANCE:

A. Extra Service Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1 Closeout Submittals Section.

1. Special Tools: Provide special wrenches and tools applicable to each different or special hardware component.
2. Maintenance Tools: Provide maintenance tools and accessories supplied by hardware component manufacturer.
3. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra service materials.

B. Maintenance Service: Submit for Owner's consideration maintenance service agreement for electronic products installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. The following manufacturers are approved subject to compliance with requirements of the Contract Documents. Approval of manufacturers other than those listed shall be in accordance with Division 1.

Item:	Manufacturer:
Hinges	Stanley
Locksets	Best
Cylinders	Best
Exit Devices	Precision
Closers	Stanley
Door Stops	Trimco
Flush Bolts	Trimco
Flat Goods	Trimco
Threshold & Gasketing	NGP

2.2 MATERIALS:

A. Fasteners:

1. Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
2. Provide concealed fasteners for hardware items on exterior doors which are exposed when door is closed
3. Provide surface-concealed fasteners where additional overlapping hardware is required.
4. Combination machine screws and expansion shields shall be used for attaching hardware to concrete or masonry
5. Fasteners exposed to the weather or corrosive environments in the finished work shall be completely non-ferrous; made of brass, bronze, or stainless steel.

B. Hinges:

1. Template screw hole locations
2. Minimum of 2 permanently lubricated non-detachable bearings
3. Equip with easily seated, non-rising pins
4. Sufficient size to allow 180-degree swing of door
5. Furnish hinges with five knuckles and flush concealed bearings
6. Provide hinge type as listed in schedule.
7. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.
8. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function and finish
9. UL10C listed for Fire
10. Provide electric hinge wires with junction box (JB-2R series) to protect wires from mortar filled frames as required.

C. Geared Continuous Hinges:

1. Tested and approved by BHMA for ANSI A156.26-1996 Grade 1
2. Anti-spinning through fastener
3. UL10C listed for 3 hour Fire rating
4. Non-handed
5. Lifetime warranty
6. Provide Fire Pins for 3-hour fire ratings
7. Sufficient size to permit door to swing 180 degrees

D. Mortise Type Locks and Latches:

1. Tested and approved by BHMA for ANSI A156.13, Series 1000, Operational Grade 1, Extra-Heavy Duty, Security Grade 2 and be UL10C
2. Fit ANSI A115.1 door preparation
3. Functions and design as indicated in the hardware groups
4. Solid, one-piece, 3/4-inch (19mm) throw, anti-friction latchbolt made of self-lubricating stainless steel
5. Deadbolt functions shall have 1 inch (25mm) throw bolt made of hardened stainless steel

6. Latchbolt and Deadbolt are to extend into the case a minimum of 3/8 inch (9.5mm) when fully extended
7. Auxiliary deadlatch to be made of one piece stainless steel, permanently lubricated
8. Provide curved-lip strike with dust box for each latch or lock bolt, with lip extended to protect frame, finished to match door hardware set, unless otherwise indicated.
9. Lever handles must be of forged or cast brass, bronze or stainless steel construction and conform to ANSI A117.1. Levers that contain a hollow cavity are not acceptable
10. Lock shall have self-aligning, thru-bolted trim
11. Levers to operate a roller bearing spindle hub mechanism
12. Mortise cylinders of lock shall have a concealed internal setscrew for securing the cylinder to the lockset. The internal setscrew will be accessible only by removing the core, with the control key, from the cylinder body.
13. Spindle to be designed to prevent forced entry from attacking of lever
14. Provide locksets with 7-pin removable and interchangeable core cylinders
15. Each lever to have independent spring mechanism controlling it
16. Core face must be the same finish as the lockset

E. Cylindrical Type Locks and Latchsets:

1. Tested and approved by BHMA for ANSI A156.2, Series 4000, Operational Grade 1, Extra-Heavy Duty, and be UL10C listed
2. Fit modified ANSI A115.2 door preparation
3. Locksets and cores to be of the same manufacturer to maintain complete lockset warranty
4. Provide curved-lip strike with dust box for each latch or lock bolt, with lip extended to protect frame, finished to match door hardware set, unless otherwise indicated.
5. Match new strikes to existing strike preps where existing conditions occur.
6. Locksets to have anti-rotational studs that are thru-bolted
7. Keyed lever shall not have exposed “keeper” hole
8. Each lever to have independent spring mechanism controlling it
9. 2-3/4 inch (70 mm) backset
10. 9/16 inch (14 mm) throw latchbolt. ¾” throw latchbolt at fire rated pairs
11. Outside lever sleeve to be seamless, of one-piece construction made of a hardened steel alloy
12. Keyed lever to be removable only after core is removed, by authorized control key
13. Provide locksets with 7-pin removable and interchangeable core cylinders
14. Hub, side plate, shrouded rose locking pin to be a one-piece casting with a shrouded locking lug.
15. Locksets outside locked lever must withstand a minimum 1400 inch pounds of torque. In excess of that, a replaceable part will shear. Key from outside and inside lever will still operate lockset
16. Core face must be the same finish as the lockset
17. Secure strike plates with 2 inch minimum long screws at wood stud walls
18. Functions and design as indicated in the hardware groups

F. Exit Devices shall:

1. Tested and approved by BHMA for ANSI 156.3, Grade 1
2. Provide 9001-Quality Management and 14001-Environmental Management.
3. Furnish UL or recognized independent laboratory certified mechanical operational testing to 9 million cycles minimum.
4. Provide a deadlocking latchbolt
5. Non-fire rated exit devices shall have cylinder dogging.

6. Touchpad shall be “T” style with beveled end caps - no overhang to catch clothing
7. Exposed components shall be of true architectural metals and finishes.
8. Lever design shall match lockset lever design
9. Provide strikes as required by application.
10. Fire exit devices to be listed for UL10C
11. UL listed for Accident Hazard
12. Shall consist of a cross bar or push pad, the actuating portion of which extends across, shall not be less than one half the width of the door leaf.
13. Provide vandal resistant or breakaway trim
14. Sex bolts only at fire doors unless specified for non-rated doors.
15. Full cover end caps with robust end cap mounting bracket

G. Cylinders:

1. Provide cylinder housings, collars, rings & springs as recommended by the manufacturer for proper installation.
2. Provide cylinder cams or tail piece as required to operate all locksets and other keyed hardware items listed in the hardware sets.
3. Provide cylinder guards for all exposed cylinders at exterior perimeter doors.
4. Coordinate and provide as required for related sections.

H. Door Closers shall:

1. Tested and approved by BHMA for ANSI 156.4, Grade 1
2. UL10C certified
3. Closer shall have extra-duty arms and knuckles where required
4. Conform to ANSI 117.1
5. Maximum 2 7/16 inch case projection with non-ferrous cover
6. Separate adjusting valves for closing and latching speed, and backcheck
7. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions
8. Full rack and pinion type closer with 1½“ minimum bore
9. Mount closers on non-public side of door, unless otherwise noted in specification
10. Closers shall be non-handed, non-sized and multi-sized 1 through 6
11. Provide BF or barrier free at non rated doors as required per code

G. Overhead Stops: Stainless steel (316) base material. Non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.

H. Magnetic Holders:

1. Integrate with UL listed fire/life safety alarm systems
2. Provide armature extensions as required for clearance of projecting hardware
3. Tri-voltage
4. No plastic parts

I. Door Stops:

1. Wall stop and floor stop shall be wrought bronze, brass or stainless steel.
2. Provide fastener suitable for wall construction.
3. Coordinate reinforcement of walls where wall stop is specified.

4. Provide dome stops where wall stops are not practical. Provide spacers or carpet riser for floor conditions encountered

J. Flush Bolts:

1. Automatic flush bolts shall meet ANSI/BHMA A156.3
2. Manual flush bolts shall meet BHMA A156.16 requirements.
3. Bottom bolt shall have 12 inch (305 mm) long operating rod. Top bolt operating rod shall be determined by door height, assuring the operator is located less than 72 inches (183 cm) above the floor.
4. Manual Flush Bolts are not to be utilized except where a pair of non-rated doors serving a room not normally occupied is needed for the movement of equipment.
5. Provide dust proof strikes for bottom bolts. Dust proof strikes shall meet BHMA A156.16.

K. Coordinator and Brackets:

1. Coordinator shall comply with ANSI/BHMA A1156.3 Type 21A full width of the opening.
2. Provide mounting brackets for soffit applied hardware.
3. Provide hardware preparation (cutouts) for latches as necessary.

L. Push Plates: Provide with four beveled edges .050 thickness, size as indicated in hardware set. Furnish oval-head countersunk screws to match finish.

M. Pulls with plates: Provide with four beveled edges .050 thickness Plate s with pull as listed in hardware set. Provide proper fasteners for door construction.

N. Kick Plates: Provide with four beveled edges ANSI J102, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.

O. Mop Plates: Provide with four beveled edges ANSI J103, 6 inches high by width less 1 inch on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.

P. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.

Q. Door Bottoms: Surface mounted or concealed door bottom where listed in the hardware sets.

1. Door seal shall be resilient seal of (Neoprene, Polyurethane, Nylon Brush, Silicone)
2. UL10C Positive Pressure rated seal set when required.
3. Coordinate auto or manual door bottom with threshold height and door undercut such that door bottom provides accurate seal with threshold or finished floor without binding door or preventing positive latching.
4. Notch as required for adjacent hardware.

R. Thresholds: Thresholds shall be aluminum or bronze type for conformance with ADA requirements. Furnish as specified and/or per details.

1. Exteriors: Seal perimeter to exclude water and vermin. Use butyl-rubber or polyisobutylene sealant complying with requirements in Division 7 "Thermal and Moisture

Protection". Non-ferrous 1/4inch fasteners and lead expansion shield anchors, or Red-Head #SFS-1420 (or approved equivalent) Flat Head Sleeve Anchors (SS/FHSL).

2. Fire-rated openings, 90 min or less duration: use thresholds to interrupt floor covering material under the door where that material has a critical radiant flux value less than 0.22 watts per square centimeter, per NFPA 253. Use threshold unit as scheduled. If none scheduled, request direction from Architect.
3. Fire-rated openings, 3hour duration: Thresholds, where scheduled, to extend full jamb depth.
4. Plastic plugs with wood or sheet metal screws are not an acceptable substitute for specified fastening methods.

S. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seals occur.

T. Sliding Barn Door Hardware: Horizontal Sliding Barn Door Hardware: BHMA A156.14, Grade 1; consisting of complete sets including rails, hangers, supports, bumpers, floor guides, and accessories indicated.

U. Junction Box:

1. Coordinate and provide as required by Electrical Contractor.
2. All electrical components to be wired to junction box and labeled.
3. Coordinate with Related Trades

V. Door Monitoring:

1. Door Position Switch: Coordinate with access control provider as required.
   a. At all fired rated door and frames the [concealed] position switch preparation will be provided by the door and frame manufacturer or by an authorized label service agent.
2. Request to Exit: Coordinate with access control provider as required.
3. Latchbolt Monitoring: Coordinate with access control provider as required.

2.3 FINISH:

A. Designations used in Schedule of Finish Hardware - 3.5, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products

B. Powder coat door closers to match other hardware, unless otherwise noted.

C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

2.4 KEYS AND KEYING:

A. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.

B. Cylinders, removable and interchangeable core master keyed system: BEST [Standard]

1. Provide keys and keying into existing system. For estimate furnish keys as indicated below.

C. Permanent keys and cores: Stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."

D. Transmit Grand Masterkeys, Masterkeys and other Security keys to Owner by Registered Mail, return receipt requested.

E. For Estimate furnish keys in the following quantities:

1. 1 each Grand Masterkeys
2. 4 each Masterkeys
3. 2 each Change keys each keyed core
4. 15 each Construction masterkeys
5. 1 each Control keys

F. Bitting List: use secured shipment direct from point of origination to Owner upon completion.

G. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Hardware Supplier. Construction cores and keys remain the property of the Hardware Supplier.

H. Keying Schedule: Arrange for a keying meeting, and programming meeting with Architect Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying and programming complies with project requirements.

1. Refer to submittals in this section for additional keying schedule requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion.

1. Do not proceed until unsatisfactory conditions have been corrected.

3.2 HARDWARE LOCATIONS:

A. Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations or facility standards.

1. Recommended Locations for Builder’s Hardware for Standard Steel Doors and Frames, by the Door and Hardware Institute (DHI).
2. NWWDA Industry Standard I.S.1.7, Hardware Locations for Wood Flush Doors.

3.3 INSTALLATION:

A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

B. Conform to local governing agency security ordinance.

C. ADA Standard: Conform to ANSI A117.1 for positioning requirements for disabled.

D. Installed hardware using the manufacturers fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use “Riv-Nuts” or similar products.

E. Install Conforming to ICC/ANSI A117.1 Accessible and Usable Building and Facilities.

1. Adjust door closer sweep period so that from an open position of 90 degrees, the time required to move the door from to a position of 12 degrees from the latch is 5 seconds minimum.

F. Closers: Coordinate installation of closer for maximum degree of hold open or opening. Hold open arms to stop door from hitting wall. Closers typically mount on interior side of room.

G. Locksets: Provide appropriate backset to center lockset on stile and rail type doors.

H. Thresholds: Set thresholds for exterior doors in full bed of sealant complying with requirements specified in Division 7 Section “Joint Sealants.” Securely and permanently anchor exterior thresholds using countersunk non-ferrous screws to match color of threshold. Stainless steel screws at aluminum thresholds. Set thresholds at interior acoustical rated openings with acoustical sealant.

I. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, verify location with Architect.

J. Mount cylinder keyways in proper position as recommended by manufacturers

K. Gaskets: install jamb-applied gaskets before closers, overhead stops, rim strikes, etc; fasten hardware over and through these seals where possible. Install sweeps across bottoms of doors before astragals, cope sweeps around bottom pivots, trim astragals to tops of sweeps.

L. Replace fasteners damaged by power-driven tools.

M. Silencers: Set in place before adjusting strikes.

N. Locksets: Install locks with keyways in proper position. Install levers, roses, and escutcheons firmly affixed.

O. Raindrips: Set in waterproof sealant and fasten as recommended by manufacturer.

P. Floor Stops: Floor stops shall be installed a maximum of 4 inches from adjacent walls.

Q. Hardware Installer shall coordinate with Security contractor to route cable to connect electrified locks, panic hardware, and fire exit hardware to power transfers or electric hinges at the time these items are installed so as to avoid disassembly and reinstallation of hardware.

R. Hardware Installer shall also be present with the security contactor when the power is turned on for the testing of the electronic hardware applications. Installer shall make adjustments to solenoids, latches, vertical rods and closer to insure proper and secure operation

S. All wiring for electro-mechanical hardware mounted on the door shall be connected through the power transfer and terminated in the interface junction box specified for the Electrical Section.

T. Conductors shall be minimum 18 gage stranded multicolored unless specified otherwise. A minimum 12 inch loop for conductors shall be coiled in the interface junction box. Each conductor shall be permanently marked with its function.

U. Make all connections required for proper operation between the power supply and the electro-mechanical hardware. Provide the proper size conductors as specified in the manufacture's technical documentation.

3.4 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

A. Contractor/Installers, Field Services: After installation is complete, contractor shall inspect completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings.

1. Check and adjust closers to ensure proper operation.

    a. Adjust "Backcheck" according to manufacturer's instructions.
    b. Set exterior doors closers to have 5 lbs maximum pressure to open, interior non-rated at 5 lbs, rated openings at 15 lbs

2. Check latchset, lockset, and exit devices are properly installed and adjusted to ensure proper operation.

    a. Verify levers are free from binding.
    b. Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.

3. Report findings, in writing, to architect and hardware supplier outlining corrective actions and recommendations.

3.5 HARDWARE SETS:

A. See door schedule in drawings for hardware set assignments.

B. The hardware sets represent the product design intent and direction of the owner and architect. They should not be considered a detailed hardware schedule. Detailed or omitted items not included in the following hardware set(s) should be scheduled and submitted with the appropriate additional hardware required for proper application and functionality.

C. Manufacturer's Abbreviations:

1. BE BEST
2. NA National Guard Products
3. PR Precision
4. TR Trimco
5. ST Stanley
6. SD Stanley Door Closers
7. DJ Don Jo

Hardware Sets

SET #001

Doors: 2, 33

2	Hinges	CB199 4 1/2 X 4 1/2 NRP	US32D	ST
1	Electric Hinge	CE CB199 4 1/2 X 4 1/2 18	US32D	ST
1	Electro-mech Lock	45HW-7DEU15H STD IDH	630	BE
1	Latch Protector	CLP-110	630	DJ
1	Door Closer	CLD-4550 HCS	689	SD
1	Gasketing	5050 @ Head & Jambs		NA
1	Door Sweep	C627 A		NA
1	Saddle Threshold	Per Detail	AL	NA
1	Power Supply	By Access Control Supplier		PR
1	Door Contact	By Access Control Supplier		
1	Card Reader System	By Access Control Supplier		
1	Junction Box	By Electrical		
1	Wiring & Riser Diagrams	COORDINATE WITH RELATED TRADES		

NOTE: Card reader to release lever for authorized access. Integrate door monitoring into security system as required.

SET #002

Doors: 22

3	Hinges	CB191 4 1/2 X 4 1/2 NRP	US32D	ST
1	Storeroom Lockset	45H-7D15H STD	630	BE
1	Latch Protector	CLP-110	630	DJ
1	Door Closer	CLD-4550 HCS	689	SD
1	Gasketing	5050 @ Head & Jambs		NA
1	Door Sweep	C627 A		NA
1	Saddle Threshold	Per Detail	AL	NA
1	Drip Cap	16 A - 4" ODW		NA

NOTE: Verify different keying requirements as required by Facility or Utility Company.

SET #003

Doors: 25

2	Continuous Hinge	661 x School Option	DB	ST

1	Exit Device	2603 CD	613	PR
1	Exit Device	2601 CD	613	PR
2	Mortise Cylinder	1E-74 STD	613	BE
1	Rim Cylinder	12E-72 STD	613	BE
2	Offset Door Pull	1158	613	DJ
2	Door Closer	CLD-4551 TJ x P45-180	695	SD
2	Door Stop	1475	613	DJ
1	Weatherstrip	By Alum. Storefront Mfg.		
1	Bumper Seal Threshold	896S-ADJ	AL	NA

SET #004

Doors: 31

2	Continuous Hinge	661 x School Option	DB	ST
2	Push/Pull Set	1738	613	TR
2	Door Closer	CLD-4551 REG	695	SD
2	Floor Stop	1211	613	TR
1	Weatherstrip	By Alum. Storefront Mfg.		
1	Saddle Threshold	Per Detail	AL	NA

SET #005

Doors: 32, 34

2	Continuous Hinge	661 CE-58 Sch Opt	DB	ST
1	Exit Device	TS 2601	613	PR
1	Exit Device	MLR TS 2603	613	PR
1	Rim Cylinder	12E-72 STD	613	BE
2	Offset Door Pull	1158	613	DJ
2	Door Closer	CLD-4551 TJ x P45-180	695	SD
2	Door Stop	1475	613	DJ
1	Weatherstrip	By Alum. Storefront Mfg.		
1	Bumper Seal Threshold	896SDKB-ADJ		NA
1	Power Supply	RPSMLR2		PR
1	Card Reader System	By Access Control Supplier		
2	Door Contact	By Access Control Supplier		
1	Junction Box	By Electrical		
1	Wiring & Riser Diagrams	COORDINATE WITH RELATED TRADES		

NOTE: Card reader to retract active door latch for authorized access. Integrate door monitoring into security system as required.

SET #006

Doors: 38, B17, B23, B27, B4, E1, E13, E14, E2, E5, E7

2	Hinges	CB199 4 1/2 X 4 1/2 NRP	US32D	ST
1	Electric Hinge	CE CB199 4 1/2 X 4 1/2 18	US32D	ST
1	Electro-mech Lock	45HW-7DEU15H STD IDH	630	BE
1	Latch Protector	CLP-110	630	DJ
1	Door Closer	CLD-4550 EDA	689	SD
1	Door Stop	1475	626	DJ

1	Gasketing	5050 @ Head & Jambs		NA
1	Door Sweep	C627 A		NA
1	Saddle Threshold	Per Detail	AL	NA
1	Drip Cap	16 A - 4" ODW		NA
1	Power Supply	By Access Control Supplier		PR
1	Door Contact	By Access Control Supplier		
1	Card Reader System	By Access Control Supplier		
1	Junction Box	By Electrical		
1	Wiring & Riser Diagrams	COORDINATE WITH RELATED TRADES		

NOTE: Card reader to release lever for authorized access. Integrate door monitoring into security system as required.

SET #007

Doors: 46

1	Continuous Hinge	661 CE-58 Sch Opt	DB	ST
1	Exit Device	MLR TS 2403	613	PR
1	Rim Cylinder	12E-72 STD	613	BE
1	Offset Door Pull	1158	613	DJ
1	Door Closer	CLD-4551 TJ x P45-180	695	SD
1	Door Stop	1475	613	DJ
1	Weatherstrip	By Alum. Storefront Mfg.		
1	Door Bottom	C627DKB		NA
1	Saddle Threshold	Per Detail	AL	NA
1	Power Supply	RPSMLR2		PR
1	Door Contact	By Access Control Supplier		
1	Card Reader System	By Access Control Supplier		
1	Junction Box	By Electrical		
1	Wiring & Riser Diagrams	COORDINATE WITH RELATED TRADES		

NOTE: Card reader to retract active door latch for authorized access. Integrate door monitoring into security system as required.

SET #008

Doors: 56, E15

6	Hinges	CB199 4 1/2 X 4 1/2 NRP	US32D	ST
1	Set Auto Flush Bolts	3820 X 3810	630	TR
1	Storeroom Lockset	45H-7D15H STD 7/8"LTC	630	BE
1	Astragal	139SSTB (pull side active leaf)	US32D	NA
2	Door Stop	1475	626	DJ
1	Gasketing	5050 @ Head & Jambs		NA
1	Bumper Seal Threshold	896S-ADJ	AL	NA
1	Drip Cap	16 A - 4" ODW		NA

SET #009

Doors: E3

3	Hinges	CB191 4 1/2 X 4 1/2 NRP	US32D	ST

1	Storeroom Lockset	45H-7D15H STD	630	BE
1	Latch Protector	ILP-212	SL	DJ
1	Door Closer	CLD-4551 REG	689	SD
1	Wall Bumper	1270CV	626	TR
1	Gasketing	5050 @ Head & Jambs		NA
1	Door Bottom	36EV		NA
1	Interlocking Threshold	442-5 Less Hook	AL	NA

NOTE: Verify different keying requirements as required by Facility or Utility Company.

SET #010

Doors: E4

3	Hinges	CB191 4 1/2 X 4 1/2 NRP	US32D	ST
1	Storeroom Lockset	45H-7D15H STD	630	BE
1	Door Closer	CLD-4551 REG	689	SD
1	Wall Bumper	1270CV	626	TR
1	Gasketing	5050 @ Head & Jambs		NA
1	Door Bottom	36EV		NA
1	Interlocking Threshold	442-5 Less Hook	AL	NA

SET #100 - Barn Door

Doors: 1, 10, 11, 12, 13, 14, 20, 3, 39, 4, 40, 41, 43, 44, 45, 47, 48, 49, 5, 50, 51, 52, 53, 54, 55, 57, 8, 9, B10, B11, B12, B14, B15, B16, B18, B19, B20, B21, B5, B6, B7, B8, B9

1	Mortise Cylinder	1E-74 STD	626	BE

NOTE: Balance of hardware provided by door manufacturer.

SET #101

Doors: 6

2	Hinges	CB179 4 1/2 X 4 1/2	US26D	ST
1	Electric Hinge	CE CB179 4 1/2 X 4 1/2 18	US26D	ST
1	Electric Locksets	9KW3-7DEU15D STD RQE S3	626	BE
1	Door Closer	CLD-4551 REG	689	SD
1	Wall Bumper	1270CV	626	TR
3	Door Silencers	1229 Series	BLACK	TR
1	Junction Box	By Electrical		
1	Door Contact	By Access Control Supplier		
1	Card Reader System	By Access Control Supplier		
1	Power Supply	By Access Control Supplier		PR
1	Wiring & Riser Diagrams	COORDINATE WITH RELATED TRADES		

NOTE: Card reader to release lever for authorized access. Integrate door monitoring into security system as required.

SET #102

Doors: 7, B20

2	Hinges	CB179 4 1/2 X 4 1/2	US26D	ST
1	Electric Hinge	CE CB179 4 1/2 X 4 1/2 18	US26D	ST
1	Electric Locksets	9KW3-7DEU15D STD RQE S3	626	BE
1	Door Closer	CLD-4551 REG	689	SD
1	Floor Stop	1211	626	TR
1	Gasketing	5050 @ Head & Jambs		NA
1	Junction Box	By Electrical		
1	Door Contact	By Access Control Supplier		
1	Card Reader System	By Access Control Supplier		
1	Power Supply	By Access Control Supplier		PR
1	Wiring & Riser Diagrams	COORDINATE WITH RELATED TRADES		

NOTE: Card reader to release lever for authorized access. Integrate door monitoring into security system as required.

SET #103

Doors: 15, 18, E8, E9

3	Hinges	CB179 4 1/2 X 4 1/2	US26D	ST
1	Push Plate	1802-25-PH	630	TR
1	Pull Plate	1802-25-PL	630	TR
1	Door Closer	CLD-4551 REG	689	SD
1	Floor Stop	1211	626	TR
3	Door Silencers	1229 Series	BLACK	TR

SET #104

Doors: 16, 19, E10, E11

3	Hinges	CB179 4 1/2 X 4 1/2	US26D	ST
1	Push Plate	1802-25-PH	630	TR
1	Pull Plate	1802-25-PL	630	TR
1	Door Closer	CLD-4551 REG	689	SD
1	Mop Plate	KM050 6" x 1" LDW x CSK B4E	630	TR
1	Kick Plate	K0050 10" x 2" LDW x CSK B4E	630	TR
1	Floor Stop	1211	626	TR
1	Solid Threshold	Per Detail		
3	Door Silencers	1229 Series	BLACK	TR

SET #105

Doors: 17

3	Hinges	CB179 4 1/2 X 4 1/2	US26D	ST
1	Storeroom Lockset	9K3-7D15D STD S3	626	BE
1	Mop Plate	KM050 6" x 1" LDW x CSK B4E	630	TR
1	Wall Bumper	1270CV	626	TR
3	Door Silencers	1229 Series	BLACK	TR

SET #106

Doors: 21, 23, 42, B25, B26

3	Hinges	CB179 4 1/2 X 4 1/2	US26D	ST
1	Office Lockset	9K3-7AB15D STD	626	BE
1	Wall Bumper	1270CV	626	TR
3	Door Silencers	1229 Series	BLACK	TR

SET #107 - Pocket Door

Doors: 24

1	Pocket Door Kit	PDFC150N-00 Series		ST
1	Pocket Door Lockset	1074-2C – ST001	630	TR
1	Mortise Cylinder	1E-74 STD	626	BE
1	Mortise Thumbturn Cylinder	1E-6 Series	626	BE

NOTE: Provide frame and hardware for complete working pocket door.

SET #108

Doors: 26, 29, 42

2	Hinges	CB179 4 1/2 X 4 1/2	US26D	ST
1	Electric Hinge	CE CB179 4 1/2 X 4 1/2 18	US26D	ST
1	Electric Locksets | Fail Safe	9KW3-7DEL15D STD RQE S3	626	BE
1	Door Closer	CLD-4551 REG	689	SD
1	Wall Bumper	1270CV	626	TR
3	Door Silencers	1229 Series	BLACK	TR
1	Door Contact	By Access Control Supplier		
1	Power Supply	By Access Control Supplier		PR
1	Card Reader System	By Access Control Supplier		
1	Junction Box	By Electrical		
1	Wiring & Riser Diagrams	COORDINATE WITH RELATED TRADES		

NOTE: Card reader to release lever for authorized access. Integrate door monitoring into security system as required. Integrate fail safe lockset into fire alarm.

SET #109

Doors: 27, 28

3	Hinges	CB179 4 1/2 X 4 1/2	US26D	ST
1	Privacy Set	9K3-0L15D S3	626	BE
1	Door Closer	CLD-4551 REG	689	SD
1	Mop Plate	KM050 6" x 1" LDW x CSK B4E	630	TR
1	Wall Bumper	1270CV	626	TR
1	Gasketing	5050 @ Head & Jambs		NA
1	Solid Threshold	Per Detail		

SET #110

Doors: 30

2	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Electric Hinge	CE CB168 4 1/2 X 4 1/2 18	US26D	ST
1	Exit Device	TS E2103 X 4908A FS S301 SNB (2)	630	PR
1	Wall Bumper	1270CV	626	TR
1	Door Closer	CLD-4550 PA	689	SD
1	Gasketing	5050 @ Head & Jambs		NA
1	Door Contact	By Access Control Supplier		
1	Power Supply	By Access Control Supplier		PR
1	Card Reader System	By Access Control Supplier		
1	Junction Box	By Electrical		
1	Wiring & Riser Diagrams	COORDINATE WITH RELATED TRADES		

NOTE: Card reader to release lever for authorized access. Integrate door monitoring into security system as required. Integrate fail safe trim into fire alarm.

SET #111

Doors: 35

6	Hinges	CB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Semi Auto Flush Bolt Set	3825L X 3815L	626	TR
1	Dustproof Strike	3910	630	TR
1	Office Lockset	9K3-7AB15D STD	626	BE
1	Wall Bumper	1270CV	626	TR
1	Gasketing	5050 @ Head & Jambs		NA

SET #112

Doors: 36, B28, B3

3	Hinges	CB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Office Lockset	9K3-7AB15D STD	626	BE
1	Door Closer	CLD-4550 HCS	689	SD
1	Wall Bumper	1270CV	626	TR
1	Gasketing	5050 @ Head & Jambs		NA

SET #113

Doors: 37

2	Hinges	CB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Electric Hinge	CE CB179 4 1/2 X 4 1/2 18	US26D	ST
1	Electric Locksets | Fail Safe	9KW3-7DEL15D STD RQE S3	626	BE
1	Door Closer	CLD-4550 PA	689	SD
1	Wall Bumper	1270CV	626	TR
1	Gasketing	5050 @ Head & Jambs		NA
1	Saddle Threshold	Per Detail	AL	NA
1	Junction Box	By Electrical		
1	Door Contact	By Access Control Supplier		
1	Card Reader System	By Access Control Supplier		
1	Power Supply	By Access Control Supplier		PR
1	Wiring & Riser Diagrams	COORDINATE WITH RELATED TRADES		

NOTE: Card reader to release lever for authorized access. Integrate door monitoring into security system as required. Integrate fail safe lockset into fire alarm.

SET #114

Doors: B22, B24

3	Hinges	CB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Office Lockset	9K3-7AB15D STD	626	BE
1	Floor Stop	1211	626	TR
3	Door Silencers	1229 Series	BLACK	TR

SET #115

Doors: B1, B2, E6

3	Hinges	CB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Passage Set	9K3-0N15D S3	626	BE
1	Door Closer	CLD-4551 REG	689	SD
1	Floor Stop	1211	626	TR
3	Door Silencers	1229 Series	BLACK	TR

SET #116

Doors: E12

3	Hinges	CB179 4 1/2 X 4 1/2	US26D	ST
1	Privacy Set	9K3-0L15D S3	626	BE
1	Mop Plate	KM050 6" x 1" LDW x CSK B4E	630	TR
1	Kick Plate	K0050 10" x 2" LDW x CSK B4E	630	TR
1	Wall Bumper	1270CV	626	TR
3	Door Silencers	1229 Series	BLACK	TR

SET #117

Doors: E16

3	Hinges	CB179 4 1/2 X 4 1/2	US26D	ST
1	Electric Hinge	CE CB179 4 1/2 X 4 1/2 18	US26D	ST
1	Electric Locksets	9KW3-7DEU15D STD RQE S3	626	BE
1	Closer	CLD-4550 HCS	AL	SD
1	Wall Bumper	1270CV	626	TR
3	Door Silencers	1229 Series	BLACK	TR
1	Junction Box	By Electrical		
1	Door Contact	By Access Control Supplier		
1	Card Reader System	By Access Control Supplier		
1	Power Supply	By Access Control Supplier		PR
1	Wiring & Riser Diagrams	COORDINATE WITH RELATED TRADES		

NOTE: Card reader to release lever for authorized access. Integrate door monitoring into security system as required.

SET #118

Doors: B13

3	Hinges	CB179 4 1/2 X 4 1/2	US26D	ST
1	Storeroom Lockset	9K3-7D15D STD S3	626	BE
1	Floor Stop	1211	626	TR
1	Gasketing	5050 @ Head & Jambs		NA

END OF SECTION

Opening List

Opening	Hdw Set	Opening Label	Door Type	Frame
1	100			
2	001			
3	100			
4	100			
5	100			
6	101			
7	102			
8	100			
9	100			
10	100			
11	100			
12	100			
13	100			
14	100			
15	103			
16	104			
17	105			
18	103			
19	104			
20	100			
21	106			
22	002			
23	106			
24	107			
25	003		AL	AL
26	108			
27	109			
28	109			
29	108			
30	110			
31	004		AL	AL
32	005		AL	AL
33	001			
34	005		AL	AL
35	111			
36	112			
37	113	Rated		
38	006			
39	100			
40	100			
41	100			
42	**108**			
43	100			
44	100			
45	100			
46	007		AL	AL
47	100			
48	100			

49	100
50	100
51	100
52	100
53	100
54	100
55	100
56	008
57	100
B1	115
B2	115
B3	112
B4	006
B5	100
B6	100
B7	100
B8	100
B9	100
E1	006
E2	006
E3	009
E4	010
E5	006
E6	115
E7	006
E8	103
E9	103
B10	100
B11	100
B12	100
B13	118
B14	100
B15	100
B16	100
B17	006
B18	100
B19	100
B20	100
B21	100
B22	114
B23	006
B24	114
B25	106
B26	106
B27	006
B28	112
E10	104
E11	104
E12	116
E13	006
E14	006
E15	008
E16	117

SECTION 088000

GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Glazing required for the following:

1. Windows.
2. Doors.
3. Glazed entrances.
4. Interior borrowed lites.
5. Storefront framing – center glazed.
6. Curtain Wall System framing – flush glazed.
7. Steel Windows
8. Spandrel panels

1.2 PERFORMANCE REQUIREMENTS

A. Engineering design of glass by Contractor.

1.3 QUALITY ASSURANCE

A. Mockups for aluminum-framed entrances and storefronts, aluminum windows, steel windows and glazed aluminum curtain walls.

1.4 WARRANTY

A. Coated-Glass Products: Not less than 10 years.

B. Laminated Glass: Not less than 10 years.

C. Insulating Glass: Not less than 10 years.

1.5 MATERIALS

A. Windborne-Debris-Impact Resistance of Exterior Glazing: Wind Zone 2.

1. Large-Missile Test: For glazing located within 30 feet (9.1 m) of grade.
2. Small-Missile Test: For glazing located more than 30 feet (9.1 m) above grade.
3. Large-Missile Test: For all glazing, regardless of height above grade.

B. Glazing Gaskets: Dense compression, Soft compression and Lock strip as recommended by system's manufacturer.

C. Silicone Glazing Sealants: Neutral curing, Class 100/50 unless otherwise required per manufacture's recommendation.

1. VOC Content: Not more than 250 g/L.

D. Glazing Tapes: Back-bedding-mastic or expanded-cellular type.

1.6 MONOLITHIC-GLASS TYPES

A. Glass Type GL-# 1: Clear float glass heat-strengthened float glass and fully tempered float glass where indicated.

1. Basis-of-Design Product:
   a. PPG Industries, Glass Technology: ¼" (6mm) Caribia.
2. Overall Unit Thickness and Thickness of Each Lite: 6.0 mm(1/4").

B. Glass Type GL-# 2: Opacifying coating, Silicone-coated spandrel glass, heat-strengthened float glass and fully tempered float glass where indicated.

1. Basis-of-Design Product:
   a. Oldcastle Glass, Commercial Projects Group: Caribia, Opaci-Coat -300 (2), ICD custom color # 2-1923 – to match Caribia (aqua green).
   b. Manufacturer: ICD High Performance Coatings, Vancouver, WA 98685. Only Approved Factory Fabricators (AFF) to produce silicone spandrel.
2. Construction: Provide units that comply with requirements specified for adjacent glass units.
3. Lite: Opacifying coating, silicone rubber-coated spandrel glass.
   a. Kind HS (heat strengthened), and FT (fully tempered) where indicated.
   b. Silicone Rubber Coating Location: (2) surface.
   c. Color: Custom color to match adjacent glazing. ICD custom color # 2-1923 – to match Caribia (aqua green).
   d. Coating Thickness: 6.5 mils dry

4. Exposed Spandrel Surface (2): Where the back of the spandrel panel is exposed to view, provide closure panel to match material, color and finish of adjacent material (mullion). Verify material selection with architect.

1.7 LAMINATED-GLASS TYPES

A. Glass Type GL-# LAM 1: Clear laminated glass; float glass; clear interlayer.

1.8 INSULATING-GLASS TYPES

A. Glass Type GL-# IL 1: Low-e-coated, tinted, solar-control insulating glass.

1. Basis-of-Design Product:
   a. PPG Industries, Glass Technology: Outdoor lite – ¼" Caribia, Vistacool (2); Indoor lite – ¼" clear,Solarban 60 (3).
2. Overall Unit Thickness and Thickness of Each Lite: 25mm(1") and 6.0 mm(1/4").
3. Interspace Content: Air.
4. Outdoor Lite: Tinted float glass heat-strengthened float glass and fully tempered float glass where indicated.
5. Indoor Lite: Clear float glass heat-strengthened float glass and fully tempered float glass where indicated.

1.9 GLAZING SCHEDULE

A. Door Lite(s): ½ inch thick required for acoustic separation at offices, classrooms, computer labs, video conferencing rooms and similar use spaces.

1.10 INSULATING-LAMINATED-GLASS TYPES

A. Glass Type GL-# INLAM 1: Solar control, Low-e-coated, tinted, Velour insulating laminated glass.

1. Basis-of-Design Product:
   a. PPG Industries, Glass Technology: Outdoor lite – ¼"(6mm) Caribia, Solarban 60 (2); Indoor lite – ¼"(6mm) clear, laminated with Velour(Frosted) inner layer.
2. Overall Unit Thickness and Thickness of Each Lite: 25mm(1") and 6.0 mm(1/4") / 7 mm(5/16").
3. Interspace Content: Air.
4. Outdoor Lite: Tinted heat-strengthened float glass and fully tempered float glass where indicated.
5. Indoor Lite: Clear laminated glass with two plies of float glass heat-strengthened float glass and fully tempered float glass where indicated.

1.11 FIRE-PROTECTION-RATED GLAZING TYPES

A. Glass Type GL-# FR 1: 20-minute fire-rated glazing with hose-stream test; monolithic ceramic glazing.

B. Glass Type GL-# FR 2: 45-minute fire-rated glazing; monolithic ceramic glazing.

1.12 GLAZING HARDWARE

A. All glazing hardware shall follow finish hardware requirements in 08710 – Finish Hardware:

1. Medeco Lock Cylinders: Campus restricted keyway.

2. Schlage locks.
3. Von Duprin Panic Hardware.
4. LCN Closers

END OF SECTION 088000

SECTION 088140

MIRRORED GLASS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Unframed safety (vinyl-backed) mirrored glass.

1.3 DEFINITIONS

A. Deterioration of Silvered Mirrored Glass: Defects developed from normal use that are attributable to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning silvered mirrored glass contrary to mirrored glass manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1.4 PERFORMANCE REQUIREMENTS

A. Provide mirrored glass that will not fail under normal usage. Failure includes glass breakage and deterioration attributable to defective manufacture, fabrication, and installation.

1.5 QUALITY ASSURANCE

A. Glazing Publications: Comply with published recommendations in GANA's "Glazing Manual," unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.

B. NAAMM's Publication: For silvered mirrored glass, comply with recommendations in NAAMM's "Mirrors, Handle with Extreme Care, Tips for the Professional on the Care and Handling of Mirrors."

C. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.

D. Preconstruction Mirror Mastic Glass Coating Compatibility Test: Submit mirror mastic products to organic protective coating manufacturer for testing to determine compatibility of adhesive with mirrored glass coating.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to mirrored glass manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For silvered mirrored glass, comply with mirrored glass manufacturer's written instructions for shipping, storing, and handling mirrored glass as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors, protected from moisture including condensation.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install mirrored glass until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.8 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Manufacturer's Special Warranty for Silvered Mirrored Glass: Written warranty, made out to Owner and signed by mirrored glass manufacturer agreeing to replace silvered mirrored glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below:

1. Warranty Period: Five years from date of manufacture.

PART 2 - PRODUCTS

2.1 FLOAT GLASS

A. Annealed Float Glass: ASTM C 1036, Type I (transparent glass, flat), class, quality, and other properties as indicated below:

1. Clear Annealed Float Glass: Class 1 (clear), Quality q2 (mirror).
   a. Thickness: 6 mm.

2.2 MIRRORED GLASS

A. Silvered Mirrored Glass: Annealed, clear float glass with successive layers of chemically deposited silver, electrically or chemically deposited copper, and manufacturer's standard organic protective coating applied to second glass surface to produce a coating system complying with FS DD-M-411.

2.3 FABRICATION

A. Mirrored Glass Sizes: Cut mirrored glass to final sizes and shapes to suit Project conditions.

B. Cutouts: Fabricate cutouts for notches and holes in mirrored glass without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrored glass.

C. Mirrored Glass Edge Treatment: Treat edges as indicated below.

1. Beveled polished edge.

2. Seal edges of silvered mirrored glass after edge treatment to prevent chemical or atmospheric penetration of glass coating.

D. Vinyl-Backed Safety Mirrored Glass: Apply vinyl backing with pressure-sensitive adhesive coating over glass coating as recommended by vinyl-backing manufacturer to produce a surface free of bubbles, blisters, and other imperfections. Use adhesives and vinyl backing compatible with mirrored glass as certified by organic coating manufacturer.

2.4 MISCELLANEOUS MATERIALS

A. Mirror Mastic: An adhesive setting compound, produced specifically for setting mirrored glass by spot application, certified by both mirrored glass manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrored glass will be installed.

B. Extruded-Aluminum Top and Bottom Trim: J-channels formed with a return deep enough to produce a glazing channel to accommodate mirrored glass units of thickness indicated and in lengths required to cover bottom edge of each mirrored glass unit in a single piece.

1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch in height, respectively, and a thickness of not less than 0.05 inch.

2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch, respectively, and a thickness of not less than 0.062 inch.

C. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

D. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, over which mirrored glass units are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance.

1. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.

2. Proceed with mirrored glass installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating surfaces with mastic manufacturer's special bond coating where applicable.

3.3 GLAZING

A. General: Install mirrored glass units to comply with written instructions of mirrored glass manufacturer and with referenced GANA and NAAMM publications. Mount mirrored glass accurately in place in a manner that avoids distorting reflected images.

B. Provide space for air circulation between back of mirrored glass units and face of mounting surface.

C. Mastic Spot Installation System: Install mirrored glass units with mastic as follows:

1. Apply barrier coat to mirrored glass backing where approved in writing by manufacturers of mirrored glass and backing material.
2. Apply mastic in spots to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrored glass units and face of mounting surface.
3. After mastic is applied, align mirrored glass units and press into place while maintaining a minimum air space of 1/8 inch between back of mirrored glass and mounting surface.

D. For wall-mounted mirrored glass units, install permanent means of support at bottom and top edges with bottom support designed to withstand mirrored glass weight and top support designed to prevent mirrored glass from coming away from wall along top edges.

1. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrored glass units.
2. For continuous bottom supports, provide setting blocks 1/8 inch thick by 4 inches long at quarter points. For channels or other continuous supports in which water could be trapped, provide, between setting blocks, two slotted weeps not less than 1/4 inch wide by 3/8 inch long.
3. Where indicated, install bottom and top trim. Fabricate trim in single lengths to fit and cover top and bottom edges of mirrored glass units.

3.4 PROTECTION AND CLEANING

A. Protect mirrored glass from breakage and contaminating substances resulting from construction operations.

1. Do not permit edges of silvered mirrored glass to be exposed to standing water.
2. Maintain environmental conditions that will prevent silvered mirrored glass from being exposed to moisture from condensation or other sources for continuous periods of time.

B. Wash mirrored glass not more than four days before date scheduled for inspections intended to establish date for Completion. Wash mirrored glass by methods recommended in NAAMM publication and in writing by mirrored glass

manufacturer. Use water and glass cleaners free from substances capable of damaging mirrored glass edges or coatings.

END OF SECTION 088140

SECTION 090561

MOISTURE VAPOR EMISSION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes fluid-applied, resin-based, membrane-forming systems that control the moisture-vapor-emission rate of high-moisture, interior concrete to prepare it for floor covering installation.

1.3 ALLOWANCES

A. Concrete MVE-control systems are part of Moisture Vapor Emission Control Allowance

1.4 UNIT PRICES

A. Work of this Section is affected by Moisture Vapor Emission

1.5 DEFINITIONS

A. MVE: Moisture vapor emission.

B. MVER: Moisture vapor emission rate.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each MVE-control system, for tests performed by a qualified testing agency.

C. Pre-installation testing reports.

D. Field quality-control reports.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Employs factory-trained personnel who are available for consultation and Project-site inspection.

B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating directions for storage and mixing with other components.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Comply with MVE-control system manufacturer's written instructions for substrate and ambient temperatures, humidity, ventilation, and other conditions affecting system installation.

1. Store system components in a temperature-controlled environment and protected from weather and at ambient temperature of not less than 65 deg F and not more than 85 deg F at least 48 hours before use.
2. Maintain ambient temperature and relative humidity in installation areas within range recommended in writing by MVE-control system manufacturer, but not less than 65 deg F or more than 85 deg F and not less than 40 or more than 60 percent relative humidity, for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.
3. Install MVE-control systems where concrete surface temperatures will remain a minimum of 5 deg F higher than the dew point for ambient temperature and relative humidity conditions in installation areas for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. MVE-Control System Capabilities: Capable of suppressing MVE without failure where installed on concrete that exhibits the following conditions:

1. MVER: Maximum 15 lb of water/1000 sq. ft**.** when tested according to ASTM F 1869.
2. Relative Humidity: Maximum 100 percent when tested according to ASTM F 2170 using in situ probes.

B. Water-Vapor Transmission: Through MVE-control system, maximum 0.02 perm when tested according to ASTM E 96/E 96M.

C. Tensile Bond Strength: For MVE-control system, greater than 200 psi with failure in the concrete according to ASTM D 7234.

2.2 MVE-CONTROL SYSTEM

A. MVE-Control System: ASTM F 3010-qualified, fluid-applied, two-component, epoxy-resin, membrane-forming system; formulated for application on concrete substrates to reduce MVER to level required for installation of floor coverings indicated and acceptable to manufacturers of floor covering products indicated, including adhesives.

1. Substrate Primer: Provide MVE-control system manufacturer's concrete-substrate primer if required for system indicated by substrate conditions.
2. Cementitious Underlayment Primer: If required for subsequent installation of cementitious underlayment products, provide MVE-control system manufacturer's primer to ensure adhesion of products to MVE-control system.

2.3 ACCESSORIES

A. Patching and Leveling Material: Moisture-, mildew-, and alkali-resistant product recommended in writing by MVE-control system manufacturer and with minimum of 3000-psi compressive strength after 28 days when tested according to ASTM C 109/C 109M.

B. Crack-Filling Material: Resin-based material recommended in writing by MVE-control system manufacturer for sealing concrete substrate crack repair.

C. Cementitious Underlayment: If required to maintain manufacturer's warranty, provide MVE-control system manufacturer's gypsum cement-based underlayment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of system indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prei-nstallation Testing:

1. Testing Agency: District will engage a qualified testing agency to perform tests.
2. Alkalinity Testing: Perform pH testing according to ASTM F 710. Install MVE-control system in areas where pH readings are less than 7.0 and in areas where pH readings are greater than 8.5**.**
3. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F 1869. Install MVE-control system in locations where concrete substrate MVER exceeds 3 lb of water/1000 sq. ft. in 24 hours.
    b. Internal Relative Humidity Test: Using in situ probes, ASTM F 2170. Install MVE-control system in locations where concrete substrates exhibit relative humidity level greater than 75 percent.

4. Tensile-Bond-Strength Testing: For typical locations indicated to receive installation of MVE-control system, install minimum 100-sq. ft. area of MVE-control system to prepared concrete substrate and test according to ASTM D 7234.

    a. Proceed with installation only where tensile bond strength is greater than 200 psi with failure in the concrete.

B. Concrete Substrates: Prepare and clean substrates according to MVE-control system manufacturer's written instructions to ensure adhesion of system to concrete.

1. Remove coatings and other substances that are incompatible with MVE-control system and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by MVE-control system manufacturer. Do not use solvents.
2. Provide concrete surface profile complying with ICRI 310.2R CSP 3 by shot blasting using apparatus that abrades the concrete surface with shot, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
3. After shot blasting, repair damaged and deteriorated concrete according to MVE-control system manufacturer's written instructions.
4. Protect substrate voids and joints to prevent resins from flowing into or leaking through them.
5. Fill surface depressions and irregularities with patching and leveling material.
6. Fill surface cracks, grooves, control joints, and other nonmoving joints with crack-filling material.

7. Allow concrete to dry, undisturbed, for period recommended in writing by MVE-control system manufacturer after surface preparation, but not less than 24 hours.
8. Before installing MVE-control systems, broom sweep and vacuum prepared concrete.

C. Protect walls, floor openings, electrical openings, door frames, and other obstructions during installation.

3.3 INSTALLATION

A. General: Install MVE-control system according to ASTM F 3010 and manufacturer's written instructions to produce a uniform, monolithic surface free of surface deficiencies such as pin holes, fish eyes, and voids.

1. Install primers as required to comply with manufacturer's written instructions.

B. Do not apply MVE-control system across substrate expansion, isolation, and other moving joints.

C. Apply system, including component coats if any, in thickness recommended in writing by MVE-control system manufacturer for MVER indicated by preinstallation testing.

D. Cure MVE-control system components according to manufacturer's written instructions. Prevent contamination or other damage during installation and curing processes.

E. After curing, examine MVE-control system for surface deficiencies. Repair surface deficiencies according to manufacturer's written instructions.

F. Install cementitious underlayment over cured membrane if required to maintain manufacturer's warranty and in thickness required to maintain the warranty.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: District will engage a qualified testing agency to perform installation inspections.

B. Installation Inspections: Inspect substrate preparation and installation of system components to ensure compliance with manufacturer's written instructions and to ensure that a complete MVE-control system is installed without deficiencies.

1. Verify that surface preparation meets requirements.
2. Verify that component coats and complete MVE-control-system film thicknesses comply with manufacturer's written instructions.
3. Verify that MVE-control-system components and installation areas that evidence deficiencies are repaired according to manufacturer's written instructions.

C. MVE-control system will be considered defective if it does not pass inspections.

3.5 PROTECTION

A. Protect MVE-control system from damage, wear, dirt, dust, and other contaminants before floor covering installation. Use protective methods and materials, including temporary coverings, recommended in writing by MVE-control system manufacturer.

B. Do not allow subsequent pre-installation examination and testing for floor covering installation to damage, puncture, or otherwise compromise the MVE-control system membrane.

END OF SECTION 090561

SECTION 092400

PORTLAND CEMENT PLASTER

PART 1 - GENERAL

1.1 SUBMITTALS

A. Product Data: Submit the following:

1. Materials list of items proposed to be provided under this Section.
2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
3. Shop drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of other Sections.
4. Manufacturer's recommended installation procedures which will become the basis for accepting or rejecting actual installation procedures used on the Work.
5. Color charts showing colors and finishes available from the proposed manufacturer in the specified products.
6. Prepare two 48" x 48" sample panels of texture specified for approval before starting any work.

1.2 QUALITY ASSURANCE

A. Codes and Reference Standards: In addition to complying with all pertinent codes and regulations, comply with the following:

1. "Lathing and Plastering Reference Specifications" published by California Lathing and Plastering Contractor's Association (CLPA).
2. ANSI A42.2, Specifications for Portland Cement and Portland Cement-Lime Plastering, Exterior (Stucco) and Interior.
3. ANSI A42.3, Specifications for Lathing and Furring for Portland Cement and Portland Cement-Lime Plastering, Exterior (Stucco) and Interior.
4. ASTM C 841 Standard Specification for Installation of Interior Lathing and Furring.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lathing Materials and Accessories:

1. Fastening and Anchorage Devices: Approved devices of type and size to suit application and to rigidly secure furring members in place.
2. Finishes: Manufacturer's standard steel products unless indicated as zinc alloy. Where not otherwise indicated, provide manufacturer's standard galvanized finish on steel products except as follows:
    a. Exterior Components: Hot-dip galvanized finish; ASTM A 525 G90 for 18 gage and lighter formed metal products, ASTM A 123 galvanized after fabrication for 16 gage and heavier products.
    b. Exterior Exposed Plastering Accessories: Provide zinc alloy accessories for exterior work, except where fully concealed in plaster.
3. Metal Lath:
    a. Expanded Metal Lath: 3.4 lbs. per sq. yd.
    b. Rib Lath: 3.4 lbs. per sq. yd, 3/8" rib depth.
4. Accessories: Coordinate depth of accessory with thickness of and number of coats of plaster to be applied.
    a. Small-Nose Corner Beads: Expanded type with 2-7/8" wide flanges.
    b. Cornerite: Manufacturer's standard preformed corner reinforcement made from 2.5 lb. per sq. yd. diamond mesh lath.
    c. Square-Edged Casing Beads: Manufacturer's standard with expanded or short flange to suit application.
    d. Control Joints: Manufacturer's standard roll-formed pair of casing beads with modified back flanges providing positive slip joint action and dust barrier, adjustable for joint width variation of 1/8" to 5/8".
    e. Corner Reinforcement: Special stucco-type woven galvanized wire corner reinforcing strips.
    f. Foundation Screed: Type 24-A weep screed, 26 gage.
5. Anchorages: Tie wire, nails, screws and other approved metal supports, of type and size to suit application and to rigidly secure lathing materials in place; galvanized coated.
6. Paper Backing: Comply with Fed. Spec. UU-B-790 as follows:
    a. Waterproof (Barrier): Type 1, Grade B.
    b. Weather Resistant (Breathing): Type 1, Grade D.

B. Membrane Waterproofing (beneath horizontal conditions): "Jiffy Seal 40/60", by Protecto Wrap Co., "Bituthene 4000", by W. R. Grace Company, or equal.

C. Plaster:

1. Cement for plaster shall be portland cement conforming to ASTM C150, Type II.
    a. Gun plastic portland cement machine application of basecoats shall conform to ASTM C 78, Type I or II. Plasticizing agents may be added in manufacturing process not to exceed 12% of the total volume.
2. Sand used for plaster shall be clean and well graded from coarse to fine, and shall conform to ASTM C 144.
3. Water used for plaster shall be clean and free from deleterious amounts of acid, alkali, and organic materials.

4. Fiber for Base Coats: Alkaline-resistant (AR) glass or polypropylene fibers, 1/2-inch long, free of contaminates, manufactured for use in portland cement plaster.
5. 5. Stucco Finish Coat: Factory mixed, integral color. Colors indicated on the drawings.
6. Lime: ASTM C 206 Type S or ASTM C 207 Type S.

2.2 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

B. Commencement of installation of any products of this Section shall be considered as acceptance of the substrate and conditions as being satisfactory for proper installation of products of this Section.

3.2 INSTALLATION - GENERAL

A. Coordinate as required with other work to assure proper and adequate provision in other work for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures

3.3 FURRING AND LATH INSTALLATION

A. Erect metal furring and lath as required for cement plaster in accordance with referenced standards.

B. Install members true to lines and levels and to provide surface flatness with maximum variation of 1/8 inch in 10 feet in any direction.

C. Cover horizontal surfaces with sheet membrane waterproofing.

D. Control Joints: Install control joints to create panels no larger than 100 sq. ft. with no dimension exceeding 16' or a length to width ratio of no more than 2-1/2 to 1. Verify locations with Architect prior to installation.

E. Place casing beads at terminations of plaster finish. Butt and align ends. Secure rigidly in place.

F. Continuously reinforce internal angles with corner mesh, except where the metal lath returns 3 inches from corner to form reinforcement. Fasten at perimeter edges only.

G. Place beaded external angle with mesh at corners. Fasten at outer edges only.

H. Place strip mesh diagonally at corners of lathed openings. Secure rigidly in place.

I. Place 4 inch wide strips of metal lath centered over junctions of dissimilar backing materials. Secure rigidly in place.

3.4 PLASTERING

A. Portland Cement Plaster Proportions and Mixing: Comply with ASTM C 926. Proportion materials by volume. Adjust mix proportions within limits specified to attain workability.

1. Fiber Content: Add fiber to base coat mixes after ingredients have mixed at least 2 minutes. Comply with fiber manufacturer's directions but do not to exceed 2 lbs. per cu. ft. of cementitious materials. Reduce aggregate quantities accordingly to maintain workability.

B. Factory-Prepared Finish Coats: Add water only; comply with finish coat manufacturer's directions.

C. Metal Lath:

1. Scratch Coat: Completely cover mesh lath in one heavy coat approximately 3/8" thick.
2. Brown Coat: Scratch and brown to total 3/4" thickness. Brown coat shall be brought to a true even surface by rodding and floating, and left rough, ready to receive finish coat.
3. Finish Coat: Textures as indicated on drawings. Finish coat to match approved sample panel, total thickness of scratch, brown and finish coats equals 7/8".

D. Curing: Cure portland cement plaster by maintaining each coat in a moist condition following application; keep enclosed and fog-spray (after initial set) as required to prevent dry-out.

1. Allow 48 hours between application of base coats. Cure base coats minimum of 10 days after application.

2. Finish coat shall not be moist cured except under adverse conditions.

E. Complete all plaster work in the same plane and panel each day; do not stop short, such as at an expansion joint, etc.

F. Plaster surfaces shall be true and flat; edges straight and even. Provide temporary supplementary bracing to prevent bowing during plaster application.

G. Tolerances: Finish all plaster true and even within a tolerance of one in 500, leaving the finished surface free from tool marks and all other blemishes.

H. Cleaning Metal Accessories: Wipe all metal accessories clean after application of each coat.

I. Patching:

1. Patch and repair all damaged plaster surfaces due to other trades, improper protection, or incomplete work of this Section.
   a. Damage includes both physical and color damage.
   b. Any patching or repair shall match adjacent color and texture.

3.5 CLEAN-UP AND PROTECTION

A. Keep premises clean and orderly at all times and adequately protect all other work from damage due to the work of this section.

B. Upon final completion of this work, clean off spatters, remove all tools, equipment and unused materials and cuttings. Leave the work in a clean orderly manner.

END OF SECTION 092400

This page left intentionally blank.

SECTION 092900

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior gypsum board.
2. Tile backing panels.

PART 2 - PRODUCTS

2.1 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M.

1. Manufacturers:
   a. G-P Gypsum.
   b. National Gypsum Company.
   c. USG Corporation.
   d. Contemporary Storage Systems, CCS

B. Type X, ASTM 36, Thickness: 5/8 inch.

C. Type C, Thickness: as required by fire-resistance-rated assembly.

D. Flexible Type: Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.

1. Thickness: 1/4 inch.

E. High-Impact Type: Manufactured with Type X core, plastic film laminated to back side for greater resistance to through-penetration (impact resistance) conforming to abrasion resistance ASTM D 4977, impact resistance ASTM E 695 and fire endurance ASTM E84.

1. Core: As indicated on Drawings 5/8 inch thick.
2. Plastic-Film Thickness: 0.010 inch.
3. Acceptable products or equal:
   a. CSS; LexCore ARR 5820.
   b. NGC (Gold Bond); Hi-Impact XP.

F. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces. Conform to ASTM C 36 and ASTM D 3273 minimum score of “8”. Use at elevator shaft interior.

1. Core: 5/8 inch, Type X.
2. Acceptable products or equal:
   a. USG; Sheetrock Humitex.
   b. G-P; DensGuard Dens Armor Interior Guard.
   c. NGC; Gold Bond XP.

2.2 TILE BACKING PANELS

A. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M or ASTM C 1396/C 1396M.

1. Manufacturers:
   a. G-P Gypsum.
   b. National Gypsum Company.
   c. USG Corporation.
2. Core: 5/8 inch, Type X.

B. Cementitious Backer Units: Water-resistant cementitious panels reinforced with a fiberglass scrim, complying with ANSI A118.9. Screws for board attachment: ASTM C 1002.

1. Products:
   a. Custom Building Products; Wonderboard.
   b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
   c. USG Corporation; DUROCK Cement Board.
   d. James Hardie Building Products; Hardibacker 500 Cement Board
2. Thickness: 1/2 inch.

2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: 26 gauge galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet as manufactured by USG, Beadex or National Gypsum. Trim units shall include corner beads, casings, edge trim and other shapes.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Manufacturers:
   a. Fry Reglet Corp.
   b. Gordon, Inc.
   c. Pittcon Industries.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.

2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

2.5 AUXILIARY MATERIALS

A. Finishing Materials:

1. High solids primer to be SHEETROCK Brand First Coat manufactured by USG or High-build primer by Sherwin Williams.
2. Texture coat finish material shall be manufactured by U.S. Gypsum, Hamilton, or Highland Stucco and Lime Products, Inc.

PART 3 - EXECUTION

3.1 FINISHING GYPSUM BOARD

A. Gypsum Board Finish Levels (New): Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Where indicated on Drawings.
3. Level 3: Where indicated on Drawings.
4. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
5. Level 5: Skim coat where indicated on Drawings i.e. high visibility lobbies. Use drying-type, all-purpose compound or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat.

B. Gypsum Board Finish Levels for Existing Plaster and Gypsum Surfaces: Finish panels to levels indicated for new gypsum board finishes:

1. Provided mud coat(s) as required to completely cover existing gypsum board or plaster surfaces, coats to go from corner to corner and top to bottom of wall or surface being prepared.

END OF SECTION 092900

This page left intentionally blank.

.

SECTION 092950

GYPSUM BOARD SHAFT-WALL ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Shaft enclosures.
2. Chase enclosures.
3. Horizontal enclosures.

B. Related Sections include the following:

1. Section 092900 "Gypsum Board Assemblies" for applying and finishing panels in gypsum board shaft-wall assemblies.

1.3 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board construction not defined in this Section or in other referenced standards.

1.4 SUBMITTALS

A. Product Data: For each gypsum board shaft-wall assembly indicated.

B. Fire-Test-Response Reports: From a qualified independent testing and inspecting agency substantiating each gypsum board shaft-wall assembly's required fire-resistance rating.

C. Research/Evaluation Reports: Evidence of compliance with building code in effect for Project, from ICBO that substantiate required fire-resistance rating for each gypsum board shaft-wall assembly.

D. Acoustical-Test-Response Reports: From a qualified independent testing agency substantiating required STC rating for each gypsum board shaft-wall assembly.

1.5 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory."

B. STC-Rated Assemblies: For gypsum board shaft-wall assemblies indicated to have STC ratings, provide assembly materials and construction complying with requirements of assemblies whose STC ratings were determined according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat on leveled supports off the ground to prevent sagging.

1.7 PROJECT CONDITIONS

A. Comply with requirements for environmental conditions, room temperatures, and ventilation specified in Division 9 Section " Gypsum Board Assemblies”

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. G-P Gypsum Corp.
2. National Gypsum Company.
3. United States Gypsum Co.

2.2 ASSEMBLY MATERIALS

A. General: Provide materials and components complying with requirements of fire-resistance-rated assemblies indicated.

1. Provide panels in maximum lengths available to eliminate or minimize end-to-end butt joints.

2. Provide auxiliary materials complying with gypsum board shaft-wall assembly manufacturer's written recommendations.

B. Steel Framing: ASTM C 645.

1. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized coating.

C. Gypsum Liner Panels: Manufacturer's proprietary liner panels in 1-inch thickness and with moisture-resistant paper faces.

D. Gypsum Wallboard: ASTM C 36, core type as required by fire-resistance-rated assembly indicated.

1. Edges: Tapered.

E. Accessories: Cornerbead, edge trim, and control joints of material and shapes specified in Division 9 Section "Gypsum Board Assemblies" that comply with gypsum board shaft-wall assembly manufacturer's written recommendations for application indicated.

F. Gypsum Wallboard Joint-Treatment Materials: ASTM C 475 and as specified in Division 9 Section "Gypsum Board Assemblies."

G. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

H. Track (Runner) Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft-wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

1. Powder-Actuated Fasteners: Provide powder-actuated fasteners with capability to sustain, without failure, a load equal to 10 times that imposed by shaft-wall assemblies, as determined by testing conducted by a qualified independent testing agency according to ASTM E 1190.

I. Acoustical Sealant: As specified in Division 9 Section "Gypsum Board Assemblies."

J. Sound Attenuation Blankets: ASTM C 665 for Type I, unfaced mineral-fiber-blanket insulation produced by combining thermosetting resins with mineral fibers manufactured from slag or rock wool.

2.3 GYPSUM BOARD SHAFT WALL

A. Studs: Manufacturer's standard profile for repetitive members and corner and end members and for fire-resistance-rated assembly indicated.

1. Depth: As indicated.

2. Minimum Base Metal Thickness: 0.0312 inch.

B. Track (Runner): Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches, in depth matching studs.

1. Minimum Base Metal Thickness: 0.0312 inch.

C. Room-Side Finish: Gypsum board.

D. Shaft-Side Finish: As indicated by fire-resistance-rated assembly design designation.

E. STC Rating: As indicated.

F. Cavity Insulation: Sound attenuation blankets.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which gypsum board shaft-wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway door frames, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Sprayed Fire-Resistive Materials: Coordinate with gypsum shaft-wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft-wall assemblies to comply with requirements specified in Division 7 Section "Sprayed Fire-Resistive Materials."

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.

2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of gypsum board assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLATION

A. General: Install gypsum board shaft-wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and the following:

1. ASTM C 754 for installing steel framing.
2. Division 9 Section "Gypsum Board Assemblies" for applying and finishing panels.

B. Do not bridge building expansion joints with shaft-wall assemblies; frame both sides of joints with furring and other support.

C. Install supplementary framing in gypsum board shaft-wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft-wall assembly framing.

1. At elevator hoistway door frames, provide jamb struts on each side of door frame.
2. Where handrails directly attach to gypsum board shaft-wall assemblies, provide galvanized steel reinforcing strip with 0.0312-inch minimum thickness of base (uncoated) metal, accurately positioned and secured behind at least 1 face-layer panel.

D. At penetrations in shaft wall, maintain fire-resistance rating of shaft-wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.

E. Isolate gypsum finish panels from building structure to prevent cracking of finish panels while maintaining continuity of fire-rated construction.

F. Install control joints to maintain fire-resistance rating of assemblies.

G. Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain an airtight and smoke-tight seal; and comply with manufacturer's written instructions or ASTM C 919, whichever is more stringent.

H. In elevator shafts where gypsum board shaft-wall assemblies cannot be positioned within 2 inches of the shaft face of structural beams, floor edges, and similar projections into shaft, install 1/2- or 5/8-inch- thick, gypsum board cants covering tops of projections.

1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches o.c. with screws fastened to shaft-wall framing.
2. Where steel framing is required to support gypsum board cants, install framing at 24 inches o.c. and extend studs from the projection to the shaft-wall framing.

END OF SECTION 092650

SECTION 093013

CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide ceramic tile installations with accessories, as required for complete installation.

1. Provide waterproofing and crack isolation membranes integral with tile setting beds.

B. Related Sections:

1. Section 033010: Concrete Floors
2. Section 079200: Joint Sealants
3. Section 092900: Gypsum Board, for wall tile backer board
4. Section 102813: Toilet Room Accessories

1.2 REFERENCES

A. ANSI A108.1: Installation of Tile with Portland Cement Mortar.

B. ANSI A108.5: Installation of Tile with Latex-Portland Cement Mortar.

C. ANSI A108.6: Installation of Tile with Chemical Resistant Water Cleanable Tile Setting and Grouting Epoxy.

D. ANSI A108.10: Installation of Grout in Tilework.

E. Tile Council of North America (TCNA): Handbook for Ceramic Tile Installation, latest edition.

1.3 SUBMITTALS

A. Product Data: Furnish manufacturer's literature for each type of material to be provided for Project.

B. Certificates: Submit Master Grade Certification for each shipment and type of ceramic tile, signed by manufacturer and installer.

C. Samples: Furnish each type of tile and grout clearly indicating pattern, coloration and joints.

1. Color Charts: Submit actual tile sections showing full range of colors, textures and patterns available for each type of tile.

2. Prepare two 12" square sample panels of each selected type of tile and grout.

1.4 PROJECT CONDITIONS

A. Provide sufficient heat and ventilation in areas where ceramic tile work is being performed, so as to allow tile to properly set.

B. Take precautionary measures necessary to ensure excessive temperature changes do not occur.

1.5 WARRANTY

A. Special Warranty: Provide for correcting failures of waterproofing membrane to resist water penetration, except where failures are result of structural failures of building. Hairline cracking of concrete due to temperature or shrinkage is not considered structural failure.

1. Repair and pay for or replace damaged materials and surfaces.
2. Special Warranty Period: Two years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Tile: Types as indicated; porcelain tile to comply with ANSI A137.1 Specifications for Ceramic Tile for types and grades of tiles; furnish tile complying with Standard Grade requirements unless otherwise indicated.

1. Color, Style and Pattern: As indicated on Finish Schedule and conforming to Architect-approved samples.
2. Floor Tile: Provide non-slip units with minimum wet and dry value of 0.60 coefficient of friction when tested in accordance with ASTM C1028. Dynamic Coefficient of Friction: Not less than 0.42. (Ceramic Tile Flooring shall be stable, firm, and slip resistant per CBC Section 11B-302.1)
3. Base and Trim: Provide complete matching trim pieces, coordinated with sizes and coursing of adjoining flat tile as directed by Architect; types as indicated, as selected by Architect where not indicated. Provide cove base trim for all tile.

B. Setting And Grouting Materials

1. Chemical-Resistant, Water-Cleanable, Tile-Setting and -Grouting Epoxy: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CRF 59, Subpart D (EPA Method 24).

C. Portland Cement Setting Bed: Portland cement bed conforming to ANSI A108.1 and TCNA Handbook, including separator sheet and reinforcing mesh.

1. Separator Sheet / Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils (0.1 mm) thick.

2. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062-inch (1.57-mm) diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.

D. Latex Thin Set: Thinset bond coat, consisting of latex-cementitious mortar conforming to ANSI A118.4.

1. Manufacturers (or approved equal):
   a. Laticrete International Inc.
   b. Bostik Construction Products/Hydroment.
   c. Custom Building Products.
   d. Mapei Corp.
   e. Mer-Kote Products, Inc.

E. Latex-Cement Grout: ANSI A118.7, latex-cementitious type, uniform in color, resistant to shrinkage. Use at all walls.

1. Manufacturers (or approved equal):
   a. Laticrete International Inc.
   b. Bostik Construction Products/Hydroment.
   c. Custom Building Products.
   d. Mapei Corp.
   e. Mer-Kote Products, Inc.
2. Grout Color: As scheduled, or as otherwise selected by Architect from manufacturer's complete line.
3. Use unsanded grout on joints 1/8 inch or less; use sanded grout on joints greater than 1/8 inch.

F. Epoxy Mortar and Grout: Chemical resistant and water cleanable thinset epoxy mortar and grout conforming to ANSI A118.3. Use at all floors.

1. Manufacturers: Same as listed above.

G. Waterproof Membrane: Manufacturer's standard sheet or liquid rubber polymer, complying with ANSI A118.10, designed specifically for application under tile in non-immersed applications. Select one system from the following.

1 Manufacturers:
   a. Laticrete International Inc./9235 Waterproof Membrane.
   b. Bostik Construction Products/Hydroment Ultra-Set.
   c. Mer-Kote Products/BFP Membrane or Hydro-Guard 2000.
   d. The Nobel Company/NobelSeal TS.
   e. Mapei Corp. PRP M19.
2. Un-reinforced, Fluid-Applied Product: Liquid-latex rubber, with a VOC content of 65 g/L of less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), in a consistency suitable for trowel application and intended for use as waterproofing.

H. Crack Isolation Membrane: A sheet membrane product specifically manufactured for thin-set installation between concrete slab-on-grade and tile floors, the purpose of

which is to protect the tile from cracking should the slab below crack. Liquid-applied products will not be allowed. Use at all ground (slab-on-grade) floors. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

1. Strataflex anti-fracture membrane; National Applied Construction Products, Inc.
2. Nobleseal CIS crack isolation sheet - The Noble Company
3. Laticrete 9235 waterproof and anti-fracture membrane - Laticrete, Intl.
4. AFM Anti-Fracture Membrane - Protecto Wrap Co.
5. CrackBuster – Custom Building Products.

I. Cleaning and Sealing Materials: As recommended by tile and grout manufacturers.

J. Marble Thresholds: (NOT APPLICABLE)

K. Provide other materials, not specifically described but as may be required for a complete and proper installation, as selected by the Contractor and subject to the approval of the Architect.

1. Do NOT use organic adhesive to set tile.

2.2 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Section 07920 "Joint Sealants." Use mold-resistant silicone type.

1. VOC Content: Not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MIXES

A. Mix and proportion cementitious materials for site-made leveling coats, setting beds and grout as recommended by the TCNA Handbook for Ceramic Tile Installation.

B. Mix and proportion pre-mixed setting beds and grout materials in accordance with manufacturer's recommendations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to installing tile, ensure surfaces are level.

1. Bed Set Tile Tolerance: Maximum surface variation of 1/4" in 10'-0".
2. Thin Set Tile Tolerance: Maximum surface variation of 1/8" in 10'-0".

B. Ensure surfaces are clean and well cured.

1. Drains: Where indicated, ensure surfaces are properly sloped to drains.

C. Do not commence work until surface conditions are within tolerances required for proper installation; apply latex leveling material where necessary to meet required tolerances.

D. Waterproof and Crack Isolation Membranes: Install waterproof membrane at tile areas located above grade (second floor), in accordance with manufacturer's recommendations; extend membrane minimum 6" up walls.

1. Comply with waterproof membrane manufacturer recommendations for installation of tile over waterproof/crack isolation membrane.
2. Install crack isolation membrane under all thin-set tile where waterproof membrane is not used. (i.e. – first or slab-on-grade floor).

3.2 INSTALLATION

A. Install tile in accordance with referenced ANSI Standards, manufacturer's specifications, and most current TCNA Handbook recommendations for type of substrate and indicated setting method.

1. Bed-Set (Thick set) Floors over Concrete: TCNA F111, with latex cement bond coat.
2. Latex-Cement Thin Set Floors with Waterproof Membrane, over a cured mortar bed: TCNA F122.
3. Latex-Cement Thin Set Floors over Crack Isolation Membrane: TCNA F125A – Full Coverage.
4. Latex-Cement Thin Set Wall Tile over Glass Mat Gypsum Backer Board: TCNA W245.

B. Place tile in accordance with patterns indicated on Drawings or as directed by Architect; carefully plan tile layouts, ensure pattern is uninterrupted from one surface to the next and through doorways.

1. Apply latex thin set to back of tile where necessary to ensure 100% bond between bond coat and substrate; replace tiles which break due to voids between tile and substrate.

C. Marble: (Not applicable)

D. Neatly cut tile around fixtures and drains; accurately form corners, base, intersections and returns. Align floor joints with base and wall joints, unless otherwise detailed.

1. Base, Coves: Flush cove type with base grout joint on wall, cove tile on floor, unless otherwise indicated.
2. Corners and Edges: Bullnose tile unless otherwise indicated.

E. Locate expansion joints, control joints, contraction joints, and isolation joints where indicated; where not indicated, provide as recommended by TCNA Handbook (EJ-171) and as approved by Architect. Color match the sealant to grout colors.

1. Install special trim pieces as indicated on Drawings and in accordance with manufacturer recommendations and installation instructions, true to lines and levels indicated and in correct relationship with tile and adjacent materials.

F. Ensure tile joints are uniform in width, subject to normal variance in tolerance allowed in tile size; ensure joints are watertight, without voids, cracks, excess mortar or grout.

G. Sound tile after setting. Remove and replace hollow sounding units.

H. Allow tile to set for a minimum 48 hours prior to grouting.

I. Grout tile to comply with recommendations of TCNA and as specified.

J. Leave completed installation free of broken, damaged and faulty tile.

3.3 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 093013

SECTION 094100

SOLID SURFACE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid Surface countertops.
2. Setting materials and accessories.

B. Related Sections:

1. Section 062023 - Interior Finish Carpentry
2. Section 079200 - Joint Sealants
3. Section 102813 - Toilet & Bath Accessories

1.2 REFERENCES

A. American National Standards Institute (ANSI):

1. A108.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
2. A118.4 - Latex-Portland Cement Mortar.

B. ASTM International (ASTM:

1. C97 - Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone.
2. C99 - Standard Test Method for Modulus of Rupture of Dimension Stone.
3. C170 - Standard Test Method for Compressive Strength of Dimension Stone.
4. C241 - Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic.
5. C482 - Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement.
6. C484 - Standard Test Method for Thermal Shock Resistance of Glazed Ceramic Tile.
7. C531 - Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
8. C648 - Standard Test Method for Breaking Strength of Ceramic Tile.
9. C650 - Standard Test Method for Resistance of Ceramic Tile to Chemical Substances.
10. C672/C672M - Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.
11. C880 - Standard Test Method for Flexural Strength of Dimension Stone.

12. C1026 - Standard Test Method for Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling.
13. C1028 - Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
14. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Shop Drawings: Include countertop layout, dimensions, materials, finishes, cutouts, and attachments.

B. Samples:

1. 3 x 3 inch quartz samples showing available colors.
2. 3 inch long joint sealer samples showing available colors.

1.4 QUALITY ASSURANCE

A. Fabricator and Installer Qualifications: Minimum 2 years documented experience in work of this Section.

B. Mockup:

1. Construct countertop mockup, 6 feet wide, full depth, with splash.
2. Include plumbing fixtures and trim.
3. Locate where directed.
4. Approved mockup may remain as part of the Work.

1.5 WARRANTY

A. Provide manufacturer's 10 year warranty against defects in materials and workmanship.

PART 2- PRODUCTS

2.1 MANUFACTURERS

A. Contract Documents are based on products by Cambria, Inc. or equal.

B. Substitutions: Under provisions of Section 013300

2.2 MATERIALS

A. Quartz Sheet:

1. Product: Cambria
2. Composition: Resin, and color pigments formed into flat slabs.

3. Anti-microbial protection: Microban by Microban International, Inc., integral to sheet.
4. Color: “Berwyn”
5. Thickness: ¾ inch
6. Physical characteristics:
    a. Static coefficient of friction: 1.02 dry, 0.51 wet, tested to ASTM C1028.
    b. Water absorption: Maximum 0.03 percent, tested to ASTM C97.
    c. Compressive strength: Minimum 29,000 psi, tested to ASTM C170.
    d. Bond strength: Minimum 210 psi, tested to ASTM C482.
    e. Modulus of rupture: Minimum 6300 psi, tested to ASTM C99.
    f. Flexural strength: Minimum 5800 psi, tested to ASTM C880.
    g. Breaking strength: Minimum 480 lbf, tested to ASTM C648.
    h. Stain resistance: Not affected by 10 percent hydrochloric acid or 10 percent KOH, tested to ASTM C650.
    i. Thermal shock resistance: Pass 5 cycles, tested to ASTM C484.
    j. Abrasive index: 65-Ha = 25, tested to ASTM C241.
    k. Thermal expansion: 1.670 x 10^{-5} in/in/deg F, tested to ASTM C531.
    l. Deicing resistance: Rating of 0, tested to ASTM C672/C672M.
    m. Freeze/thaw resistance: 0 tiles at 15 cycles, tested to ASTM C1026.
    n. Flame spread rating: Class 1, tested to ASTM E84.

2.3 ACCESSORIES

A. Adhesive: Type recommended by manufacturer.

B. Joint Sealer:

1. Latisil Tile and Stone Sealant by Laticrete International, Inc.
2. Color: To be selected from manufacturer’s full color range.

2.4 FABRICATION

A. Cut quartz panels accurately to required shapes and dimensions.

B. Radius exposed edges.

C. Fabricate with hairline joints.

D. Cut holes for sinks, faucets and toilet accessories.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive countertops; remove loose and foreign matter than could interfere with adhesion.

3.2 INSTALLATION

A. Set in thin set mortar bed in accordance with ANSI A 108.5.

B. Set plumb and level. Align adjacent pieces in same plane.

C. Install with hairline joints.

D. Fill joints between countertops and adjacent construction with joint sealer; finish smooth and flush.

3.3 INSTALLATION TOLERANCES

A. Maximum variation from level and plumb: 1/8 inch in 10 feet, non-cumulative.

B. Maximum variation in plane between adjacent pieces at joint: Plus or minus 1/16 inch.

3.4 CLEANING

A. Clean countertops in accordance with manufacturer's instructions.

3.5 PROTECTION

A. Protect installed countertops with non-staining sheet coverings.

END OF SECTION 094100

SECTION 095110

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes ceilings consisting of acoustical panels and exposed suspension systems.

1.3 SUBMITTALS

A. Product Data: For each type of product specified.

B. Samples for Initial Selection: Manufacturer's color charts consisting of actual acoustical panels or sections of acoustical panels, suspension systems, and moldings showing the full range of colors, textures, and patterns available for each type of ceiling assembly indicated.

C. Samples for Verification: Full-size units of each type of ceiling assembly indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.

1. 6-inch- square samples of each acoustical panel type, pattern, and color.

D. Product Test Reports: Indicate compliance of acoustical panel ceilings and components with requirements based on comprehensive testing of current products.

E. Research/Evaluation Reports: Evidence of acoustical panel ceilings and components' compliance ICBO evaluation report.

F. Certification: Manufacturer’s statement that products being supplied do not contain formaldehyde.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Fire-response tests were performed by UL, ITS/Warnock Hersey, or another independent testing and inspecting agency that is acceptable to authorities having jurisdiction and that performs testing and follow-up services.

2. Surface-burning characteristics of acoustical panels comply with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.

3. Fire-resistance-rated assemblies, which are indicated by design designations from UL's "Fire Resistance Directory," from ITS/Warnock Hersey's "Directory of Listed Products," or from the listings of another testing and inspecting agency, are identical in materials and construction to those tested per ASTM E 119.

4. Products are identified with appropriate markings of applicable testing and inspecting agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Acoustical Panel Ceiling Schedule at the end of Part 3.

2.2 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

1. Mounting Method for Measuring Noise Reduction Coefficient: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

C. Panel Characteristics: Comply with requirements indicated in the Acoustical Panel Ceiling Schedule at the end of Part 3, including those referencing ASTM E 1264 classifications.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System: Provide manufacturer's “heavy duty” direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.

B. Metal Suspension System Characteristics: Comply with requirements indicated in the Acoustical Panel Ceiling Schedule at the end of Part 3.

C. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

D. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.

1. Cast-in-Place and Postinstalled Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488, conducted by a qualified testing and inspecting agency.
   a. Type: Cast-in-place anchors.
   b. Type: Postinstalled expansion anchors.
   c. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC service condition (mild).

E. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.

F. Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.

1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
3. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.

G. Hold-Down Clips for Non-Fire-Resistance-Rated Ceilings: For interior ceilings consisting of acoustical panels weighing less than 1 lb/sq. ft., provide hold-down clips spaced 24 inches o.c. on all cross tees.

2.4 ACOUSTICAL SEALANT

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following requirements:

1. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage, and other conditions affecting performance of acoustical panel ceilings.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other Sections.

1. Furnish cast-in-place anchors and similar devices to other trades for installation well in advance of time needed for coordinating other work.

B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.
2. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
3. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."
4. U.B.C.'s "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings": U.B.C. Standard 25-2.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, powder-actuated fasteners, or drilled-in anchors that extend through forms into concrete.
7. Do not attach hangers to steel deck tabs.

8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 inches from ends of each member.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:
   a. Install panels with pattern running in one direction parallel to long axis of space.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.

3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.

4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.

5. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated or required.

6. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and

replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.5 ACOUSTICAL PANEL CEILING SCHEDULE

A. Water-Felted, Mineral-Base Acoustical Panels for Acoustical Panel Ceiling APC: Where this designation is indicated, provide acoustical panels complying with the following:

1. Products: Provide the following:
   a. "Dune Square" (Fine Textured) panels by Armstrong or equal
2. Classification: Panels fitting ASTM E 1264 for Type III, mineral base with painted finish; Form 2, water felted.
3. Color: White.
4. Light Reflectance Coefficient: Not less than [LR 0.86.
5. Noise Reduction Coefficient: NRC 0.65.
6. Ceiling Attenuation Class: Not less than CAC 40.
7. Edge Detail: Beveled Tegular
8. Thickness: 3/4 inch.
9. Size: 24 by 24 inches.

B. Solid Poplar wood pre-finished Acoustical Panels for Acoustical Panel Ceiling APC: Where this designation is indicated, provide acoustical panels complying with the following:

1. Products: Provide the following:
   a. "WoodWorks Grille" Tegular horizontal wood slats ceiling tiles by Armstrong or equal

C. Suspension System for Acoustical Panel Ceiling APC: Where this designation is indicated, provide acoustical panel ceiling suspension system complying with the following:

10. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, pre-painted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/653M, G01 coating designation, with pre-finished 9/16-inch-wide metal caps on flanges; other characteristics as follows:
    a. Structural Classification: Heavy-duty system.
    b. End Condition of Cross Runners: Butt-edge type.
    c. Face Design: Flush face.
    d. Cap Finish: Painted white.

END OF SECTION 095110

This page left intentionally blank.

SECTION 096520

VINYL FLOOR COVERING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Section, apply to this Section.

1.2 SUMMARY

A. Section include the following:

1. Resilient Sheet Flooring

B. Related Sections include the following:

1. Sections 01 - 32

1.3 SUBMITTALS

A. Product Data: Submit 3 copies of manufacturer's technical data and installation instructions for each type of resilient flooring and accessory.

1. Sheet flooring must be ordered a minimum of sixty (60) days prior to start of scheduled installation.

B. Samples: Submit 3 sets of samples of each type, color, and finish of resilient flooring and accessory required, indicating full range of color and pattern variation. Provide 6" square samples of sheet flooring and 3" long samples of accessories.

C. Closeout Submittals: Submit 3 copies of the following:

1. Maintenance and operations data includes – methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.

2. Warranty: Warranty documents specified herein.

D. Flame Spread Certification: Submit manufacturer's certification that resilient flooring furnished for areas indicated to comply with required flame spread rating has been tested and meets or exceeds indicated standard.

E. Replacement Material: After completion of work, deliver to project site replacement materials from same manufactured lot as materials installed, and as follows;

1. Sheet Flooring: Not less than 5 linear yards for each type, pattern, and color installed.

2. Resilient Base: Not less than 10 linear feet for each 500 linear feet or fraction thereof of each different type and color installed.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project and who is acceptable to product manufacturer.

B. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction, approving acceptable installer and application method.

C. Regulatory Requirements: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities have jurisdiction.

1. Critical Radiant Flux: Class 1 Rating per ASTM E-648 (0.45 watts/sq. cm or greater).

2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E-662.

D. Mock Ups: Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner and Architect's acceptance of finish, color, texture and pattern, and workmanship standard.

1. Mock up Size: 5'. 0 x 5'. 0, illustrating heat welding and butt seaming.

2. Maintenance: Maintenance mock up during construction of workmanship comparison; remove and legally dispose of mock-up when no longer required.

1.5 WARRANTY

A. Manufacturers Warranty: Submit manufacturer's standard warranty document.

1. Warranty Period: Five (5) year limited warranty commencing on Date of Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Storage and Protection: Store materials protected for exposure to harmful weather conditions and at a temperature and humidity conditions recommended by manufacturer.

1. Materials should be stored in areas that are fully enclosed, weather tight with the permanent HVAC system set at a uniform temperature of at least

68 degrees F (20 degrees C) for 72 hours prior to, during, and after installation. Store rolls upright.

2. Move resilient flooring and installation accessories into spaces where they will be installed at least 48 hours before installation, unless longer conditioning periods are recommended in writing by manufacturer.

1.7 PROJECT CONDITIONS

A. Substrate Conditions: The installer shall verify in writing to the Owner, a minimum of thirty (30) days prior to scheduled resilient flooring installation, the following substrate conditions:

1. Moisture: initial emission rate, as tested with a calcium chloride test kit.

2. Alkalinity: pH range of 7-9.

B. After the application of the concrete sealer, if required, the installer shall perform second calcium chloride test. These second test results will be compared with the previous results. Final results shall not exceed resilient flooring manufacturer's allowable emission rate.

C. Environmental Requirements/Conditions: In accordance with manufacturer's recommendations. Areas to receive flooring shall be clean, fully enclosed, weather tight with the permanent HVAC set at a uniform temperature of at least 68 degrees F (20 degrees C). The flooring material should be conditioned in the same manner.

D. Temperature Requirements: Maintain air temperature in spaces where products will be installed for time period before, during, and after installation as recommended by manufacturer.

1. Temperature Conditions: Minimum 68 degrees for 72 hours prior to, during and for not less than 48 hours after installation.

E. Close spaces to traffic during resilient flooring installation and for time period after installation recommended in writing by manufacturer.

F. Install resilient flooring material and accessories after other finishing operations, including painting, have been completed.

G. Where demountable partitions and other items are indicated for installation on top of sheet resilient flooring material, install flooring material before these items are installed.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. "Vinyl #1" Vinyl Tile Flooring: To establish a standard of quality, design and performance, "Amtico" by Mannington Commercial has been selected. Alternatives will be considered provided they meet or exceed the specification criteria contained herein. The Architect and city shall be the joint determinants of equivalency. Reference spec section 012500 for substitution procedures.
2. "Vinyl #2" Vinyl Sheet Flooring: To establish a standard of quality, design and performance, "Biospec MD" by Mannington Commercial has been selected. Alternatives will be considered provided they meet or exceed the specification criteria contained herein. The Architect and city shall be the joint determinants of equivalency. Reference spec section 012500 for substitution procedures.

2.2 MATERIALS

A. Per Finish Schedule

2.3 ACCESSORIES

A. Resilient Base: Provide rubber base complying with FS SS-W-40, Type 1, with matching end stops and preformed or molded corner units, as follows:
   1. Height: 6"
   2. Thickness: 1/8" gauge
   3. Style: Standard top-set cove
   4. Style: Straight base without cove (at carpet edges)
   5. Resilient Edge Strips: 1/8 " thick, homogeneous vinyl or rubber composition, tapered or bullnose edge, color to match flooring, or as selected by Architect from standard colors available, no less than 1" wide.
   6. Cove Cap: Type for flash coved applications will be selected by Architect.
   7. Cove Stick: Type for flash coved applications will be selected by Architect provided it has a minimum radius of 7/8".
   8. Adhesive: Solvent-free, water-resistant, stabilized type as recommended by flooring manufacturer to suit material and substrate conditions. Conduct and document bond test.
   9. Concrete Vapor Reduction System: Two part, one coat Koster VAP1 2000. Follow manufacturer's directions.
   10. Leveling and Patching Compounds: Portland cement types as recommended by flooring manufacturer.
   11. Heat Welding Thread: Heat welding thread in matching color, as supplied by flooring manufacturer.

PART 3 – EXECUTION

3.1 INSPECTION

A. Installer must examine areas and conditions under which resilient flooring and accessories are to be installed and must notify General Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Owner and Architect.

3.2 PREPARATION

A. Surface Preparation:

1. General: Broom clean or vacuum surfaces to be covered, and inspect subfloor. Start of flooring installation indicates acceptance of subfloor conditions and full responsibility for completed work.

2. Floor Substrate: Prepare floor substrate to be smooth, rigid, flat, level, permanently dry, clean and free of foreign materials such as dirt, paint, grease, oils, solvent, curing and hardening compounds, sealers, asphalt and old adhesive residue.

3. Concrete Floor Substrate: Concrete floor substrate shall have a minimum compressive strength of 3500 psi. Refer to Division 3 Concrete sections for patching and repairing crack materials, and leveling compounds with Portland cement-based compounds. Do not use or install flooring over gypsum-based leveling or patching materials.

4. Concrete Moisture Test: Perform moisture tests on concrete floors regardless of the age or grade level with a minimum of three tests for the first 1000 square feet. The test should be a calcium chloride test. The moisture emission form the concrete shall not exceed 5.0 lbs per 1000 square feet in 24 hours. A diagram of the area showing the location and results of each test should be submitted to the Architect, General Contractor or End User. If the test results exceed the limitations, the installation must not proceed until the problem has been corrected with the application of Koster VAP1 2000 to bring moisture levels to an acceptable level.

5. Concrete pH Test: Perform pH tests on concrete floors regardless of the age or grade level. If the pH is greater than 10, it must be neutralized prior to beginning the installation.

3.3 INSTALLATION

A. Adhesive Flooring Installation: Cut required length of sheet flooring from roll, allowing enough material to extend up the wall 4 to 6 inches at either end. Layout and position sheet flooring so that any seams will fall at least 6 inches from underlayment joints or saw cuts in concrete substrate. Scribe and cut flooring material to shape of vertical surfaces, including walls and partitions. Apply adhesive and lay sheet flooring into wet adhesive and roll with a 100-pound roller, install sheet flooring square with room axis.

1. Adhesive, Seamless Flooring Installation: Rout out seams and heat weld together with complementary colored heat welding rod of complimentary

composition in accordance with resilient flooring manufacturer's recommendations.

2. Adhesive Flooring and Flash Coved Base Installation: Extend flooring up the wall in a flash-coved method to a height of 4 inches or 6 inches, as indicated.

3. Adhesive Material Installation: use trowel as recommended by flooring manufacturer for specific adhesive. Spread at a rate, as recommended by flooring manufacturer.

B. Installation Techniques:

1. Where demountable partitions and other items are indicated for installation on top of finished flooring, install flooring before these items are installed.

2. Scribe, cut, fit flooring to butt tightly to vertical surfaces, permanent fixtures and built-in furniture, including pipes, outlets, edgings, thresholds, nosings and cabinets.

3. Extend flooring into toe spaces, floor reveals, closets, and similar openings.

4. Install flooring on covers for telephone and electrical ducts, and similar items occurring within finish floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on these covers.

5. Do not install resilient flooring over expansion joints. Use expansion joint covers manufactured for use with resilient flooring. Refer to other specification sections for expansion joint covers.

6. Adhere resilient flooring to substrate without producing open cracks, voids, raising and puckering at joints, telegraphing to adhesive spreader marks, or other surface imperfections in completed installation.
   a. Use adhesive applied to substrate in compliance with flooring manufacturer's recommendations, including those for trowel notching, adhesive mixing, and adhesive open and working times.

7. Roll resilient flooring as required by resilient flooring manufacturer.

8. In situations were flashcoved is specified, the use of cove cap (type to be determined by architect) and rigid cove stick (with a minimum radius of 7/8") shall be mandatory.

9. All seams shall be heat welded.

C. Finish Flooring Patterns: As selected by Architect.

3.4 FIELD QUALITY REQUIREMENTS

A. Manufacturer's Field Services: Upon Owner and Architect's request, and with at least 72 hours notice, provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

1. Site Visits: (specify number and duration of periodic site visits.)

3.5 CLEANING

A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions, prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

1. Remove visible adhesive and other surface blemishes using cleaning methods recommended by flooring manufacturer.

2. Sweep and vacuum floor after installation

3. Do not wash floor until after time period recommended by flooring manufacturer.

4. Damp-mop flooring to remove black marks and soil.

3.6 PROTECTION

A. Protection: Protect installed product and finish surfaces from damage during construction. Remove and legally dispose of protective covering at time of Completion.

END OF SECTION 096520

This page left intentionally blank.

SECTION 096800

CARPET TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. RS “peel and stick” cushion back carpet.

B. Related Sections include the following:

1. Section 014000 “Quality Requirements” for testing moisture and alkalinity of concrete floors.

2. Section 072613 “Vapor Reduction Systems” for treatment of concrete floors with excess moisture.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, closed-cell vinyl-cushion backing, and fade resistance. Include installation recommendations for each type of substrate required.

B. Maintenance Data: For carpet to include in maintenance manuals specified in Division 1. Include the following:

1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.

2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide product, with its attached backing, with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

B. Moisture Test:

1. Test concrete floors for moisture and alkalinity as described in Division 1 Section “Quality Requirements”. For vapor emissions above 8 lbs. provide two parts, one coat Koester VAP 1 – 2000 vapor reduction system at

spread rate of 130 sf/gal rate. For vapor emissions above 15 lbs. provide the two parts, one coat Koester system at 90 sf/gal rate.

2. Vapor reduction system is not required on areas where Tandus carpet is to be installed over existing VAT, VCT or other resilient floor.

C. PH TEST

1. For conditions where pH exceeds 10, neutralize concrete per manufacturer's requirements and if that method does not reduce the PH level to 10 or below, then with the District's written approval apply the one coat Koester VAP 1 – 2000 system at the 130 sf/gal rate.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with CRI 104, Section 5, "Storage and Handling."

1.6 PROJECT CONDITIONS

A. General: Comply with CRI 104 and CRI 105 except as otherwise specified.

B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with RS tackifier and concrete slabs have a 7 - 10 pH range.

D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.7 WARRANTY - MINIMUM 20 YEAR NON-PRORATED

A. Provide a standard, printed, non-prorated warranty from the Manufacturer. All warranty items to be full term, not pro-rated, for the individual period. If the product fails to perform as warranted when properly installed and maintained the affected area will be repaired or replaced at the discretion of the Manufacturer.

B. The term of the carpet warranty shall be twenty years and shall cover against:

1. Excessive surface wear.

2. Excessive wear means more than 15% loss of pile fiber weight measured before and after use.

3. Edge ravel.

4. Zippering.

5. Backing delamination.
   a. Backing delamination is defined as separation of the secondary backing from the primary backing.

6. Watermark on any product not 100% loop construction.
   a. Watermark means an apparent color difference between areas of the same carpet due to permanent pile reversal with random

differences in pile lay direction and differences in the amount of light reflected by carpet fibers.

7. Excessive static electricity.
   a. Excessive static electricity means more than 3.0 kilovolts when tested per AATCC 134 at a relative humidity of 20% and a room temperature of 70° F.

C. Chair pads are not required for carpet warranty coverage.

D. All carpet warranties to be sole source responsibility of the Manufacturer. Second source warranties or warranties that involve parties other than the Manufacturer are unacceptable.

E. Carpet selected, including all components, shall be 100% recyclable meeting FTC guidelines. Floor coverings selected will be recycled at the end of their useful life in an environmentally responsible program. No carpeting returned for recycling shall be land filled, incinerated or down cycled.

F. All carpet warranties shall be signed and notarized by a company representative.

PART 2 - PRODUCTS

2.1 CARPET

A. General Specifications

1. Product Name – Per Finish Schedule
2. Product Type – Patterned Loop
3. Face Fiber – Invista Antron Legacy
4. Pile Thickness - .119 inches
5. Tufted Yarn Weight – 20 oz. per sq. yard
6. Standard size: 24” x 24” modular tiles

B. Backing System

1. Primary Backing – 100% Woven Synthetic
2. Secondary Backing – Infinity Modular Reinforced Composite Closed Cell Polymer

C. Product Notes

1. Product specifications are derived from averages resulting from normal manufacturing tolerances in fiber, yarn, temperature, humidity and color may vary within normal industry and standardized testing tolerances.
2. These specifications reflect mean averages based on tests of production runs of this carpet style by testing laboratories. A range of variances is implicit in the testing. Furthermore, the standard test methods established to derive these specifications lack a high degree of precision and repeatability and therefore, individual test results on the actual carpet purchased may vary above or below the mean average.

3. Colors may vary slightly from dye lot to dye lot.

2.2 PERFORMANCE ASSURANCE – GENERAL

A. Flammability Requirements

1. The carpet product when tested with its attached backing, as represented by averages of testing from random samplings of production lots, must meet flammability requirements for the following nationally recognized Building Codes for floor coverings:
   a. BOCA National Building Code NFPA 101 Life Safety Code for Safety to Life in Buildings and Structures Standard Building Code (SBC) Uniform Fire Code (UFC)

B. Face Fiber Characteristics

1. Invista Antron Legacy type 6, 6.

C. Stain Inhibiting

1. Stain inhibitor applied to the product during manufacture to resist fiber staining and soiling.

D. Backing Characteristics

1. Thermoplastic vinyl composite.
2. Fully fused to provide for no delamination.
3. Closed cell, vinyl cushion backing.
4. Backing system to provide a barrier to moisture penetration.
5. Product to provide for a chemically welded seam.

E. Adhesive System Characteristics

1. Carpet as installed to be securely attached to the floor in compliance with Americans with Disabilities Act (ADA), Section 4.5.3.
2. Product to be installed without use of wet adhesives.
3. Product to be supplied with a cured Microencapsulated Tackifier applied to the back at the time of manufacture.

F. Environmental Impact Characteristics

1. Product, inclusive of adhesive, to comply with the 1994 State of Washington protocol. The product, when tested as manufactured (no air-out period required), shall pass the protocol as written and shall have the following characteristics:
   a. Less than 0.05 ppm (part per million) of formaldehyde.
   b. Less than 0.50 mg/cubic meter of total volatile organics.
   c. Less than 50 ug/cubic meter of total particulates.
   d. Less than 1.0 ppb (part per billion) 4-PC.
   e. Test over a 96 hour time period.
   f. Submit compliance table.
2. Carpet to be delivered with a recycle bag for recycling of the plastic film used to protect the Microencapsulated Tackifier.

3. All carpet products must pass the University of Pittsburgh protocol for toxicity being “no more toxic than wood” when burned under the same conditions.

4. Carpet to be a reduction barrier to radon flow.

5. Carpet to provide asbestos enclosure properties.
   a. Enclosure means an airtight, impermeable, permanent barrier around ACBM (Asbestos Containing Building Material) to prevent the release of asbestos fibers into the air.

6. Carpet to be installed without the use of wet adhesives.

7. Company to have an in-place, operational recycling program for product (at the end of its useful life) and manufacturing waste. Program shall recycle 100% of the product in the same operation. This program shall not consist of incineration or warehousing.

2.3 PERFORMANCE ASSURANCE – TESTING

A. Test reports shall be submitted for all performance assurance specifications listed below.

B. All products must meet requirements listed below.

C. All submitted test numbers shall represent average results for production goods of the referenced style.

D. Required Test Reports

1. Flooring Radiant Panel

   ASTM E-648 or NFPA 253: Class 1 (CRF greater than 0.45 Watts/Sq. Cm)

2. Backing Cellular make-up: Closed cell

   Microscopic – As manufactured

3. Backing Cellular make-up: Closed Cell

   Microscopic – After 50,000 Phillips Chair Cycles

4. VOC Chamber Testing Results

   ASTM D 5116: Passing 1994 State of Washington Protocol

5. University of Pittsburgh Protocol (LC-50) for toxicity: “no more toxic than wood” when burned under the same conditions

6. Radon Flow Barrier Testing – Certified Lab

   Flow Reduction Barrier

7. Moisture Barrier

   Moisture Penetration by Impact @ 10 psi: No Penetration after 10,000 impacts

8. Air Permeability of Textile Fabrics: No air flow (0.0 cubic ft./min)

9. Seam Integrity after Phillips Chair Test:

   Seam to remain intact after 50,000 cycles

10. Delamination of Secondary Backing of Pile Floor Coverings

    ASTM D-3936: No delamination

11. Vetterman Drum Test: Minimum 3
12. Lightfastness
    AATCC 134: Min 4 after 100 AFU
13. Static Propensity
    AATC 134: 3.0 KV or Less
14. Static Coefficient of Friction
    ASTM C – 1028: Passes ADA requirements
15. Backing Density
    ASTM D 1667: 18.5 lbs/cu ft +/- 5%
16. Backing Compression Set
    ASTM D 1667: Max – 10%
17. Backing Compression Deflection
    ASTM D 1667: Min 7 lbs/sq. in. at 25%

2.4 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: If necessary, provide a latex based Portland cement patching compound.

B. Adhesives. Infinity Pressure-sensitive adhesive

C. Vapor/PH reducer: As specified in Section 072613

D. Edge Strips: Extruded or molded heavy-duty rubber with minimum 2-inch wide anchorage flange, color as selected by Architect.

PART 3 - EXECUTION

3.1 PRE-INSPECTION AND PREPARATION

A. All floors must be inspected and approved by a manufacturing representative and the installation contractor prior to installation of carpet.

B. There will be no exceptions to the provisions stated on the Manufacturer's installation instructions.

1. Floor Inspection – The floor must be structurally sound and dry prior to installation. Any curing chemicals, sealers, finishers or other chemical treatments used on floors must be chemically and physically compatible with the backing and adhesive systems.

2. Floor Debris Cleaning – Clean the floor of all excess concrete spots, solid debris or paint spots using suitable scraping methods. Completely remove all wax, dirt, grease, paints or old adhesives (especially cutback or emulsion). Do not use solvents to clean the floor. Do not use an oil-based sweeping compound.

3. Floor Patching and Leveling – All floors should be level to assure good installation. Concrete floors should be troweled smooth and should conform to the standard specifications as recommended by the Portland Cement Association. The floor should be flat to within 1/8" in 10 feet.

Cracks, holes, and depressions can be filled using a good grade of Portland Cement/Latex based patch material. Do not install over loose tile (VAT, VCT or others).

4. Floor Cleaning – Sweep and vacuum the floor after patching and debris removal. Do not use an oil-based sweeping compound. Make sure all perimeter areas are clean. Smooth, nonporous floors should be damp mopped prior to product installation.

5. Floor Priming *(General)* - All porous, gritty, chalky and dusty surfaces should be primed. All patched areas must be fully primed. Surfaces that are nonporous do not require primer. These surfaces must be cleaned as noted above. Primer can be applied using a paint roller. Allow the primer to dry completely.

3.2 INSTALLATION

A. Product installation to proceed as specified in the Manufacturer's installation instructions. Determine the lay direction of the carpet based on building design and installation efficiencies.

1. Place (snap) a white chalk line in the center of the room in the lay direction. Do not use blue or red chalk.

2. Starting in a corner

A. All rubbish, wrappings, debris, trimmings, etc. to be removed from the site and disposed of properly.

B. All usable scraps of carpet should be left for use by the owner.

C. Carpet to be completely vacuumed using a beater brush/bar commercial vacuum after installation.

D. Carpet to be protected

1. Of one quadrant, install tiles in a pyramid fashion.

3.3 PROTECTION AND CLEANING

A. As needed from damage from other trades.

End of Section 096800

This page left intentionally blank.
.

SECTION 099113

EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Concrete.
2. Clay masonry.
3. Concrete masonry units (CMUs).
4. Steel and iron.
5. Galvanized metal.
6. Aluminum (not anodized or otherwise coated).
7. Copper.
8. Wood.
9. Portland cement plaster (stucco).
10. Gypsum board.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates.
2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
3. Section 055213 "Pipe and Tube Railings" for shop priming pipe and tube railings.
4. Section 099123 "Interior Painting".

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Indicate VOC content.

B. Samples for Initial Selection: For each type of topcoat product.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 QUALITY ASSURANCE

A. Paint Contractor shall have a minimum of five years documented experience in application of paints and coatings specified. Contractor shall maintain qualified painting crews during entire painting process.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

A. Do not provide any extra materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Frazee Paint; Comex Group.
2. Sherwin-Williams Company (The).
3. Vista Paint Corporation.
4. Or equal.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Colors: As selected by Architect from manufacturer's full range. Material Quality: Provide manufacturer's best quality paint material of the various types specified that are factory formulated and recommended by manufacturer for application indicated. Use only paint material containers displaying manufacturer's product identification.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: District reserves the right to invoke the following procedure:

1. District will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. District may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

2.4 BLOCK FILLERS

A. Exterior Latex Block Filler:

1. Frazee Paint; C302 Ultratech Block Filler.
2. Sherwin-Williams Company; B25W25 Block Filler.
3. Vista Paint Corporation; 40 Block Kote.
4. Or equal.

2.5 PRIMERS/SEALERS

A. Concrete and Masonry Alkali-Resistant Primer:

1. Frazee Paint; C251 FlexLox Masonry Primer.
2. Sherwin-Williams Company; Loxon Primer A24W8300
3. Vista Paint Corporation; 4600 Uniprime.

4. Or equal.

B. Acrylic Bonding Primer (for previously painted or glossy surfaces):

1. Frazee Paint; 168 Prime Plus.
2. Sherwin-Williams Company; PrepRite ProBlock B51W8020.
3. Vista Paint Corporation; 4000 Uniprime.
4. Or equal.

2.6 METAL PRIMERS

A. Acrylic Ferrous Metal Primer:

1. Frazee Paint; C309 Ultra Tech Metal Primer.
2. Sherwin-Williams Company; ProCryl B66.
3. Vista Paint Corporation; 4800 Metal Pro Acrylic Primer.
4. Or equal.

B. Acrylic Galvanized and Non-Ferrous Metal Waterborne Primer. (Galvanized metal shall be acid-etched with manufacturer's recommended phosphoric acid solution and rinsed before priming.):

1. Frazee Paint; C309 Ultra Tech Metal Primer.
2. Sherwin-Williams Company; ProCryl B66.
3. Vista Paint Corporation; 4800 Metal Pro Acrylic Primer.
4. Or equal.

2.7 WOOD PRIMERS

A. Exterior Latex Wood Primer:

1. Frazee Paint; 168 Prime Plus.
2. Sherwin-Williams Company; Prep Rite Pro Block B51W8020.
3. Vista Paint Corporation; 4200 Terminator.
4. Or equal.

2.8 EXTERIOR LATEX PAINTS

A. Exterior Acrylic Latex (Flat):

1. Frazee Paint; 203 Duratec II.
2. Sherwin-Williams Company; A-100 Flat A6.
3. Vista Paint Corporation; 2000 Duratone.
4. Or equal.

B. Exterior Acrylic Latex (Semigloss):

1. Frazee Paint; 124 Mirroglide Acrylic Semigloss.

2. Sherwin-Williams Company; Sologloss Acrylic Semigloss A 76 Series.
3. Vista Paint Corporation; 8400 Carefree.
4. Or equal.

C. Exterior Acrylic Latex (Gloss):

1. Frazee Paint; 143 Mirroglide Acrylic Gloss.
2. Sherwin-Williams Company; Sologloss Acrylic Gloss A77 Series.
3. Vista Paint Corporation; 8500 Carefree Gloss.Or equal.
4. Or equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMUs): 12 percent.
3. Wood: 15 percent.
4. Portland Cement Plaster: 12 percent.
5. Gypsum Board: 12 percent.

C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Clay Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content of surfaces or alkalinity of mortar joints to be painted exceed that permitted in manufacturer's written instructions.

F. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

G. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 2.
2. SSPC-SP 3.
3. SSPC-SP 7/NACE No. 4.
4. SSPC-SP 11.

H. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

I. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

J. Exterior Plaster Substrates: Verify that exterior plaster has fully cured.

K. Aluminum Substrates: Remove surface oxidation per SSPC-SP1.

L. Exterior Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

M. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates

N. Wood Substrates:

1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Apply paints to meet manufacturer's recommended dry film thickness per coat.
3. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
4. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
5. Paint entire exposed surface of window frames and sashes.
6. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
7. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed to view:

a. Equipment, including panelboards and switch gear.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: District may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:

1. Latex System:

a. Prime Coat: Concrete and Masonry Alkali-Resistant Primer.
b. Intermediate Coat: Exterior Acrylic Latex.
c. Topcoat: Exterior Acrylic Latex, low gloss.

B. Concrete Substrates, Traffic Surfaces:

1. Latex Floor Paint System:

a. Prime Coat: Latex Floor Paint, matching topcoat.
b. Intermediate Coat: Latex Floor Paint, matching topcoat.
c. Topcoat: Latex Floor Paint, low gloss.

C. Clay-Masonry Substrates:

1. Latex System:

a. Prime Coat: Concrete and Masonry Alkali-Resistant Primer.
b. Intermediate Coat: Exterior Acrylic Latex.
c. Top Coat: Exterior Acrylic Latex, low gloss.

D. CMU Substrates:

1. Latex System:

a. Prime Coat: Exterior Latex Block Filler.
b. Intermediate Coat: Exterior Acrylic Latex.
c. Topcoat: Exterior Acrylic Latex, low gloss.

E. Steel and Iron Substrates:

1. Acrylic System:

a. Prime Coat: Acrylic Ferrous Metal Primer.
b. Intermediate Coat: Exterior Acrylic Latex.
c. Topcoat: Exterior Acrylic Latex, low gloss.

F. Galvanized-Metal Substrates:

1. Latex System:

a. Pretreatment: Non-ferrous metal pretreatment recommended by paint system manufacturer.
b. Prime Coat: Acrylic Galvanized and Non-Ferrous Metal Waterborne Primer.
c. Topcoats: Two coats of Exterior Acrylic Latex, low gloss.

G. Aluminum Substrates:

1. Latex System:

a. Prime Coat: Quick Dry Aluminum Primer.
b. Intermediate Coat: Exterior Latex, match topcoat.
c. Topcoat: Exterior Latex, low gloss.

H. Wood Substrates: Glued-laminated construction.

1. Latex System:

a. Prime Coat: Exterior Latex Wood Primer.
b. Intermediate Coat: Exterior Acrylic Latex.
c. Topcoat: Exterior Acrylic Latex, low gloss.

I. Copper Substrates:

1. Latex System:

a. Prime Coat: Primer, quick dry, for aluminum.
b. Topcoat: Latex, exterior, low sheen.

J. Wood Substrates: Exposed framing.

1. Latex System:

a. Prime Coat: Exterior Latex Wood Primer.
b. Intermediate Coat: Exterior Acrylic Latex.
c. Topcoat: Exterior Acrylic Latex, low gloss.

K. Wood Substrates: Wood trim and Architectural woodwork.

1. Latex System:

a. Prime Coat: Exterior Latex Wood Primer.
b. Intermediate Coat: Exterior Acrylic Latex.
c. Topcoat: Exterior Acrylic Latex, low gloss.

L. Wood Substrates: Wood-based panel products.

1. Latex System:

a. Prime Coat: Exterior Latex Wood Primer.
b. Intermediate Coat: Exterior Acrylic Latex.
c. Topcoat: Exterior Acrylic Latex, low gloss.

M. Portland Cement Plaster Substrates:

1. Latex System

a. Prime Coat: Exterior Acrylic Latex.
b. Topcoat: Exterior Acrylic Latex, low gloss.

END OF SECTION 099113

SECTION 099123

INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Concrete.
2. Concrete masonry units (CMUs).
3. Steel and iron.
4. Galvanized metal.
5. Wood.
6. Gypsum board.
7. Plaster.
8. Acoustic panels and tiles.
9. Spray-textured ceilings.
10. Cotton or canvas insulation covering.
11. ASJ insulation covering.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for shop priming structural steel.
2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
3. Section 099113 “Exterior Painting”.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Initial Selection: For each type of topcoat product.

C. Indicate VOC content.

D. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

E. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 QUALITY ASSURANCE

A. Paint Contractor shall have a minimum of five years documented experience in application of paints and coatings specified. Contractor shall maintain qualified painting crews during entire painting process.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

A. Do not provide any extra materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Frazee Paint; Comex Group.
2. Sherwin-Williams Company (The).
3. Vista Paint Corporation.
4. Or equal.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Colors: As indicated on the Finish Schedule in the Drawings.

C. Material Quality: Provide manufacturer's best quality paint material of the various types specified that are factory formulated and recommended by manufacturer for application indicated. Use only paint material containers displaying manufacturer's product identification.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: District reserves the right to invoke the following procedure:

1. District will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. District may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

2.4 BLOCK FILLERS

A. Interior/Exterior Latex Block Filler:

1. Frazee Paint; C302 Block Filler.
2. Sherwin-Williams Company; B25W25 Block Filler.
3. Vista Paint Corporation; 40 Block Kote.
4. Or equal.

2.5 PRIMERS/SEALERS

A. Interior Latex Primer/Sealer for gypsum board:

1. Frazee Paint; C153 Ultratech Low VOC Primer.

2. Sherwin-Williams Company; ProMar 200 Zero VOC Primer, B28W2600.
3. Vista Paint Corporation; 6000 EarthCoat Primer.
4. Or equal.

B. Interior Latex Primer/Sealer for concrete, plaster and porous surfaces:

1. Frazee Paint; 168 Prime Plus.
2. Sherwin-Williams Company; Prep Rite ProBlock B51W8020.
3. Vista Paint Corporation; 4000 Uniprime.
4. Or equal.

C. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

2.6 METAL PRIMERS

A. Acrylic Ferrous Metal Primer:

1. Frazee Paint; C309 Ultra Tech Metal Primer.
2. Sherwin-Williams Company; ProCryl B66.
3. Vista Paint Corporation; 4800 Metal Primer.
4. Or equal.

B. Acrylic Non-Ferrous Metal Primer:

1. Frazee Paint; C309 Ultra Tech Metal Primer.
2. Sherwin-Williams Company; ProCryl B66.
3. Vista Paint Corporation; 4800 Metal Pro Acrylic Metal Primer.
4. Or equal.

C. Non-Ferrous Metal Pretreatment:

1. Frazee Paint; Krud Kutter Metal Clean and Etch.
2. Sherwin-Williams Company; GLL Clean ‘n Etch.
3. Vista Paint Corporation; Jasco Prep ‘n Prime.
4. Or equal.

2.7 WOOD PRIMERS

A. Interior Latex Wood Primer:

1. Frazee Paint; 168 Prime Plus.
2. Sherwin-Williams Company; Pro Block B51W8020.
3. Vista Paint Corporation; 4000 Uniprime.
4. Or equal.

2.8 ACRYLIC LATEX PAINTS

A. Interior Acrylic Latex (Flat):

1. Frazee Paint; 015 Majestic II.
2. Sherwin-Williams Company; ProMar 200 Zero VOC Flat B30W2600.
3. Vista Paint Corporation; 8100 Carefree.
4. Or equal.

B. Interior Acrylic Latex (Eggshell):

1. Frazee Paint; 022 LoGlo.
2. Sherwin-Williams Company; ProMar 200 Zero VOC Eggshell B20W2600.
3. Vista Paint Corporation; 8300 Carefree.
4. Or equal.

C. Interior Acrylic Latex (Low Sheen):

1. Frazee Paint; 126 Mirroglide Low Sheen.
2. Sherwin-Williams Company; Solo Acrylic Eggshell A 75 Series.
3. Vista Paint Corporation; 8200 Carefree Velvasheen.
4. Or equal.

D. Interior Acrylic Latex (Semigloss):

1. Frazee Paint; 124 Mirroglide Semigloss.
2. Sherwin-Williams Company; Solo Acrylic Semigloss A 76 Series.
3. Vista Paint Corporation; 8400 Carefree.
4. Or equal.

E. Interior Acrylic Latex (Gloss):

1. Frazee Paint; 143 Mirroglide Gloss.
2. Sherwin-Williams Company; Solo Acrylic Gloss A 77 Series.
3. Vista Paint Corporation; 8500 Carefree.
4. Or equal.

F. Institutional Low-Odor/VOC Latex (Flat):

1. Frazee Paint; C129 Ultratech Low VOC Flat.
2. Sherwin-Williams Company; ProMar 200 Zero VOC Flat B30-2600.
3. Vista Paint Corporation; 6100 EarthCoat.
4. Or equal.

G. Institutional Low-Odor/VOC Latex (Eggshell):

1. Frazee Paint; C132 Ultratech Low VOC Eggshell.
2. Sherwin-Williams Company; ProMar 200 Zero VOC Eggshell B20-2600.
3. Vista Paint Corporation; 6300 EarthCoat.

4. Or equal.

H. Institutional Low-Odor/VOC Latex (Semigloss):

1. Frazee Paint; C153 Ultratech Low VOC Semigloss.
2. Sherwin-Williams Company; ProMar 200 Zero VOC Semigloss B31-2600.
3. Vista Paint Corporation; 6400 EarthCoat.
4. Or equal.

2.9 DRY FOG/FALL COATINGS

A. Latex Dry Fog/Fall:

1. Frazee Paint; 504 Latex Dry Fall.
2. Sherwin-Williams Company; Low VOC WB Dryfall Flat B42W81.
3. Vista Paint Corporation; DF12 Dry Fall.
4. Or equal.

2.10 FLOOR COATINGS

A. Interior/Exterior Clear Concrete Floor Sealer (Water Based):

1. Frazee Paint; Monopole Aquaseal SS.
2. Sherwin-Williams Company; H&C WL Sealer.
3. Vista Paint Corporation; Monpole Aquaseal SS.
4. Or equal.

B. Latex Floor Enamel (Non-skid, low gloss):

1. Frazee Paint; Epoxacryl Solid Color Concrete Stain.
2. Sherwin-Williams Company; Armorseal Tread-plex B90W111.
3. Vista Paint Corporation; Acripoxy 400.
4. Or equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Fiber-Cement Board: 12 percent.

3. Masonry (Clay and CMUs): 12 percent.
4. Wood: 15 percent.
5. Gypsum Board: 12 percent.
6. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Plaster Substrates: Verify that plaster is fully cured.

E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.

F. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

G. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 2.
2. SSPC-SP 3.
3. SSPC-SP 11.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue, per SSPC-SP1, from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

J. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

K. Plaster Substrates: Do not begin paint application until plaster is fully cured and dry.

L. Spray-Textured Ceiling Substrates: Do not begin paint application until surfaces are dry.

M. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

a. Equipment, including panelboards and switch gear.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Tanks that do not have factory-applied final finishes.
h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
i. Mechanical equipment that is indicated to have factory-primed finish for field painting.
j. Electrical equipment that is indicated to have a factory-primed finish for field painting.

2. Paint the following work where exposed in occupied spaces:

a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
h. Other items as directed by Architect.
i. Exposed mechanical ductwork.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: District may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.

2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:

1. Latex System:

a. Prime Coat: Interior Latex Primer/Sealer for concrete, plaster and porous surfaces.
b. Intermediate Coat: Interior Acrylic Latex.
c. Topcoat: Interior Acrylic Latex, low gloss.

B. Concrete Substrates, Traffic Surfaces:

1. Latex Floor Enamel System:

a. Prime Coat: Latex Floor Enamel.
b. Topcoat: Latex Floor Enamel.

2. Water-Based Clear Sealer System:

a. Prime Coat: Interior/Exterior clear concrete floor sealer (water based).
b. Topcoat: Interior/Exterior clear concrete floor sealer (water based).

C. CMU Substrates:

1. Latex System:

a. Block Filler/Prime Coat: Interior/Exterior Latex Block Filler.

b. Intermediate Coat: Interior Acrylic Latex.
c. Topcoat: Interior Acrylic Latex, low gloss.

D. Steel Substrates:

1. Latex System:

a. Prime Coat:Acrylic Ferrous Metal Primer.
b. Intermediate Coat: Primer, Interior Acrylic Latex.
c. Topcoat: Interior Acrylid Latex, low gloss.

E. Galvanized-Metal and Non-Ferrous Substrates:

1. Latex System:

a. Pretreatment: Non-Ferrous Metal Pretreatment.
b. Prime Coat: Acrylic Non-Ferrous Metal Primer.
c. Topcoat: Two coats of Interior Acrylic Latex, low gloss.

F. Wood Substrates: Exposed framing.

1. Latex System:

a. Prime Coat: Interior Latex Wood Primer.
b. Intermediate Coat: Interior Acrylic Latex.
c. Topcoat: Interior Acrylic Latex, low gloss.

G. Wood Substrates: Wood trim, Architectural woodwork, Doors, Windows and wood board paneling.

1. Latex System:

a. Prime Coat: Interior Latex Wood Primer.
b. Intermediate Coat: Interior Acrylic Latex.
c. Topcoat: Interior Acrylic Latex, low gloss.

H. Wood Substrates: Wood paneling and casework.

1. Latex System:

a. Prime Coat: Interior Latex Wood Primer.
b. Intermediate Coat: Interior Acrylic Latex.
c. Topcoat: Interior Acrylic Latex, low gloss.

I. Spray-Textured Ceiling Substrates:

1. Latex, (Flat) System:

a. Prime Coat: Interior Latex Primer/Sealer appropriate for surface.
b. Topcoat: Latex Dry Fog/Fall.

J. Gypsum Board Substrates:

1. Latex System:

a. Prime Coat: Interior Latex Primer/Sealer for gypsum board.
b. Intermediate Coat: Interior Acrylic Latex.
c. Top Coat: Interior Acrylic Latex, low gloss.

K. Plaster Substrates:

1. Latex System:

a. Prime Coat: Interior Latex Primer/Sealer for concrete, plaster and porous surfaces.
b. Intermediate Coat: Interior Acrylic Latex.
c. Top Coat: Interior Acrylic Latex, low gloss.

END OF SECTION 099123

SECTION 101000

MARKERBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Porcelain enamel markerboards.

1.3 SUBMITTALS

A. Product Data: For each type of visual display board indicated.

B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors and textures available for the following:

1. Markerboards: Actual sections of porcelain enamel finish for each type of markerboard required.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide vinyl-fabric-faced tackboards with the following surface-burning characteristics as determined by testing assembled materials composed of facings and backings identical to those required in this Section per ASTM E 84 by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify vinyl-fabric-faced tackboards with appropriate markings of applicable testing and inspecting agency.

1. Flame Spread: 25 or less.

2. Smoke Developed: 100 or less.

1.5 WARRANTY

A. General Warranty: The special porcelain enamel chalkboard warranty specified in this Article shall not deprive the Owner of other rights the Owner may have

under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Porcelain Enamel Chalkboard Warranty: Submit a written warranty executed by manufacturer agreeing to replace porcelain enamel chalkboards that do not retain their original writing and erasing qualities, become slick and shiny, or exhibit crazing, cracking, or flaking within the specified warranty period, provided the manufacturer's written instructions for handling, installation, protection, and maintenance have been followed.

1. Warranty Period: 50 years from date of Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Markerboard/Tackboard Manufacturer: Subject to compliance with requirements, provide products by one of the following:

1. A-1 Visual Systems.
2. Claridge Products and Equipment, Inc.
3. Greensteel, Inc.
4. Lemco, Inc.
5. Nelson Adams Company.

B. Map Rail Manufacturer: Rand McNally

2.2 MATERIALS

A. Porcelain Enamel Markerboards: Balanced, high-pressure-laminated, porcelain enamel chalkboards of 3-ply construction consisting of face sheet, core material, and backing.

1. Face Sheet: 0.024-inch enameling grade steel especially processed for temperatures used in coating porcelain on steel. Coat exposed face and edges with a 3-coat process consisting of primer, ground coat, and color cover coat. Coat concealed face with a 2-coat process consisting of primer and ground coat. Fuse cover and ground coats to steel at manufacturer's standard firing temperatures, but not less than 1200 deg F.
2. Face Sheet: 0.024-inch-, "Vitracite," porcelain enamel clad, Type 1, stretcher-leveled aluminized-steel face sheet, as manufactured by Claridge Products and Equipment. Fuse porcelain enamel coating to steel at approximately 1000 deg F.

a. Cover Coat: Provide manufacturer's standard, light-colored, special writing surface with gloss finish intended for use with erasable dry markers.

3. Core: 3/8-inch- thick, particleboard core material complying with requirements of ANSI A208.1, Grade 1-M-1.

4. Core for Sliding Units: 3/8-inch- heavy kraft-paper, honeycomb core material.

5. Backing Sheet: 0.015-inch- thick, aluminum-sheet backing.

6. Laminating Adhesive: Manufacturer's standard, moisture-resistant, thermoplastic-type adhesive.

2.3 SLIDING UNITS

A. Horizontal Sliding Markerboard Panels: Provide panels required that operate smoothly under manual activation without vibration or chatter.

1. Hardware: Manufacturer's standard horizontal sliding hardware consisting of overhead extruded-aluminum track with nylon ball-bearing rollers and channel-shaped bottom guides.

2.4 ACCESSORIES

A. Metal Trim and Accessories: Fabricate frames and trim of not less than 0.062-inch- thick, extruded-aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single-length units. Keep joints to a minimum. Miter corners to a neat, hairline closure.

1. Map Rail: Furnish Rand McNally “Ranally” map and display rail with heavy-duty hooks and roller shade brackets.

2. Flag Holder: Provide one flag holder for each room.

2.5 FABRICATION

A. Porcelain Enamel markerboards: Laminate facing sheet and backing sheet to core material under pressure with manufacturer's recommended flexible, waterproof adhesive.

2.6 FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

C. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine wall surfaces, with Installer present, for compliance with requirements and other conditions affecting installation of visual display boards.

1. Surfaces to receive markerboards shall be free of dirt, scaling paint, and projections or depressions that would affect smooth, finished surfaces of chalkboards or markerboards.
2. Surfaces to receive tackboards shall be dry and free of substances that would impair the bond between tackboards and substrate.
3. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Deliver factory-built visual display boards completely assembled in one piece without joints, where possible. If dimensions exceed panel size, provide 2 or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment.

B. Install units in locations and at mounting heights indicated and according to manufacturer's written instructions. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

C. Coordinate Project-site-assembled units with grounds, trim, and accessories. Join parts with a neat, precision fit.

3.3 ADJUSTING AND CLEANING

A. Verify that accessories required for each unit have been properly installed and that operating units function properly.

B. Clean units according to manufacturer's written instructions.

END OF SECTION 101000

This page left intentionally blank.

.

SECTION 101400

ENVIRONMENTAL GRAPHICS

PART 1 - GENERAL

1.1 SUMMARY

A. Related Documents: Provisions established within the Contract Documents, consisting of specifications, graphics schedule and design drawings, are collectively related to this Section.

B. Section Includes: Requirements for fabricating and installing project signage. Project sign types are:

1. Sign Type 2 – Disabled Access Identification – wall mounted
2. Sign Type 3 – Exterior Room ADA Identification
3. Sign Type 4 – Exterior Directory
4. Sign Type 5 - Disabled Access Directional
5. Sign Type 6 – Building ID
6. Sign Type 10 – Building Identification – dimensional letters/numbers
7. Sign Type 11 – Vinyl Copy or Plaque on Glass
8. Sign Type 12 – Recessed dimensional letters
9. Sign Type 21 – Room Directional
10. Sign Type 30 – Interior ADA Room Identification
11. Sign Type 32 – Interior ADA Room Identification – with name insert
12. Sign Type 33 – Title 24 Restroom Identification Signs
13. Sign Type 34 – Restroom ADA Identification
14. Sign Type 35 – Assisted Listening
15. Sign Type 41 – Exit Identification ADA
16. Sign Type 42 – Emergency Evacuation Plan
17. Sign Type 43 – Room Occupancy
18. Sign Type 44 – Elevator ID & Directional
19. Sign Type 50 – Level ID
20. Sign Type 51 – Fire Equipment
21. Sign Type 60 – Letter Insert Frame
22. Sign Type 61 – Information

C. References

1. South Coast Air Quality Management District (SCAQMD) Rule #1168
2. Green Seal Standard GS-11

D. Contractor's Responsibilities:

1. Provide all services, labor, materials, and product required to fabricate and install project signage and graphic items detailed, noted and specified in the Contract Documents.

2. Obtain and pay for required permits and taxes.
3. Provide engineering design as required for approvals and permits.
4. Provide graphic art services for production of life safety evacuation plans and directory map plans, and coordinate necessary reviews and approvals with regulatory agencies prior to fabrication.
5. Provide typesetting, copy layouts and all other finished artwork unless otherwise specified.
6. Provide engineering services as required to develop complete engineering drawings for project signage. Drawings shall be reviewed, stamped and signed by a California-registered structural engineer.
7. Provide complete shop drawings, drawn to scale, of all signing elements.
8. Visit site to inspect existing conditions and verify dimensions that are related to fabrication and installation of project signage.
9. Thoroughly review contract documents, checking conditions and dimensions shown. Contractor shall immediately notify Owner's Representative of any discrepancies in contract documents or field dimensions and conditions.

E. Order of Precedence:

1. Written dimensions on the drawings shall have precedence over scaled dimensions.
2. Specifications shall take precedence in quality over information noted on the drawings.

1.2 QUALITY ASSURANCE

A. Suppliers: Obtain all products from approved suppliers as identified in Part 2 of this Section.

B. Installer: Installation shall be performed by installer specialized and experienced in work similar to that required for this project.

C. Subcontractors: Subject to same submittal, work experience and supervision requirements as the contractor.

D. Regulatory Requirements: Products shall meet requirements of all applicable codes pertaining to signage, including, but not limited to:

1. Americans With Disabilities Act Accessibility Guidelines (ADAAG) and local amendments and modifications.
2. California Title 24.
3. Engineering codes and requirements.

E. Materials: Materials used in the execution of this work shall be new and of the highest quality available to meet the specific requirements noted in Part 2 of this Section.

1.3 SUBMITTALS

A. Contractor Drawings:

1. Shop Drawings: Provide complete shop drawings, drawn to scale, detailing interior construction, placement of lighting, electrical equipment, method of service, access and full-size details affecting exterior appearance. Submit one complete set in reproducible form to Owner's Representative for review and approval prior to fabrication.
2. Engineering Drawings: Provide complete structural design drawings, drawn to scale, showing engineering details and calculations for sign structures, concrete footings, bases, rebar and building attachments as required for compliance with local codes. Submit one complete set in reproducible form to Owner's Representative for review and approval prior to fabrication.
3. Lettering Patterns: Submit two full-size lettering patterns of sign messages, symbols or other graphic elements related to sign fabrication for approval by Owner's Representative.
4. Vinyl Copy: Submit two mounted, one-line samples of each size, color, type style and font on pre-spaced tapes for approval by Owner's Representative.
5. Screen Processed Copy: Submit two blueline prints of film positives for approval by the Owner's Representative.
6. Evacuation Maps: Prior to fire agency review, submit two color prints of camera-ready artwork to Owner's Representative for review. Include all information as required in Title 19 (3.09) of the California Code of Regulations and any other regulatory agencies.

B. Technical Specifications: Submit technical specifications of paint, coatings and other finish materials. Include actual samples of these finishes. Submit two copies for approval by Owner's Representative.

C. Material Data:

1. Submit material cost data for all materials required to construct the work in place. The material cost shall reflect the actual cost of material without mark-up.
2. Provide manufacturer's information/data sheet or a letter from the manufacturer indicating the location of manufacture, amount of recycled content (post consumer and industrial percentage) in the product, and the location of raw material harvest if within 500 miles of the project site.
3. Submit manufacturer's descriptive technical data and material safety data sheet for all adhesives and sealants indicating the volatile organic compound level in grams/liter.

D. Samples:

1. Paint Color Samples: Submit samples of paint for review of color, sheen and texture, on 4"x 6" aluminum sheets to simulate actual finish. Contractor shall resubmit each sample as requested until required color, sheen and texture is achieved. Submit (2) two copies each for review by Owner's Representative.
2. Hardware Samples: Submit samples of hardware such as hinges, locks and fasteners that will be exposed to view. Submit two copies each for review by Owner's Representative.

3. Concrete Finish Samples: Submit sample of concrete finish for pre-cast or cast-in place exterior signs and sign bases. Submit two copies to Owner's Representative for review.

E. Prototypes: Submit complete, finished prototypes to Owner's Representative for review as requested. Subsequent fabrication of contract work shall conform with the accepted prototypes, which may be used on the job. Submit one sample each of the following:

1. Sign Types 2, 3, 4, 10, 12, 20, 21 and 23: One complete sign including copy application.
2. Sign Types 5, 6, 11 and 24: Not required.
3. Sign Type 10: One finished letter.
   a. Prototype review shall be conducted at fabricator's shop and job site. Prototypes may be used on job, if accepted.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery, installation and/or storage of signs to meet schedule requirements as instructed by Owner's Representative.

B. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

C. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.

D. Store products in location that is protected from weather, temperature, and other harmful conditions as recommended by supplier.

E. In the event of phased installed, store products in a lockable location as agreed upon with Owner's Representative.

F. Handle products in accordance with manufacturer's instructions.

1.5 RIGHTS AND GUARANTEE

A. Design Rights: Contractor is hereby granted limited right to the designs as shown and specified herein for the sole purpose of completing contractual obligations to fabricate and install project signage. Contractor may not manufacture, reproduce or exhibit these designs, or modify them for any other purpose with prior written consent.

B. Project Warranty: Contractor shall guarantee his work for a period of one year from the date of acceptance or in accordance with the provisions of Division 1, whichever is greater.

C. Manufacturer's Warranty: Submit manufacturer's standard warranty document executed by authorized company official.

PART 2 - PRODUCTS

2.1 SIGNAGE SYSTEMS

A. Acceptable Manufacturers:

1. Acrylic Polyurethane: Matthews Paint Company, or approved equal.
2. Adhesives: General Electric, Dow Corning or approved equal.
3. Interior Digital Color Prints: 1200dpi Design Winder or approved equal.
4. Screen-Printing Inks: Warnow's Decal Du-Well Enamel or approval equal.
5. Vinyl Graphics: 3M Scotchcal & Scotchlite Film, Calon II or approved equal.

2.2 SIGN MATERIALS

A. Aluminum: Provide angles, extrusions, channels, shapes, tubes and panel flat, aluminum plate or sheets of thickness required to prevent oil-canning.

1. Provide alloy 5005-h34 for anodized finishes.
2. Provide alloy 3003-h14, mill finish, for painted finishes.

B. Structural Steel and Aluminum: Provide structural steel and aluminum shapes, channels and extrusions of wall thickness and alloy temper required to meet or exceed engineering requirements and satisfy applicable codes.

C. Steel Tubing: Provide material conforming to specifications for electric resistance welded carbon and alloy steel mechanical tubing ASTM A513. Remove scale before finishing. Provide wall thickness to meet structural requirements.

D. Stainless Steel: Provide stainless steel alloy #304. Where polished finish is specified, it shall be standard #8 mirror finish. Where brushed finish is specified, it shall be standard #4 finish. Brushed grain shall be horizontal, unless otherwise specified.

E. Acrylic Plastic: Provide acrylic of thickness indicated on the drawings, but not less than 1/8" thick, unless otherwise specified. Cement used to fabricate plastic parts shall be #4 cement as manufactured by industrial polychemical or equal. Plastics shall be of uniform color and translucence as supplied by manufacturer.

F. Tactile (ADA) Signs: Provide sign panels, consisting of light-sensitive coating (exterior grade photopolymer) on polyester or steel backing. Back-up substrate material shall consist of 1/4” acrylic panel painted in color shown on drawings. When aluminum back-up substrate material is specified, photopolymer on aluminum shall be used. Laminate together with VHB industrial tape/adhesive as required.

G. Paint: Provide two component acrylic polyurethane with low volatile organic compounds and ultraviolet (UV) inhibitors.

1. All interior paint must comply with volatile organic compound and chemical component limits of Green Seal Standard GS-11.

H. Concrete: Provide formed concrete, cast in place or precast, using 16 ga. galvanized iron metal forms for all concrete work exposed above grade. Exposed surfaces shall be finished free of air pockets, pits, exposed aggregate or other imperfections.

I. Vinyl Material: Provide high performance vinyl products guaranteed for a minimum of seven years of durability for exterior applications. Application of vinyl films shall meet manufacturer's specifications and recommendations.

1. Opaque Vinyl Graphics: Provide machine-cut vinyl graphics as shown on drawings. Graphics and copy shall be pre-spaced on 3m series scpm-3 application tape or equal.
2. Reflective Graphics: Provide reflective letters and machine-cut vinyl graphics as shown on drawings. Graphics shall be pre-spaced on 3M series scpm-3 application tape or equal.

J. Message Strips: Provide pre-trimmed acetate or acrylic message strips to sizes and quantities specified. Lexan shall be clear and .005" minimum thickness.

K. Digital Color Prints: Provide digital color prints as noted on the drawings for interior or exterior application. Shall warranty the durability performance of such prints for two years for exterior use and seven years for interior use.

L. Indoor Adhesives: All indoor adhesive products must comply with the volatile organic compound limits of SCAQMD Rule #1168.

M. Indoor Sealants: All indoor sealant products used as fillers must comply with the volatile organic compound limits of the BAAQMD Regulation 8, Rule 51.

2.3 FABRICATION METHODS

A. Exercise highest level of care during fabrication and installation, including:

1. Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes and details of construction.
2. Preassemble signs in the shop to the greatest extent possible to minimize field assembly. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in a location not exposed to view after final assembly.
3. Conceal fasteners if possible; otherwise, located fasteners to appear inconspicuous.
4. Form panels to required size and shape as shown on drawings. Comply with requirements for design, dimensions, finish, color and details of construction.
5. Coordinate dimensions and attachment methods to produce message panels with closely fitted joints. Align edges and surfaces with one another in the relationship indicated.

B. Aluminum

1. Welded Construction: Provide sign cabinets or structures of welded construction with joints filled and finished smooth, unless otherwise noted on the drawings. Exposed fasteners may not be used, except for access panels, which shall be attached with stainless steel flat head screws painted to match adjacent metal.
2. Seamless Construction: Provide signs cabinets of seamless welded construction with edges break formed, and joints welded, ground and finished smooth. Exposed fasteners may not be used, except for access panels, which shall be attached with stainless steel flat head screws painted to match adjacent metal.
3. Structural Reinforcements: Provide sign enclosures or cabinets reinforced with interior structural metal framing as required.
4. Oil-Canning: Adhere panels to structural framing with industrial adhesive or by providing additional welded structural support as required to prevent oil canning.
5. Multi-panel Surfaces: Run grain in the same direction where aluminum and or stainless steel multi-panel surfaces are used.
6. Electrolysis: Prevent corrosive action due to electrolysis by separating ferrous and non-ferrous metals with neoprene or vinyl spacers, or by using stainless steel fasteners.

C. Very High Bond (VHB) 3M Tape: Apply VHB tape as specified and recommended by manufacturer for sign fabrication applications.

1. Pretreat all surfaces prior to the application of VHB tape, removing all oil and foreign matter, and lightly sand bonding surfaces prior to tape application.
2. Prior to removal of the carrier tape, burnish the tape to the first applied surface to activate adhesive properties.
3. Reburnish bonded areas and clamp elements together for time specified by manufacturer.

D. Life Safety Evacuation Plans: Prepare all graphic layouts and camera-ready artwork for plans based upon the design shown in the drawings and as required by the agency responsible for review and approval.

E. Acrylic Signs: Finish all exposed edges of plexiglass smooth with a polished or painted finish as noted on the drawings. Exposed lamination seams shall not be permitted.

F. Exposed Concrete Signs and Bases: Shape, dimension and form concrete bases as detailed and noted on the drawings. Provide steel reinforcing rods in quantities, size and placement as required. Provide wood forms built with metal form liner to produce flat exposed surfaces and smooth edges.

G. Concrete Footings: Provide concrete mixed and poured in accordance with engineering specifications. Provide 16 gauge, galvanized iron metal forms for exposed concrete that is free of air pockets, pits, exposed aggregate or other imperfections, unless otherwise noted. Exposed tops of concrete footings shall be finished with 6” wide mow-strip surround, sloping away from sign structure toward finished grade.

2.4 FINISHING

A. Painted Finish: Prepare surfaces to be painted in accordance with the manufacturer's specifications and recommendations. Pre-treatment of paint finished surfaces to include:

1. Ensure that all surfaces are free of tooling marks, scratches, dings, dents, bondo, joint fillers or foreign matter.
2. Thoroughly sand surfaces to be paint finished as required, using dual action sander with 320 grit paper prior to application of primer and finish coats.
3. Provide sufficient primer coats to achieve a smooth uniform surface.
4. Spray paint all surfaces as required, following paint manufacturer's recommendations concerning thinning, application and drying time.
5. Provide primer coats and top coats of two component acrylic polyurethane with low volatile organic compounds.
6. Provide finish paint containing ultraviolet UV inhibitors and antioxidants as required for highest degree of color and finish retention.
7. Provide satin gloss finish unless otherwise specified.

2.5 COPY APPLICATION

A. General Requirements: Provide Adobe Type I Postscript Font available from Abode Systems for all copy applications except as otherwise noted on drawings. Typestyles shown on drawings are for information only.

1. Provide typestyle available with film or machine cut positives produced by phototypesetter, GSP Sign Maker, or approved equal. Large copy shall be photo-mechanically or digitally enlarged.
2. Ensure that size and placement of copy comply with dimensions for letter height, line spacing and placement as either noted on drawings, in digital files, or final approved lettering patterns.
3. Ensure that baselines of all copy is straight and parallel with top or bottom of sign structure unless otherwise noted.
4. Ensure that edges of letter forms are true and smooth with straight and curved portions representing the specified project typestyle exactly.
5. Ensure that corners of letter forms and numerals are true to form. Rounded letter forms shall extend slightly below the normal baseline per respective typestyle characteristics. All letter forms shall be free of imperfections, ticks and distortion of straight lines and curves.

B. Tactile ADA Signs: Execute tactile ADA signs with typestyle and symbols indicated on the drawings. Include grade II Braille translations. Letter forms shall be crisp and free of imperfection.

1. Symbols, copy and grade II Braille shall be processed from original machine cut or photo-mechanically produced film positives. Individually applied, hand-spaced letters and or symbols will not be accepted.
2. All tactile copy shall be raised a minimum of 1/32" in-relief from the background field.

C. Screened-Printed Copy: Provide photo-mechanically produced screens. Print all copy using fine mesh screens and screening inks.

1. Pretreat surfaces by applying one protective coat of clear acrylic polyurethane.
2. Ensure that the surface of all letters are uniform in color, finish and free of pinholes or imperfections.
3. Match sign message and background colors to approved color samples in every respect for consistency in chroma, value and coverage.
4. Provide sign colors that maintain proper opacity or translucency and are free of blistering, bleeding or fading. Color registration shall be crisp, sharp and free of imperfection.
5. Provide screen process copy on porcelain enamel signs executed in accordance with PEI:ALS 105(69).

D. Vinyl Copy Applications: Prepare surfaces for vinyl sheet and copy applications in accordance with manufacturer's specifications and recommendations. Surfaces shall be perfectly smooth and free of dust, grease, wax or other foreign matter prior to application. Spacing of all copy shall be done according to approved samples utilizing pre-spacing application tapes.

E. ADA Signs: Provide tactile copy and symbols for ADA room identification signs that is raised-in-relief 1/32" above sign background surface. Copy shall be painted to colors indicated on the drawings. Letter forms shall be crisp and clear and free from imperfection.

F. Printing Digital Directory Map: Provide digitally printed directory plans unless otherwise noted on the drawings. Produce plans with 3M Scotch Print Electronic Graphic System. Exterior prints shall have a 2 year guarantee and interior prints a 7 year guarantee. Laminate digital prints with UV-protected, graffiti-resistant clear overlay film.

PART 3 - EXECUTION

3.1 PREPARATION

A. Site Verification of Conditions: Verify that installation conditions are acceptable for product installation in accordance with manufacturer's instructions. Notify Owner's Representative in writing of conditions detrimental to proper and timely execution of work. Work shall not proceed until unsatisfactory conditions are corrected.

B. Review documents to identify number of units and locations of project signage.

1. Sign locations shown on location plans are for reference only. Exact locations shall be field verified with Owner's Representative prior to installation.
2. Exterior sign locations shall be identified by numbered stakes that include sign type item numbers.

3.2 INSTALLATION

A. Install signs plumb and true, at mounting heights indicated, by method shown, and in accordance with manufacturer's recommendations.

B. Install signs at heights to conform with ADAAG and applicable local amendments and regulations.

C. Prepare all surfaces as required and properly align, level and true, all signs flush to mounted surface. For freestanding signs, remove excess visible adhesive, if used.

D. Permanently install signs using concealed vandal proof, fastening methods.

E. Connect electrical signs to the stubbed power source.

F. Provide Owner's Representative with all warranty information and manufacturer's paperwork upon completion of installation.

3.3 CLEANING, PROTECTION AND REPAIR

A. Upon completion of installation, clean and polish sign surfaces in accordance with manufacturer's instructions.

B. Protect product and finishes from damage until accepted by Owner's Representative. Repair damage of any kind to sign or surrounding surfaces to satisfaction of Owner's Representative or item shall be replaced.

1. Check items for correct placement.
2. Repair and repaint building surfaces damaged during installation.

C. Remove protective coating and identifying stickers, paper, upon completion of the installation.

D. All surrounding surfaces impacted by installation shall be restored to original elevation and condition. Sod and topsoil to be preserved carefully and replaced after the backfilling is completed. Sod that is damaged is to be replaced by sod of quality equal to that removed. Where the surface is disturbed in a newly seeded area, the restored surface to be reseeded with the same quantity and formula of seed as that used in the original seedings.

E. Contractor shall be responsible for all tools and personal items. Owner shall not assume risk for loss of tools or personal items that are left on the project site.

F. Remove crating and debris from project site and leave premises in clean condition. All cartons, packing materials, etc., shall be immediately removed from project site by Contractor providing such materials.

3.4 COMPLETION

A. Once installation, cleaning, protection and repair measures have been completed, perform a punch walk with Owner's Representative to inspect project. Errors shall be corrected in a timely manner to the satisfaction of the Owner's Representative.

END OF SECTION 101400

This page left intentionally blank.

SECTION 101550

TOILET PARTITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes toilet compartments and screens as follows:

1. Type: Solid-plastic, polymer resin.
2. Compartment Style: Overhead braced and floor anchored.
3. Screen Style: Floor anchored.

1.3 SUBMITTALS

A. Product Data: For each type and style of toilet compartment and screen specified. Include details of construction relative to materials, fabrication, and installation. Include details of anchors, hardware, and fastenings.

B. Samples for Initial Selection: Manufacturer's color charts consisting of sections of actual units showing the full range of colors, textures, and patterns available for each type of compartment or screen indicated.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Accurate Partitions Corporation.
2. Capitol Partitions, Inc.
3. Global Steel Products Corp.
4. Santana Products, Inc.
5. Sanymetal Products Co.
6. Legacy Polymer Products, Inc.

2.2 MATERIALS

A. Solid-Plastic, Polymer Resin: High-density polyethylene (HDPE) with homogenous color throughout. Provide material not less than 1 inch thick with seamless construction and eased edges in color and pattern as follows:

1. Color and Pattern: One color and pattern in each room as selected by Architect from manufacturer's full range of colors and patterns.

B. Pilaster Shoes and Sleeves (Caps): ASTM A 666, Type 302 or 304 stainless steel, not less than 0.0312 inch thick and 3 inches high, finished to match hardware.

C. Full-Height (Continuous) Brackets: Manufacturer's standard design for attaching panels and screens to walls and pilasters of the following material:

1. Material: Stainless steel.

D. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories of the following material:

1. Material: Stainless steel.

E. Overhead Bracing: Manufacturer's standard continuous, stainless steel rail with antigrip profile in manufacturer's standard finish.

F. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.3 FABRICATION

A. General: Provide standard doors, panels, screens, and pilasters fabricated for compartment system. Provide units with cutouts and drilled holes to receive compartment-mounted hardware, accessories, and grab bars, as indicated.

B. Solid-Plastic, Polymer-Resin Compartments and Screens: Provide aluminum heat-sink strips at exposed bottom edges of HDPE units to prevent burning.

C. Overhead-Braced-and-Floor-Anchored Compartments: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and

securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.

D. Floor-Anchored Screens: Provide pilasters and panels of same construction and finish as toilet compartments. Provide manufacturer's standard corrosion-resistant anchoring assemblies complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

E. Doors: Unless otherwise indicated, provide 30-inch- wide in-swinging doors for standard toilet compartments and 36-inch- wide in-swinging doors with a minimum 32-inch- wide clear opening for compartments indicated to be handicapped accessible.

1. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold door open at any angle up to 90 degrees.

2. Latch and Keeper for In-Swinging Doors: Recessed latch unit designed for emergency access and with combination rubber-faced door strike and keeper.

3. Latch and Keeper for Out-Swinging Doors: Manufacturer's standard surface-mounted latch unit with combination rubber-faced door strike and keeper designed for emergency access. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be handicapped accessible.

4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.

5. Door Bumper: Manufacturer's standard rubber-tipped bumpers at out-swinging doors.

6. Door Pull: Manufacturer's standard unit that complies with accessibility requirements of authorities having jurisdiction at out-swinging doors. Provide units on both sides of doors at compartments indicated to be handicapped accessible.

7. Toilet stalls for disabled persons shall have a flip-over style or sliding latch, with a loop or U-shaped handle immediately below the latch on both sides of the door and an automatic closing device. Door hardware shall be mounted at 30” to 40” above finished floor. CBC Section 1115B.3.1, Item 4.5.

8. Doors at front entry stalls shall have 32” minimum clear width when the door is open 90°. CBC Section 1115B.3.1, Item 4.4 and Figure 11B-1A.

9. Doors at side entry stall shall have 34” minimum clear width when the door is open 90°. CBC Section 1115B.3.1, Item 4.4 and Figure 11B-1B.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, plumb, and level. Provide clearances of not more than 1/2 inch between pilasters and panels and not more than 1 inch between panels and walls. Secure units in position with manufacturer's recommended anchoring devices.

1. Secure panels to walls and panels with full-height brackets attached not more than 8” o.c.

B. Overhead-Braced-and-Floor-Anchored Compartments: Secure pilasters to floor and level, plumb, and tighten. Secure continuous head rail to each pilaster with not less than 2 fasteners. Hang doors and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Screens: Attach with anchoring devices according to manufacturer's written instructions and to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.2 ADJUSTING AND CLEANING

A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and swing doors in entrance screens to return to fully closed position.

B. Provide final protection and maintain conditions that ensure toilet compartments and screens are without damage or deterioration at the time of Completion.

END OF SECTION 101550

SECTION 102000

LOUVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Fixed, extruded-aluminum louvers.
2. Fixed, formed-metal louvers.
3. Adjustable louvers.

B. Related Sections include the following:

1. Section 079200 "Joint Sealants" for sealants installed in perimeter joints between louver frames and adjoining construction.
2. Section 081113 "Hollow Metal Doors and Frames" for louvers in hollow-metal doors and frames.
3. Section 099123 "Interior Painting" for field painting louvers.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section, unless otherwise defined in this Section or in referenced standards.

B. Standard Free Area: Free area of a louver 48 inches wide by 48 inches high, identical to that provided.

C. Maximum Standard Airflow: Airflow at point of beginning water penetration through a louver 48 inches wide by 48 inches high, identical to that provided.

D. Drainable-Blade Louver: Louver designed to collect and drain water to exterior at sill by means of gutters in front edges of blades and channels in jambs and mullions.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide exterior metal louvers capable of withstanding the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of louver components including blades, frames, and supports; noise or metal fatigue caused by louver blade rattle or flutter; or permanent damage to fasteners and anchors.

1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward or outward.

2. Thermal Movements: Provide louvers that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, and other detrimental effects:
   a. Temperature Change (Range): 1o0 deg F, ambient; 160 deg F, material surfaces.

B. Air-Performance, Water-Penetration, and Air-Leakage Ratings: Provide louvers complying with performance requirements indicated, as demonstrated by testing manufacturer's stock units 48 inches wide by 48 inches high. Test units according to AMCA 500.

1. Perform testing on unpainted, cleaned, degreased units.

2. Perform water-penetration testing on louvers without screens.

1.5 SUBMITTALS

A. Product Data: For each type of product specified.

B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.

C. Samples for Verification: Of each type of metal finish required, prepared on Samples of same thickness and material indicated for final Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

D. Product Certificates: Signed by manufacturers of louvers certifying that the products furnished comply with requirements and are licensed to bear the AMCA seal based on tests made according to AMCA 500 and complying with AMCA's Certified Ratings Program.

1.6 QUALITY ASSURANCE

A. SMACNA Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" recommendations for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Airline Products Co.
2. Airolite Co.
3. Construction Specialties, Inc.

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 zinc coating, mill phosphatized.

D. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.
2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.

E. Anchors and Inserts: Of type, size, and material required for loading and installation indicated. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as needed for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.

F. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 but containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1. Continuous Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates and without interrupting blade-spacing pattern.

B. Maintain equal louver blade spacing to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining materials' tolerances, and perimeter sealant joints.

1. Frame Type: Channel type, unless otherwise indicated.

2. Frame Type: Exterior flange, unless otherwise indicated.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less. At horizontal joints between louver units, provide horizontal mullions, unless continuous vertical assemblies are indicated.

F. Provide sill extensions and loose sills made of same material as louvers where indicated or required for drainage to exterior and to prevent water penetrating to interior.

G. Join frame members to one another and to fixed louver blades with fillet welds concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.4 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Louver Construction: Provide fixed-blade louvers with extruded-aluminum frames and blades.

B. Horizontal Louvers: Either drainable- or non-drainable-blade type complying with the following:

1. Louver Depth: 4 inches, unless otherwise indicated.

2. Frame Thickness: 0.081 inch.

3. Blade Thickness: 0.081 inch.

4. Performance Requirements: Maximum standard airflow not less than 5800 cfm with not more than 0.12- inch wg static-pressure loss.

5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

C. Continuous, Horizontal, Drainable-Blade Louvers: Fabricated with close-fitting, field-made splice joints in blades designed to permit expansion and contraction without deforming blades or framework and with mullions recessed from front edges of blades so blades have continuous appearance.

D. Continuous, Horizontal, Non-drainable-Blade Louvers: Fabricated with close-fitting, field-made splice joints in blades designed to permit expansion and contraction without deforming blades or framework. Supporting framework is concealed from view by placing braces, mullions, and brackets on inside face of louver.

1. Louver Depth: 4 inches, unless otherwise indicated.
2. Frame Thickness: 0.081 inch.
3. Blade Thickness: 0.081 inch.
4. Exterior Corners: Prefabricated corner units with mitered and welded blades aligned with straight sections, with concealed bracing.

2.5 FIXED, FORMED-METAL LOUVERS

A. Louver Construction: Provide fixed-blade louvers with frames and blades formed from metal sheet of metal indicated.

B. Horizontal Louvers: Either drainable- or non-drainable-blade type complying with the following:

1. Louver Depth: 4 inches, unless otherwise indicated.
2. Frame and Blade Material: Galvanized steel sheet, 0.064 inch.
3. Performance Requirements: Maximum standard airflow not less than 5000 cfm with not more than 0.10- inch wg static-pressure loss.
4. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.6 LOUVER SCREENS

A. General: Provide each exterior louver with louver screens complying with the following requirements:

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Bird screening, unless otherwise indicated.

B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate screen frames with mitered corners to louver sizes indicated and to comply with the following requirements:

1. Metal: Same kind and form of metal as indicated for louver to which screens are attached.
   a. Reinforce extruded-aluminum screen frames at corners with clips.
2. Finish: Same finish as louver frames to which louver screens are attached.
3. Type: Non-rewirable, U-shaped frames for permanently securing screen mesh.

D. Louver Screening for Aluminum Louvers: As follows:

1. Bird Screening: Aluminum, 1/2-inch- square mesh, 0.063-inch wire.

E. Louver Screening for Galvanized Steel Louvers: As follows:

1. Bird Screening: Galvanized steel, 1/2-inch- square mesh, 0.041-inch wire.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish louvers after assembly.

2.8 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 607.1.

C. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 606.1 or AAMA 608.1.

1. Color: Light gray.

D. High-Performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Fluoropolymer Three-Coat Coating System: Manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2.
    a. Color and Gloss: As selected by Architect from manufacturer's full range of colors and glosses.

2.9 GALVANIZED STEEL SHEET FINISHES

A. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating of type suited to organic coating applied over it.

B. Baked-Enamel Finish: Immediately after cleaning and pre-treating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat, with not less than 1.0-mil dry film thickness for topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2.0 mils.
    1. Color and Gloss: As selected by Architect from manufacturer's full range of choices for color and gloss.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate Setting Drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.2 INSTALLATION

A. Locate and place louver units level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

G. Install flashings and joint fillers as louver installation progresses. Comply with Division 7 Section "Joint Sealants" for sealants applied during louver installation.

3.3 ADJUSTING, CLEANING, AND PROTECTING

A. Periodically clean exposed surfaces of louvers that are not protected by temporary covering to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Protect louvers from damage during construction. Use temporary protective coverings where needed and approved by louver manufacturer. Remove protective covering at the time of Completion.

D. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Clean and touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 102000

SECTION 102600

WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Corner guards.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes for each impact-resistant wall-protection unit.

B. Shop Drawings: For each impact-resistant wall-protection unit showing locations and extent. Include sections, details, and attachments to other work.

C. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Corner Guards: 12 inches long. Include examples of joinery, corners, and field splices.

E. Qualification Data: For Installer.

F. Maintenance Data: For each impact-resistant wall-protection unit to include in maintenance manuals.

G. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain impact-resistant wall-protection units through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall-protection units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall-protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

B. Field Measurements: Verify actual locations of walls, columns, and other construction contiguous with impact-resistant wall-protection units by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall-protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures.
   b. Deterioration of materials beyond normal use.

2. Warranty Period: Five years from date of Completion.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Include mounting and accessory components. Replacement materials shall be from same production run as installed units.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless-Steel: ASTM A 666.

B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners.

2.2 CORNER GUARDS

A. Surface-Mounted, Metal Corner Guards: Fabricated from 1-piece, formed metal with formed edges; with 90- or 135-degree turn to match wall condition.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Balco, Inc.
   b. Construction Specialties, Inc.
2. Material: Stainless steel, Type 304.
   a. Thickness: Minimum 0.0625 inch.
   b. Finish: Directional satin, No. 4.
3. Wing Size: Nominal 2 inches by 2 inches.
4. Corner Radius: 1/8 inch.
5. Height as indicated but not less than 6 feet high.
6. Mounting: Install using countersunk screws in accordance with the manufacturer's instructions, compatible with the wall construction receiving the impact-resistant wall protection units.

2.3 FABRICATION

A. Fabricate impact-resistant wall-protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.4 METAL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Remove tool and die marks and stretch lines or blend into finish.
2. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

B. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

C. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of mounting hardware and anchors.

2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall-protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install impact-resistant wall-protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

1. Provide mounting hardware, anchors, and other accessories required for a complete installation.

a. Provide anchoring devices to withstand imposed loads.

3.4 CLEANING

A. Immediately after completion of installation, clean covers and accessories using a standard, ammonia-based, household cleaning agent.

END OF SECTION 102600

SECTION 102813

TOILET ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Toilet and bath accessories.
2. Building accessories
3. Warm-air dryers.
4. Infant-care products

B. Related Sections:

1. Section 088000 - Glazing: Glass mirrors.
2. Section 092900 - Gypsum Board: Metal anchor reinforcement in walls.
3. Section 093013 - Ceramic Tile

1.2 SUBMITTALS

A. Submit in accordance with Section 013300

B. Product Data: Illustrate each accessory at large scale and show installation method.

C. Samples: Submit finish samples.

D. Schedule indicating types, quantities, sizes, and installation locations (by room) for each toilet accessory item to be provided for project.

E. Setting drawings where cutouts are required in other work, including templates, substrate preparation instructions, and directions for preparing cutouts and installing anchorage devices.

F. Maintenance instructions, including replaceable parts and service recommendations.

1.3 QUALITY ASSURANCE

A. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule.

1. Products of other manufacturers listed in Part 2 with equal characteristics, as judged solely by Architect, may be provided.

2. Do not modify aesthetic effects, as judged solely by Architect, except with Architect's approval. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.4 DELIVERY, STORAGE AND HANDLING

A. Do not deliver accessories to site until rooms in which they are to be installed are ready to receive them.

B. Pack accessories individually in manner to protect accessory and its finish.

1.5 PROTECTION

A. Protect adjacent or adjoining finished surfaces and work from damage during installation of work of this section.

1.6 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.

1.7 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Manufacturer's Mirror Warranty: Written warranty, executed by mirror manufacturer agreeing to replace mirrors that develop visible silver spoilage defects within minimum warranty period indicated.

1. Minimum Warranty Period: 15 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide accessories by one of the following:

B. Washroom Equipment

1. Bobrick Washroom Equipment Inc.
2. American Specialties Inc.

3. Bradley Corporation
4. GAMCO

C. Warm-Air Dryers:

1. Bobrick Washroom Equipment, Inc.
2. Excel Dryer Corporation.
3. World Dryer.

D. Infant-Care Products:

1. American Infant Care Products Inc.
2. Bobrick Koala Kare Products.

E. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated in the Toilet and Bath Accessory Schedule at the end of Part 3.

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch minimum nominal thickness, unless otherwise indicated. Adhesive: Epoxy type contact cement.

B. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.

C. Galvanized Steel Sheet: ASTM A 653/A 653M, G60.

D. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.

E. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication

F. Fasteners, Screws, and Bolts: Hot dip galvanized. Expansion Shields: Fiber, lead or rubber as recommended by accessory manufacturer for component and substrate. Provide exposed fasteners with finish to match accessories.

2.3 FINISHES

A. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

B. Chrome/Nickel Plating: Satin finish.

C. Stainless Steel: No. 4 satin finish.

D. Baked-Enamel Finish: Factory-applied, gloss-white, baked-acrylic-enamel coating.

2.4 FABRICATION

A. General: Names or labels are not permitted on exposed faces of accessories. On interior surface not exposed to view or on back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.

B. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.

C. Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.

D. Framed Glass-Mirror Units: Fabricate frames for glass-mirror units to accommodate glass edge protection material. Provide mirror backing and support system that permits rigid, tamper-resistant glass installation and prevents moisture accumulation.

E. Provide galvanized steel backing sheet, not less than 0.034 inch and full mirror size, with non-absorptive filler material. Corrugated cardboard is not an acceptable filler material.

F. Mirror-Unit Hangers: Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant installation, as follows:

1. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.

G. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 EXECUTION

3.1 PREPARATION

A. Deliver inserts and rough-in frames to jobsite at appropriate time for building-in. Provide templates and rough-in measurements as required.

B. Before starting work notify Architect in writing of conflicts detrimental to installation or operation of units.

C. Verify exact location of accessories with Architect. Verify blocking is in place prior to gypsum board installation.

D. Accessory Locations: Coordinate accessory locations with other work to avoid interference and to assure proper operation and servicing of accessory units.

3.2 INSTALLATION

A. Toilet accessories required to be accessible shall be mounted at heights and locations in accordance with CBC Section 1115B.9.

1. Grab bars can not project more than 3 inches into the 48-inch minimum clear space in front of the water closet per CBC Section 1115B.7.1.3. Accessories such as toilet paper holders and sanitary napkin disposals should not project more than grab bars. Do not mount accessories closer than 1-1/2 inches from tangent point of grab bars. Do not surface-mount accessories above grab bars where doing so will restrict usability of grab bars).

B. Install fixtures, accessories and items in accordance with manufacturer's printed instructions.

C. Install true, plumb and level, securely and rigidly anchored to substrate and sealed to protect structural elements of wall from moisture.

D. Use tamper proof (security) type fasteners.

3.3 ADJUSTING AND CLEANING

A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.

B. Clean and polish exposed surfaces in accordance with manufacturer's recommendations after removing labels and protective coatings.

3.4 TOILET AND BATH ACCESSORY SCHEDULE

A. (BA-1) Mop and Broom Holder: Bobrick 223, 3 holders, 24 inches long.

B. Coat Hooks:

1. (CH-1) Single Coat Hook: Bobrick B-212, satin finish, 1-5/8 inch projection, single hook.
2. (CH-2) Double Coat Hooks: Bobrick 76727, satin finish, 1-7/8 inch projection, double hook.
3. (CH-3) Multiple Coat Hook: GOF Ltd. V18/H170, silver anodized aluminum with grey end caps, 18 hat and coat hooks 6 3/4 inch spacers.

C. (GB-1) Grab Bars: Bobrick Series 5806 1-1/4 inch diameter with concealed mounting, with 1/8 inch thick stainless steel plate.

1. Sizes and configurations as indicated.
2. Use Bobrick Series 6806.99, for grab bars in showers or steam rooms.

D. (HD-1) Hand Dryer / Warm-Air Dryers: Surface-mounted automatically activated.

1. Acceptable Products: One of the following:
   a. Excel Dryer, Inc., XLerator.
   b. ASI Turbo-Dri.
   c. Sloan Valve Company, Xlerator.
   d. American Dryer, eXtremeAir.
   e. World Dryer Corporation, AirForce.
   f. Comac Blast.
   g. Zurn / World Dryer AirMax. Model Z6704.
   h. Bradley Aerix.
2. Mounting: Surface mounted.
   a. ADA mounting height: As indicated on Drawings.
3. Operation: Electronic-sensor activated with timed power cut-off switch.
   a. Operation Time: 80 seconds.
4. Cover Material and Finish: Baked enamel.
   a. Color: Selected by Architect from manufacturer's full range of options.

E. (ICS-1) Infant Changing Stations: Polyethylene construction, safety strap, pneumatic controlled opening and closing, liner dispensers, surface mounted and projects 4 inches from wall.

1. Bobrick: 2210, color No. 889 Grey
2. American Infant Care Products "Diaper Deck".
3. Koala Corporation. Grey plastic wall mounted unit.

F. Mirrors:

1. (MIR-1) Framed Mirrors: Bobrick 290 Series, B-293, verify with facilities, sizes as indicated.
2. (MIR-2) Framed Mirrors/Shelf: Bobrick 292 Series, sizes as indicated.
3. Tilted Mirror: Bobrick 293 at locations indicated.

G. Paper Towel Cabinets:

1. (PTC-1) Paper Towel Dispensers: Bobrick 263, surface mounted multifold.
2. (PTC-2) Combined Paper Towel Dispenser and Waste Receptacle: Bobrick B-3961, recessed compact unit, 12 gal capacity with 4 inch projection.
3. (PTC-3) Combined Paper Towel Dispenser and Waste Receptacle: Bobrick 3947, recessed compact unit, 18 gal. capacity with 8 inch projection.
4. (PTC-4) Paper Towel Dispensers: Bobrick 359, recessed-wall 4 inches.

H. Soap Dispensers:

1. (SDISP-1) Powdered Soap Dispensers: Bobrick B132, surface mounted, vertical design.
2. (SDISP-2) Soap Dispensers: Bobrick 8226, lavatory mounted, 34 fl.oz. container, 6 inch long spout (B-155, surface mounted).
3. (SDISP-3) Soap Dispensers: Bobrick 2014, soap/self combination unit, surface mounted

I. Sanitary Napkin Cabinets:

1. (SNC-1) Sanitary Napkin/Tampon Dispensers: Bobrick B-3706, 25 cent operation, recessed mounted.
2. (SNC-2) Sanitary Napkin/Tampon Dispensers: Bobrick 2800, 25 cent operation, surface mounted.

J. Sanitary Napkin Disposal Units:

1. (SND-1) Sanitary Napkin Disposal Units: Bobrick 354, partition mounted.
2. (SND-2) Sanitary Napkin Disposal Units: Bobrick 254, surface mounted.
3. (SND-3) Sanitary Napkin Disposal Units: Bobrick 5270, surface mounted, ABS plastic.
4. (SND-4) Sanitary Napkin Disposal Units: Bobrick 353, recessed mounted

K. Toilet Paper Holders:

1. (TPH-1) Toilet Paper Holders: Bobrick 2730, surface mounted single.
2. (TPH-2) Toilet Paper Holders: Bobrick 2888, multi-roll, surface mounted (double).
3. (TPH-3) Toilet Paper Holders: Bobrick 3888, multi-roll, recessed.
4. (TPH-4) Toilet Paper Holders: Bobrick 386, partition mounted multi-roll (for double sided use).

L. Toilet Seat Covers:

1. (TSC-1) Toilet Seat Covers: Bobrick B-301 recessed, stainless steel.

M. Utility Shelves:

1. (US-1) Stainless Steel Shelf: Bobrick B-295, 5 inch deep, surface mounted; 24 inches long unless indicated otherwise on Drawings.

N. Combination Units:

1. Seat Cover Dispenser / Sanitary Napkin Disposal / Toilet Tissue Dispenser: Bobrick Model No. B-3574, recessed, stainless steel.
2. Seat Cover / Toilet Tissue Dispenser: Bobrick Model No. B-3474, recessed, stainless steel.

END OF SECTION 102813

This page left intentionally blank.

SECTION 104413

FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes fire protection cabinets for portable fire extinguishers.

B. Related Sections:

1. Section 104416 - Fire Extinguishers.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.

1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, and cabinet type, trim style, and panel style. Cabinet size to fit extinguishers series.

B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function.

D. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

B. Fire Extinguisher Cabinets must comply with CBC Sections 1117B.6 and 1118B.

1.5 COORDINATION

A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

2.2 FIRE PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

1. Manufacturers: Subject to compliance with requirements, available manufacturers that may be incorporated into the Work include, but are not limited to, the following:
   a. Larsen's Manufacturing Company.
   b. J. L. Industries, Inc., a division of Activar Construction Products Group.
   c. Potter Roemer LLC.

B. Basis-of-Design Product: Subject to compliance with requirements, provide:

1. Larsen's Manufacturing Company, Architectural Series, Model 2409/Model 2712 or equal.

2. Semi-recessed, ADA compliant.

3. Size cabinet for specific fire extinguisher.

C. Cabinet Construction: Nonrated or fire rated as indicated on drawings.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- thick, cold-rolled steel sheet lined with minimum 5/8-inch- thick, fire-barrier material. Provide factory-drilled mounting holes.

D. Cabinet Material: Steel sheet.

E. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter doorframe overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Rolled-Edge Trim: Backbend depth, 2 ½ -inch maximum.

F. Cabinet Trim Material: Steel sheet.

G. Door Material: Steel sheet.

H. Door Style: Solid flush panel.

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting door pull (4" max projection) and friction latch operable with 5 lbs. maximum force.

2. Provide manufacturer's standard continuous hinge permitting door to open 180 degrees.

J. Accessories:

1. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
   a. Identify fire extinguisher in fire protection cabinet with the words “FIRE EXTINGUISHER."
      1) Location: Applied to cabinet door.
      2) Application Process: Die cut lettering.
      3) Lettering Color: Red.
      4) Orientation: Vertical.

K. Finishes:

1. Manufacturer's standard baked-enamel paint for the following:
   a. Exterior of cabinet, door and trim.
   b. Interior of cabinet and door.

2.3 FABRICATION

A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.

2. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.

2. Fabricate door frames of one-piece construction with edges flanged.

3. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if

they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

1. Color and Gloss: Gloss white.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for recessed and semirecessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire protection cabinets in locations and at mounting heights indicated.

B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.

2. Fire-Rated Cabinets: Seal through penetrations with firestopping sealant as specified in Section 078410 – Through-Penetration Firestop Systems.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturers written installation instructions.

B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures

recommended or furnished by fire protection cabinet and mounting bracket manufacturers.

E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

This page left intentionally blank.

SECTION 104416

FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes portable, hand-carried fire extinguishers.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Operation and Maintenance data.

C. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

C. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a) Failure of hydrostatic test according to NFPA 10.
   b) Faulty operation of valves or release levers.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 – PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Amerex Corporation.
   b. Ansul Incorporated; Tyco International Ltd.
   c. Badger Fire Protection; a Kidde company.
   d. Buckeye Fire Equipment Company.
   e. Fire End & Croker Corporation.
   f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
   g. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
   h. Larsen's Manufacturing Company.
   i. Moon-American.
   j. Pem All Fire Extinguisher Corp.; a division of PEM Systems, Inc.
   k. Potter Roemer LLC.
   l. Pyro-Chem; Tyco Safety Products.
2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

B. Regular Dry-Chemical Type: UL-rated 40-B:C, 10-lb nominal capacity, with sodium bicarbonate-based dry chemical in manufacturer's standard enameled container.

END OF SECTION 104416

SECTION 105113

METAL VENTED WARDROBE LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal vented wardrobe locker units with hinged doors.

1.2 REFERENCES

A. ASTM International (ASTM):

1. A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
2. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvanealed) by the Hot-Dip Process.

1.3 SYSTEM DESCRIPTION

A. Metal Lockers:

1. Configuration: Single tier.
2. Size: 24 inches wide x 24 inches deep x 72 inches high with 6” sloping top.

B. Base Drawers:

1. Configuration: Single tier.
2. Size: 24 inches wide x 24 inches deep x 15 inches high.

1.4 SUBMITTALS

A. Submittals for Review:

1. Shop Drawings: Include dimensioned plans and elevations showing locker layout and relationship to adjacent construction.
2. Product Data: Manufacturer's descriptive data.
3. Samples: 3-1/4 x 1-1/2 inch paint samples showing available colors.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 10 years experience in work of this Section.

B. Installer Qualifications: Minimum 2 years documented experience in work of this Section.

C. Accessibility: Conform to applicable accessibility code for accessible locker units.

1.6 WARRANTIES

A. Provide manufacturer's 5 year warranty against defects in materials and workmanship.

PART 2 - PRODUCTS

1.7 MANUFACTURERS

A. Contract Documents are based on Airflow Wardrobe Lockers by Tiffin Metal Products. (www.sentinellockers.com)

1.8 MATERIALS

A. Steel Sheet:
   1. ASTM A1008/A1008M.

1.9 FABRICATION

A. Construction:
   1. Doors, shelves, and reinforcements: Minimum 16 gauge [stainless] steel.
   2. Top, bottom, back and sides: Minimum 14 gauge [stainless] steel.
   3. Top, bottom, and front perforated for ventilation.
   4. Shelves spaced 2 inches off back panel for ventilation.

B. Doors:
   1. Louverless.
   2. Door hinges: 14 gauge steel, continuous type, concealed, 180 degree opening.

C. Frames:
   1. Formed and welded into integrated units with doors installed.
   2. Body parts flanged and angled to provide rigidity; assembled by welding, bolting, or riveting using corrosion-resistant bolts and aluminum or stainless steel rivets.
   3. Provide mounting holes for attaching lockers back-to-back and side-by-side.

D. Internal Components:
   1. Shelves: Steel.
      a. Two small and two large shelves.
      b. One small shelf with lockable valuables compartment.
   2. Coat bar.
   3. Perforated steel boot tray.
   4. Double hook for storage.
   5. Single coat hooks on each side panel.
   6. Pegboard panels on inside of doors, with storage pocket.
   7. Unbreakable mirror with magnetic attachment.

8. Knockouts for electrical conduit; verify location in field.

E. Drawer Unit:
1. Located under locker unit.
2. Width to match locker x 24 inches deep x 15 inches high (typical).
3. 200 pound capacity drawer slides.
4. Integrally formed ventilated handles.
5. Keyless lock; locks when locker door is closed. Released by pull handle inside locker.

F. Body Armor Drying Rack: Perforated steel.

G. Door Locks and Latches:
1. Lift latch operated, top and bottom bayonet style permitting closing without lifting latch handle.
2. Recessed door latch, painted cup with integral door latch/pull, pry-resistant, not protruding beyond face of door.
3. Locks: Combination locks with master key override; furnish two master keys.

H. Number Plates:
1. Number plates furnished loose and affixed to locker using pop rivets in pre-drilled holes in door.
2. Number doors as directed by Owner.

I. Accessories:
1. Finished end panels without exposed fasteners.
2. Filler panels.

1.10 FINISHES

A. Steel:
1. Minimum 3 mil thick factory-applied baked-on textured powder coat finish.
2. Color: Gray

PART 3 - EXECUTION

1.11 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved Shop Drawings.

B. Set plumb, level, and aligned.

C. Attach lockers to supporting construction with anchors best suited to substrate conditions.

D. Bolt adjacent locker units together to provide rigid installation.

E. Install end panels, filler panels and sloped tops.

1.12 ADJUSTING

A. Adjust doors and latches to operate correctly.

END OF SECTION 105113

SECTION 108116

PEST CONTROL / TERMITE TENTING

TO BE ISSUED AS AN ADDENDUM

END OF SECTION 108116

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 114000

APPLIANCES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Commercially Manufactured Equipment.

2. Related Sections:
   a. Division 21, 22, and 23 Sections for supply and exhaust fans; exhaust ductwork; service roughing-ins; drain traps; atmospheric vents; valves, pipes, and fittings; fire-extinguishing systems; and other materials required to complete foodservice equipment installation.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Manufacturer's model number.

2. Accessories and components that will be included for Project.

3. Clearance requirements for access and maintenance.

4. Utility service connections for water, drainage, power; include roughing-in dimensions. Electrical, plumbing and mechanical rough-in plans.

B. Operation and Maintenance Data: For foodservice equipment to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 Operation and Maintenance Data, include the following:

1. Product Schedule: For each foodservice equipment item, include the following:
   a. Designation indicated on Drawings.
   b. Manufacturer's name and model number.
   c. List of factory authorized service agencies including addresses and telephone numbers.

C. Record Drawings of Kitchen and all Serving Areas.

D. Warranty: Samples of special warranty. Standard per manufacturer and additional purchase.

1.4 QUALITY ASSURANCE

A. UL Certification: Provide electric and fuel-burning equipment and components that are evaluated by UL for fire, electric shock, and casualty hazards according to applicable safety standards, and that are UL certified for compliance and labeled for intended use.

B. Regulatory Requirements: Install equipment to comply with the following:

1. ASHRAE 15, "Safety Code for Mechanical Refrigeration."
2. NFPA 54, "National Fuel Gas Code."
3. NFPA 70, "National Electrical Code."
4. NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations."
5. Local Health Code.
6. National Electric Manufacturer's Association (N.E.M.A.).
7. Underwriters Laboratories Inc., (U.L.), must bear label.
8. National Sanitation Foundation, (N.S.F.), including NSF-7, must bear label.
9. American Society of Mechanical Engineers must carry the (A.S.M.E.) stamp.
10. Occupational Safety and Health Act (O.S.H.A.) Standards.
11. Hazard Analysis Critical Control Path (H.A.C.C.P.).
12. Standards, America Disability Act (A.D.A.) Standards.
13. California Building Code (CBC).
14. Food Establishment Waste Water Discharge (F.E.W.D.) Program

C. Seismic Restraints: Comply with SMACNA's "Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines," Appendix A, "Seismic Restraint Details," unless otherwise indicated.

D. Pre-installation Conference: Per Section 013100 – Project Management and Coordination

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of construction contiguous with foodservice equipment by field measurements before fabrication. Indicate measurements on Coordination Drawings.

1.6 COORDINATION

A. Coordinate foodservice equipment layout and installation with other work, including layout and installation of plumbing, electrical and mechanical, and fire-suppression system components.

B. Coordinate locations and requirements of utility service connections.

C. Coordinate sizes, locations, and requirements of the following:

1. Overhead equipment supports.
2. Equipment bases.
3. Floor depressions.
4. Insulated floors.
5. Floor areas with positive slopes to drains.
6. Floor sinks and drains serving foodservice equipment.
7. Roof curbs, equipment supports, and penetrations.
8. Mechanical Exhaust.
9. Fire Suppression System.

1.7 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace compressors that fail in materials or workmanship within specified warranty period.

1. Failure includes, but is not limited to, inability to maintain set temperature.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 APPLIANCES

A. Per Finish Schedule

PART 3 – EXECUTION

3.1. INSTALLATION

A. Install appliances level and plumb according to manufacturer’s written instructions.

B. Connect equipment to utilities.

C. Provide cutouts in equipment, neatly formed, where required to run service lines through equipment to make final connections.

D. Complete equipment assembly where field assembly is required.

E. Install equipment with access and maintenance clearances that comply with manufacturer’s written installation instructions and with requirements of authorities having jurisdiction.

3.2. CLEANING AND PROTECTION

A. After completing installation of equipment, repair damaged finishes.

B. Clean and adjust equipment as required to produce ready-for-use condition.

C. Protect equipment from damage during the remainder of the construction period.

3.3. DEMONSTRATION

A. Engage a factory authorized service representative to train OWNER's maintenance personnel to adjust, operate, and maintain appliances.

END OF SECTION 114000

SECTION 115200

AUDIO VISUAL EQUIPMENT

TO BE ISSUED AS AN ADDENDUM

END OF SECTION 115200

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 116000

BOTTLE FILLING STATION

SEE FOLLOWING ELKAY CUT SHEET

ELKAY®
SPECIFICATIONS

Elkay EZH2O In-Wall Bottle Filling Station
Non-Filtered Non-Refrigerated Stainless
Model EZWSMDK

PRODUCT SPECIFICATIONS

Elkay ezH2O® In-Wall Bottle Filling Station, Non-Filtered Non-Refrigerated Stainless. Features shall include Hands-Free, Green Ticker™, Laminar Flow, Antimicrobial, Real Drain. Electronic Bottle Filler Sensor activation. Product shall be Wall Mount (In-Wall Frame/Plate), for Indoor applications, serving 1 station(s). Unit shall be certified to UL 399 and CAN/CSA C22.2 No. 120. Unit shall be lead-free design which is certified to NSF/ANSI 61 & 372 (lead free) and meets Federal and State low-lead requirements.

Special Features:	Hands-Free, Green Ticker™, Laminar Flow, Antimicrobial, Real Drain
Finish:	Stainless Steel
Power:	115V/60Hz
Bubbler Style:	No Bubbler
Activation by:	Electronic Bottle Filler Sensor
Mounting Type:	Wall Mount (In-Wall Frame/Plate)
Chilling Option:	Non-Refrigerated
Full Load Amps	1
Rated Watts:	15
Dimensions (L x W x H):	19-3/4" x 3-1/2" x 40-13/16"
Approx. Shipping Weight:	33 lbs.
Installation Location:	Indoor
No. of Stations Served:	1

- Touchless, sensor-activation, designed for easy use.
- Green Ticker: Informs user of number of 20 oz. plastic water bottles saved from waste.
- Laminar flow provides clean fill with minimal splash.
- Silver Ion Antimicrobial protection on key plastic components to inhibit the growth of mold and mildew.
- Real Drain System eliminates standing water.

AMERICAN PRIDE. A LIFETIME TRADITION.
Like your family, the Elkay family has values and traditions that endure. For almost a century, Elkay has been a family-owned and operated company, providing thousands of jobs that support our families and communities.

Included with Product: Bottle Filler (EZWSMDC), Mounting Frame (MFWS100)

▼ **Ships in multiple boxes.**

PRODUCT COMPLIANCE

ADA & ICC A117.1
Buy American Act
CAN/CSA C22.2 No. 120
GreenSpec®
NSF/ANSI 61 & 372 (lead free)
UL 399

Complies with ADA & ICC A117.1 accessibility requirements when installed according to the requirements outlined in these standards. Installation may require additional components and/or construction features to be fully compliant. Consult the local Authority Having Jurisdiction if necessary.

Installation Instructions (PDF) - 98557C
Installation Instructions (PDF) - 98560C

Electrical components and water system are warranted for 12 months from date of installation. **Warranty pertains to drinking water applications only. Non-drinking water applications are not covered under warranty.**

Warranty (PDF)

OPTIONAL ACCESSORIES

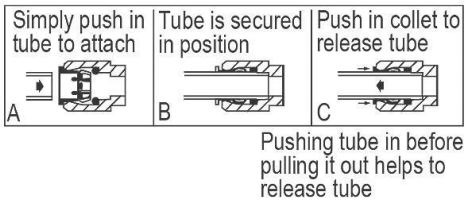
EWF3000 - WaterSentry Plus Filter System Kit (Bottle Fillers)

PART:_____QTY: _____
PROJECT:_____
CONTACT:_____
DATE:_____
NOTES:_____
APPROVAL:_____

In keeping with our policy of continuing product improvement, Elkay reserves the right to change product specifications without notice. Please visit elkay.com for the most current version of Elkay product specification sheets. This specification describes an Elkay product with design, quality, and functional benefits to the user. When making a comparison of other producers' offerings, be certain these features are not overlooked.

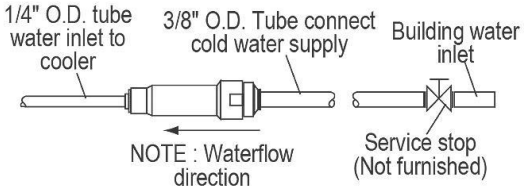
Elkay EZH2O In-Wall Bottle Filling Station
Non-Filtered Non-Refrigerated Stainless
Model EZWSMDK

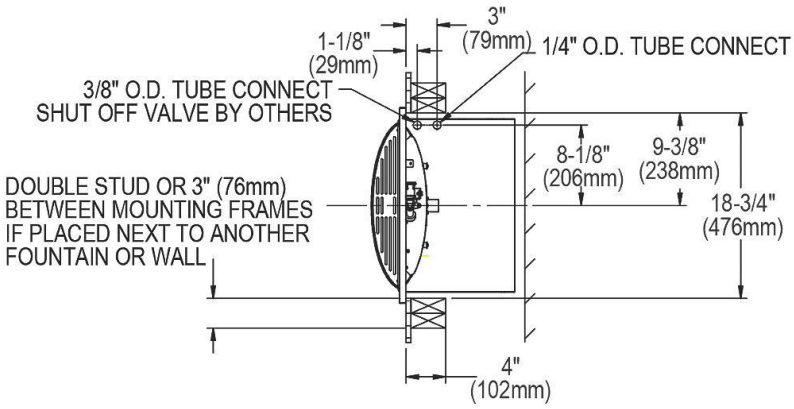
OPERATION OF QUICK CONNECT FITTINGS



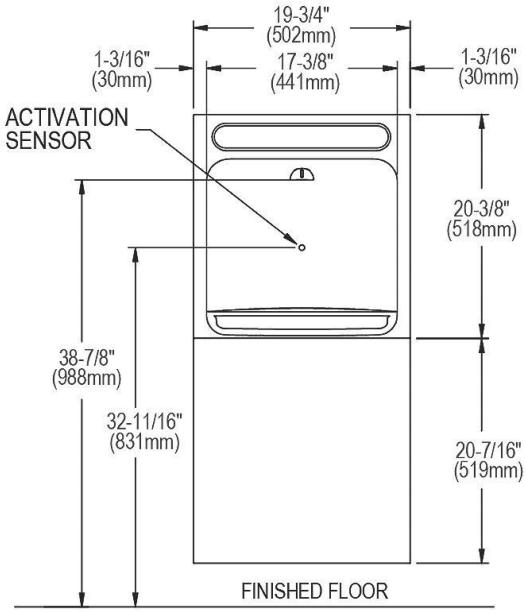
IMPORTANT!
INSTALLER PLEASE NOTE :

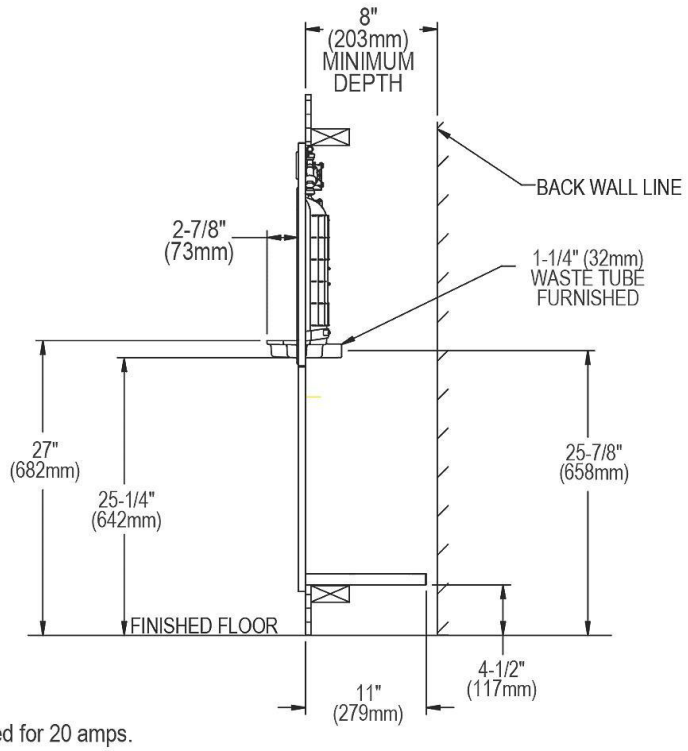
The grounding of electrical equipment such as telephone, computers, etc., to water lines is a common procedure. This grounding may be in the building or may occur away from the building. This grounding can cause electrical feedback into a water cooler, creating an electrolysis which causes a metallic taste or causes an increase in the metal content of the water. This condition is avoidable by using the proper materials as indicated below. The drain fittings which are provided by the installer should also be plastic to electrically isolate the cooler from the building plumbing system.
These products are designed to operate on 20 psi to 105 psi supply line pressure.





BOTTLE FILLER SPECIFICATIONS





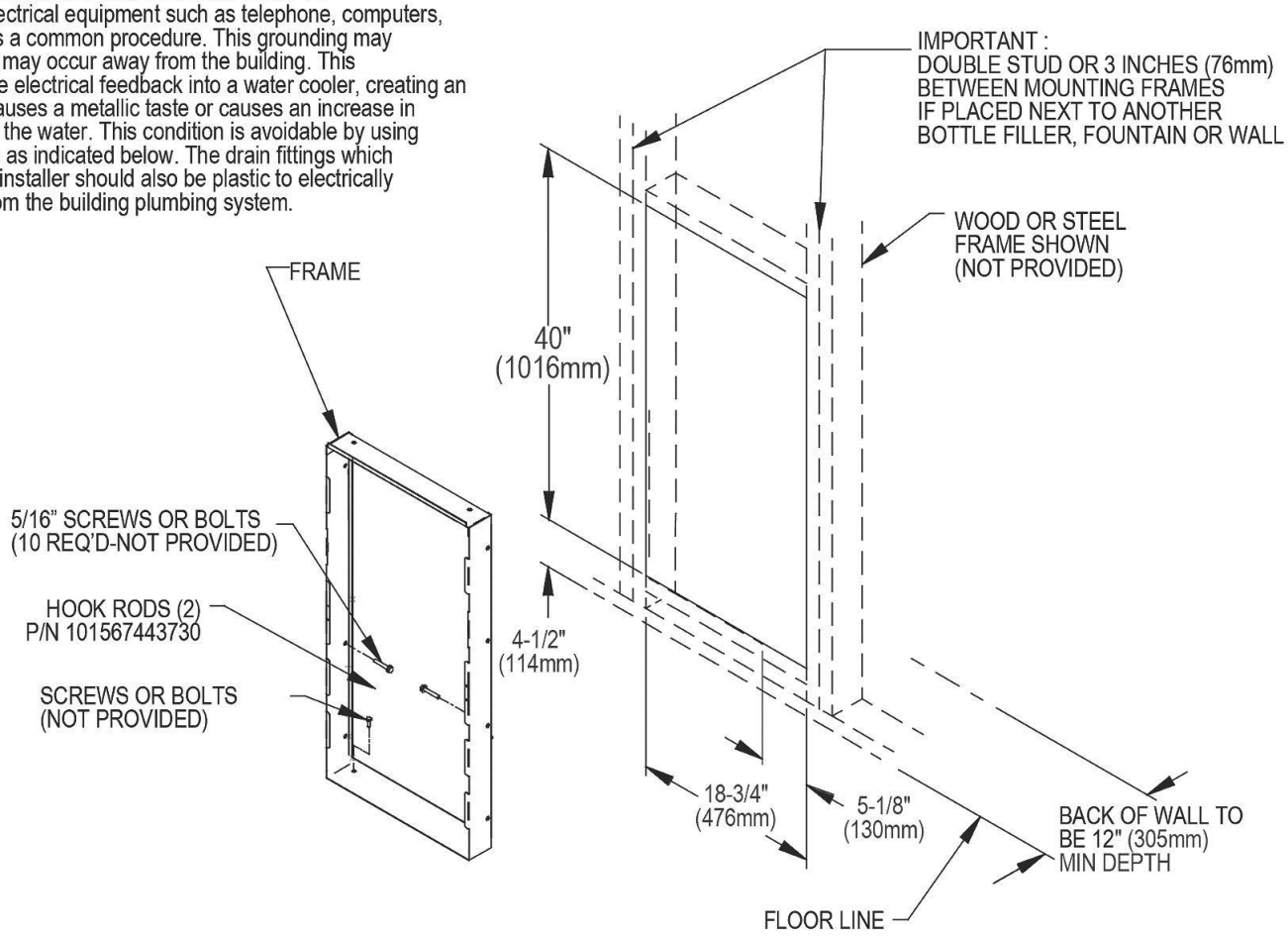
Note : New Installations Must Use Ground Fault Circuit Interrupter (GFCI).
It is highly recommended that the circuit be dedicated and the load protection be sized for 20 amps.

In keeping with our policy of continuing product improvement, Elkay reserves the right to change product specifications without notice. Please visit elkay.com for the most current version of Elkay product specification sheets. This specification describes an Elkay product with design, quality, and functional benefits to the user. When making a comparison of other producers' offerings, be certain these features are not overlooked.

MOUNTING FRAME MFWS100 WITHOUT CHILLER SHELF

IMPORTANT!
INSTALLER PLEASE NOTE:

The grounding of electrical equipment such as telephone, computers, etc., to water lines is a common procedure. This grounding may be in the building or may occur away from the building. This grounding can cause electrical feedback into a water cooler, creating an electrolysis which causes a metallic taste or causes an increase in the metal content of the water. This condition is avoidable by using the proper materials as indicated below. The drain fittings which are provided by the installer should also be plastic to electrically isolate the cooler from the building plumbing system.



In keeping with our policy of continuing product improvement, Elkay reserves the right to change product specifications without notice. Please visit elkay.com for the most current version of Elkay product specification sheets. This specification describes an Elkay product with design, quality, and functional benefits to the user. When making a comparison of other producers' offerings, be certain these features are not overlooked.

SECTION 122123

ELECTRONIC ROLLER SHADE SYSTEM

TO BE ISSUED AS AN ADDENDUM

END OF SECTION 122123

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 122124

MANUAL ROLLER SHADE SYSTEM

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Provide manually operated, sunscreen and blackout roller shades as applicable.

B. Related Sections:

1. Division 09 - Gypsum Board Assemblies:
   a. Coordination with gypsum board assemblies for blocking, installation of shade pockets, closures and related accessories.
2. Division 09 - Acoustical Ceilings:
   a. Coordination with acoustical ceiling systems for blocking, installation of shade pockets, closures and related accessories.
3. Division 26 - Electrical:
   a. Electric service for EDU's, and EDU controls, internal communication, low voltage wiring and data transfer, and connection to the Internet and required.

1.2 SUBMITTALS

A. Bid Submittal, Information Required with Submittal of Bid: In order to evaluate proposals for integrated lighting or AV control and window shade systems, the Architect requires the following information be submitted prior to the award of the system.

1. Bid proposal shall be accompanied with a document that notes all deviations from these specifications on a line-by-line basis.
2. Bid shall confirm that roller shade EDU's and all related controls shall be integrated into a compatible control system as specified herein.
3. Bid shall include separate line items listing the control/interface components required for building automation systems and building management systems (BAS/BMS), daylighting, audiovisual, and/or central integration systems. Roller shade controls manufacturer shall list all components included in their bid and shall include a letter stating that they shall be financially responsible for any change orders and/or back charges required by the BAS/BMS, audiovisual, or lighting control systems contractors to interface with the motorized roller shade system.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
3. Storage and handling requirements and recommendations.
4. Mounting details and installation methods.
5. Typical wiring diagrams including integration of EDU controllers with building management system, audiovisual and lighting control systems as applicable.
6. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.
7. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements. Shade cloth samples and aluminum finish sample as selected. Mark face of material to indicate interior faces.
8. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.
9. Warranty: Provide manufacturer's warranty documents as specified in this Section.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades system through one source from a single manufacturer with a minimum of ten years experience and minimum of five projects of similar scope and size in manufacturing products comparable to those specified in this section. This includes but is not limited to all required extrusions, accessories, controls and fabricated roller shades or else all stated and published warranties may be void.

B. Installer Qualifications: Engage an installer, which shall assume responsibility for installation of all system components, with the following qualifications:

1. Installer for roller shade system shall be trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section.
2. Shadecloth Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, and ATCC9645.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver components in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Power and control wiring shall be complete and certified, fully operational with uninterrupted communication on the lines and minimal noise certified by a commissioning agent (engaged by others).

C. 485, ICON, Lonmark and Dry Contract Network: Noise on the line not to exceed shade manufacturer's limits.

1.6 WARRANTY

A. Warranty: Provide manufacturer's standard warranties, including the following:

1. Roller Shade Hardware, and Shadecloth: Manufacturer's standard non-depreciating twenty-five year limited warranty.

2. EcoVeil standard non-depreciating 10-year limited warranty.

3. Electronic Roller Shade EDU's and EDU Control Systems: Manufacturer's standard non-depreciating five-year warranty.

4. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to access to the work above 12' Feet AFF, which are the responsibility of others.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design Manufacturer for Window Shade System:

1. Products by MechoSystems; 42-03 35th Street, Long Island City, NY 11101

2.2 SHADE BANDS

A. Shade Bands: Construction of shade band includes the fabric, the enclosed hem weight, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.

B. Concealed Hembar: Shall be continuous extruded aluminum for entire width of shade band and with the following characteristics:

1. Hembar shall be heat sealed on all sides.

2. Open ends shall not be accepted.

C. Shade Band and Shade Roller Attachment:

1. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection.

2. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a “snap-on” snap-off” spline mounting, without having to remove shade roller from shade brackets.

3. Mounting Spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.

4. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets, does not meet the performance requirements of this specification and shall not be accepted.

2.3 ROLLER SHADE FABRICATION

A. Fabricate shade cloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch (3.18 mm) in either direction per 8 feet (2438 mm) of shade height due to warp distortion or weave design.

B. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shade bands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer’s standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.

C. For railroaded shade bands, provide seams in railroaded multi-width shade bands as required to meet size requirements and in accordance with seam alignment as acceptable to Architect. Seams shall be properly located. Furnish battens in place of plain seams when the width, height, or weight of the shade exceeds manufacturer’s standards. In absence of such standards, assure proper use of seams or battens as required to, and assure the proper tracking of the railroaded multi-width shade bands

D. Provide battens for railroaded shades when width-to-height (W:H) ratios meet or exceed manufacturer’s standards. In absence of manufacturer’s standards, be responsible for proper use and placement of battens to assure proper tracking and roll of shade bands.

E. Blackout shade bands, when used in side channels, shall have horizontally mounted, roll-formed stainless steel or tempered-steel battens not more than 3 feet (115 mm) on center extending fully into the side channels. Battens shall be concealed in an integrally colored fabric to match the inside and outside colors of the shade band, in accordance with manufacturer’s published standards for spacing and requirements.

F. Battens shall be roll formed of stainless steel or tempered steel and concave to match the contour of the roller tube.

2.4 ROLLER SHADE COMPONENTS

A. Access and Material Requirements:

1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.

2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.

3. Use only Delran engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester shall not be accepted.

B. Manual Operated Chain Drive Hardware and Brackets:

1. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.

2. Provide hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.

3. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.

4. Provide shade hardware system that allows for operation of multiple shade bands (multi-banded shades) by a single chain operator, subject to manufacturer's design criteria. Connectors shall be offset to assure alignment from the first to the last shade band.

5. Provide shade hardware system that allows multi-banded manually operated shades to be capable of smooth operation when the axis is offset a maximum of 6 degrees on each side of the plane perpendicular to the radial line of the curve, for a 12 degrees total offset.

6. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable.

7. Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel or heavier as required to support 150 percent of the full weight of each shade.

C. Drive Bracket / Brake Assembly:

1. MechoShade Drive Bracket model M5 shall be fully integrated with all MechoShade accessories, including, but not limited to: SnapLoc fascia,

room darkening side / sill channels, center supports and connectors for multi-banded shades.

2. M5 drive sprocket and brake assembly shall rotate and be supported on a welded 3/8 inch (9.525 mm) steel pin.

3. The brake shall be an over running clutch design which disengages to 90 percent during the raising and lowering of a shade. The brake shall withstand a pull force of 50 lbs. (22 kg) in the stopped position.

4. The braking mechanism shall be applied to an oil-impregnated hub on to which the brake system is mounted. The oil impregnated hub design includes an articulated brake assembly, which assures a smooth, non-jerky operation in raising and lowering the shades. The assembly shall be permanently lubricated. Products that require externally applied lubrication and or not permanently lubricated are not acceptable.

5. The entire M5 assembly shall be fully mounted on the steel support bracket, and fully independent of the shade tube assembly, which may be removed and reinstalled without effecting the roller shade limit adjustments.

6. Drive Chain: #10 qualified stainless steel chain rated to 90 lb. (41 kg) minimum breaking strength. Nickel plate chain shall not be accepted.

2.5 ROLLER SHADE SCHEDULE

A. Roller Shade Schedule:

1. Shade Type WT-1: Manual operating, chain drive, sunscreen roller shades in all exterior windows of rooms and spaces shown on the Drawings. Fascias.

2. Shade Type WT-2: Manual operating interior, chain drive room darkening blackout roller shades with blackout fabric in all exterior windows of rooms and spaces shown on Drawings, and related mounting systems and accessories. Fascias

2.6 SHADECLOTH

A. Visually Transparent Single-Fabric Shadecloth: MechoSystems, ThermoVeil® group, single thickness, opaque non-raveling 0.030-inch (0.762 mm) thick vinyl fabric, woven from 0.018-inch (0.457 mm) diameter extruded vinyl yarn comprising of 21 percent polyester and 79 percent reinforced vinyl, in colors selected from manufacturer's available range.

B. Dense Linear Weave: "1000 series", 3 percent open, dense linear-weave pattern. VLT range 50 to 60 percent.

C. Room Darkening (PVC Free) Shadecloth with Opaque Acrylic Backing: MechoSystems, "Equinox 0100 series", .008 inches thick (.19 mm) blackout material and weighing .94 lbs. per square yard, comprising of 53% fiberglass, 45% acrylic, 2% poly finish.

D. Color: Selected from manufacturer's standard colors.

2.7 ROLLER SHADE ACCESSORIES

A. Fascia:

1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
2. Fascia shall be able to be installed across two or more shade bands in one piece.
3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
4. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.

B. Room Darkening Side and Sill Channels (Provide at "Conference" – Room #104 Only):

1. Extruded aluminum with polybond edge seals and SnapLoc-mounting brackets and with concealed fastening. Exposed fasting is not acceptable. Channels shall accept one-piece exposed blackout hembar with vinyl seal to assure side light control and sill light control.
2. MechoSystems side channels, 1-15/16 inches (49.2 mm) wide by 1-3/16 inches (30.1 mm) deep, two-band center channels, 2-5/8 inches (66.6 mm) wide by 1-3/16 inches (30.1 mm) deep. The 2-5/8-inch (66.6 mm) double-center channels may be installed at center-support positions of multi-band-shade ElectroShades. MechoSystems side channels 2-5/8 inch (66.6 mm) may be used as center supports for ElectroShades; shade bands up to 8 high. For shade bands over 8 feet (2438 mm), provide ElectroShade side channels.
3. ElectroShade side channels, 2-1/2 inches (63.5 mm) wide by 1-3/16 inches (30.1 mm) deep; two-band center channels 5 inches (127 mm) wide by 1-3/16 inches (30.1 mm) deep. The 2-5/8-inch (66.6 mm) double-center channels may be installed at center-support positions of multi-band-shade ElectroShades. MechoSystems side channels 2-5/8 inches (66.6 mm) may be used as center supports for ElectroShades. Also provide for use with manually operated room darkening MechoSystems's over 8 feet (2438 mm) in height.
4. Color: Selected from manufacturer's standard colors or custom color as selected by Architect.

PART 3 – EXECUTION

3.1. EXAMINATION

A. Do not begin installation until substrates have been properly prepared. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2. PREPARATION

A. Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3. INSTALLATION OF ROLLER SHADES

A. Contractor Furnish and Install Responsibilities:

1. Window Covering Contractor (WC) shall provide an on site, Project Manager, and shall be present for all related jobsite scheduling meetings.
2. WC shall supervise the roller shade installation, and setting of intermediate stops of all shades to assure the alignment of the shade bands within a single EDU group, which shall not exceed +/- 0.125 inches (3.175mm), and to assure the alignment between EDU groups, which shall not exceed +/- 0.25 inches (6.35mm).
3. WC shall be responsible for field inspection on an area-by- area and floor-by-floor basis during construction to confirm proper mounting conditions per approved shop drawings.
4. Verification of Conditions: examine the areas to receive the work and the conditions under which the work would be performed and notify General Contractor and Owner of conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected. Commencement of installation shall constitute acceptance of substrate conditions by the installer.
5. WC shall provide accurate to 0.0625 inch (1.5875mm); field measurements for custom shade fabrication on the Roller Shades manufacturers input forms.
6. WC Installer shall install roller shades level, plumb, square, and true according to manufacturer's written instructions, and as specified here in. Blocking for roller shades installed under the contract of the interior General Contractor shall be installed plumb, level, and fitted to window mullion as per interior architect's design documents and in accordance with industry standard tolerances. The horizontal surface of the shade pocket shall not be out-of-level more than 0.625 inch (15.875mm) over 20 linear feet (6.096 meters)
7. Shades shall be located so the shade band is not closer than 2 inches (50 mm) to the interior face of the glass. Allow proper clearances for window operation hardware.

8. Adjust, align and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
9. Installer shall set Upper, Lower and up to 3 intermediate stop positions of all motorized shade bands, and assure alignment in accordance with the above requirements.
10. WC shall certify the operation of all motorized shades and turn over each floor for preliminary acceptance.
11. The WC shall participate and cooperate with the electrical contractor, the window shade manufacturer and the Commissioning agent to verify and certify the installation is in full conformance with the specifications and is fully operational. This work to occur during the commissioning stage and is in addition to preliminary acceptance required for each floor.
12. Clean roller shade surfaces after installation, according to manufacturer's written instructions.
13. WC shall train Owner's maintenance personnel to adjust, operate and maintain roller shade systems.
14. Protect installed products until completion of project.
15. Touch-up, repair or replace damaged products before Substantial Completion.

3.4. PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 122124

This page left intentionally blank.

SECTION 211300

AUTOMATIC FIRE SPRINKLER SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Work in this Section includes, but is not necessarily limited to, providing all labor, materials, supervision, testing, permits and design review required to design, install and obtain final acceptance of the automatic fire protection sprinkler system complete in all respects.

1.02 SYSTEM DESCRIPTION

A. Systems to be designed and installed in accordance with NFPA 13 (2016 Edition) as well as local standards. The criteria drawings are intended to provide direction to the installing contractor for their preparation of Shop Drawings for submittal to the jurisdiction. Discrepancies with NFPA or local requirements shall be brought to the attention of the Fire Protection Consultant prior to bid. The Contractor shall prepare fire protection drawings and documents for submittal to the local authority having jurisdiction (AHJ) for approval.

B. Systems shall provide compete protection of all occupied spaces as well as all attic spaces and combustible concealed spaces as required in NFPA-13 and shall avoid interference with work of all other trades in the building.

C. In addition to complete NFPA-13 coverage of all areas, the Computer Hardware rooms (Room #107) shall also be protected with a Clean-Agent Fire Suppression system, such as FM-200, Inergen, or approved equal. The Clean-Agent system shall comply with applicable codes and NFPA standards as well as manufacturer's specifications and recommendations. The Clean-Agent system is intended to provide an early-response alternative to the fire sprinklers in the rooms; detection and activation shall be designed such that the suppression agent is released well before the 286^0F fire sprinklers would be expected to activate.

D. Provide fire protection system complete with all UL listed component or Factory Mutual approved equipment and material items. Install and test in full conformity with the requirements of all applicable codes, National Fire Protection Association (NFPA) standards, local code enforcing agencies, Owner's insurance company, and Owner's Reviewing Consultant.

E. Sprinkler deflectors shall be positioned with relation to obstructions and ceilings as per NFPA 13, 2016 edition.

F. Sprinkler heads in finished ceilings shall be spaced to provide proper coverage, and to avoid interference with lights, diffusers, grilles, or other ceiling mounted equipment. Heads located in ceiling tile shall be centered in tiles to a tolerance of +/-1 ½ inches. The head layout shall conform to a typical pattern where doing so does not require additional heads to accomplish.

G. Sprinkler heads in finished ceilings shall be quick response concealed heads with white cover plates. Sprinkler heads in electrical rooms, server rooms, storage rooms, and closets may be white recessed pendent at the contractor's option. All heads in ceilings are to use either oversized escutcheons allowing 1" movement all around or use flexible hose connections.

H. Inspectors tests to be provided with orifice sized per code, discharging at six inches above a hard paved surface or drain as required by local jurisdiction. Inspector's test shall be piped to a location acceptable to the Owner's representative. Inspector's test discharge shall not flow where pedestrian traffic is present or into any obstructions, such as doors, or into enclosed spaces such as vestibules.

I. Provide flushing and drainage as per required in NFPA 13.

J. Provide a calculation information card showing system demand and pressure required at the base of the riser, design density and area calculated, as well as installing contractor's address and phone number. Card is to be metal, and to be affixed to each riser with a chain. Other type cards, or card not affixed with chain will not be acceptable.

K. System control valves shall be provided. All control valves shall be supervised and monitored through the fire alarm/ supervisory system and clearly marked as to their function and location.

L. Provide sprinkler protection at electrical rooms per the requirements of the local jurisdiction. No main piping is permitted in the electrical room. Sprinkler piping shall not be routed above panel boards. The installing sprinkler contractor is responsible to verify locations of panel boards. Where required, provide shielding of electrical equipment and special routing of fire sprinkler piping to satisfy all AHJ requirements.

M. Alarm notification devices are to be provided under the fire alarm scope. Wiring of tamper switches, flow switches, and/or notification devices is to be provided under fire alarm scope.

N. Route all piping around all obstructions and provide sprinkler protection under mechanical units, ducting or other obstructions as required by NFPA 13.

O. Systems shall be monitored by an off site Central Station including tamper switches on all valves and system flow detection devices.

1.03 SUBMITTALS

A. Submit completed shop drawings and material data direct to the Fire Department and owner's Fire Protection Consultant within 30 working days of the award of contract or less as required by project schedule.

B. Deliver all certificates of inspections to the Building Owner prior to final acceptance by Owner.

C. Installation shall commence upon Fire Department and Owner's approval.

D. As-built sprinkler shop drawings shall be provided to the Building Owner upon the completion of punch list items and prior to final acceptance by Owner. Final payment will not be made until as-built drawings are received by the Owner.

1.04 WARRANTY

A. Provide warranty in accordance with the General Conditions.

B. The Contractor shall further warrant that in the event of the failure of any system or its component equipment items, or the improper functioning thereof, during the period of the warranty, the Contractor shall have available, and on call, competent service personnel for the restoration of all systems and equipment for complete operation. Should the nature of the failure be such as to present an emergency, in the opinion of the Owner, such personnel shall be promptly available, regardless of the hour of the day or the day of the week. Should the failure be such as to fall under the warranty, the cost of the service shall be borne by the Contractor. Otherwise, the Owner will pay therefore at the prevailing rate for such services.

C. If service personnel are not promptly available "on call" as required by the warranty, the Owner may employ such personnel as are available to him at the expense of the Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All materials shall be as required by applicable codes and standards. All equipment used shall be UL listed and/ or Factory Mutual approved for use in fire sprinkler system installations.

B. All fire sprinkler heads shall be UL listed and Factory Mutual Approved. Contractor shall include in his cost, corrosion protection for sprinklers when required by the local jurisdiction. Provide one complete equipped sprinkler cabinet with 12 spare sprinklers.

C. Hanger, seismic bracing, or thrust bracing attachment to building structure shall be per the requirements of NFPA 13, 2016 Edition. All hanger materials shall be UL listed and/ or Factory Mutual approved for use in the support or bracing of fire sprinkler systems

D. All piping shall be new and approved for 175 psi working pressure conforming to ASTM specifications and listed/ approved by UL or FM for fire sprinkler system installation. All piping shall be black steel, prepared for painting. Contractor shall include in his cost corrosion protection for sprinkler piping when required by the local jurisdiction. Welding to be done in accordance with AWS D10.9 and NFPA 13. Contractor shall provide all welding stamps, certificates, or other documentation as required to gain approval from all authorities. These stamps shall be placed at each welded outlet, and/ or as required by the local authorities. Arrange for all inspections for welding as required by the local authorities.

E. Crimp type installations are not acceptable.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Furnish and install under this Section all hangers and steel fabrications, other than building structure, required for proper support of piping and equipment. All support criteria listed below is based on the use of schedule 10 piping no larger than 4" nominal diameter. Heavier piping may only be used with prior written approval from a Structural Engineer.

B. All piping, piping supports, hangers and attachments shall be sized as required by NFPA-13 (2016 edition) and shall be capable of resisting seismic forces as required by the more stringent of the requirements of NFPA-13 (2016 editions) or local building code requirements.

C. Hanger attachment:
Do not hang or support any loads or make any attachments to the metal roof deck or joist bridging.

No cutting, punching or openings are permitted in any structural member without prior written approval from a Structural Engineer. Provide all necessary piping supports, hangers, attachments and seismic bracing complying with the more stringent of NFPA 13 (2016 edition) or local building code requirements. All hangers and supporting steel shall be secured to the top chord of girders or joists using approved attachments.

D. Filling the sprinkler system with air or water shall be done in such a manner as to minimize any horizontal thrust or undue lateral force. Contractor shall ensure that all piping is installed and left straight and plumb.

E. Any deviations and changes from the above criteria must be brought to the attention of the Fire Protection Consultant in writing.

F. Installation of automatic sprinkler systems shall be by a licensed and certified automatic sprinkler and/or fire protection contractor. The contractor shall have a minimum of five years experience in installing sprinkler systems in similar type occupancies and shall be able to furnish evidence of such qualifications. References of satisfactory installations shall be furnished upon request.

3.02 INSPECTION, TESTING AND CLEANING

A. Arrange for all inspections, examinations and tests in full conformity with the requirements of all applicable codes, National Fire Protection Association (NFPA) standards, Authority having jurisdiction, the owner's insurance company, and the owner's fire protection consultant as necessary to obtain complete and final acceptance of the fire sprinkler system. The minimum test certificates to be submitted to the Architect of record prior to final acceptance shall be an overhead hydro, overhead final, underground flush, fire pump acceptance test and final fire sprinkler system building final.

B. Flush underground piping and pressure test at 200 psi for 2 hours prior to connection to overhead piping. Flushing and testing shall be witnessed by the Fire Department. It shall be the responsibility of the fire sprinkler contractor to ensure that satisfactory flushing of the underground piping has occurred prior to connection to overhead sprinkler piping. If the sprinkler contractor is not installing the underground under their scope of work, the sprinkler contractor is required to obtain a copy of the completed test certificate prior to making connection.

C. Leave entire sprinkler system clean in every respect at the conclusion of the work.

D. After the systems have been installed, tested, and accepted, the contractor is to provide three copies of the operating instructions and maintenance manuals of all equipment. Included with these manuals are; a copy of the approved shop drawings, copy of NFPA 25, a spare parts list and a list of phone numbers of emergency repair personnel to the Building Owner.

Fire Protection Consultant: Response Fire Protection
3056 Renault Street
San Diego, CA 92122
Phone: 858-677-9278
Fax: 858-459-3415
Email: info@responsefire.com

END OF SECTION 211300

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.

2. CPVC: Chlorinated polyvinyl chloride plastic.

3. PE: Polyethylene plastic.

4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.5 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

2.2 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping at indicated slopes.

D. Install piping free of sags and bends.

E. Install fittings for changes in direction and branch connections.

F. Select system components with pressure rating equal to or greater than system operating pressure.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Nonpressure Piping: Join according to ASTM D 2855.

J. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

END OF SECTION 220500

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Valve tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches (38 mm) high.

2.3 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:

1. Domestic Water Piping:

   a. Background Color: White.
   b. Letter Color: Green.

2. Waste and Vent Piping:

   a. Background Color: White.
   b. Letter Color: Green.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

END OF SECTION 220553

SECTION 220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Insulation Materials:

a. Mineral fiber.

2. Insulating cements.
3. Adhesives.
4. Sealants.
5. Factory-applied jackets.
6. Tapes.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

D. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Fibrex Insulations Inc.; Coreplus 1200.
b. Johns Manville; Micro-Lok.
c. Knauf Insulation; 1000(Pipe Insulation.
d. Manson Insulation Inc.; Alley-K.
e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Insulco, Division of MFS, Inc.; Triple I.
    b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Products, Division of ITW; CP-82.
    b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    d. Marathon Industries, Inc.; 225.
    e. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Products, Division of ITW; CP-82.
    b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    d. Marathon Industries, Inc.; 225.
    e. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 SEALANTS

A. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Products, Division of ITW; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.6 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
b. Compac Corp.; 104 and 105.
c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

O. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

C. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

3.6 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

3.8 FINISHES

A. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.9 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Domestic and Industrial Hot and Recirculated Hot Water:

1. NPS 1-1/4 (DN 32) and Smaller: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

2. NPS 1-1/2 (DN 40) and Larger: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch (38 mm) thick.

END OF SECTION 220700

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.

1.3 SUBMITTALS

A. Product Data: For the following products:

1. Pipe, tube and fittings

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type B) water tube, drawn temper.

1. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

B. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) water tube, annealed temper.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

2.4 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105.

B. Form: Sheet.

C. Material: High-density, cross-laminated PE film of 0.004-inch (0.10-mm) minimum thickness.

D. Color: Natural

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105.

D. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 221119 Section "Domestic Water Piping Specialties" for pressure-reducing valves.

E. Install piping free of sags and bends.

F. Install fittings for changes in direction and branch connections.

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

D. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

E. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.3 VALVE INSTALLATION

A. Install shutoff valve close to water main. Use butterfly or gate valves for piping NPS 2-1/2 (DN 65) and larger.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
2. NPS 2 (DN 50) and Larger: Sleeve-type coupling.

3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 (DN 50) and smaller: Use dielectric unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flange kits.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in this Section for pipe hanger and support products and installation.

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m) If Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 (DN 20) and smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
5. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.

E. Install supports for vertical copper tubing every 10 feet (3 m).

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

    a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.9 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

C. Under-building-slab, domestic and industrial water, building service piping, NPS 4 (DN 100) and smaller shall be either of the following:

1. Hard copper ASTM B88 Type K (ASTM B88M, Type A) wrought-copper solder-joint fittings; and brazed joints. Encased in PE film

2. Soft copper Type K tubing annealed with no fittings conforming to ASTM B 88.

D. Under-building-slab, domestic water piping for trap primer application shall be the following:

1. Hard copper ASTM B88 Type K (ASTM B88M, Type A) wrought-copper solder-joint fittings; and brazed joints. Encased in PE film.

2. Soft copper Type K tubing annealed with no fittings conforming to ASTM B 88.

E. Aboveground domestic and industrial water piping, NPS 3/4 to NPS 4 shall be the following:

1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper solder-joint fittings; and soldered joints.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Water pressure-reducing valves.
2. Strainers.
3. Water-hammer arresters.
4. Trap-seal primer valves.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 Annex G and NSF 14

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa) unless otherwise indicated.

2.3 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Watts; a Watts Water Technologies company.
b. Zurn Industries, LLC.

2. Standard: ASSE 1003.

3. Pressure Rating: Initial working pressure of 150 psig (1035 kPa).
4. Body: Bronze with chrome-plated finish for NPS 2 (DN 50) and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

5. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

2.4 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 (DN 65) and larger.
3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.

2.5 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. MIFAB, Inc.
   b. Precision Plumbing Products.
   c. Sioux Chief Manufacturing Company, Inc.
   d. Watts; a Watts Water Technologies company.
   e. Zurn Industries, LLC.

2. Standard: ASSE 1010 or PDI-WH 201.

3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.6 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. MIFAB, Inc.
   b. Precision Plumbing Products.
   c. Sioux Chief Manufacturing Company, Inc.
   d. Watts; a Watts Water Technologies company.
   e. Zurn Industries, LLC.

2. Standard: ASSE 1018.

3. Pressure Rating: 125 psig (860 kPa) minimum.

4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.

B. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve.

C. Install water-hammer arresters in water piping according to PDI-WH 201.

D. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 CONNECTIONS

A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each reduced-pressure-principle backflow according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

3.4 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 221119

SECTION 221316 - SANITARY WASTE AND VENT AND INDUSTRIAL WASTE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following for soil, waste, condensate drainage and vent piping inside the building:

1. Pipe, tube, and fittings.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. PE: Polyethylene plastic.

D. PP: Polypropylene plastic

E. PVC: Polyvinyl chloride plastic.

F. CPVC: Chlorinated polyvinyl chloride plastic

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.

a. Available Manufacturers:

1) ANACO.
2) Tyler Pipe; Soil Pipe Div.

2. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.

a. Available Manufacturers:

1) ANACO.
2) Tyler Pipe; Soil Pipe Div.

C. PP Drainage Pipe and Fittings: ASTM F 1412, pipe extruded and drainage-pattern fittings molded, with Schedule 40 dimensions, from PP resin with fire-retardant additive complying with ASTM D 4101; with fusion-joint ends.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Aboveground, soil and waste piping shall be the following:

1. Hubless cast-iron soil pipe and fittings heavy-duty shielded stainless-steel couplings; and hubless-coupling joints.

B. Aboveground, vent piping shall be the following:

1. Hubless cast-iron soil pipe and fittings; standard, shielded stainless-steel couplings; and hubless-coupling joints.

C. Underground, soil, waste, and vent piping shall be the following:

1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
2. Dissimilar Pipe-Material Couplings: Shielded non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

3.2 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 220500 Section "Common Work Results for Plumbing."

B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

C. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

D. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is

from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

E. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

F. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.

G. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

H. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 220500 Section "Common Work Results for Plumbing."

B. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

C. PVC Non-pressure Piping Joints: Join piping according to ASTM D 2665.

3.4 HANGER AND SUPPORT INSTALLATION

A. "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Install individual, straight, horizontal piping runs according to the following:

a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

D. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 (DN 150): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.

E. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.

3.6 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.7 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Floor Cleanouts
2. Wall Cleanouts
3. Floor drains
4. Floor Sinks

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FOG: Fats, oils, and greases.

C. FRP: Fiberglass-reinforced plastic.

D. HDPE: High-density polyethylene plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Metal Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Watts Drainage Products Inc.
    b. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Adjustable housing
5. Body or Ferrule: Cast iron.
6. Clamping Device: Required.
7. Outlet Connection: Threaded.
8. Closure: Brass plug tapered.
9. Adjustable Housing Material: Cast iron with set-screws or other device.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Medium Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
14. Standard: ASME A112.3.1.
15. Size: Same as connected branch.
16. Housing: Cast Iron.
17. Closure: Cast Iron with seal.
18. Riser: Cast Iron drainage pipe fitting to cleanout.

B. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Watts Drainage Products Inc.
    b. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, drilled-and-threaded cast-iron plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
8. Wall Access: Round nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains FD-1 : Refer to Plumbing Schedule for make and model numbers of fixtures

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 220500 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
2. Locate at minimum intervals of 100 feet (15 m).
3. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.

E. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

3.2 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 221413 – FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following storm drainage piping inside the building:

1. Pipe, tube, and fittings.

2. Special pipe fittings.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. LLDPE: Linear, low-density polyethylene plastic.

C. PE: Polyethylene plastic.

D. PVC: Polyvinyl chloride plastic.

E. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working-pressure, unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water (30 kPa).

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.

a. Available Manufacturers:

1) ANACO.
2) Fernco, Inc.
3) Tyler Pipe; Soil Pipe Div.

2.4 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. Solvent Cement and Adhesive Primer:

1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Aboveground storm drainage piping shall be the following:

1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and coupled joints.

2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

B. Underground storm drainage piping shall be the following:

1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

3.3 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 220500 Section "Common Work Results for Plumbing."

B. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 22 Section "Storm Drainage Piping Specialties."

C. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

D. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

E. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

F. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:

1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.

2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.

G. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

H. Install PVC storm drainage piping according to ASTM D 2665.

I. Install underground PVC storm drainage piping according to ASTM D 2321.

J. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Hubless Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

B. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 HANGER AND SUPPORT INSTALLATION

A. "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.

2. Individual, Straight, Horizontal Piping Runs: According to the following:

a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

D. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.

2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.

3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.

4. NPS 6 (DN 150): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.

5. NPS 8 to NPS 12 (DN 200 to DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.

6. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

E. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect storm drainage piping to roof drains and storm drainage specialties.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Test Procedure: Test storm drainage piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

5. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

2. Cap and subject piping to static-water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

4. Prepare reports for tests and required corrective action.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION

SECTION 221423 – STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following storm drainage piping specialties:

1. Cleanouts.
2. Roof & Overflow drains.
3. Miscellaneous storm drainage piping specialties.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FOG: Fats, oils, and greases.

C. FRP: Fiberglass-reinforced plastic.

D. HDPE: High-density polyethylene plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. PUR: Polyurethane plastic.

H. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

1.6 COORDINATION

A. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Watts Drainage Products Inc.
   b. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.

3. Size: Same as connected drainage piping.

4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.

5. Closure: Countersunk cast-iron plug.

6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Closure: Stainless-steel plug with seal.

B. Cast-Iron Wall Cleanouts

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Watts Drainage Products Inc.
   b. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.

3. Size: Same as connected drainage piping.

4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.

5. Closure: Countersunk drilled-and-threaded cast-iron plug.

6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

7. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.

8. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.2 ROOF & OVERFLOW DRAINS

A. Combination Roof & Overflow Drain RD-1/OD-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Zurn Plumbing Products Group; Specification Drainage Operation.
b. Watts Drainage Products Inc.

2. Standard: ASME A112.21.2M.

3. Pattern: Combination Roof/Overflow drain.

4. Body Material: Dura Coated Cast iron.

5. Outlets: Bottom.

6. Dome Material: Cast iron.

7. Combination Membrane Flashing Clamp: Required.

2.3 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Downspout Nozzles DSN-1:

1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.

2. Size: Same as connected conductor.

2.4 FLASHING MATERIALS

A. Copper Sheet: ASTM B 152/B 152M, 12 oz./sq. ft. (3.7 kg/sq. m or 0.41-mm) thickness.

B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.

C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.

D. Fasteners: Metal compatible with material and substrate being fastened.

E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

F. Solder: ASTM B 32, lead-free alloy.

G. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Roofing materials are specified in Division 07.

1. Install roof-drain flashing collar or flange so that there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Position roof drains for easy access and maintenance.

F. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

G. Install cast-iron soil pipe downspout boots at grade with top of hub 6 inches (152 mm) and 18 inches (457 mm) above grade.

H. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

(This page intentionally left blank.)

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial, light-duty, storage, electric, domestic-water heaters.
2. Domestic-water heater accessories.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex, "Drinking Water System Components - Health Effects."

PART 2 - PRODUCTS

2.1 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

A. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:

1. Standard: UL 174.
2. Storage-Tank Construction: Steel, vertical arrangement.

    a. Tappings: ASME B1.20.1 pipe thread.
    b. Pressure Rating: 150 psig (1035 kPa).
    c. Interior Finish: Comply with NSF 61 Annex barrier materials for potable-water tank linings, including extending lining material into tappings.

3. Factory-Installed Storage-Tank Appurtenances:

    a. Anode Rod: Replaceable magnesium.
    b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
    c. Drain Valve: ASSE 1005.
    d. Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2.
    e. Jacket: Steel with enameled finish.
    f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
    g. Heating Elements: Two; electric, screw-in immersion type; wired for simultaneous operation unless otherwise indicated. Limited to 12 kW total.
    h. Temperature Control: Adjustable thermostat.
    i. Safety Control: High-temperature-limit cutoff device or system.
    j. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.

B. Capacity and Characteristics:

1. Capacity: 65 gal..
2. Recovery: 36 gph at 80 deg F temperature rise.
3. Temperature Setting: 140 deg F
4. Power Demand: 7 kilowatts.
5. Heating Elements:

    a. Number of Elements: Two
    b. Kilowatts Each Element: 3.5 kilowatts.
    c. Number of Stages: One

6. Electrical Characteristics:

    a. Volts: 208.
    b. Phases: Single.
    c. Hertz: 60.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
2. Construction:

   a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
   b. Interior Finish: Comply with NSF 61 Annex barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   c. Air-Charging Valve: Factory installed.

3. Capacity and Characteristics:

   a. Working-Pressure Rating: 150 psig.
   b. Capacity Acceptable: 2 gal. minimum.
   c. Air Precharge Pressure: 50 psig.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 (DN 20) with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Pressure-Reducing Valves: ASSE 1003 for water. Set at 25-psig- (172.5-kPa-) maximum outlet pressure unless otherwise indicated.

D. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

E. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.

F. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

G. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches (457 mm) above the floor.

H. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping."

B. Install commercial, electric, domestic-water heaters with seismic-restraint devices.

C. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

D. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

E. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

F. Install pressure-reducing valve with integral bypass relief valve in electric, domestic-water booster-heater inlet piping and water hammer arrester in booster-heater outlet piping. Set pressure-reducing valve for outlet pressure of 25 psig (172 kPa) Comply

with requirements for pressure-reducing valves and water hammer arresters specified in Section 221119 "Domestic Water Piping Specialties."

G. Fill electric, domestic-water heaters with water.

H. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.

END OF SECTION 223300

(This page intentionally left blank.)

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following conventional plumbing fixtures and related components:

1. Fixtures, Faucets, Hose Bibbs
2. Protective shielding guards.
3. Fixture supports.
4. Kitchen sinks.

B. Related Sections include the following:

1. Division 15430 Section "Plumbing Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.

D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.

E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

F. FRP: Fiberglass-reinforced plastic.

G. PMMA: Polymethyl methacrylate (acrylic) plastic.

H. PVC: Polyvinyl chloride plastic.

I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

E. Low Lead Requirements: Comply with Senate Bill AB 1953 for lead content in plumbing fixture materials that will be in contact with potable water.

F. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

H. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.
2. Vitreous-China Fixtures: ASME A112.19.2M.

I. Comply with the following applicable standards and other requirements specified for faucets:

1. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.

2. Faucets: ASME A112.18.1.
3. Hose-Connection Vacuum Breakers: ASSE 1011.
4. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
5. NSF Potable-Water Materials: NSF 61.
6. Pipe Threads: ASME B1.20.1.
7. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
8. Supply Fittings: ASME A112.18.1.
9. Brass Waste Fittings: ASME A112.18.2.

J. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Dishwasher Air-Gap Fittings: ASSE 1021.
4. Manual-Operation Flushometers: ASSE 1037.
5. Plastic Tubular Fittings: ASTM F 409.
6. Brass Waste Fittings: ASME A112.18.2.
7. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

K. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Disposers: ASSE 1008 and UL 430.
2. Dishwasher Air-Gap Fittings: ASSE 1021.
3. Flexible Water Connectors: ASME A112.18.6.
4. Floor Drains: ASME A112.6.3.
5. Off-Floor Fixture Supports: ASME A112.6.1M.
6. Pipe Threads: ASME B1.20.1.
7. Plastic Toilet Seats: ANSI Z124.5.
8. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of whirlpools that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures of unit shell.
b. Faulty operation of controls, blowers, pumps, heaters, and timers.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period for Commercial Applications: One year from date of Substantial Completion.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
3. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed.
4. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES, FAUCETS, HOSE BIBBS

A. Refer to contract drawings for make and model numbers of fixtures, faucets & valves.

2.2 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Engineered Brass Co.
b. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
c. McGuire Manufacturing Co., Inc.
d. Plumberex Specialty Products Inc.
e. TCI Products.
f. TRUEBRO, Inc.
g. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.
h. Or Equal.

3. Description: Manufactured plastic wraps for covering plumbing fixture and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.3 FIXTURE SUPPORTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company.
2. MIFAB Manufacturing Inc.
3. Smith, Jay R. Mfg. Co.
4. Tyler Pipe; Wade Div.
5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
6. Zurn Plumbing Products Group; Specification Drainage Operation.
7. Or Equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install wall-mounting fixtures with tubular waste piping attached to supports.

D. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.

E. Install counter-mounting fixtures in and attached to casework.

F. Install fixtures level and plumb according to roughing-in drawings.

G. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces

behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 15 Section "Valves."

H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

J. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

K. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 15050 Section "Basic Mechanical Materials and Methods."

L. Set service basins in leveling bed of cement grout. Grout is specified in Division 15050 Section "Basic Mechanical Materials and Methods."

M. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 7 Section "Joint Sealants."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment according to Division 16 Section "Grounding and Bonding."

D. Connect wiring according to Division 16 Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Operate and adjust disposers. Replace damaged and malfunctioning units.

C. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

D. Replace washers and seals of leaking and dripping faucets and stops.

E. Install fresh batteries in sensor-operated mechanisms.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

(This page intentionally left blank.)

SECTION 230516 - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Flexible-hose seismic expansion loops.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.

B. Capability: Products to absorb 200 percent of maximum axial movement between anchors. As determined in structural building calculations.

2.2 Flexible-Hose Seismic Expansion loops

A. Manufacturers: Available manufacturers that may be used in the work include, but are not limited to, the following:
   1. Metraflex
   2. Or Equal

B. Description: Manufactured assembly with two parallel sections of corrugated metal hose, compatible braid, 180 degree return bend, with inlet and outlet connections. Field fabricated loops shall not be acceptable.

C. Flexible Hose: Corrugated-metal inner hoses and double-braided outer sheaths.

D. Expansion Joints for Copper Tubing NPS 2 (DN 50) and Smaller: Copper-alloy fittings with solder-joint end connections.
   1. Bronze hoses and double-braid bronze sheaths.

E. Where multiple pipes are located, the expansion joints shall be provided in a nested configuration.

2.3 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides

   1. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding slider for bolting to pipe.

PART 3 - EXECUTION

3.1 FLEXIBLE HOSE EXPANSION LOOP INSTALLATION

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

B. Install and guide per manufacturers' installation instructions and Mechanical Contractors Association of America "Guidelines for Quality Piping Installations."

C. Flexible hose expansion loop return fitting shall be supported to allow movement.

3.2 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install one guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than fourpipe diameters from expansion joint.

C. Attach guides to pipe, and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:

1. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
2. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24; U bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.
1. Anchor Attachment to Steel Structural Members: Attach by welding.
2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION 230516

(This page intentionally left blank.)

SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

2.2 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

C. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

D. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

END OF SECTION 230517

SECTION 230523.12 - BALL VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Bronze ball valves.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, grooves, and weld ends.
   3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

   1. ASME B1.20.1 for threads for threaded-end valves.
   2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
   3. ASME B16.18 for solder-joint connections.
   4. ASME B31.1 for power piping valves.
   5. ASME B31.9 for building services piping valves.

C. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

D. Refer to HVAC valve schedule articles for applications of valves.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:

1. Handlever: For quarter-turn valves smaller than NPS 4 (DN 100)

H. Valves in Insulated Piping:

1. Include 2-inch (50-mm) stem extensions.
2. Extended operating handle of nonthermal-conductive material, and protective sleeves that allow operation of valves without breaking the vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

I. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Two-Piece Bronze Ball Valves with Full Port and Stainless-Steel Trim:
1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Solder-joint valve-end option is indicated in valve schedules below.
2. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.

3.4 REFRIGERANT VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller: Two piece, full port, bronze with stainless-steel trim.

1. Valves may be provided with solder-joint ends instead of threaded ends.

END OF SECTION 230523.12

(This page intentionally left blank.)

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems
4. Thermal-hanger shield inserts.
5. Equipment supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design seismic-restraint hangers and supports for piping and equipment per Structural Engineer’s requirements.

1.5 ACTION SUBMITTALS

A. Product Data: for the following:
1. Steel pipe hangers and supports.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include product data for components.
2. Equipment supports.
3. Pipe stands. Include product data for components.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
5. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

C. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.4 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.5 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

K. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    b. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3.2 METAL FABRICATIONS

A. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

B. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.3 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1 inch.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.5 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
3. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
4. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
5. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
6. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).
    c. Heavy (MSS Type 33): 3000 lb (1360 kg).

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
10. Horizontal Travelers (MSS Type 58): For supporting piping sysems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

L. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

END OF SECTION 230529

(This page intentionally left blank.)

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Valve Tags
4. Ceiling grid, access panel and door markers
5. Damper ribbons

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black
3. Background Color: White
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1/2 inch (13 mm)

2.3 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.4 DUCT IDENTIFICATION DEVICES

A. Damper Ribbons: Plastic ribbon or tape. 3/4 Inch width minimum. Red or yellow.

2.5 CEILING GRID, ACCESS PANEL, AND DOOR MARKERS

A. Color coded dots: ¼ inch, self-adhering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.

7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:

1. Refrigerant Piping:

a. Background Color: Black.
b. Letter Color: White.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

a. Refrigerant: 1-1/2 inches (38 mm).
b. Hot Water: 1-1/2 inches (38 mm).
c. Gas: 1-1/2 inches (38 mm).

2. Valve-Tag Color:

a. Refrigerant: Natural.
b. Hot Water: Natural.
c. Gas: Natural.

3. Letter Color:

a. Refrigerant: Black.
b. Hot Water: Black.
c. Gas: Black.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.6 DUCT IDENTIFICATION

A. All duct dampers that will be located above a ceiling will have an identification ribbon tied to the damper handle. The ribbon is to hang down at least 12 inches below the bottom of the duct or to the level of the ceiling; whichever is shorter.

3.7 CEILING GRID, ACCESS PANEL, AND DOOR MARKERS

A. Provide ¼" self-adhering color coded dots to the ceiling grid and access doors. Color code is as follows;
   1. Blue – HVAC. Includes fire/smoke dampers, energy management system (EMS) controls, control or modulating dampers, in-line fans, steam traps, fan coils, air vents, etc. Does not apply to fixed position balancing dampers.
   2. Green – plumbing. Applies to cleanouts, drains, isolation valves, etc.

B. Installation; locate dots on following locations;

   1. For T-bar ceilings, locate dot at the intersection of the grid. Dot is to be placed towards the tile that should be removed to gain access to the device. This does not necessarily mean that it is the tile directly below the item being identified.
   2. For access doors, place dots on door for all services being identified (red, blue and/or green).

3.8 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

END OF SECTION 230553

(This page intentionally left blank.)

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

F. TDH: Total dynamic head.

1.3 ACTION SUBMITTALS

A. Contract Documents Examination Report: Within 15days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

1.4 INFORMATIONAL SUBMITTALS

A. Strategies and Procedures Plan: Within 30days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

B. Certified TAB reports.

C. Sample report forms.

D. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.

4. Dates of use.
5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC, NEBB or TABB.
2. TAB Technician: Employee of the TAB specialist and certified by AABC, NEBB or TABB as a TAB technician.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

E. TAB Conference: Meet with Construction Manageron approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Coordination and cooperation of trades and subcontractors.
d. Coordination of documentation and communication flow.

F. TAB Report Forms: Use standard TAB contractor's forms approved by Architect.

1.6 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.

K. Examine operating safety interlocks and controls on HVAC equipment.

L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures for balancing the systems.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Duct systems are complete with terminals installed.
b. Volume, smoke, and fire dampers are open and functional.
c. Clean filters are installed.
d. Fans are operating, free of vibration, and rotating in correct direction.
e. Variable-frequency controllers' startup is complete and safeties are verified.
f. Automatic temperature-control systems are operational.
g. Ceilings are installed.
h. Windows and doors are installed.
i. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance"ASHRAE 111 NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
    b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
    c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
    d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:

    a. Measure static pressure directly at the fan outlet or through the flexible connection.
    b. Measure static pressure directly at the fan inlet or through the flexible connection.

c. Measure static pressure across each component that makes up the air-handling system.
d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

3.6 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent
2. Air Outlets and Inlets: Plus or minus 10 percent

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.7 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for fan coil units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Pipe and valve sizes and locations.
4. Fan coil units.
5. Balancing stations.
6. Position of balancing devices.

E. VRF System Test Reports: include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Number, type, and size of filters.

2. Motor Data:

    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.

3. Test Data (Indicated and Actual Values):

    a. Total airflow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan rpm.
    d. Discharge static pressure in inches wg.
    e. Coil static-pressure differential in inches wg.
    f. Outdoor airflow in cfm.
    g. Return airflow in cfm.

F. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

    a. System identification.
    b. Location.
    c. Make and type.
    d. Model number and size.
    e. Manufacturer's serial number.
    f. Arrangement and class.

2. Motor Data:

    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e.

3. Test Data (Indicated and Actual Values):

    a. Total airflow rate in cfm.

b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

G. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft.
g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

H. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.8 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.
b. Measure water flow of at least 5 percent of terminals.
c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
d. Verify that balancing devices are marked with final balance position.
e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Architect.
3. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
4. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.9 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes

1. Insulation Materials:

a. Mineral fiber.

2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Lagging adhesives.
6. Sealants.
7. Factory-applied jackets.
8. Tapes.
9. Securements.
10. Corner angles.

B. Related Sections:

1. Section 230716 "HVAC Equipment Insulation."
2. Section 233113 "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

C. Qualification Data: For qualified Installer.

D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of

insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General" and "Indoor Duct and Plenum Insulation Schedule," articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. CertainTeed Corp.; Duct Wrap.
   b. Johns Manville; Microlite.
   c. Knauf Insulation; Duct Wrap.
   d. Manson Insulation Inc.; Alley Wrap.
   e. Owens Corning; All-Service Duct Wrap.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

2.4 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Childers Products, Division of ITW; CP-76-8.
   b. Foster Products Corporation, H. B. Fuller Company; 95-44.
   c. Marathon Industries, Inc.; 405.
   d. Mon-Eco Industries, Inc.; 44-05.
   e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 SECUREMENTS

A. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
   a. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-(0.41-mm-) thick, stainless-steel sheet, with beveled edge sized as required to

hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

C. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel

2.7 CORNER ANGLES

A. PVC Corner Angles: 30 mils (0.8 mm) thick, minimum 1 by 1 inch (25 by 25 mm), PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

3.4 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
    b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface

to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).

5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

8. section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
9. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.6 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and return air.

B. Items Not Insulated:
1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.

6. Factory-insulated access panels and doors.

3.7 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket: **Minimum R-4.2 Thermal Performance**.

END OF SECTION 230713

(This page intentionally left blank.)

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following HVAC piping systems:
   1. Refrigerant suction and hot-gas piping, indoors and outdoors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness and jackets (both factory and field applied, if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail attachment and covering of heat tracing inside insulation.
   3. Detail insulation application at pipe expansion joints for each type of insulation.
   4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   5. Detail removable insulation at piping specialties.
   6. Detail application of field-applied jackets.
   7. Detail application at linkages of control devices.
   8. Detail field application for each equipment type.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Insulation temperature ratings shall meet or exceed DX equipment manufacturer recommendations and requirements for the specified equipment.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

H. Mineral-Fiber, Preformed Pipe Insulation:

1. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

I. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

C. Vapor-Barrier Mastic: Water based; suitable for outdoor use on below-ambient services.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

2.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
2. Service Temperature Range: Minus 50 to plus 180 deg F (Minus 46 to plus 82 deg C).

2.5 SEALANTS

A. Joint Sealants:

1. FSK and Metal jacket Flashing Sealants:

a. Materials shall be compatible with insulation materials, jackets, and substrates.
b. Permanently flexible, fire-and water-resistant, elastomeric sealant.
c. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
d. Color: Aluminum
e. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: White.
5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. PVDC Jacket for Outdoor Applications: 6-mil- (0.15-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perm (0.007 metric perm) when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.

1. Factory-Fabricated Fitting Covers:

a. Same material, finish, and thickness as jacket.
b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
c. Tee covers.
d. Flange and union covers.
e. End caps.
f. Beveled collars.
g. Valve covers.
h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

D. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

2.9 SECUREMENTS

A. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-)diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
   a. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-(0.41-mm-) thick, stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

   a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

C. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel.

2.10 CORNER ANGLES

A. PVC Corner Angles: 30 mils (0.8 mm) thick, minimum 1 by 1 inch (25 by 25 mm), PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005; Temper H-14.

C. Stainless-Steel Corner Angles: 0.024 inch (0.61 mm) thick, minimum 1 by 1 inch (25 by 25 mm), stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or 316.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
6. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
7. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
8. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.9 INDOOR PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping: Mineral-fiber, preformed pipe insulation. Insulation shall meet the following conductivity and thickness requirements.

TABLE 120.3-A PIPE INSULATION THICKNESS

FLUID TEMPERATURE RANGE (°F)	CONDUCTIVITY RANGE (in Btu-inch per hour per square foot per °F)	INSULATION MEAN RATING TEMPERATURE (°F)	NOMINAL PIPE DIAMETER (in inches)				
			< 1	1 to <1.5	1.5 to < 4	4 to < 8	8 and larger
			INSULATION THICKNESS REQUIRED (in inches)				
Space heating, Hot Water systems (steam, steam condensate and hot water) and Service Water Heating Systems							
Above 350	0.32-0.34	250	4.5	5.0	5.0	5.0	5.0
251-350	0.29-0.31	200	3.0	4.0	4.5	4.5	4.5
201-250	0.27-0.30	150	2.5	2.5	2.5	3.0	3.0
141-200	0.25-0.29	125	1.5	1.5	2.0	2.0	2.0
105-140	0.22-0.28	100	1.0	1.5	1.5	1.5	1.5
Space cooling systems (chilled water, refrigerant and brine)							
40-60	0.21-0.27	75	0.5	0.5	1.0	1.0	1.0
Below 40	0.20-0.26	50	1.0	1.5	1.5	1.5	1.5

3.10 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping: Insulation shall be the following:

1. Flexible Elastomeric: Insulation conductivity and thickness requirements per Table 120.3-A (above).

3.11 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Outdoor Pipe Jacketing:

1. Aluminum

END OF SECTION 230719

(This page intentionally left blank.)

SECTION 230923 - DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. VRF Controls Network shall be an integrated controls platform for specialized for Variable Refrigerant Flow (VRF) systems. The customizable Controls Network shall allow the level of control to match the needs of the building and its occupants.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at the Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product include the following:

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
3. Product description with complete technical data, performance curves, and product specification sheets.
4. Installation, operation and maintenance instructions including factors effecting performance.
5. Bill of materials of indicating quantity, manufacturer, and extended model number for each unique product.

6. When manufacturer's product datasheets apply to a product series rather than a specific product model, clearly indicate and highlight only applicable information.
7. Each submitted piece of product literature shall clearly cross reference specification and drawings that submittal is to cover.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting details where applicable.
2. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail means of vibration isolation and show attachments to rotating equipment.
4. Plan Drawings indicating the following:

a. Screened backgrounds of walls, structural grid lines, HVAC equipment, ductwork and piping.
b. Room names and numbers with coordinated placement to avoid interference with control products indicated.
c. Each desktop operator workstation, server, gateway, router, DDC controller, control panel instrument connecting to DDC controller, and damper and valve connecting to DDC controller, if included in Project.
d. Exact placement of products in rooms, ducts, and piping to reflect proposed installed condition.
e. Network communication cable and raceway routing.
f. Proposed routing of wiring, cabling, conduit, and tubing, coordinated with building services for review before installation.

5. Schematic drawings for each controlled HVAC system indicating the following:

a. I/O points labeled with point names shown. Indicate instrument range, normal operating set points, and alarm set points. Indicate fail position of each damper and valve, if included in Project.
b. I/O listed in table format showing point name, type of device, manufacturer, model number, and cross-reference to product data sheet number.
c. A graphic showing location of control I/O in proper relationship to HVAC system.
d. Wiring diagram with each I/O point having a unique identification and indicating labels for all wiring terminals.
e. Unique identification of each I/O that shall be consistently used between different drawings showing same point.
f. Elementary wiring diagrams of controls for HVAC equipment motor circuits including interlocks, switches, relays and interface to DDC controllers.
g. Narrative sequence of operation.
h. Graphic sequence of operation, showing all inputs and output logical blocks.

6. Control panel drawings indicating the following:

a. Panel dimensions, materials, size, and location of field cable, raceways, and tubing connections.
b. Interior subpanel layout, drawn to scale and showing all internal components, cabling and wiring raceways, nameplates and allocated spare space.
c. Front, rear, and side elevations and nameplate legend.
d. Unique drawing for each panel.

7. DDC system network riser diagram indicating the following:

a. Each device connected to network with unique identification for each.
b. Interconnection of each different network in DDC system.
c. For each network, indicate communication protocol, speed and physical means of interconnecting network devices, such as copper cable type, or fiber-optic cable type. Indicate raceway type and size for each.
d. Each network port for connection of an operator workstation or other type of operator interface with unique identification for each.

8. DDC system electrical power riser diagram indicating the following:

    a. Each point of connection to field power with requirements (volts/phase//hertz/amperes/connection type) listed for each.
    b. Each control power supply including, as applicable, transformers, power-line conditioners, transient voltage suppression and high filter noise units, DC power supplies, and UPS units with unique identification for each.
    c. Each product requiring power with requirements (volts/phase//hertz/amperes/connection type) listed for each.
    d. Power wiring type and size, race type, and size for each.

9. Monitoring and control signal diagrams indicating the following:

    a. Control signal cable and wiring between controllers and I/O.
    b. Point-to-point schematic wiring diagrams for each product.
    c. Control signal tubing to sensors, switches and transmitters.
    d. Process signal tubing to sensors, switches and transmitters.

10. Color graphics indicating the following:

    a. Itemized list of color graphic displays to be provided.
    b. For each display screen to be provided, a true color copy showing layout of pictures, graphics and data displayed.
    c. Intended operator access between related hierarchical display screens.

C. System Description:

1. Full description of DDC system architecture, network configuration, operator interfaces and peripherals, servers, controller types and applications, gateways, routers and other network devices, and power supplies.
2. Complete listing and description of each report, log and trend for format and timing and events which initiate generation.

3. Complete bibliography of documentation and media to be delivered to Owner.
4. Description of testing plans and procedures.
5. Description of Owner training.

D. Delegated-Design Submittal: For DDC system products and installation indicated as being delegated.

1. Sequencing for the operation and optimization of the VRF system and all associated appurtenances.

2. Supporting documentation showing DDC system design complies with performance requirements indicated, including calculations and other documentation necessary to prove compliance.

1.4 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

B. Field quality-control reports.

C. Sample Warranty: For manufacturer's warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For DDC system to include in emergency, operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Project Record Drawings of as-built versions of submittal Shop Drawings provided in electronic PDF format.
b. Testing and commissioning reports and checklists of completed final versions of reports, checklists, and trend logs.
c. As-built versions of submittal Product Data.
d. Names, addresses, e-mail addresses and 24-hour telephone numbers of Installer and service representatives for DDC system and products.
e. Operator's manual with procedures for operating control systems including logging on and off, handling alarms, producing point reports, trending data, overriding computer control and changing set points and variables.
f. Programming manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
g. Engineering, installation, and maintenance manuals that explain how to:

1) Design and install new points, panels, and other hardware.
2) Perform preventive maintenance and calibration.
3) Debug hardware problems.
4) Repair or replace hardware.

h. Documentation of all programs created using custom programming language including set points, tuning parameters, and object database.
i. Backup copy of graphic files, programs, and database on electronic media such as DVDs.
j. List of recommended spare parts with part numbers and suppliers.
k. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
l. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
m. Licenses, guarantees, and warranty documents.
n. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
o. Owner training materials.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace products that fail in materials or workmanship within specified warranty period.

1. Failures shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner.
2. Include updates or upgrades to software and firmware if necessary to resolve deficiencies.

    a. Install updates only after receiving Owner's written authorization.

3. Warranty service shall occur during normal business hours and commence within 24-hours of Owner's warranty service request.
4. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer shall be the same or an approved control system as the VRF system manufacturer.

2.2 DDC SYSTEM DESCRIPTION

A. Wall Mounted Controller

1. Overview:
   The Controller shall be capable of controlling the group in terms of On/Off, Mode of Operation, Fan Speed, and space temperature set point based on the available functions of the connected system. Additionally, the Controller Remote Controller will be available with or without Mode of Operation control, and offered in white.

2. General:

    a. The Simple Remote Controller shall communicate to the VRF indoor unit via included communications cable.
    b. The Simple Remote Controller shall be able to display temperature in °F or °C based on user settings.

3. Basic Functions:

Function	Description	Monitor	Control
On/Off	On/Off operation for group	X	X
Mode of Operation**	Mode of Operation for group (Heat/Cool/Fan/Dry/Auto)	X	X
Set Point	Space temperature set point for group. Setting temperature range 64°F-84°F	X	X

	depending on operation mode and connected equipment.		
Space Temperature	Display measured space temperature	X	
Fan Speed	Select fan speeds	X	X

4. Electrical:

    a. Controller shall be powered via the VRF indoor units communication wiring.

B. VRF Central Facility Controller, Central Controller

1. Overview:
   The Central Controller shall be capable of monitoring and control of up to 128 indoor units or 130 Input/Outputs points through a touchscreen interface and embedded web browser. The shall provide multiple energy management schemes and control of third-party equipment when paired with associated I/O controllers. Additionally, the Central Controller shall be capable of providing daily, weekly, yearly, and holiday programmable scheduling of Occupied/Unoccupied settings, On/Off, Mode of Operation, set point and fan speed based on the available functions of the connected system.

2. General:

    a. The Central Controller shall communicate to the VRF indoor unit via the daisy-chain communication protocol.
    b. The Central Controller shall have a minimum 10.2” backlit touchscreen LCD display screen.
    c. The Central Controller shall have web access with user control.
    d. The Central Controller shall be able to generate an operation and error history log with reporting capabilities.
    e. The Central Controller shall be able to control up to 128 indoor units in a group or as a single zone.
    f. The Central Controller shall support two digital input and two digital outputs for device interlock.
    g. The Central Controller shall have two set point auto changeover.
    h. The Central Controller shall have occupied/unoccupied set point control.
    i. The Central Controller shall have remote controller lock (All, Setpoint, Mode, and Fan Speed).
    j. The Central Controller shall have error e-mail notification.
    k. The Central Controller shall have visual floor plan navigation.

3. Basic Functions:

Function	Description	Monitor	Control
On/Off	On/Off operation for group	X	X
Mode of Operation	Mode of Operation for group (Heat/Cool/Fan/Auto/Dry)	X	X
Set Point	Space temperature setpoint for group. Setting temperature range 64°F-84°F depending on operation mode and	X	X

	connected equipment.		
Space Temperature	Display measured space temperature	X	
Fan Speed	Select fan speeds Hi-Mid1-Mid2-Low-Auto	X	X
Airflow Direction	Select air direction settings Auto/Swing/Fixed	X	X
Group Control	Control and Monitor a group or multiple groups	X	X
Operational and Event Log History	Record system operation and fault code history	X	
Language Selection	Choice of multiple languages		X

4. Advanced Functions:

Function	Description	Monitor	Control
Schedule	Daily, Weekly, Yearly and Holiday programmable schedule Minimum of five events per day with On/Off, Occupied/Unoccupied, Mode, Set temperature, and Fan	X	X
Timed Override	Timed override of Unoccupied settings	X	X
Occupied/Unoccupied Setting	Ability to have different settings for both modes	X	X
Energy Use Display	Display actual operational time and power consumption.	X	X
Operation Run Time Limit	Limit the run time of an indoor unit	X	X
Two set-point auto operation	Automatically manage room temperature for heating and cooling	X	X
Error E-Mail Notification	Send E-Mail when a system failure has been detected	X	X
Peak/Demand Control	Control and Limit power consumption of external devices	X	X
Temperature set-point range limit	Ability to limit heating and cooling setpoint ranges	X	X
Remote controller Lock setting	Ability to lock out operation of the controller	X	X

5. Electrical:

    a. The Central controller shall be powered via 24 VAC or 12 VDC.

C. Specialty Application Expansion Controllers, Input/Output Module

1. Overview:
   Input/Output Expansion Module shall be capable of controlling an additional (3) Digital Output's, (3) Digital Input's, (4) Analog Output's and (4) Universal Inputs and shall be networked to the Central Controller.

2. General:

    a. The Input/Output Module Digital Input is a binary (Dry Contact)
    b. The Input/Output Module Digital Output shall have a contact rating of 2amps at 30 VAC/DC.
    c. The Input/Output Module Analog Outputs shall have output voltage of 0-10V.

D. Digital Output (DO) Kit: (Dry Board Expansion)

1. Overview:
   The Digital Output (DO) Kit shall allow On/Off control of third-party devices via V-Net communications. The DO Kit shall allow monitor and control from Central Controllers and BMS Gateways.

2. General:

    a. The Digital Output Kit shall have a double-pole, single-throw, normally open relay rated at 25A.
    b. The Digital Output Kit shall be furnished with a pre-fabricated line voltage connection cable.
    c. The Digital Output Kit shall be furnished with a two-piece steel surface-mounted enclosure.

3. Electrical:

    a. Power shall be 220 VAC.

E. Dry Contact Simple

1. Overview:
   The Simple Dry Contact shall allow on/off control of a indoor unit via a 3rd party signal. The Simple Dry Contact shall allow monitoring of a indoor unit operation and error status.

2. General:

    a. The Simple Dry Contact shall connect directly to the LG Multi V indoor unit.
    b. The Simple Dry Contract input shall be 24 VAC.
    c. The Simple Dry Contact shall provide ability for operation status and error status.

3. Electrical:

    a. Power shall be 12 VDC (powered from indoor unit).

F. Dry Contact For Thermostat

1. Overview:

The Dry Contact for Thermostat shall allow on/off control of a Multi V indoor unit via a 3rd party signal. The Dry Contact shall allow monitoring of Multi V indoor unit run and error status.

2. General:

   a. The Dry Contact for Thermostat shall connect directly to the Multi V indoor unit.
   b. The Dry Contact for Thermostat input shall be 5 - 12 VDC or 24VAC.
   c. The Dry Contact for Thermostat shall be able to connect to a third-party thermostat.
   d. The Dry Contact for Thermostat shall provide ability to set desired temperature of the dry contact module via a temperature switch.
   e. The Dry Contact for Thermostat shall provide the ability to control a heat pump thermostat with O and B.
   f. The Dry Contact for Thermostat shall provide ability for operation status and error status.

3. Electrical:

   a. Power shall be 12 VDC (powered from indoor unit).

2.3 SOURCE QUALITY CONTROL

A. Product(s) will be considered defective if they do not pass tests and inspections.

B. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

   1. Verify compatibility with and suitability of substrates.

B. Examine roughing-in for products to verify actual locations of connections before installation.

   1. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.
   2. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where product will be installed.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install products to satisfy more stringent of all requirements indicated.

B. Install products level, plumb, parallel, and perpendicular with building construction.

C. Support products, tubing, piping wiring and raceways.

D. If codes and referenced standards are more stringent than requirements indicated, comply with requirements in codes and referenced standards.

E. Fabricate openings and install sleeves in ceilings, floors, roof, and walls required by installation of products. Before proceeding with drilling, punching, and cutting, check for concealed work to avoid damage. Patch, flash, grout, seal, and refinish openings to match adjacent condition.

F. Firestop penetrations made in fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

G. Seal penetrations made in acoustically rated assemblies. Comply with requirements in Section 079200 "Joint Sealants."

H. If product locations are not indicated, install products in locations that are accessible and that will permit service and maintenance from floor, equipment platforms, or catwalks without removal of permanently installed furniture and equipment.

3.3 CENTRAL CONTROLLER INSTALLATION

A. Touchscreen Installation:

1. Install in location as directed by Owner.
2. Develop Project-specific graphics, trends, reports, logs and historical database.

B. Color Graphics Application:

1. Use system schematics indicated as starting point to create graphics.
2. Develop Project-specific library of symbols for representing system equipment and products.
3. Incorporate digital images of Project-completed installation into graphics where beneficial to enhance effect.
4. Submit sketch of graphic layout with description of all text for each graphic for Owner's and Architect's review before creating graphic using graphics software.
5. Seek Owner input in graphics development once using graphics software.
6. Final editing shall be done on-site with Owner's and Architect's review and feedback.

7. Refine graphics as necessary for Owner acceptance.
8. On receiving Owner acceptance, print a hard copy for inclusion in operation and maintenance manual. Prepare a scanned copy PDF file of each graphic and include with softcopy of DDC system operation and maintenance manual.

3.4 CONTROLLER INSTALLATION

A. Install controllers in enclosures to comply with indicated requirements.

B. Connect controllers to field power supply.

C. Install controller with latest version of applicable software and configure to execute requirements indicated.

D. Test and adjust controllers to verify operation of connected I/O to achieve performance indicated requirements while executing sequences of operation.

E. Installation of Network Controllers:

1. Quantity and location of network controllers shall be determined by DDC system manufacturer to satisfy requirements indicated.
2. Install controllers in a protected location that is easily accessible by operators.

F. Installation of Programmable Application Controllers:

1. Quantity and location of programmable application controllers shall be determined by DDC system manufacturer to satisfy requirements indicated.
2. Install controllers in a protected location that is easily accessible by operators.

G. Application-Specific Controllers:

1. Quantity and location of application-specific controllers shall be determined by DDC system manufacturer to satisfy requirements indicated.
2. For controllers not mounted directly on equipment being controlled, install controllers in a protected location that is easily accessible by operators.

3.5 ELECTRIC POWER CONNECTIONS

A. Connect electrical power to DDC system products requiring electrical power connections.

B. Design of electrical power to products not indicated with electric power is delegated to DDC system provider and installing trade. Work shall comply with NFPA 70 and other requirements indicated.

C. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers" for electrical power circuit breakers.

D. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical power conductors and cables.

E. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for electrical power raceways and boxes.

3.6 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements in Section 260553 "Identification for Electrical Systems" for identification products and installation.

3.7 CONTROL WIRE, CABLE AND RACEWAYS INSTALLATION

A. Comply with NECA 1.

B. Comply with TIA 568-C.1.

C. Wiring Method: Install cables in raceways and cable trays. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for cable trays specified in Section 260536 "Cable Trays for Electrical Systems."
3. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

D. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

E. Field Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

F. Wire and Cable Installation:

1. Cables serving a common system may be grouped in a common raceway. Install control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
2. Install cables with protective sheathing that is waterproof and capable of withstanding continuous temperatures of 90 deg C with no measurable effect on physical and electrical properties of cable.

    a. Provide shielding to prevent interference and distortion from adjacent cables and equipment.

3. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in

BICSI ITSIMM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.

5. Identify each wire on each end and at each terminal with a number-coded identification tag. Each wire shall have a unique tag.
6. Provide strain relief.
7. Terminate wiring in a junction box.

    a. Clamp cable over jacket in junction box.
    b. Individual conductors in the stripped section of the cable shall be slack between the clamping point and terminal block.

8. Terminate field wiring and cable not directly connected to instruments and control devices having integral wiring terminals using terminal blocks.
9. Install signal transmission components according to IEEE C2, REA Form 511a, NFPA 70, and as indicated.
10. Keep runs short. Allow extra length for connecting to terminal boards. Do not bend flexible coaxial cables in a radius less than 10 times the cable OD. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
11. Ground wire shall be copper and grounding methods shall comply with IEEE C2. Demonstrate ground resistance.
12. Wire and cable shall be continuous from terminal to terminal without splices.
13. Use insulated spade lugs for wire and cable connection to screw terminals.
14. Use shielded cable to transmitters.
15. Use shielded cable to temperature sensors.
16. Perform continuity and meager testing on wire and cable after installation.
17. Do not install bruised, kinked, scored, deformed, or abraded wire and cable. Remove and discard wire and cable if damaged during installation, and replace it with new cable.
18. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Testing:

1. Perform preinstallation, in-progress, and final tests, supplemented by additional tests, as necessary.
2. Preinstallation Cable Verification: Verify integrity and serviceability for new cable lengths before installation. This assurance may be provided by using vendor verification documents, testing, or other methods. As a minimum, furnish evidence of verification for cable attenuation and bandwidth parameters.
3. In-Progress Testing: Perform standard tests for correct pair identification and termination during installation to ensure proper installation and cable placement. Perform tests in addition to those specified if there is any reason to question condition of material furnished and installed. Testing accomplished is to be documented by agency conducting tests. Submit test results for Project record.
4. Final Testing: Perform final test of installed system to demonstrate acceptability as installed. Testing shall be performed according to a test plan supplied by DDC system manufacturer. Defective Work or material shall be corrected and retested. As a minimum, final testing for cable system, including spare cable, shall verify conformance of attenuation, length, and bandwidth parameters with performance indicated.
5. Test Equipment: Use a fiber-optic time domain reflectometer for testing of length and optical connectivity.
6. Test Results: Record test results and submit copy of test results for Project record.

3.9 DDC SYSTEM I/O CHECKOUT PROCEDURES

A. Check installed products before continuity tests, leak tests and calibration.

B. Check instruments for proper location and accessibility.

C. Check instruments for proper installation on direction of flow, elevation, orientation, insertion depth, or other applicable considerations that will impact performance.

D. Instrument Checkout:

1. Verify that instrument is correctly installed for location, orientation, direction and operating clearances.
2. Verify that attachment is properly secured and sealed.
3. Verify that conduit connections are properly secured and sealed.
4. Verify that wiring is properly labeled with unique identification, correct type and size and is securely attached to proper terminals.
5. Inspect instrument tag against approved submittal.
6. For instruments with tubing connections, verify that tubing attachment is secure and isolation valves have been provided.
7. For temperature instruments:

    a. Verify sensing element type and proper material.
    b. Verify length and insertion.

3.10 DDC SYSTEM I/O ADJUSTMENT, CALIBRATION AND TESTING:

A. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.

B. Provide a written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.

C. For each analog instrument, make a three-point test of calibration for both linearity and accuracy.

D. Equipment and procedures used for calibration shall comply with instrument manufacturer's written instructions.

E. Provide diagnostic and test equipment for calibration and adjustment.

F. Field instruments and equipment used to test and calibrate installed instruments shall have accuracy at least twice the instrument accuracy being calibrated. An installed instrument with an accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.

G. Calibrate each instrument according to instrument instruction manual supplied by manufacturer.

H. If after calibration indicated performance cannot be achieved, replace out-of-tolerance instruments.

I. Comply with field testing requirements and procedures indicated by ASHRAE's Guideline 11, "Field Testing of HVAC Control Components," in the absence of specific requirements, and to supplement requirements indicated.

J. Analog Signals:

1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistant source.

K. Digital Signals:

1. Check digital signals using a jumper wire.
2. Check digital signals using an ohmmeter to test for contact making or breaking.

L. Meters: Check sensors at zero, 50, and 100 percent of Project design values.

M. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.

N. Switches: Calibrate switches to make or break contact at set points indicated.

O. Transmitters:

1. Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.
2. Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistant source.

3.11 DDC CONTROLLER I/O CONTROL LOOP TESTS

A. Testing:

1. Test every I/O point connected to DDC controller to verify that safety and operating control set points are as indicated and as required to operate controlled system safely and at optimum performance.
2. Test every I/O point throughout its full operating range.
3. Test every control loop to verify operation is stable and accurate.
4. Adjust control loop proportional, integral and derivative settings to achieve optimum performance while complying with performance requirements indicated. Document testing of each control loop's precision and stability via trend logs.
5. Test and adjust every control loop for proper operation according to sequence of operation.
6. Test software and hardware interlocks for proper operation. Correct deficiencies.
7. Operate each analog point at the following:

    a. Upper quarter of range.
    b. Lower quarter of range.
    c. At midpoint of range.

8. Exercise each binary point.
9. For every I/O point in DDC system, read and record each value at operator workstation, at DDC controller and at field instrument simultaneously. Value displayed at operator workstation, at DDC controller and at field instrument shall match.
10. Prepare and submit a report documenting results for each I/O point in DDC system and include in each I/O point a description of corrective measures and adjustments made to achieve desire results.

3.12 DDC SYSTEM VALIDATION TESTS

A. Perform validation tests before requesting final review of system. Before beginning testing, first submit Pretest Checklist and Test Plan.

B. After approval of Test Plan, execute all tests and procedures indicated in plan.

C. After testing is complete, submit completed test checklist.

D. Pretest Checklist: Submit the following list with items checked off once verified:

1. Detailed explanation for any items that are not completed or verified.

2. Required mechanical installation work is successfully completed and HVAC equipment is working correctly.
3. HVAC equipment motors operate below full-load amperage ratings.
4. Required DDC system components, wiring, and accessories are installed.
5. Installed DDC system architecture matches approved Drawings.
6. Control electric power circuits operate at proper voltage and are free from faults.
7. Required surge protection is installed.
8. DDC system network communications function properly, including uploading and downloading programming changes.
9. Each controller's programming is backed up.
10. Equipment, products, tubing, wiring cable and conduits are properly labeled.
11. All I/O points are programmed into controllers.
12. Testing, adjusting and balancing work affecting controls is complete.
13. Dampers and actuators zero and span adjustments are set properly.
14. Each control damper and actuator goes to failed position on loss of power.
15. Valves and actuators zero and span adjustments are set properly.
16. Each control valve and actuator goes to failed position on loss of power.
17. Meter, sensor and transmitter readings are accurate and calibrated.
18. Control loops are tuned for smooth and stable operation.
19. View trend data where applicable.
20. Each controller works properly in standalone mode.
21. Safety controls and devices function properly.
22. Interfaces with fire-alarm system function properly.
23. Electrical interlocks function properly.
24. Operator workstations and other interfaces are delivered, all system and database software is installed, and graphic are created.
25. Record Drawings are completed.

E. Validation Test:

1. Verify operating performance of each I/O point in DDC system.

    a. Verify analog I/O points at operating value.
    b. Make adjustments to out-of-tolerance I/O points.

        1) Identify I/O points for future reference.
        2) Simulate abnormal conditions to demonstrate proper function of safety devices.
        3) Replace instruments and controllers that cannot maintain performance indicated after adjustments.

2. Simulate conditions to demonstrate proper sequence of control.
3. Readjust settings to design values and observe ability of DDC system to establish desired conditions.
4. After 24 Hours following Initial Validation Test:

    a. Re-check I/O points that required corrections during initial test.
    b. Identify I/O points that still require additional correction and make corrections necessary to achieve desired results.

5. After 24 Hours of Second Validation Test:

a. Re-check I/O points that required corrections during second test.
b. Continue validation testing until I/O point is normal on two consecutive tests.

6. Completely check out, calibrate, and test all connected hardware and software to ensure that DDC system performs according to requirements indicated.
7. After validation testing is complete, prepare and submit a report indicating all I/O points that required correction and how many validation re-tests it took to pass. Identify adjustments made for each test and indicate instruments that were replaced.

3.13 FINAL REVIEW

A. Submit written request to Architect and Construction Manager when DDC system is ready for final review. Written request shall state the following:

1. DDC system has been thoroughly inspected for compliance with contract documents and found to be in full compliance.
2. DDC system has been calibrated, adjusted and tested and found to comply with requirements of operational stability, accuracy, speed and other performance requirements indicated.
3. DDC system monitoring and control of HVAC systems results in operation according to sequences of operation indicated.
4. DDC system is complete and ready for final review.

B. Review by Architect and Construction Manager shall be made after receipt of written request. A field report shall be issued to document observations and deficiencies.

C. Take prompt action to remedy deficiencies indicated in field report and submit a second written request when all deficiencies have been corrected. Repeat process until no deficiencies are reported.

D. Should more than two reviews be required, DDC system manufacturer and Installer shall compensate entity performing review for total costs, labor and expenses, associated with third and subsequent reviews. Estimated cost of each review shall be submitted and approved by DDC system manufacturer and Installer before making the review.

E. Prepare and submit closeout submittals when no deficiencies are reported.

F. A part of DDC system final review shall include a demonstration to parties participating in final review.

1. Provide staff familiar with DDC system installed to demonstrate operation of DDC system during final review.
2. Provide testing equipment to demonstrate accuracy and other performance requirements of DDC system that is requested by reviewers during final review.
3. Demonstration shall include, but not be limited to, the following:

a. Correct sequence of operation after electrical power interruption and resumption after electrical power is restored for randomly selected HVAC systems.
b. Reporting of alarm conditions for randomly selected alarms, including different classes of alarms, to ensure that alarms are properly received by operators and operator workstations.
c. Trends, summaries, logs and reports set-up for Project.
d. For up to three HVAC systems randomly selected by reviewers, use graph trends to show that sequence of operation is executed in correct manner and that HVAC systems operate properly through complete sequence of operation including different modes of operations indicated. Show that control loops are stable and operating at set points and respond to changes in set point of 20 percent or more.
e. Software's ability to communicate with controllers, operator workstations, uploading and downloading of control programs.
f. Software's ability to edit control programs off-line.
g. Data entry to show Project-specific customizing capability including parameter changes.
h. Step through penetration tree, display all graphics, demonstrate dynamic update, and direct access to graphics.
i. Execution of digital and analog commands in graphic mode.
j. Spreadsheet and curve plot software and its integration with database.
k. Online user guide and help functions.
l. System speed of response compared to requirements indicated.

m. Touchscreen:

1) I/O points lists agree with naming conventions.
2) Graphics are complete.
3) UPS unit, if applicable, operates.

3.14 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.15 DEMONSTRATION

A. Engage a factory-authorized service representative with complete knowledge of Project-specific system installed to train Owner's maintenance personnel to adjust, operate, and maintain DDC system.

B. Extent of Training:

1. Base extent of training on scope and complexity of DDC system indicated and training requirements indicated. Provide extent of training required to satisfy

requirements indicated even if more than minimum training requirements are indicated.

2. Inform Owner of anticipated training requirements if more than minimum training requirements are indicated.

C. Attendee Training Manuals:

1. Provide each attendee with a color hard copy of all training materials and visual presentations.
2. Hard-copy materials shall be organized in a three-ring binder with table of contents and individual divider tabs marked for each logical grouping of subject matter. Organize material to provide space for attendees to take handwritten notes within training manuals.
3. In addition to hard-copy materials included in training manual, provide each binder with a sleeve or pocket that includes a DVD or flash drive with PDF copy of all hard-copy materials.

END OF SECTION 230923

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Refrigerant pipes and fittings.
2. Refrigerant piping valves and specialties.
3. Refrigerants.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve, refrigerant piping, and refrigerant piping specialty.

B. Shop Drawings:

1. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
2. Show interface and spatial relationships between piping and equipment.
3. For verification of pipe sizes shop drawings shall be coordinated with VRF Equipment Manufacturer prior to ordering piping.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Refer to VRF manufactured recommendations.

2.2 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 280, Type ACR

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Brazing Filler Metals: AWS A5.8/A5.8M.

E. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch (20-mm) misalignment in minimum 7-inch- (180-mm-) long assembly.
4. Working Pressure Rating: Factory test at minimum 500 psig (3450 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).

2.3 VALVES AND SPECIALTIES

A. Service Valves:
1. Design Pressure/Maximum abnormal pressure (MAP): 775 psig, 53 bar.
2. Continuous operating temperature (COT): - 40F to 300F.
3. Full port ball valve.
4. Internally equalized ball design.
5. Rupture proof encapsulated stem.
6. Bi-directional flow.
7. UL listed.
8. Compatible with CFC, HCFC and HFC refrigerants and oils.

B. System Wye Branch

1. Proprietary system Wye Branches as required by the VRF manufacturer.

2.4 REFRIGERANTS

A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

B. Hot-Gas and Liquid Lines: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

C. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install safety relief valves where required by 2010 ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

B. Install service valves at each inlet and outlet of the heat recovery terminal and at each of the outdoor heat recovery modules.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping adjacent to machines to allow service and maintenance.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

J. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

K. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

L. Slope refrigerant piping per VRV manufacturer requirements.

M. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

N. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

O. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."

P. Install sleeves for piping penetrations of walls, ceilings, and floors.

Q. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Comply with ASME B31.5, Chapter VI.

2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

B. Prepare test and inspection reports.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers (67 Pa). If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
1. Verify that compressor oil level is correct.
2. Open compressor suction and discharge valves.
3. Open refrigerant valves except bypass valves that are used for other purposes.
4. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.
6. Seismic-restraint devices.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.

C. Seismic Hazard Level per ASCE/SEI 7 Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, and static-pressure classes.

4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.
f. Perimeter moldings.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

C. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare).

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2.6 SEISMIC-RESTRAINT DEVICES

A. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

B. Restraint Cables: ASTM A 603, galvanized or ASTM A 492, stainless-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

C. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

D. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2. Supply-Air Ducts: Seal Class C.
3. Return/Exhaust Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Refer to structural plans for attachment requirements.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems" and ASCE/SEI 7.

1. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
2. Brace a change of direction longer than 12 feet (3.7 m).

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.8 DUCT SCHEDULE

A. Supply Ducts:

1. Ducts Connected to Fan Coil Units, and Supply Fans:

a. Pressure Class: Positive 1-inch wg (250 Pa)
b. Minimum SMACNA Seal Class: C
c. SMACNA Leakage Class for Rectangular: 24
d. SMACNA Leakage Class for Round and Flat Oval: 12

B. Return Ducts:

1. Ducts Connected to Fan Coil Units:

a. Pressure Class: negative 1-inch wg (250 Pa)
b. Minimum SMACNA Seal Class: C
c. SMACNA Leakage Class for Rectangular: 24
d. SMACNA Leakage Class for Round and Flat Oval: 12

C. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 1-inch wg (250 Pa)
b. Minimum SMACNA Seal Class: C
c. SMACNA Leakage Class for Rectangular: 12
d. SMACNA Leakage Class for Round and Flat Oval: 12

D. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, and Supply Fans:

a. Pressure Class: Positive 1-inch wg (250 Pa)
b. Minimum SMACNA Seal Class: C.
c. SMACNA Leakage Class for Rectangular: 24
d. SMACNA Leakage Class for Round and Flat Oval: 12

E. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Manual volume dampers.
2. Combination fire and smoke dampers.
3. Turning vanes.
4. Remote damper operators.
5. Duct-mounted access doors.
6. Flexible connectors.
7. Flexible ducts.
8. Duct accessory hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
a. Special fittings
b. Manual volume damper installations
c. Control damper installations
d. Fire-damper, smoke-damper, combination fire-and-smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct mounted access doors and remote damper operators.
e. Duct security bars
f. Wiring diagrams: for power, signal, and control wiring.
2. Coordination drawings: reflected ceiling plans, drawn to scale, on which ceiling mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
3. Source quality-control reports.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90 (Z275).
2. Exposed-Surface Finish: Mill phosphatized.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

D. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Standard leakage rating**,** with linkage outside airstream.
2. Suitable for horizontal or vertical applications.
3. Frames:

a. Frame: Hat-shaped, 0.064-inch- (1.62-mm-) thick, galvanized sheet steel.
b. Mitered and welded corners.
c. Flanges for attaching to walls and flangeless frames for installing in ducts.

4. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.

d. Galvanized-steel, 0.064 inch (1.62 mm) thick.

5. Blade Axles: Galvanized steel.
6. Bearings:

   a. Oil-impregnated bronze.
   b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

7. Tie Bars and Brackets: Galvanized steel.

2.4 COMBINATION FIRE AND SMOKE DAMPERS

A. Type: Static and dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

B. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 4000-fpm (20-m/s) velocity.

C. Fire Rating: 1-1/2 and 3 hours.

D. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.

E. Heat-Responsive Device: Electric resettable link and switch package, factory installed, rated.

F. Smoke Detector: Integral, factory wired for single-point connection.

G. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.

H. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.

I. Leakage: Class I

J. Rated pressure and velocity to exceed design airflow conditions.

K. Mounting Sleeve: Factory-installed, 0.052-inch- (1.3-mm-) thick, galvanized sheet steel; length to suit wall or floor application.

L. Master control panel for use in dynamic smoke-management systems.

M. Damper Motors: two-position action.

N. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors.

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
3. Non-spring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
4. Electrical Connection: 115 V, single phase, 60 Hz.

O. Accessories:

1. Auxiliary switches for position indication.
2. Test and reset switches

2.5 TURNING VANES

A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

B. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

C. Vane Construction: Single wall for ducts up to 48 inches (1200 mm) wide and double wall for larger dimensions.

2.6 REMOTE DAMPER OPERATORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Metropolitan Air Technology
2. Or equal

B. Description: Low-voltage battery powered balancing dampers with universal drive mechanisms.

C. Drive: DC Motor

D. Mounting for damper drive: Standoff bracket

E. Cable: Plenum rated data cable

F. Furnish with battery operated damper drive remote

G. Furnish with multiple port wall plate.

2.7 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc.
2. McGill AirFlow LLC.
3. Or equal

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Vision panel.
d. Hinges and Latches: 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.
e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches (300 mm) Square: No hinges and two sash locks.
b. Access Doors up to 18 Inches (460 mm) Square: Two hinges and two sash locks.
c. Access Doors up to 24 by 48 Inches (600 by 1200 mm): Three hinges and two compression latches with outside and inside handles.
d. Access Doors Larger than 24 by 48 Inches (600 by 1200 mm): Four hinges and two compression latches with outside and inside handles.

2.8 FLEXIBLE CONNECTORS

A. Materials: Flame-retardant or noncombustible fabrics.

B. Coatings and Adhesives: Comply with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to 2 strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel. Provide metal compatible with connected ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz/sq. yd. (880 g/sq. m).

2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

2.9 FLEXIBLE DUCTS

A. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).
4. Insulation R-value: As required by Title-24; R-4.2

B. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches (75 through 460 mm), to suit duct size.

2.10 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct

liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. At outdoor-air intakes and mixed-air plenums.
2. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
3. Upstream from turning vanes.
4. Control devices requiring inspection.
5. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
5. Body Access: 25 by 14 inches (635 by 355 mm).
6. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).

K. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

L. Install flexible connectors to connect ducts to equipment.

M. Connect flexible ducts to metal ducts with] adhesive plus sheet metal screws.

N. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.

2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range

END OF SECTION 233300

SECTION 233423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Centrifugal roof ventilators.
2. In-line centrifugal fans.
3. Louvered Penthouse Fans

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated include rated capacities, furnished specialties, and accessories and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power rating
3. Motor ratings and electrical characteristics, plus motor and electrical accessories
4. Dampers, including housings, linkages, and operators.
5. Roof Curbs

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.
3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
4. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards

D. UL Standards: Power ventilators shall comply with UL 705.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Housing: Removable, galvanized steel, mushroom-domed top; square, one-piece, aluminum base with venturi inlet cone.

1. For Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.
2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

B. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

C. Belt Drives:

1. Resiliently mounted to housing.
2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
4. Pulleys: Cast-iron, adjustable-pitch motor pulley.
5. Fan and motor isolated from exhaust airstream.
6. Provide with auto tensioning belt system.

D. EC Motors

1. Provide with motor mounted speed control dial
2. Provide with low voltage communication wiring for remote start/stop.

E. Accessories:

1. Dampers: Counterbalanced, parallel-blade, backdraft dampers; factory set to close when fan stops.

F. Roof Curbs: Galvanized steel; mitered and welded corners; rigid, fiberglass insulation adhered to inside walls; and wood nailer. Size as required to suit roof opening and fan base.

2.2 IN-LINE CENTRIFUGAL FANS

A. Manufacturers:

1. Greenheck
2. Loren Cook Company
3. Or Equal

B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Direct-Drive Units: Motor mounted in airstream.

D. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

E. Accessories:

1. Companion Flanges: For inlet and outlet duct connections.

F. Capacities and Characteristics:

1. Refer to equipment schedules on plans for equipment capacities and characteristics.

2.3 LOUVERED PENTHOUSE FANS

A. Manufacturers:

1. Greenheck
2. Loren Cook Company
3. Or Equal

B. Housing: Heavy gauge extruded aluminum louvers with mitered and welded corners.

C. Belt-Drive Units: Motor mounted on vibration isolators, out of the airstream.

D. Fan Wheels: heavy gauge steel, forward curved centrifugal wheel shall be double width and double inlet.

E. Accessories:

1. Filters: washable, aluminum two-inch rack

F. Capacities and Characteristics:

1. Refer to equipment schedules on plans for equipment capacities and characteristics.

2.4 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Enclosure Type: Totally enclosed, fan cooled.

2.5 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment Mounting:

1. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. See Section 077200 "Roof Accessories" for installation of roof curbs.

C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

D. Support suspended units from structure using threaded steel rods and elastomeric hangers having a static deflection of 1 inch (25 mm) Vibration-control devices are specified in Section 230548 "Vibration and Seismic Controls for HVAC."

E. Install units with clearances for service and maintenance.

F. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION 233423

SECTION 233713.13 - AIR DIFFUSERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Diffusers and grilles.

B. Related Requirements:

   1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:
   1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
   2. Diffuser and grille schedule: indicate drawing designation, room location, quantity, model number, size and accessories furnished.

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

   1. Ceiling suspended assembly members
   2. method of attaching hangers to building structure
   3. Size and location of initial access modules for acoustical tile.
   4. Ceiling-mounted items including lighting, fixtures, diffusers, grilles, speakers, sprinklers, access panels and special moldings.
   5. Duct access panels.

C. Source quality-control reports.

PART 2 - PRODUCTS

2.1 Diffusers and Grilles

A. Products: See equipment schedules on plans for product description and application.

   1. Manufacturers: available manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

      a. Titus

b. Price Industries
c. Or Equivalent

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.13

SECTION 233723 - HVAC GRAVITY VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gravity Ventilators.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Ventilators shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of ventilator components, noise or metal fatigue caused by ventilator blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

B. Seismic Performance: Ventilators, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For gravity ventilators. Include plans, elevations, sections, details, ventilator attachments to curbs, and curb attachments to roof structure.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For ventilators, accessories, and components, from manufacturer.

1.5 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.

C. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 (Z275) zinc coating, mill phosphatized.

D. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.

E. Post-Installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors made from stainless-steel components, with capability to sustain without failure a load equal to 4 times the loads imposed for concrete, or 6 times the load imposed for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 FABRICATION, GENERAL

A. Factory fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.

D. Fabricate supports, anchorages, and accessories required for complete assembly.

2.3 INTAKE AND RELIEF GRAVITY VENTILATORS

A. Manufacturers: available manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Greenheck Fan Corporation
2. Loren Cook Company

3. Or Equal.

B. Factory fabricated according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figures 6-6 and 6-7.

C. Materials: Hood constructed of aluminum and internal structure constructed of galvanized steel; suitably reinforced.

D. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to fit roof opening and ventilator base.

1. Configuration: Built-in raised cant and mounting flange.
2. Overall Height: 12 inches (300 mm)

E. Bird Screening: Galvanized-steel, 1/2-inch- (12.7-mm-) square mesh, 0.041-inch (1.04-mm) wire

F. Insect Screening: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh, 0.012-inch (0.30-mm) wire.

G. Galvanized-Steel Sheet Finish:

1. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.
2. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.
3. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard finish consisting of prime coat and thermosetting topcoat.

a. Color and Gloss: As selected by Architect from manufacturer's full range.

H. Capacities and Characteristics:

1. See mechanical plans for details.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.

B. Secure gravity ventilators to roof curbs with cadmium-plated hardware. Use concealed anchorages where possible. Refer to Section 077200 "Roof Accessories."

C. Install gravity ventilators with clearances for service and maintenance.

D. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Section 079200 "Joint Sealants" for sealants applied during installation.

F. Label gravity ventilators according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

G. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

H. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

END OF SECTION 233723

SECTION 236313 – VARIABLE REFRIGERANT FLOW UNITS

PART 1 - **GENERAL**

1.1 SUMMARY

A. Variable Refrigerant Flow (VRF) HVAC system shall be a variable capacity, direct expansion (DX) heat recovery engineered system. The outdoor unit shall consist of one or more frames) connected through common refrigerant piping and control communication wiring. Each system shall have single or multiple, inverter compressor(s). Each system shall be connected to multiple indoor units (ducted, non-ducted or mixed combinations) through a common refrigerant piping network and integrated system controls and communication network. Each indoor unit shall be controlled individually or as a group. Additionally, heat recovery systems shall be capable of simultaneous heating and cooling of individual zones.

1.2 ACRONYMS/DEFINITIONS.

A. Variable Refrigerant Flow: VRF

B. Direct Expansion Refrigeration: DX

C. Heat Recovery Distribution Terminal/Branch Selector: BS or HR

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For air-cooled refrigerant condensers. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASBSAE/IESNA 90.1 Compliance: Applicable requirements in ASBSAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design (BOD) Manufacturer shown on plans. Acceptable standards shall be supplied based upon the performance characteristics and features of the BOD manufacturer. Request by the contractor to bid an alternate supplier to the basis of design, listed or not listed, shall not relieve the contractor of supplying all materials, options, controls, sequences, efficiencies and intents of the original plans and specifications.

2.2 VRF OUTDOOR UNITS (HEAT RECOVERY)

A. General.
1. Heat recovery system shall consist of one to three outdoor unit modules, conjoined to make a single refrigerant circuit, connected to Heat Recovery unit(s) and indoor unit(s). Multi-port branch selector units shall allow simultaneous heating and cooling of individual zone(s) at various capacities as required to satisfy their zone requirements. Simultaneous heating and cooling shall be supported.

B. Refrigerant: R-410A

C. Compressor(s).

1. Each inverter driven, HSS scroll compressor shall be capable of operating from 15 Hz up to 150 Hz with control in 1 Hz increments in any and all modes (cooling OR heating)
2. Manufacturers that employ speed limiting algorithms designed to limit compressor capacity to lower power amperage draw shall not be permitted.
3. The compressor shall employ a factory metered charge of oil.
4. The compressor shall be designed for a separate port for oil to be directly returned to the compressor oil sump.
5. The compressor bearing(s) shall have Teflon coating or equal.
6. The compressor(s) shall be protected with:

    a. High Pressure switch
    b. Over-current /under current protection
    c. Oil sump sensor
    d. Phase failure
    e. Phase reversal
    f. Compressor shall be capable of receiving injection of medium pressure gas at a point in the compression cycle where such injection shall allow a greater mass flow of refrigerant at lower outdoor ambient and achieving a higher heating capability.. The VRF outdoor unit shall have published

performance data for heating mode operation down to 0F on both heat pump and heat recovery systems.

g. Standard, non-inverter driven compressors shall not be permitted, nor shall a compressor without vapor injection or direct sump oil return capabilities.

D. Inverter Compressor Controller(s)

1. The VRF outdoor unit shall be provided with a separate inverter compressor controller PCB for each compressor. Inverter compressor controllers that host more than one compressor shall not be accepted.
2. The inverter compressor controller shall be designed and programmed to utilize the entire range of operation of the connected compressor during cooling cycle operation and/or heating cycle operation.
3. Inverter compressor controllers programmed to limit the compressors heating or cooling capacity to reduce or limit power consumption is not acceptable.

E. Air Cooled Unit.

1. Condenser Coil: Factory tested
   a. Shall be comprised of aluminum fins mechanically bonded to copper tubing.
   b. The aluminum fins shall have factory applied corrosion resistant top coat.
   c. Coil coating shall be tested in accordance with ASTM B-117 salt spray procedure for a minimum of 6000 hours.
   d. Shall have multiple circuits designed for path isolation and variable velocity control.
   e. Shall be designed, built and provided by the VRF outdoor unit manufacturer
   f. The outdoor unit coil, all indoor units and pipe network shall be field tested to the recommended minimum testing pressure as specified by the manufacturer.
2. Condenser Fans and Drives
   a. The fan(s) blades shall be made of Acrylonitrile Butadiene Styrene (ABS) material or equal.
   b. The fan(s) motor shall be equipped with permanently lubricated bearings.
   c. The fan motor shall be variable speed
   d. The fan shall have a raised guard to help prevent contact with moving parts.
   e. The cabinet shall have an option to redirect the discharge air direction from vertical to horizontal with the addition of optional factory provided air guides.

F. Outdoor Cabinet Casings: Galvanized or zinc-coated steel treated and finished with manufacturer's standard paint coating designed for outdoor installation with weather protection for components and controls. Cabinet shall be tested in accordance with ASTM B-117 salt spray test procedure for a minimum of 1000 hours and shall be provided with the following:

1. Removable panels for access to controls, condenser fans, motors, and drives.
2. Plated steel fan guards.
3. Lifting eyes.
4. Removable legs.

G. Indoor Cabinet Casing: Galvanized or zinc-coated steel treated and finished with manufacturer's standard paint coating designed for indoor installation with protection for components and controls. Cabinet shall be tested in accordance with ASTM B-117 salt spray test procedure for a minimum of 1000 hours and shall be provided with the following:

1. Removable panels for access to controls, condenser fans, motors, and drives.
2. Plated steel fan guards.
3. Lifting eyes.
4. Removable legs.

H. Sensors

1. Each outdoor unit module shall have

a. Suction temperature sensor
b. Discharge temperature sensor
c. Oil level sensor
d. High Pressure sensor
e. Low Pressure sensor
f. Outdoor temperature sensor
g. Outdoor unit heat exchanger temperature sensor

I. System shall be capable of an automatic refrigerant charge function for use in both the heat mode and cool mode to ensure the proper amount of refrigerant is installed into the system.

J. System shall consist of one, two or three air source outdoor unit modules conjoined together in the field to result in the capacity specified elsewhere in these documents

K. Factory installed microprocessor controls in the outdoor unit(s), BS unit(s), and indoor unit(s) shall perform functions to optimize the operation of the VRF system and communicate in a daisy chain configuration between outdoor unit and BS unit(s) and indoor unit(s). Controls shall also be available to control other building systems as required from the VRF control system. DIO/AIO capabilities shall be available as well as a central controller to perform operation changes, schedules and other duties

L. Integration Each system shall be able to integrate via open protocol via BACnet IP, allowing third party control and monitoring.

M. The outdoor unit refrigerant circuit shall employ for safety a threaded fusible plug.

N. The unit shall be shipped from the factory fully assembled including internal refrigerant piping, inverter driven compressor(s), controls, contacts, relay(s), fans, power and communications wiring as necessary.

O. Each outdoor unit refrigeration circuit shall include, but not limited to, the following components:

1. Refrigerant strainer(s)
2. Check valve(s)

3. Inverter driven, medium pressure vapor injection, high pressure shell compressors
4. Heat pipe cooled inverter PCB
5. Oil separator(s)
6. Accumulator(s)
7. 4-way reversing valve(s)
8. Vapor injection valve(s)
9. Variable path heat exchanger control valve(s)
10. Oil balancing control
11. Oil Level sensor(s)
12. Electronic expansion valve(s)
13. Sub-cooler (s)
14. High and low side Schrader valve service ports with caps.
15. Service valves

P. Refrigerant Flow Control

a) System shall have a variable flow and path outdoor heat exchanger function to vary the refrigerant flow and volume and path. Control of the variable path circuits shall be based on system operating mode and operating conditions as targeted to manage the efficiency of the system.
b) System shall have a medium pressure gas vapor injection function employed in the heating mode to increase system capacity when the outdoor ambient temperatures are low. The compressor vapor injection flow amount shall be controlled an algorithm reset by discharge gas temperatures of the compressor.
c) System shall have an active refrigerant control and multi section accumulator that dynamically changes the volume of refrigerant circulating in the system based on operating mode and operating conditions to ensure maximum system efficiency.
d) The compressor design shall be of the high pressure shell scroll type where the internal pressure below the suction valves of the compressor shall be same as discharge pressure. The motor shall be cooled by high pressure gas and as a result oil shall be stable and non-foaming increasing the efficiency of the system.
e) The VRF outdoor unit shall include a factory provided and mounted sub-cooler assembly and controls.

Q. OIL MANAGEMENT

a) The system shall utilize a high pressure oil return system to ensure a consistent film of oil on all moving compressor parts at all points of operation.
b) Each compressor shall be provided with an independent centrifugal oil separator, designed to extract oil from the oil/refrigerant gas stream leaving the compressor.
c) The system shall have an oil level sensor in the compressor to provide direct oil level sensing data to the main controller.

d) The system shall only initiate an oil return cycle if the sensed oil level is below oil level target values as determined by the microprocessor.
e) A default oil return algorithm shall automatically initiate the oil return mode if the system detects a failure of the oil sump sensor. A fault code shall be reported by the system.
f) Timed oil return operations or systems that do not directly monitor compressor oil level shall not be permitted.
g) Indoor Unit Fan Operation During Oil Return Cycle

1. During oil return cycle indoor units operating in cooling or dry mode shall continue normal operation.
2. During oil return, indoor units that are commissioned with fans set for continuous operation shall maintain normal fan speed unless the leaving air temperature drops, then the fan speed will be reduced to low speed for the remainder of the oil return cycle.

1. During oil return cycle indoor unit fans will cycle off and remain off during oil return cycle while operating in all modes.

R. CAPACITIES AND CHARACTERISTICS

1. Refer to Mechanical schedules on plans for required capacities and other characteristics not noted in the specifications.

S. Refrigerant Pipe.
1. All field refrigerant lines between outdoor unit and BS unit and from BS unit to indoor unit shall be Type-L copper pipe with brazed connections. Piping shall be insulated per building or energy code requirements and as instructed by the installed VRF manufacturer.

T. Refrigerant Pipe Connections and Sizing:

1. Plans indicate preliminary sizing used to determine general conformance with the BOD manufacturer and may be used by the contractor for estimated pipes and routing requirements. The Contractor shall develop fully coordinated shop drawings with all trades. The coordinated shop drawings shall be used for final pipe size determination and routing requirements. Alterations by the Contractor to the prescribed routing paths as shown on the plans shall be submitted and coordinated with Architect and Engineer of Record.

U. Isolation valves.

The Contractor shall provide isolation valves on all pipes connected to the Heat Recovery unit and Boxes to allow the servicing of connected units, without evacuating the balance of the piping system.

V. Fans (Air Cooled Units only)
1. Refer to manufacturer installation and operation manual for quantity, size, speed and airflow of fans

W. Electrical Characteristics:

1. Refer to manufacturer installation and operation manual for details.

2.3 BRANCH SELECTOR (BS)

A. General

1. BS unit shall be designed and manufactured by the same manufacturer of VRF indoor unit(s) and outdoor unit(s).
2. BS unit casing shall be constructed with galvanized steel.
3. BS Unit shall be an intermediate refrigerant control device between the air source outdoor unit and the indoor units to control the systems cooling and heating operation.
4. Each port shall be capable of operating in cooling or heating independently regardless of the operating mode of any other port on the BS unit or in the system.
5. BS unit shall be internally piped, wired, assembled and run tested at the factory.
6. BS unit shall be designed for installation in a conditioned environment per specifications.
7. BS unit shall have a balancing valve to control the pressure between the high pressure and low pressure pipe during mode switching to minimize any change-over pressure related sounds.
8. BS unit shall employ an electronic expansion valve to ensure proper sub cooling of the refrigerant.
9. BS unit shall be internally factory insulated.

B. Controls

1. BS unit(s) shall have factory installed unit mounted control boards and integral microprocessor to communicate with other devices in the VRF system.
2. The contractor is instructed to review the Electrical and ATC drawings and specifications for other items or tasks which the contractor is responsible to provide. Failure to do so will not relieve this contractor of their responsibility to provide such materials and/or labor for a complete VRF system and installation.

2.4 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Enclosure Type: Totally enclosed, fan cooled.
2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
3. Mount unit-mounted disconnect switches on interior of unit.

2.5 SOURCE QUALITY CONTROL

A. Testing Requirements: Factory test sound-power-level ratings according to ARI 270.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb, firmly anchored in locations indicated; maintain manufacturer's recommended clearances.

B. Maintain manufacturer's recommended clearances for service and maintenance.

C. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

3.2 Additional Refrigerant Charge

A. The contractor shall provide and charge the system with additional refrigerant. Additional refrigerant charge quantities to be based on manufacturer recommendations and contractor developed shop drawings.

3.3 CONNECTIONS

A. Install piping adjacent to machine to allow service and maintenance.

B. Refrigerant Piping: Connect piping to unit with pressure relief, service valve, filter-dryer, and moisture indicator on each refrigerant-circuit liquid line.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Perform electrical test and visual and mechanical inspection.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Complete manufacturer's starting checklist.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
5. Verify proper airflow over coils.

C. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

D. Air-cooled refrigerant condensers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 236313

(This page intentionally left blank.)

SECTION 236314 – VARIABLE REFRIGERANT FLOW INDOOR FANCOIL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes ducted and ductless refrigerant fan coil units and accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale and coordinated with each other based on input from installers of the items involved:

B. Seismic Qualification Certificates: For fan coil units, accessories, and components, from manufacturer.

C. Field quality-control reports.

D. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Factory-packaged and -tested units rated according to AHRI 440, ASHRAE 33, and UL 1995.

2.2 MANUFACTURER

A. Manufacturer for VRF air distribution devices (Fancoils, Air handlers, etc) shall be the same manufacturer as the VRF system manufacturer.

2.3 DUCTLESS FAN COIL UNITS

A. Casing
   1. Galvanized steel with coated enamel. Provide with 1/2" polystyrene insulation with anti-microbial coating.
   2. Unit shall have a factory supplied condensate drain pan below the coil constructed of EPS (expandable polystyrene resin).

B. Fan Assembly and Control
   1. Single, direct-drive, crossflow tangential fan
   2. Constructed with high strength ABS BSN-7530 polymeric resin or equal
   3. Fan motor shall be brushless digitally controlled design with permanently lubricated and sealed ball bearing
   4. Fan/motor assembly shall be mounted on vibration attenuating rubber grommets
   5. Fan impeller shall be statically and dynamically balanced
   6. Fan speed shall be controlled using a microprocessor-based direct digital control algorithm
   7. Unit shall have one supply air outlet and one return air inlet with a manual or motorized sweeping guide vane that automatically changes the direction of airflow from side-to-side and up-and-down.
   8. Unit shall be equipped with factory installed temperature thermistors for:
      a. Return air
      b. Refrigerant entering coil
      c. Refrigerant leaving coil

C. Unit shall have a factory assembled, piped and wired electronic expansion valve (EEV) for refrigerant control.

D. Unit shall have a built-in control panel to communicate with other indoor units and to the outdoor unit.

E. Unit shall have the following functions as standard:
   a. Self-diagnostic function
   b. Auto addressing
   c. Auto restart function

d. Auto changeover function (Heat Recovery system only)
e. Auto operation function
f. Auto clean function
g. Child lock function
h. Forced operation
i. Dual thermistor control
j. Sleep mode
k. Dual set point control
l. Filter life timer
m. Power consumption data
n. External on/off control input

9.

C. Coils
1. Constructed with copper tubes with Aluminum fins.

D. Filter Assembly:
1. The return air inlet shall have a factory supplied removable, washable filter
2. The filter access shall be from the front of the unit without the need of tools.

E. Additional Control devices are specified in Section 236313 "Variable Refrigerant Flow Units"

F. Basic Unit Controls:

1. Wired wall-mounting temperature sensor with digital display.
2. Unoccupied-period-override push button.
3. Data entry and access port.

a. Input data includes room temperature and humidity set points and occupied and unoccupied periods.
b. Output data includes room temperature, operating mode, and status.

G. Terminal Controller:

1. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.
2. Unoccupied-Period-Override Operation: Two hours.
3. Unit Supply-Air Fan Operation:

a. Occupied Periods: Fan runs continuously.
b. Unoccupied Periods: Fan cycles to maintain room setback temperature.

4. Controller shall have volatile-memory backup.

H. Electrical Connection: Factory wire motors and controls for a single electrical connection.

I. Capacities and Characteristics:

1. Refer to mechanical schedules for details.

2.4 DUCTED FAN COIL UNITS

A. Casing
   1. Unit case to be 22-gauge coated galvanized steel and the external surfaces to be finished with a high gloss baked enamel finish. Provide with 1/2" foil faced, polystyrene fiber insulation.
   2. All access panels to be provided with gasket seals to minimize leakage.
   3. The cold surfaces of the unit shall be covered internally with a coated polystyrene insulating material.

B. Fan Assembly and Control
   1. Integral, direct-drive fan with galvanized steel housing and a forward-curved fan wheel.
   2. Fan motor shall be brushless digitally controlled design with permanently lubricated and sealed ball bearing
   3. Fan/motor assembly shall be mounted on vibration attenuating rubber grommets
   4. Fan motor shall have thermal, overcurrent and RPM protection.
   5. Fan impeller shall be statically and dynamically balanced
   6. Fan speed shall be controlled using a microprocessor-based direct digital control algorithm
   7. Unit shall be equipped with factory installed temperature thermistors for:
      a. Return air
      b. Refrigerant entering coil
      c. Refrigerant leaving coil

E. Unit shall have a factory assembled, piped and wired electronic expansion valve (EEV) for refrigerant control.
F. Unit shall have a built-in control panel to communicate with other indoor units and to the outdoor unit.
G. Unit shall have the following functions as standard:
a. Self-diagnostic function
b. Auto addressing
c. Auto restart function
d. Auto changeover function (Heat Recovery system only)
e. Auto operation function
f. Auto clean function
g. Child lock function
h. Forced operation
i. Dual thermistor control
j. Sleep mode
k. Dual set point control
l. Filter life timer
m. Power consumption data
n. External on/off control input

C. Coils
   1. Constructed with copper tubes with Aluminum fins.

D. Filters:
   1. If not provided as part of the standard unit configuration, indoor units shall be provided with Filter housing enclosures and be provided with filtration levels as specified on the plans.

a. Minimum arrestance and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2 and all addendums.
b. MERV Rating: Refer to plans for filter rating requirements.

E. Additional control devices are specified in Section 236313 "Variable Flow Refrigerant Units"

F. Basic Unit Controls:

1. Wired wall-mounting temperature sensor with digital display.
2. Unoccupied-period-override push button.
3. Data entry and access port.

a. Input data includes room temperature and humidity set points and occupied and unoccupied periods.
b. Output data includes room temperature, operating mode, and status.

G. Terminal Controller:

1. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.
2. Unoccupied-Period-Override Operation: Two hours.
3. Unit Supply-Air Fan Operation:

a. Occupied Periods: Fan runs continuously.
b. Unoccupied Periods: Fan cycles to maintain room setback temperature.

4. Controller shall have volatile-memory backup.

H. Electrical Connection: Factory wire motors and controls for a single electrical connection.

I. Capacities and Characteristics:

1. Refer to mechanical schedules for details.

J. Refrigerant Piping and Connections
1. All refrigerant piping from outdoor unit to indoor unit shall be field insulated. Each pipe should be insulated separately

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fan coil units level and plumb.

B. Install fan coil units to comply with NFPA 90A.

C. Suspend fan coil units from structure with threaded rod hangers. Vibration isolators are specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

D. Verify locations of thermostats, and other exposed control sensors with Drawings and room details before installation. Refer to architectural or mechanical plans for mounting details.

E. Install new filters in each fan coil unit within two weeks after Substantial Completion.

F. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

1. Install piping adjacent to machine to allow service and maintenance.
2. Connect condensate drain to indirect waste.

    a. Install condensate trap of adequate depth to seal against fan pressure. Install cleanouts in piping at changes of direction.

G. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

H. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After electrical circuitry, has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

C. Prepare test and inspection reports.

3.3 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

END OF SECTION 238219

SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Warranty

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.
b. For Parts: Five year(s) from date of Substantial Completion.
c. For Labor: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INDOOR UNITS (5 TONS (18 kW) OR LESS)

A. Wall-Mounted, Evaporator-Fan Components:

1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.

3. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
4. Fan: Direct drive, centrifugal.
5. Fan Motors:

    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
    b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
    c. Enclosure Type: Totally enclosed, fan cooled.
    d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
    e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
7. Condensate Drain Pans:
    a. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on both ends of pan.

2.2 OUTDOOR UNITS (5 TONS (18 kW) OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

    a. Compressor Type: Scroll.
    b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
    c. Refrigerant Charge: R-410A
    d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 210/240.

3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 45 deg F (7 deg C).
7. Mounting Base: Polyethylene.

2.3 ACCESSORIES

A. Thermostat: Low voltage with subbase to control compressor and evaporator fan.

B. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:

1. Compressor time delay.
2. 24-hour time control of system stop and start.
3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection including auto setting.

C. Automatic-reset timer to prevent rapid cycling of compressor.

D. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

E. Drain Hose: For condensate.

F. Additional Monitoring:

1. Monitor constant and variable motor loads.
2. Monitor variable-frequency-drive operation.
3. Monitor economizer cycle.
4. Monitor cooling load.
5. Monitor air distribution static pressure and ventilation air volumes.

2.4 CAPACITIES AND CHARACTERISTICS

A. Refer to mechanical plans and schedules for capacities and characteristics.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126

(This page intentionally left blank.)

SECTION 260519 - LOW-VOLTAGE POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. 1. Belden, Inc.

2. Southwire Company

3. Thomas & Betts Corporation

4. Or Equal

B. **Copper** Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for **Type THHN/THWN-2**

2.2 CONNECTORS AND SPLICES

A. 1. 3M

2. AFC Cable Systems

3. Hubbell Power Systems

4. Or Equal

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: **Copper**. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for **No. 12** AWG and smaller; stranded for **No. 10** AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: **Type THHN/THWN-2, single conductors in raceway**.

B. Exposed Feeders: **Type THHN/THWN-2, single conductors in raceway**.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: **Type THHN/THWN-2, single conductors in raceway**.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: **Type THHN/THWN-2, single conductors in raceway**.

E. Exposed Branch Circuits, Including in Crawlspaces: **Type THHN/THWN-2, single conductors in raceway**.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: **Type THHN/THWN-2, single conductors in raceway**.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: **Type THHN/THWN-2, single conductors in raceway**.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material.

1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least **6 inches (150 mm)** of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test **service entrance and feeder conductors and conductors feeding the following critical equipment and services** for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

    a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

D. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 1.Burndy

2. ERICO

3. Thomas & Betts

4. Or Equal

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

A. Insulated Conductors: **Copper** wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for **No. 8** AWG and smaller, and stranded conductors for **No. 6** AWG and larger unless otherwise indicated.

B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

C. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

D. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Hangers.
b. Steel slotted support systems.
c. Nonmetallic support systems.
d. Trapeze hangers.
e. Clamps.
f. Turnbuckles.
g. Sockets.
h. Eye nuts.
i. Saddles.
j. Brackets.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which hangers and supports will be attached.
3. Size and location of initial access modules for acoustical tile.
4. Items penetrating finished ceiling, including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.

1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified **and the system will be fully operational after the seismic event**."
2. Component Importance Factor: **1.0**.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.

1. a. ERICO

   b. Thomas & Betts

   c. Unistrut

   d. Or Equal

2. Material: **Galvanized steel**
3. Channel Width: **1-5/8 inches (41.25 mm)**
4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
5. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
6. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
8. Channel Dimensions: Selected for applicable load criteria.

B. Conduit and Cable Support Devices: **Steel** hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

   a. Hilti

   b. Or Equal

2. Mechanical-Expansion Anchors: Insert-wedge-type, **zinc-coated steel**, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

   a. Hilti

   b. Or Equal

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: **All-steel** springhead type.
7. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.

B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as **required by** NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, **EMTs** may be supported by openings through structure members, according to NFPA 70.

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: **Spring-tension clamps**.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. 1.Allied Tube & Conduit

2. Southwire

3. Wheatland Tube Company

4. Or Equal

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. EMT: Comply with ANSI C80.3 and UL 797.

E. FMC: Comply with UL 1; **zinc-coated steel**.

F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:

   a. Material: **Steel**
   b. Type: **compression**.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

H. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. 1. CANTEX, Inc.

2. Thomas & Betts

3. Topaz Electric

4. Or Equal

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. ENT: Comply with NEMA TC 13 and UL 1653.

D. RNC: **Type EPC-40-PVC**complying with NEMA TC 2 and UL 651 unless otherwise indicated.

E. LFNC: Comply with UL 1660.

F. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

G. Fittings for LFNC: Comply with UL 514B.

H. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 BOXES, ENCLOSURES, AND CABINETS

A. 1.Crouse-Hinds

2.Hubbell

3. Thomas & Betts

4. Or Equal (See Legrand Floor Box cut sheet following this specification Section 260533)

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, **ferrous alloy**, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

I. Device Box Dimensions:**4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep)**

J. Gangable boxes **are allowed**.

K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, **Type 1**with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

L. Cabinets:

1. NEMA 250, **Type 1**galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: **GRC**
2. Concealed Conduit, Aboveground: **EMT**
3. Underground Conduit: RNC, **Type EPC-40-PVC**
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): **LFMC**
5. Boxes and Enclosures, Aboveground: NEMA 250, **Type 3R**

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: **EMT**
2. Exposed, Not Subject to Severe Physical Damage: **EMT**
3. Exposed and Subject to Severe Physical Damage: **GRC**. Raceway locations include the following:
   a. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   b. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: **EMT**
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: **GRC**

C. Minimum Raceway Size: **3/4-inch (21-mm)** trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use **compression**, **steel** fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds **120 deg F (49 deg C)**.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches (300 mm)of enclosures to which attached.

I. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

P. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

R. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for **recessed and semirecessed luminaires,** equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

S. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to **bottom** of box unless otherwise indicated.

T. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

U. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

V. Locate boxes so that cover or plate will not span different building finishes.

W. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

X. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 PROTECTION

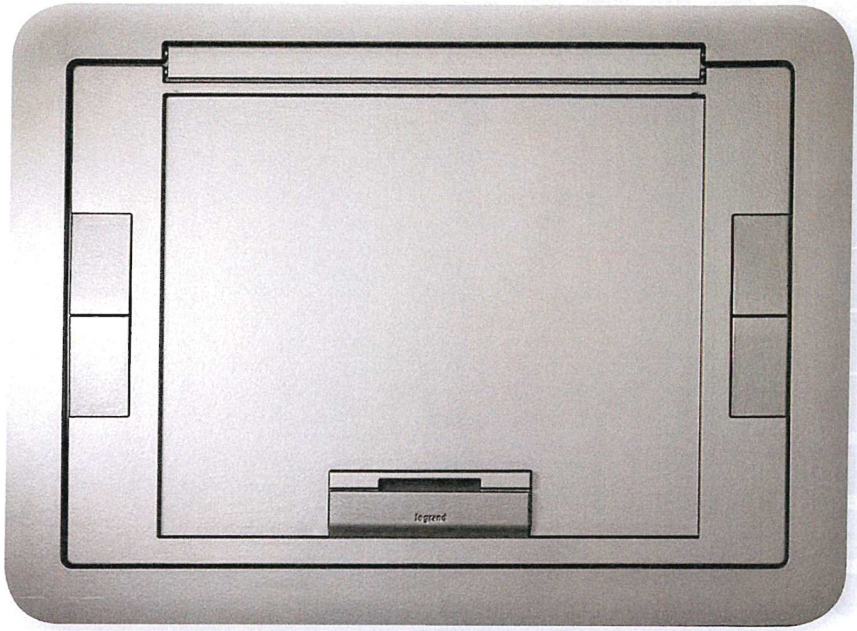
A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

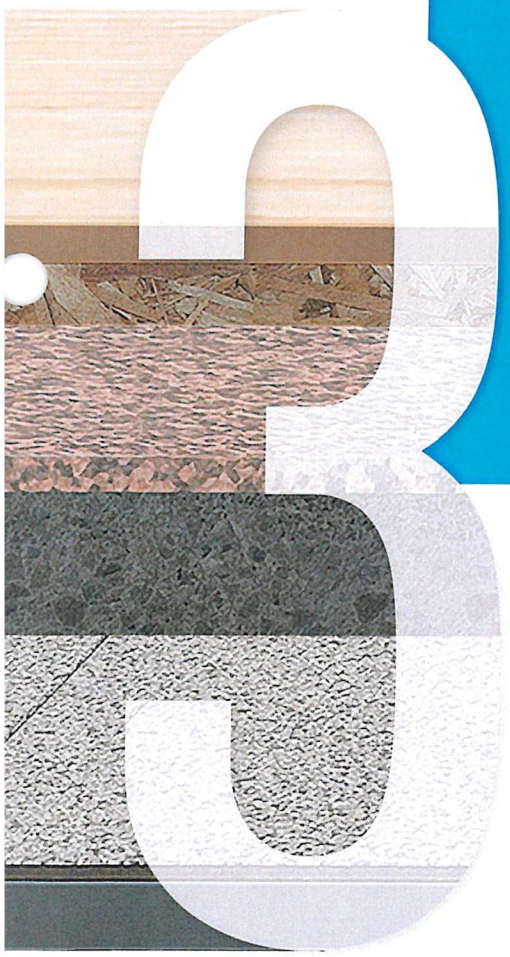
END OF SECTION 260533

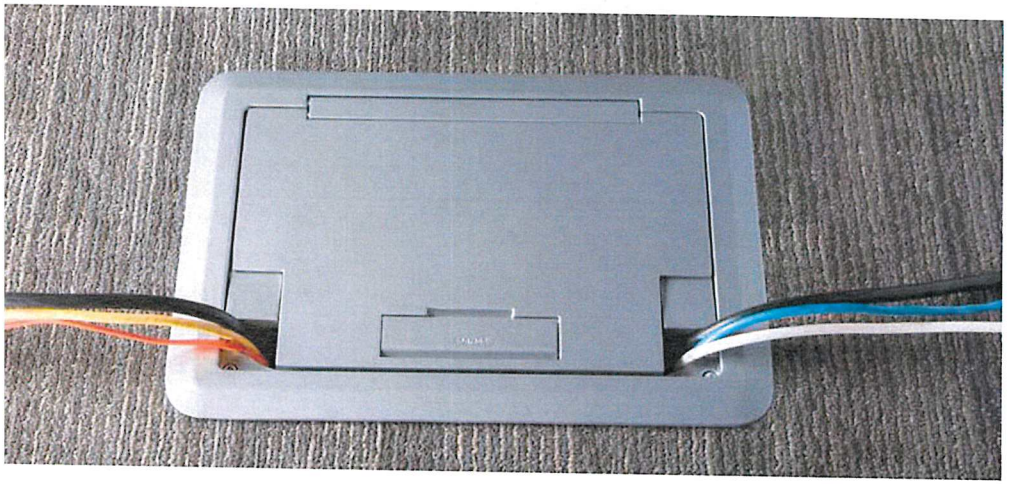
This page left intentionally blank

1 BOX.



3 FLOOR TYPES.





1 FLOOR BOX WORKS IN ANY FLOOR TYPE.

For a long time, different floor types called for different floor box styles. The idea that a single floor box could be used across multiple floor constructions was inconceivable. But with the Evolution Series Floor Box, the way we think and work has changed. It's more than just a floor box. It's a more efficient way to do business.

Evolution Series Floor Boxes are designed for every type of floor construction. Whether used in wood, concrete or raised floors, the Evolution Series Floor Box installs with ease. They can be installed before or after the floor covering has been put down and they are fully adjustable pre- and post-concrete pour. In addition, all boxes are TopGuard™ protected, keeping out water, dirt and debris.

So, no matter where you work, installing one box provides countless benefits.

1 BOX. MULTIPLE FLOOR TYPES AND SURFACES.

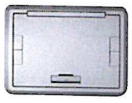
Wood Floor

Concrete Floor

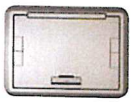
Raised Floor

Carpet, tile, wood, terrazzo and polished concrete surfaces

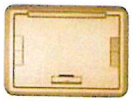
1 BOX. 6 FINISHES.



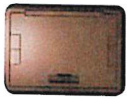
Aluminum



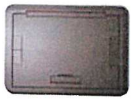
Nickel



Brass



Bronze



Gray

Black

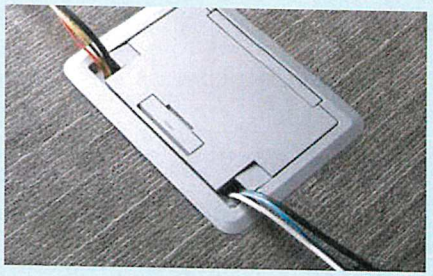
Covers are available in the above six finishes. There is also the option for a carpet insert or solid cover for surface and flush mount applications.

Standard Floor Boxes
For raised, wood and above-grade concrete floors. Available in 4, 5, 6, 8 and 10-gang and furniture feed versions.

On-Grade Floor Boxes
For on-grade applications. Available in 4, 5, 6, 8 and 10-gang and furniture feed versions.

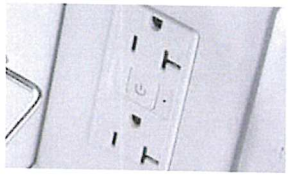
Fire Classified Floor Boxes
For fire rated above-grade applications (up to two hours). Available in 4, 5, 6, 8 and 10-gang versions.

1 BOX. MANY BENEFITS.



Sliding Doors Reduce Trip Hazards – Auto-close egress doors lock into position when slid open and automatically wrap around cables when the cover is closed, reducing trip hazards.

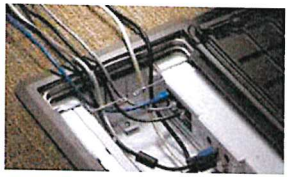
Easy Interior Access – Cover opens 180º providing easy access when working inside the box.



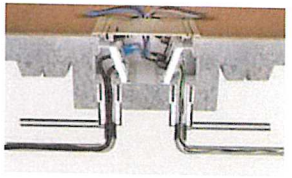
Plug Load Control up to 30 Feet – Tested with Pass & Seymour® Wireless RF receptacles to control plug loads up to a distance of 30 feet when the cover is closed.

High Capacity Furniture Feed – Boxes are designed for concrete, wood and raised floor applications.

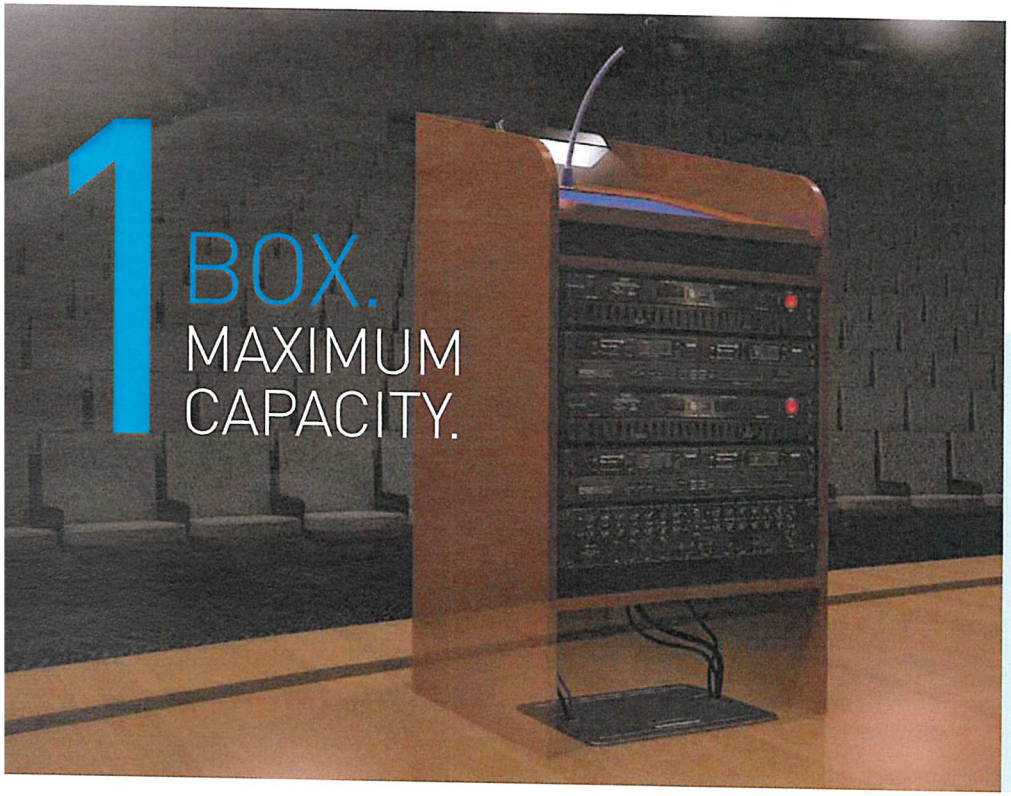
Accepts Standard Size Device Plates – Including single, double and triple standard size wall plates.



Keeps Cables Organized – Built-in cable management guides keeps cables orderly in the egress location, freeing up one hand when activating devices.

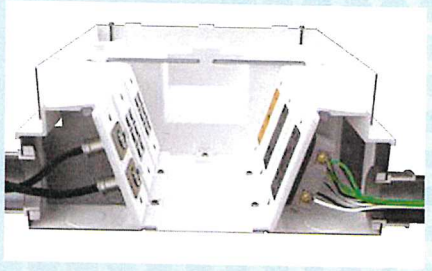


Two Hour Fire Rating – Fire classified for up to two hours and pre-assembled for fast, efficient installation. Just install conduit caps (included), position and secure the box to the desired height in the floor opening.

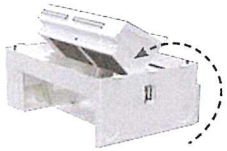


legrand®

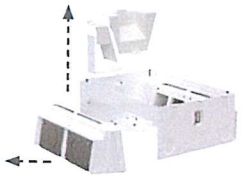
Fully Finished White Painted Interior – Every floor box features a fully finished white painted interior, offering a professional and aesthetically pleasing look.



Maximum Depth Behind Modules – All boxes give the end user maximum plug and hand access. There is 3½" of wire space behind the device plate, offering maximum capacity for the deeper A/V style devices.

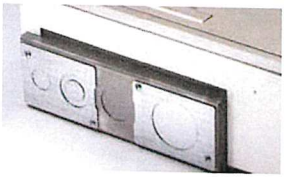


Removable Modules for Easy Changes – For easy installation, moves, adds and changes, modules can be removed out of the top and back. In addition, they can move from point "A" to point "B" without disconnecting services.



Tunnel Provides Additional Capacity – Built-in tunnel allows for services to be wrapped to the other side of the box for additional capacity.

Open System for Flexibility – Accepts a wide range of communications and A/V devices from leading manufacturers.



Various Knockout Sizes – The Evolution Series Floor Box knockouts range from ¾" trade size up to 2" trade size.

High Capacity – Able to accommodate between four and ten gangs.

Configure an Evolution Floor Box to fit your needs:
www.legrand.us/evolution

designed to be better.™

legrand®

Electrical Wiring Systems

60 Woodlawn Street
West Hartford, CT 06110
1.877.BY.LEGRAND (295.3472)
www.legrand.us

570 Applewood Crescent
Vaughan, Ontario L4K 4B4
905.738.9195
www.legrand.ca

FOLLOW US

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Direct-buried conduit, ducts, and duct accessories.
2. Concrete-encased conduit, ducts, and duct accessories.
3. Handholes and boxes.
4. Manholes.

1.3 DEFINITIONS

A. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include duct-bank materials, including separators and miscellaneous components.
2. Include ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Include accessories for manholes, handholes, boxes**, and other utility structures**.
4. Include warning tape.
5. Include warning planks.

B. Shop Drawings:

1. Precast or Factory-Fabricated Underground Utility Structures:

a. Include plans, elevations, sections, details, attachments to other work, and accessories.
b. Include duct entry provisions, including locations and duct sizes.
c. Include reinforcement details.
d. Include frame and cover design and manhole frame support rings.
e. Include **Ladder** details.

f. Include grounding details.
g. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
h. Include joint details.

1.5 INFORMATIONAL SUBMITTALS

A. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.

1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
2. Drawings shall be signed and sealed by a qualified professional engineer.

B. Product Certificates: For concrete and steel used in precast concrete **manholes** as required by ASTM C 858.

C. Qualification Data: For professional engineer and testing agency responsible for testing nonconcrete handholes and boxes.

D. Source quality-control reports.

E. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

1.7 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify **Owner** no fewer than 14 days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without **Owner's** written permission.

B. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR DUCTS AND RACEWAYS

A. Comply with ANSI C2.

2.2 CONDUIT

A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

B. RNC: NEMA TC 2, **Type EPC-40-PVC and Type EPC-80-PVC**, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.3 NONMETALLIC DUCTS AND DUCT ACCESSORIES

A. 1. CANTEX, Inc.

2. IPEX USA

3. Or Equal

B. Underground Plastic Utilities Duct: NEMA TC 2, UL 651, ASTM F 512, **Type EPC-80 and Type EPC-40**, with matching fittings complying with NEMA TC 3 by same manufacturer as the duct.

C. Solvents and Adhesives: As recommended by conduit manufacturer.

D. Duct Accessories:

1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and size of ducts with which used, and selected to provide minimum duct spacing indicated while supporting ducts during concreting or backfilling.
2. Warning Tape: Underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."
3. Concrete Warning Planks: Nominal 12 by 24 by 3 inches (300 by 600 by 75 mm) in size, manufactured from 6000-psi (41-MPa) concrete.

    a. Color: Red dye added to concrete during batching.
    b. Mark each plank with "ELECTRIC" in 2-inch- (50-mm-) high, 3/8-inch- (10-mm-) deep letters.

2.4 PRECAST CONCRETE HANDHOLES AND BOXES

A. 1. Utility Concrete

2. Utility Vault

3. Or Equal

B. Comply with ASTM C 858 for design and manufacturing processes.

C. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.

1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.

2. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
3. Cover Legend: Molded lettering, **"ELECTRIC."**
4. Configuration: Units shall be designed for flush burial and have **integral closed** bottom unless otherwise indicated.
5. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.

    a. Extension shall provide increased depth of **12 inches (300 mm)**.
    b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.

6. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.
7. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks, plus an additional 12 inches (300 mm) vertically and horizontally to accommodate alignment variations.

    a. Windows shall be located no less than 6 inches (150 mm) from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
    b. Window opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
    c. Window openings shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.

8. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

    a. Type and size shall match fittings to duct or conduit to be terminated.
    b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.

9. Handholes **12 inches wide by 24 inches long (300 mm wide by 600 mm long)** and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.5 PRECAST MANHOLES

A. 1. Utility Concrete

2. Utility Vault

3. Or Equal

B. Comply with ASTM C 858.

C. Structural Design Loading: Comply with requirements in "Underground Enclosure Application" Article.

D. Precast Manholes: One-piece units and units with interlocking mating sections, complete with accessories, hardware, and features.

E. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks, plus an additional 12 inches (300 mm) vertically and horizontally to accommodate alignment variations.

1. Windows shall be located no less than 6 inches (150 mm) from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.
2. Window opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
3. Window openings shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.

F. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

1. Type and size shall match fittings to duct or conduit to be terminated.
2. Fittings shall align with elevations of approaching ducts and be located near interior corners of manholes to facilitate racking of cable.

G. Concrete Knockout Panels: 1-1/2 to 2 inches (38 to 50 mm) thick, for future conduit entrance and sleeve for ground rod.

H. Ground Rod Sleeve: Provide a 3-inch (75-mm) PVC conduit sleeve in manhole floors 2 inches (50 mm) from the wall adjacent to, but not underneath, the ducts routed from the facility.

I. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

2.6 UTILITY STRUCTURE ACCESSORIES

A. 1. Utility Concrete

2. Utility Vault

3. Or Equal

B. Manhole Frames, Covers, and Chimney Components: Comply with structural design loading specified for manhole.

1. Frame and Cover: Weatherproof, **gray cast iron complying with ASTM A 48/A 48M, Class 30B** with milled cover-to-frame bearing surfaces; diameter, **26 inches (660 mm)**

a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
b. Special Covers: Recess in face of cover designed to accept finish material in paved areas.

2. Cover Legend: Cast in. Selected to suit system.
a. Legend: "ELECTRIC-HV" for duct systems with medium-voltage cables.

C. Manhole Sump Frame and Grate: ASTM A 48/A 48M, Class 30B, gray cast iron.

D. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch- (50-mm-) diameter eye, and 1-by-4-inch (25-by-100-mm) bolt.

1. Working Load Embedded in 6-Inch (150-mm), 4000-psi (27.6-MPa) Concrete: 13,000-lbf (58-kN) minimum tension.

E. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch- (22-mm-) diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.

1. Ultimate Yield Strength: 40,000-lbf (180-kN) shear and 60,000-lbf (270-kN) tension.

F. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch (13-mm) ID by 2-3/4 inches (69 mm) deep, flared to 1-1/4 inches (31 mm) minimum at base.

1. Tested Ultimate Pullout Strength: 12,000 lbf (53 kN) minimum.

G. Ground Rod Sleeve: 3-inch (75-mm), PVC conduit sleeve in manhole floors 2 inches (50 mm) from the wall adjacent to, but not underneath, the ducts routed from the facility.

H. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch (13-mm) bolt, 5300-lbf (24-kN) rated pullout strength, and minimum 6800-lbf (30-kN) rated shear strength.

I. Cable Rack Assembly: Steel, **hot-rolled** galvanized, except insulators.

1. Stanchions: T-section or channel; 2-1/4-inch (56-mm) nominal size; punched with 14 holes on 1-1/2-inch (38-mm) centers for cable-arm attachment.

2. Arms: 1-1/2 inches (38 mm) wide, lengths ranging from 3 inches (75 mm) with 450-lb (204-kg) minimum capacity to 18 inches (450 mm) with 250-lb (114-kg) minimum capacity. Arms shall have slots along full length for cable ties and be arranged for secure mounting in horizontal position at any vertical location on stanchions.
3. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.

J. Cable Rack Assembly: Nonmetallic. Components fabricated from nonconductive, fiberglass-reinforced polymer.

1. Stanchions: Nominal 36 inches (900 mm) high by 4 inches (100 mm) wide, with minimum of nine holes for arm attachment.
2. Arms: Arranged for secure, drop-in attachment in horizontal position at any location on cable stanchions, and capable of being locked in position. Arms shall be available in lengths ranging from 3 inches (75 mm) with 450-lb (204-kg) minimum capacity to 20 inches (500 mm) with 250-lb (114-kg) minimum capacity. Top of arm shall be nominally 4 inches (100 mm) wide, and arm shall have slots along full length for cable ties.

K. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F (2 deg C). Capable of withstanding temperature of 300 deg F (150 deg C) without slump and adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

L. Fixed Manhole Ladders: Arranged for attachment to **roof or wall and floor** of manhole. Ladder and mounting brackets and braces shall be fabricated from **hot-dip galvanized steel**.

M. Cover Hooks: **Heavy duty, designed for lifts 60 lbf (270 N) and greater**. **Two** required.

2.7 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.

C. Clear and grub vegetation to be removed, and protect vegetation to remain according to Section 311000 "Site Clearing." Remove and stockpile topsoil for reapplication according to Section 311000 "Site Clearing."

3.2 UNDERGROUND DUCT APPLICATION

A. Ducts for Electrical Cables More than 600 V: RNC, NEMA **Type EPC-40**-PVC, in concrete-encased duct bank unless otherwise indicated.

B. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA **Type EPC-40**-PVC, in concrete-encased duct bank unless otherwise indicated.

C. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA **Type EPC-40**-PVC, in direct-buried duct bank unless otherwise indicated.

D. Underground Ducts Crossing **Paved Paths, Walks and Driveways, Roadways and Railroads**: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

3.3 UNDERGROUND ENCLOSURE APPLICATION

A. Manholes: **Precast** concrete.

1. Units Located in Roadways and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating according to AASHTO HB 17.
2. Units Not Located in Deliberate Traffic Paths by Heavy or Medium Vehicles: H-10 load rating according to AASHTO HB 17.

3.4 EARTHWORK

A. Excavation and Backfill: Comply with Section 312000 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 329200 "Turf and Grasses" and Section 329300 "Plants."

D. Cut and patch existing pavement in the path of underground ducts and utility structures according to the "Cutting and Patching" Article in Section 017300 "Execution."

3.5 DUCT INSTALLATION

A. Install ducts according to NEMA TCB 2.

B. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes, to drain in both directions.

C. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of **48 inches (1200 mm)** both horizontally and vertically, at other locations unless otherwise indicated.

D. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

E. Installation Adjacent to High-Temperature Steam Lines: Where duct banks are installed parallel to underground steam lines, perform calculations showing the duct bank will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct bank crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.

F. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches (250 mm) o.c. for 5-inch (125-mm) ducts, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to end-bell spacing 10 feet (3 m) from the end bell without reducing duct line slope and without forming a trap in the line.
2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line direct-buried duct banks with calculated expansion of more than 3/4 inch (19 mm).
3. Grout end bells into structure walls from both sides to provide watertight entrances.

G. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet (3 m) outside the building wall, without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit

transition. Install conduit penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

H. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.

I. Pulling Cord: Install 100-lbf- (445-N-) test nylon cord in empty ducts.

J. Concrete-Encased Ducts: Support ducts on duct separators.

1. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Section 312000 "Earth Moving" for pipes less than 6 inches (150 mm) in nominal diameter.
2. Width: Excavate trench 12 inches (300 mm) wider than duct bank on each side.
3. Width: Excavate trench 3 inches (75 mm) wider than duct bank on each side.
4. Depth: Install top of duct bank at least 24 inches (600 mm) below finished grade in areas not subject to deliberate traffic, and at least 30 inches (750 mm) below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
5. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
6. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than **four** spacers per 20 feet (6 m) of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches (150 mm) between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
7. Minimum Space between Ducts: 3 inches (75 mm) between ducts and exterior envelope wall, 2 inches (50 mm) between ducts for like services, and 4 inches (100 mm) between power and signal ducts.
8. Elbows: Use manufactured duct elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run unless otherwise indicated. Extend concrete encasement throughout length of elbow.
9. Elbows: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
    b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of base. Install insulated grounding bushings on terminations at equipment.

10. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
11. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
12. Concrete Cover: Install a minimum of 3 inches (75 mm) of concrete cover at top and bottom, and a minimum of 2 inches (50 mm) on each side of duct bank.

13. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.

    a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
    b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch (15-mm) reinforcing-rod dowels extending a minimum of 18 inches (450 mm) into concrete on both sides of joint near corners of envelope.

14. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 033000 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

K. Direct-Buried Duct Banks:

1. Excavate trench bottom to provide firm and uniform support for duct bank. Comply with requirements in Section 312000 "Earth Moving" for preparation of trench bottoms for pipes less than 6 inches (150 mm) in nominal diameter.
2. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
3. Space separators close enough to prevent sagging and deforming of ducts, with not less than **four** spacers per 20 feet (6 m) of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches (150 mm) between tiers.
4. Depth: Install top of duct bank at least 36 inches (900 mm) below finished grade unless otherwise indicated.
5. Set elevation of bottom of duct bank below frost line.
6. Install ducts with a minimum of 3 inches (75 mm) between ducts for like services and 6 inches (150 mm) between power and signal ducts.
7. Elbows: Install manufactured duct elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
8. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
    b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

9. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and

contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches (100 mm) over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 312000 "Earth Moving" for installation of backfill materials.

a. Place minimum 3 inches (75 mm) of sand as a bed for duct bank. Place sand to a minimum of 6 inches (150 mm) above top level of duct bank.
b. Place minimum 6 inches (150 mm) of engineered fill above concrete encasement of duct bank.

L. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried ducts and duct banks, placing them 24 inches (600 mm) o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional planks 12 inches (300 mm) apart, horizontally.

M. Warning Tape: Bury warning tape approximately 12 inches (300 mm) above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches (75 mm) of centerline of duct bank. Provide an additional warning tape for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional tapes 12 inches (300 mm) apart, horizontally.

3.6 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Precast Concrete Handhole and Manhole Installation:

1. Comply with ASTM C 891 unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch (25-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:

1. Manhole Roof: Install with rooftop at least 15 inches (375 mm) below finished grade.
2. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch (25 mm) above finished grade.
3. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
4. Where indicated, cast handhole cover frame integrally with handhole structure.

C. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.

D. Manhole Access: Circular opening in manhole roof; sized to match cover size.

1. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
2. Install chimney, constructed of precast concrete collars and rings, to support cast-iron frame to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for frame to chimney.

E. Waterproofing: Apply waterproofing to exterior surfaces of manholes after concrete has cured at least three days. After ducts have been connected and grouted, and before backfilling, waterproof joints and connections, and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.

F. Dampproofing: Apply dampproofing to exterior surfaces of manholes after concrete has cured at least three days.

G. Hardware: Install removable hardware, including pulling eyes, cable stanchions, **and** cable arms, **and insulators,** as required for installation and support of cables and conductors and as indicated.

H. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.

I. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches (97 mm) for manholes and 2 inches (50 mm) for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

3.7 GROUNDING

A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 6-inch- (150-mm-) long mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
3. Test manhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.9 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 260543

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
1. Sealing Elements: **EPDM, Nitrile (Buna N)** rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: **Stainless steel**.
3. Connecting Bolts and Nuts: **Stainless steel** of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide [**1/4-inch (6.4-mm)**] <**Insert dimension**> annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed[**or unless seismic criteria require different clearance**].
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using **steel** pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

SECTION 260548 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Spring isolators.
3. Restrained spring isolators.
4. Channel support systems.
5. Restraint cables.
6. Hanger rod stiffeners.
7. Anchorage bushings and washers.

B. Related Sections include the following:

1. Section 260529 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 DEFINITIONS

A. The IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by **an agency acceptable to authorities having jurisdiction**.
b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For **vibration isolation and** seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.

a. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other electrical Sections for equipment mounted outdoors.

2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
3. Field-fabricated supports.
4. Seismic-Restraint Details:

a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events.
c. Preapproval and Evaluation Documentation: By**an agency acceptable to authorities having jurisdiction**, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

B. Qualification Data: For **professional engineer and testing agency**.

C. Welding certificates.

D. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

E. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide or a comparable product by one of the following:

1. California Dynamics Corporation.
2. Vibration Isolation.
3. Vibration Mountings & Controls, Inc.
4. Or Equal

D. Pads : Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant **neoprene**

E. Spring Isolators : Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

F. Restrained Spring Isolators : Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.2 SEISMIC-RESTRAINT DEVICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide or a comparable product by one of the following:

1. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Hilti Inc.
3. Unistrut; Tyco International, Ltd.
4. Or Equal

D. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by **an agency acceptable to authorities having jurisdiction**.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least **four** times the maximum seismic forces to which they will be subjected.

E. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

F. Restraint Cables: **ASTM A 603 galvanized**- steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

G. Hanger Rod Stiffener: **Steel tube or steel slotted-support-system sleeve with internally bolted connections** to hanger rod. Do not weld stiffeners to rods.

H. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.

I. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.

J. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

K. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

L. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.3 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by **an agency acceptable to authorities having jurisdiction**.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment and Hanger Restraints:

1. Install restrained isolators on electrical equipment.
2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
3. Install seismic-restraint devices using methods approved by**an agency acceptable to authorities having jurisdiction** providing required submittals for component.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

D. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least **four** of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after isolated equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 260548

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Warning labels and signs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1 **and IEEE C2**.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. **Black letters on an orange field**.
2. Legend: Indicate voltage **and system or service type**.

B. Warning labels and signs shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.3 LABELS

A. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

B. Snap-Around Labels for Raceways and Cables Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters of raceways they identify, and that stay in place by gripping action.

C. Self-Adhesive Labels:

1. **Preprinted** 3-mil- (0.08-mm-) thick, **polyester** flexible label with acrylic pressure-sensitive adhesive.

    a. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized to fit the **cable** diameter, such that the clear shield overlaps the entire printed legend.

2. **Polyester**, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

    a. Nominal Size: 3.5-by-5-inch (76-by-127-mm).

3. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
4. Marker for Tags: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

2.4 BANDS AND TUBES:

A. Snap-Around, Color-Coding Bands for Raceways and Cables: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameters sized to suit diameters of raceways or cables they identify, and that stay in place by gripping action.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameters of and shrunk to fit firmly around cables they

identify. Full shrink recovery occurs at a maximum of 200 deg F (93 deg C). Comply with UL 224.

2.5 TAPES AND STENCILS:

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide; compounded for outdoor use.

C. Tape and Stencil for Raceways Carrying Circuits 600 V or Less: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers placed diagonally over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stop stripes at legends.

2.6 Signs

A. Baked-Enamel Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal Size: 7 by 10 inches (180 by 250 mm).

B. Metal-Backed Butyrate Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch (1-mm) galvanized-steel backing and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal Size: 10 by 14 inches (250 by 360 mm).

C. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:

    a. For signs up to 20 sq. inches (129 sq. cm), minimum 1/16-inch- (1.6-mm-).
    b. For signs larger than 20 sq. inches (129 sq. cm), 1/8 inch (3.2 mm) thick.
    c. Engraved legend with **black letters on white face**.
    d. **Self-adhesive**.
    e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.7 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black, except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, self-locking.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C) according to ASTM D 638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

G. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

I. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

J. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

K. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

3.3 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than **30** A and **120** V to Ground: Identify with **self-adhesive vinyl label** Install labels at **10-foot (3-m)** maximum intervals.

B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase- **and Voltage-Level** Identification, 600 V or Less: Use colors listed below for ungrounded **service, feeder and branch-circuit** conductors.

a. Color shall be factory applied.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where

splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

C. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm unless equipment is provided with its own identification.

1. Labeling Instructions:

   a. Indoor Equipment: **Engraved, laminated acrylic or melamine plastic label, punched or drilled for mechanical fasteners**. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
   b. Outdoor Equipment: **Engraved, laminated acrylic or melamine label**.
   c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   d. Unless labels are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment To Be Labeled:

   a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a **self-adhesive, engraved,** laminated acrylic or melamine label.
   b. Enclosures and electrical cabinets.
   c. Access doors and panels for concealed electrical items.
   d. Contactors.
   e. Remote-controlled switches, dimmer modules, and control devices.

END OF SECTION 260553

SECTION 262413 - SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Service and distribution switchboards rated 600 V and less.
2. Surge protection devices.
3. Disconnecting and overcurrent protective devices.
4. Accessory components and features.
5. Identification.

1.3 ACTION SUBMITTALS

A. Product Data: For each switchboard, overcurrent protective device, surge protection device, ground-fault protector, accessory, and component.

1. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
6. Detail utility company's metering provisions with indication of approval by utility company.
7. Include evidence of NRTL listing for series rating of installed devices.
8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
9. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
10. Include diagram and details of proposed mimic bus.

11. Include schematic and wiring diagrams for power, signal, and control wiring.

C. Samples: Representative portion of mimic bus with specified material and finish, for color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For **testing agency**.

B. Seismic Qualification Certificates: For switchboards, overcurrent protective devices, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Routine maintenance requirements for switchboards and all installed components.
b. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
c. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

B. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 COORDINATION

A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace switchboard enclosures, buswork, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within specified warranty period.

1. Warranty Period: **Three** years from date of Substantial Completion.

B. Manufacturer's Warranty: Manufacturer's agrees to repair or replace surge protection devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: **Five** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SWITCHBOARDS

A. 1. Eaton

2. General Electric

3. Siemens

4. Square D

B. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 2.

F. Comply with NFPA 70.

G. Comply with UL 891.

H. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: **Panel** mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

I. Nominal System Voltage: As indicated on plans.

J. Main-Bus Continuous: As indicated on plans.

K. Seismic Requirements: Fabricate and test switchboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation. Shake-table testing shall comply with ICC-ES AC156.

    a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
    b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

L. Indoor Enclosures: Steel, NEMA 250, **Type 1**.

M. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's **standard gray** finish over a rust-inhibiting primer on treated metal surface.

N. Outdoor Enclosures: **Type 3R**.

1. Finish: Factory-applied finish in manufacturer's **standard** color; undersurfaces treated with corrosion-resistant undercoating.
2. Enclosure: **Flat** roof; **bolt-on rear covers** for each section, with provisions for padlocking.
3. Doors: Personnel door at each end of aisle, minimum width of **30 inches (762 mm)** ; opening outwards; with panic hardware and provisions for **padlocking**. At least one door shall be sized to permit the largest single switchboard section to pass through without disassembling doors, hinges, or switchboard section.

O. Barriers: Between adjacent switchboard sections.

P. Insulation and isolation for **main bus of main section and** main and vertical buses of feeder sections.

Q. Service Entrance Rating: Switchboards intended for use as service entrance equipment shall contain from one to six service disconnecting means with overcurrent protection, a neutral bus with disconnecting link, a grounding electrode conductor terminal, and a main bonding jumper.

R. Utility Metering Compartment: Barrier compartment and section complying with utility company's requirements; hinged sealable door; buses provisioned for mounting utility company's current transformers and potential transformers or potential taps as required by utility company. If separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features.

S. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

T. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

U. Pull Box on Top of Switchboard:

1. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.
2. Set back from front to clear circuit-breaker removal mechanism.
3. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
4. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
5. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.

V. Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Provide phase bus arrangement A, B, C from front to back, top to bottom, and left to right when viewed from the front of the switchboard.
2. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity.
3. Phase- and Neutral-Bus Material: Tin-plated, high-strength, electrical-grade aluminum alloy with tin-plated aluminum circuit-breaker line connections.
4. Copper feeder circuit-breaker line connections.
5. Tin-plated aluminum feeder circuit-breaker line connections.
6. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with **mechanical** connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
7. Ground Bus: **1/4-by-2-inch- (6-by-50-mm-)** hard-drawn copper of 98 percent conductivity, equipped with **mechanical** connectors for feeder and branch-circuit ground conductors.
8. Main-Phase Buses and Equipment-Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
9. Disconnect Links:

a. Isolate neutral bus from incoming neutral conductors.
b. Bond neutral bus to equipment-ground bus for switchboards utilized as service equipment or separately derived systems.

10. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with **mechanical** connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
11. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.

W. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of 105 deg C.

X. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components including instruments and instrument transformers.

2.2 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with **interrupting capacity** to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long and short time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.
4. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
5. MCCB Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: **Mechanical** style, suitable for number, size, trip ratings, and conductor material.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: **Integrally mounted** relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

2.3 IDENTIFICATION

A. Mimic Bus: Entire single-line switchboard bus work, as depicted on factory record drawing, on a photoengraved nameplate.

1. Nameplate: At least 0.032-inch- (0.813-mm-) thick anodized aluminum, located at eye level on front cover of the switchboard incoming service section.

B. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards according to **NEMA PB 2.1**.

1. Lift or move panelboards with spreader bars and manufacturer-supplied lifting straps following manufacturer's instructions.
2. Use rollers, slings, or other manufacturer-approved methods if lifting straps are not furnished.
3. Protect from moisture, dust, dirt, and debris during storage and installation.
4. Install temporary heating during storage per manufacturer's instructions.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work or that affect the performance of the equipment.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install switchboards and accessories according to **NEMA PB 2.1**.

B. Equipment Mounting: Install switchboards on concrete base, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in **Section 033000 "Cast-in-Place Concrete."**

1. Install conduits entering underneath the switchboard, entering under the vertical section where the conductors will terminate. Install with couplings flush with the concrete base. Extend 2 inches (50-mm) above concrete base after switchboard is anchored in place.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to switchboards.

6. Anchor switchboard to building structure at the top of the switchboard if required or recommended by the manufacturer.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, straps and brackets, and temporary blocking of moving parts from switchboard units and components.

D. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

E. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

F. Install filler plates in unused spaces of panel-mounted sections.

G. Install overcurrent protective devices, surge protection devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges.

H. Install spare-fuse cabinet.

I. Comply with NECA 1.

3.3 CONNECTIONS

A. Comply with requirements for terminating feeder bus specified in Section 262500 "Enclosed Bus Assemblies." Drawings indicate general arrangement of bus, fittings, and specialties.

B. Comply with requirements for terminating cable trays specified in Section 260536 "Cable Trays for Electrical Systems." Drawings indicate general arrangement of cable trays, fittings, and specialties.

C. Bond conduits entering underneath the switchboard to the equipment ground bus with a bonding conductor sized per NFPA 70.

D. Support and secure conductors within the switchboard according to NFPA 70.

E. Extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections:

1. Acceptance Testing:

    a. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit. Open control and metering circuits within the switchboard, and remove neutral connection to surge protection and other electronic devices prior to insulation test. Reconnect after test.
    b. Test continuity of each circuit.

2. Test ground-fault protection of equipment for service equipment per NFPA 70.
3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
4. Correct malfunctioning units on-site where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
5. Perform the following infrared scan tests and inspections, and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove **front** panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
    c. Instruments and Equipment:

        1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

6. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Switchboard will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

3.7 PROTECTION

A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

END OF SECTION 262413

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. HID: High-intensity discharge.

E. MCCB: Molded-case circuit breaker.

F. SPD: Surge protective device.

G. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.

3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Include evidence of NRTL listing for series rating of installed devices.
7. Include evidence of NRTL listing for SPD as installed in panelboard.
8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
9. Include wiring diagrams for power, signal, and control wiring.
10. Key interlock scheme drawing and sequence of operations.
11. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Panelboard Schedules: For installation in panelboards.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: **18** months from date of Substantial Completion.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace SPD that fails in materials or workmanship within specified warranty period.

1. SPD Warranty Period: **Five** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

F. Enclosures: **Flush and Surface**-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

    a. Indoor Dry and Clean Locations: NEMA 250, **Type 1**.
    b. Outdoor Locations: NEMA 250, **Type 3R**.
    c. Other Wet or Damp Indoor Locations: NEMA 250, **Type 4**.
    d. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, **Type 12**.

2. Height: 84 inches (2.13 m) maximum.
3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
5. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
6. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
7. Finishes:

    a. Panels and Trim: **Steel and galvanized steel**, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    b. Back Boxes: **Galvanized steel**.
    c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

G. Incoming Mains:

1. Location: **Convertible between top and bottom**.

2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

H. Phase, Neutral, and Ground Buses:

1. Material: **Hard-drawn copper, 98 percent conductivity**.

   a. Plating shall run entire length of bus.
   b. Bus shall be fully rated the entire length.

2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
5. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.

I. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: **Hard-drawn copper, 98 percent conductivity**.
2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: **Mechanical** type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: **Mechanical** type, with a lug on the bar for each pole in the panelboard.
6. Feed-Through Lugs: **Mechanical** type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
7. Subfeed (Double) Lugs: **Mechanical** type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
8. Gutter-Tap Lugs: **Mechanical** type suitable for use with conductor material and with matching insulating covers. Locate at same end of bus as incoming lugs or main device.

J. NRTL Label: Panelboards or load centers shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

K. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

1. Percentage of Future Space Capacity: **20** percent.

L. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.

2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

B. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD **Type 1**.

2.3 POWER PANELBOARDS

A. 1. Eaton

2. General Electric

3. Siemens

4. Square D

B. Panelboards: NEMA PB 1, distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than **36 inches (914 mm)** high, provide two latches, keyed alike.

D. Mains: **Circuit breaker**.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: **Bolt-on circuit breakers**.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: **Bolt-on circuit breakers**.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. 1. Eaton

2. General Electric

3. Siemens

4. Square D

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: **Circuit breaker**.

D. Branch Overcurrent Protective Devices: **Bolt-on** circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

F. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. 1. Eaton

2. General Electric

3. Siemens

4. Square D

B. MCCB: Comply with UL 489, with **interrupting capacity** to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

a. Inverse time-current element for low-level overloads.
b. Instantaneous magnetic trip element for short circuits.
c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip Circuit Breakers:

a. RMS sensing.
b. Field-replaceable rating plug or electronic trip.
c. Digital display of settings, trip targets, and indicated metering displays.
d. Multi-button keypad to access programmable functions and monitored data.
e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
f. Integral test jack for connection to portable test set or laptop computer.
g. Field-Adjustable Settings:

1) Instantaneous trip.
2) Long- and short-time pickup levels.
3) Long and short time adjustments.
4) Ground-fault pickup level, time delay, and I squared T response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. Subfeed Circuit Breakers: Vertically mounted.

6. MCCB Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.
b. Breaker handle indicates tripped status.
c. UL listed for reverse connection without restrictive line or load ratings.
d. Lugs: **Mechanical** style, suitable for number, size, trip ratings, and conductor materials.
e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
f. Multipole units enclosed in a **factory assembled to operate as a single unit**.
g. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in **on or off** position.
h. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.6 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in **metal frame with transparent protective cover**.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

D. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.7 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to **NEMA PB 1.1**.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to **NEMA PB 1.1**.

D. Equipment Mounting:
1. Attach panelboard to the vertical finished or structural surface behind the panelboard.
2. Comply with requirements for seismic control devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

G. Mount top of trim **90 inches (2286 mm)** above finished floor unless otherwise indicated.

H. Mount panelboard cabinet plumb and rigid without distortion of box.

I. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

J. Mounting panelboards with space behind is recommended for damp, wet, or dirty locations. The steel slotted supports in the following paragraph provide an even mounting surface and the recommended space behind to prevent moisture or dirt collection.

K. Mount surface-mounted panelboards to steel slotted supports **5/8 inch (16 mm)** in depth. Orient steel slotted supports vertically.

L. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.
2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

M. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

N. Install filler plates in unused spaces.

O. Stub four 1-inch (27-EMT) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-EMT) empty conduits into raised floor space or below slab not on grade.

P. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

Q. Mount spare fuse cabinet in accessible location.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads **after balancing panelboard loads**; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

D. Tests and Inspections:

1. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
2. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
    c. Instruments and Equipment:

        1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

E. Panelboards will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.

1. Measure loads during period of normal facility operations.
2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

3.6 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Straight-blade convenience receptacles.
2. GFCI receptacles.
3. Toggle switches.
4. Decorator-style convenience.
5. Wall-box dimmers.
6. Wall plates.

1.3 DEFINITIONS

A. Abbreviations of Manufacturers' Names:

1. Cooper: Cooper Wiring Devices; Division of Cooper Industries, Inc.
2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
3. Leviton: Leviton Mfg. Company, Inc.
4. Pass & Seymour: Pass& Seymour/Legrand.

B. BAS: Building automation system.

C. EMI: Electromagnetic interference.

D. GFCI: Ground-fault circuit interrupter.

E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

F. RFI: Radio-frequency interference.

G. SPD: Surge protective device.

H. UTP: Unshielded twisted pair.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

D. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STRAIGHT-BLADE RECEPTACLES

A. Duplex Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Hubbell

2. Leviton

3. Or Equal

2.3 GFCI RECEPTACLES

A. General Description:

1. 125 V, 20 A, straight blade, **feed**-through type.

2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles:

1. Hubbell

2. Leviton

3. Or Equal

2.4 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Single Pole:

a. Hubbell

b. Leviton

c. Or Equal

2. Three Way:

a. Hubbell

b. Leviton

c. Or Equal

2.5 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable **slider**; with single-pole or three-way switching. Comply with UL 1472.

C. LED Lamp Dimmer Switches: Modular; compatible with LED lamps; trim potentiometer to adjust low-end dimming; capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.6 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: **Smooth, high-impact thermoplastic**.
3. Material for Unfinished Spaces: **Smooth, high-impact thermoplastic**.
4. Material for Damp Locations: **Thermoplastic** with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant **thermoplastic** with lockable cover.

2.7 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: **As selected by Architect** unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: **Red**.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles **up** and on horizontally mounted receptacles to the **right**.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan-speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with **black**-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Perform the following tests and inspections:
   1. Test Instruments: Use instruments that comply with UL 1436.
   2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

D. Tests for Convenience Receptacles:

   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
   4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
   5. Using the test plug, verify that the device and its outlet box are securely mounted.
   6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

E. Test straight-blade for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g).

F. Wiring device will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600 V ac and less for use in the following:
   a. Enclosed switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit **in PDF format**.
4. Coordination charts and tables and related data.
5. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. Include the following:
1. Current-limitation curves for fuses with current-limiting characteristics.
2. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse used on the Project. Submit **in PDF format**.
3. Coordination charts and tables and related data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 1.Bussman

2. Littlefuse

3. Or Equal

B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
1. Type RK-5: **600**-V, zero- to 600-A rating, 200 kAIC**, time delay**.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:
   1. Motor Branch Circuits: **Class RK5** time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

This page left intentionally blank

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Enclosures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

C. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Manufacturer's field service report.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. 1. General Electric

2. Siemens

3. Square D

4. Or Equal

B. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with **cartridge** fuse interiors to accommodate **indicated** fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Single Throw, **600**-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate **indicated** fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Lugs: **Mechanical** type, suitable for number, size, and conductor material.

2.2 NONFUSIBLE SWITCHES

A. 1. General Electric

2. Siemens

3. Square D

4. Or Equal

B. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Single Throw, **600** -V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Lugs: **Mechanical** type, suitable for number, size, and conductor material.

2.3 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, **Type 1**.
2. Outdoor Locations: NEMA 250, **Type 3R**.
3. Other Wet or Damp, Indoor Locations: NEMA 250, **Type 4**.
4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
    c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262816

SECTION 263213 - ENGINE GENERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract.

1.2 SUMMARY

A. This Section includes packaged engine-generator sets for standby power supply with the following features:

1. 350kw Diesel engine.
2. Unit–mounted cooling system.
3. Unit-mounted control and monitoring.
4. Outdoor enclosure.
5. 24 Hour runtime dual walled base tank.
6. Generator and ATS switch shall provide compliance with NFPA 110,
   Class 24, runtime
   Type 10, starting
   Type M, manual operation, no UPS
   Level 2, non-life critical.

   Equipment, installation, and operation shall comply.

B. Related Sections include the following:

1. Section 263600 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.3 DEFINITIONS

A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:

1. Thermal damage curve for generator.
2. Time-current characteristic curves for generator protective device.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
2. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
3. Vibration Isolation Base Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
4. Wiring Diagrams: Power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer Seismic Qualification Certification: Submit certification that Base tank, engine-generator set, batteries, battery racks, accessories, and components will withstand seismic Zone 4 forces:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

B. Qualification Data: For manufacturer.

C. Source quality-control test reports.

1. Certified summary of prototype-unit test report.
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
5. Report of sound generation.
6. Report of exhaust emissions showing compliance with applicable regulations.
7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

D. Field quality-control test reports.

E. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified include the following:

1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer. Maintain, within **200 miles (321 km)** of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL), and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

C. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with ASME B15.1.

F. Comply with NFPA 37.

G. Comply with NFPA 70.

H. Comply with NFPA 99.

I. Comply with NFPA 110 requirements for Level **2** emergency power supply system.

J. Comply with UL 2200.

K. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

1.8 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Owner no fewer than 15 days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service Owner's written permission.

B. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: 5 to 40 deg C.
2. Relative Humidity: 0 to 95 percent.
3. Altitude: Sea level to **1000 feet (300 m)**.

1.9 COORDINATION

A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 1 year from date of Substantial Completion.

1.11 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Caterpillar; Engine Div.
2. Kohler Co.
3. Onan/Cummins Power Generation; Industrial Business Group.

2.2 ENGINE-GENERATOR SET

A. Factory-assembled and -tested, engine-generator set.

B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.

1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

C. Capacities and Characteristics:

1. Power Output Ratings: 350kw
2. Output Connections: 208/120 volt, Three-phase, Four wire.
3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

D. Generator-Set Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.3 ENGINE

A. Fuel: Fuel oil, Grade DF-2.

B. Rated Engine Speed: 1800 rpm.

C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).

D. Lubrication System: The following items are mounted on engine or skid:

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.

2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

E. Engine Fuel System:

1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

G. Governor: Adjustable isochronous, with speed sensing.

H. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.

    a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
    b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

I. Muffler/Silencer: Residential type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

1. Minimum sound attenuation of 18 dB at 500 Hz.
2. Sound level measured at a distance of 10 feet (3 m) from exhaust discharge after installation is complete shall be 95 dBA or less.

J. Air-Intake Filter: Standard-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

K. Starting System: 12-V electric, with negative ground.

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: As required by NFPA 110 for system level specified.
4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least three times without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in Part 1 "Project Conditions" Article. Include accessories required to support and fasten batteries in place.
7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:

    a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
    b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
    c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
    d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
    e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
    f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.4 FUEL OIL STORAGE

A. Comply with NFPA 30.

B. Base-Mounted Fuel Oil Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features include the following:

1. Tank level indicator.
2. Capacity: Fuel for (NFPA 110 Class 24) 24 hours' continuous operation at 100 percent rated power output.
3. Vandal-resistant fill cap.
4. Containment Provisions: Comply with requirements of authorities having jurisdiction.

2.5 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

B. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.

C. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level **2** system, and the following:

1. AC voltmeter.
2. AC ammeter.
3. AC frequency meter.
4. DC voltmeter (alternator battery charging).
5. Engine-coolant temperature gage.
6. Engine lubricating-oil pressure gage.
7. Running-time meter.
8. Ammeter-voltmeter, phase-selector switch(es).
9. Generator-voltage adjusting rheostat.
10. Fuel tank derangement alarm.
11. Generator overload.

D. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

2.6 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker: Molded-case, electronic-trip type; 100 percent rated; complying with UL 489.

1. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
2. Trip Settings: Selected to coordinate with generator thermal damage curve.
3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
4. Mounting: Adjacent to or integrated with control and monitoring panel.

2.7 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H or Class F.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Enclosure: Dripproof.

G. Instrument Transformers: Mounted within generator enclosure.

H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.

1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.

I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. Subtransient Reactance: 12 percent, maximum.

2.8 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description: Vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph (160 km/h). Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.

B. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.

1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.

2.9 VIBRATION ISOLATION DEVICES

A. Provide generator with integral vibration isolation to eliminate need for under unit vibration spring isolators.

2.10 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.11 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with NFPA 110, Level 2 Energy Converters and with IEEE 115.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

C. Install packaged engine generator on cast-in-place concrete equipment bases per manufacturers directions.

D. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 IDENTIFICATION

A. Identify system components according to Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection (except those indicated to be optional) for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
    a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
    b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
    c. Verify acceptance of charge for each element of the battery after discharge.
    d. Verify that measurements are within manufacturer's specifications.
4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
6. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg (120 kPa). Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
7. Exhaust Emissions Test: Comply with applicable government test criteria.
8. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.

9. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
10. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge measured at 21 feet on four sides of the generator, and compare measured levels with required values.

D. Coordinate tests with tests for transfer switches and run them concurrently.

E. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.

F. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

G. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

H. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

I. Remove and replace malfunctioning units and re-inspect as specified above.

J. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

K. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION 263213

SECTION 263600 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract.

1.2 SUMMARY

A. Section includes transfer switches rated 600 V and less, including the following:

1200A-4 pole Automatic Transfer Switch, 208V rated. Switch shall be coordinated with and for operation of contractor provided 100kw generator.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

1. Single-Line Diagram: Show connections between transfer switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches accessories, and components will withstand seismic forces defined. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. Include the following:

1. Features and operating sequences, both automatic and manual.
2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

C. Source Limitations: Obtain automatic transfer switches through one source from a single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA ICS 1.

F. Comply with NFPA 70.

G. Comply with NFPA 99.

H. Comply with NFPA 110.

I. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.7 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:

1. Notify Owner no fewer than 15 days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Contactor Transfer Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Caterpillar; Engine Div.
   b. Emerson; ASCO Power Technologies, LP.
   c. GE Zenith Controls.
   d. Kohler Power Systems; Generator Division.
   e. Onan/Cummins Power Generation; Industrial Business Group.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

G. Neutral Switching. Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.

H. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

I. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversize neutral shall be double the nominal rating of circuit in which switch is installed.

J. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.

K. Battery Charger: For generator starting batteries.

1. Float type rated 2A.
2. Ammeter to display charging current.
3. Fused ac inputs and dc outputs.

L. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.

M. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Section 260553 "Identification for Electrical Systems."

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

N. Enclosures: General-purpose NEMA 250, Type 3R, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 2 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

D. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.

E. Automatic Transfer-Switch Features:

1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

    a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
    b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Instantaneous; shall initiate shutdown sequence at remote engine-generator controls after retransfer of load to normal source.

12. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
13. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer. Confirm setting preferences with owner prior to setting.
    b. Push-button programming control with digital display of settings.
    c. Integral battery operation of time switch when normal control power is not available.

2.4 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Design each fastener and support to carry load indicated by unit being provided and seismic Zone 4 requirements.

B. Pad-Mounting Switch: Anchor to concrete pad by bolting.

1. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges minimum. Refer to Architectural plans and specifications for exact requirements. Extend base no more than 4 inches (100 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support.

C. Identify components according to Section 260553 "Identification for Electrical Systems."

D. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

    a. Check for electrical continuity of circuits and for short circuits.
    b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
    c. Verify that manual transfer warnings are properly placed.
    d. Perform manual transfer operation.

4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.

    a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    b. Simulate loss of phase-to-ground voltage for each phase of normal source.
    c. Verify time-delay settings.
    d. Verify pickup and dropout voltages by data readout or inspection of control settings.
    e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
    f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
    g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

    h. Verify grounding connections and locations.

D. Testing Agency's Tests and Inspections:

1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

    a. Check for electrical continuity of circuits and for short circuits.
    b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
    c. Verify that manual transfer warnings are properly placed.
    d. Perform manual transfer operation.

4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.

    a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    b. Simulate loss of phase-to-ground voltage for each phase of normal source.
    c. Verify time-delay settings.
    d. Verify pickup and dropout voltages by data readout or inspection of control settings.
    e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
    f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
    g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

    h. Verify grounding connections and locations and ratings of sensors.

E. Coordinate tests with tests of generator and run them concurrently.

F. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

G. Remove and replace malfunctioning units and retest as specified above.

H. Prepare test and inspection reports.

I. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment.

B. Coordinate this training with that for generator equipment.

END OF SECTION 263600

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 265119 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior solid-state luminaires that use LED technology.
2. Lighting fixture supports.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
6. Photometric data and adjustment factors based on laboratory tests.

a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. LEED Submittals:

1. Product Data for Credit IEQ 4.2: For paints and coatings, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4.2: For paints and coatings, documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Product Schedule: For luminaires and lamps. **Use same designations indicated on Drawings.**

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Lighting luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches (300 mm) of the plane of the luminaires.
4. Structural members to which luminaires will be attached.
5. Initial access modules for acoustical tile, including size and locations.
6. Items penetrating finished ceiling, including the following:

a. Other luminaires.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.
f. Ceiling-mounted projectors.

7. Moldings.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

D. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Product Certificates: For each type of luminaire.

F. Product Test Reports: For each luminaire, for tests performed by **manufacturer and witnessed by a qualified testing agency**.

G. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

C. Provide luminaires from a single manufacturer for each luminaire type.

D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.9 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: **Five** year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.

B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.

1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified."

2.2 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. Recessed Fixtures: Comply with NEMA LE 4.

E. Bulb shape complying with ANSI C79.1.

F. Lamp base complying with **ANSI C81.61 or IEC 60061-1**.

G. CRI of **minimum 80**. CCT of **4100 K**.

H. Rated lamp life of **50,000** hours.

I. Lamps dimmable from 100 percent to 0 percent of maximum light output.

J. Internal driver.

K. Nominal Operating Voltage: **120 V ac 277 V ac**.

1. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

L. Housings:

1. **Extruded-aluminum** housing and heat sink.

2.3 DOWNLIGHT

A. As scheduled on Plans

B. Minimum **1,000** lumens. Minimum allowable efficacy of **80** lumens per watt.

C. Universal mounting bracket.

D. Integral junction box with conduit fittings.

2.4 HIGHBAY, LINEAR

A. As scheduled on Plans

B. Minimum **10,000** lumens. Minimum allowable efficacy of **80** lumens per watt.

2.5 HIGHBAY, NONLINEAR

A. As scheduled on Plans

B. Minimum **10,000** lumens. Minimum allowable efficacy of **80** lumens per watt.

C. Universal mounting bracket.

D. Integral junction box with conduit fittings.

2.6 LINEAR INDUSTRIAL

A. As scheduled on Plans

B. Minimum **5,000** lumens. Minimum allowable efficacy of **80** lumens per watt.

2.7 LOWBAY

A. As scheduled on Plans

B. Minimum **5,000** lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Universal mounting bracket.

2.8 RECESSED LINEAR

A. As scheduled on Plans

B. Minimum **3,000** lumens. Minimum allowable efficacy of **85** lumens per watt.

C. Integral junction box with conduit fittings.

2.9 STRIP LIGHT

A. As scheduled on Plans

B. Minimum **750** lumens. Minimum allowable efficacy of **80** lumens per watt.

C. Integral junction box with conduit fittings.

2.10 SURFACE MOUNT, LINEAR

A. As scheduled on Plans

B. Minimum **750** lumens. Minimum allowable efficacy of **80** lumens per watt.

C. Integral junction box with conduit fittings.

2.11 SURFACE MOUNT, NONLINEAR

A. As scheduled on Plans

B. Minimum **750** lumens. Minimum allowable efficacy of **80** lumens per watt.

C. Integral junction box with conduit fittings.

2.12 SUSPENDED, LINEAR

A. As scheduled on Plans

B. Minimum **3,000** lumens. Minimum allowable efficacy of **85** lumens per watt.

2.13 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:

1. **Clear, UV-stabilized acrylic**.
2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Glass: Annealed crystal glass unless otherwise indicated.
4. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

D. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI for all luminaires.

2.14 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.15 LUMINAIRE FIXTURE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, **12 gage (2.68 mm)**.

D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaire Support:

1. **Attached to structural members in walls**.
2. Do not attach luminaires directly to gypsum board.

G. Ceiling-Mounted Luminaire Support:

1. Ceiling mount with **two** 5/32-inch- (4-mm-) diameter aircraft cable supports **adjustable to 120 inches (6 m) in length**.
2. Ceiling mount with **pendant mount four-point pendant mount** with **5/32-inch- (4-mm)** diameter aircraft cable supports **adjustable to 120 inches (6 m) in length**.
3. Ceiling mount with hook mount.

H. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and **tubing or rod** for suspension for each unit length of luminaire chassis, including one at each end.

4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Comply with requirements for startup specified in Section 260943.16 "Addressable-Fixture Lighting Controls."

B. Comply with requirements for startup specified in Section 260943.23 "Relay-Based Lighting Controls."

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within **12** months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to **two** visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 265119

SECTION 265219 - EMERGENCY AND EXIT LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Exit signs.
   2. Luminaire supports.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.

D. Fixture: See "Luminaire" Paragraph.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.

   1. Include data on features, accessories, and finishes.
   2. Include physical description of the unit and dimensions.
   3. Battery and charger for light units.
   4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
   5. Include photometric data and adjustment factors based on laboratory tests, complying with IES LM-45, for each luminaire type.

      a. Testing Agency Certified Data: For indicated **luminaires and signs**, photometric data certified by a qualified independent testing agency. Photometric data for remaining **luminaires and signs** shall be certified by manufacturer.

b. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Samples: For each product and for each color and texture specified.

D. Samples for Initial Selection: For each type of luminaire with factory-applied finishes.

E. Samples for Verification: For each type of luminaire.

1. Include Samples of luminaires and accessories to verify finish selection.

F. Product Schedule:

1. For exit signs. **Use same designations indicated on Drawings**.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches (300 mm) of the plane of the luminaires.
4. Structural members to which equipment will be attached.
5. Size and location of initial access modules for acoustical tile.
6. Items penetrating finished ceiling including the following:

a. Other luminaires.
b. Air outlets and inlets.
c. Speakers.
d. Ceiling-mounted projectors.
e. Sprinklers.
f. Access panels.

7. Moldings.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Product Certificates: For each type of luminaire.

D. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Product Test Reports: For each luminaire for tests performed by **manufacturer and witnessed by a qualified testing agency**.

F. Sample Warranty: For manufacturer's **special** warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.9 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: **Two** year(s) from date of Substantial Completion.

B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for **Self-Powered Exit Sign** Batteries: **Seven** years from date of Substantial Completion. Full warranty shall apply for **the entire warranty period**.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.

1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified."

2.2 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.

C. Comply with NFPA 70 and NFPA 101.

D. Comply with NEMA LE 4 for recessed luminaires.

E. Comply with UL 1598 for fluorescent luminaires.

F. Lamp Base: Comply with **ANSI C81.61 or IEC 60061-1**.

G. Bulb Shape: Complying with ANSI C79.1.

H. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body **and compatible with ballast**.

1. Emergency Connection: Operate **one** lamp(s) continuously at an output of **1100** lumens each upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.
2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Less than 0 deg F (minus 18 deg C) or exceeding 104 deg F (40 deg C), with an average value exceeding 95 deg F (35 deg C) over a 24-hour period.
b. Ambient Storage Temperature: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C).
c. Humidity: More than 95 percent (condensing).
d. Altitude: Exceeding 3300 feet (1000 m).

4. Nightlight Connection: Operate lamp continuously at **40** percent of rated light output.
5. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.

    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

6. Battery: Sealed, maintenance-free, **nickel-cadmium** type.
7. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
8. Remote Test: Switch in handheld remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

I. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more lamps, remote mounted from luminaire.

1. Emergency Connection: Operate **one LED** lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire **ballast**.
2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
3. Nightlight Connection: Operate lamp in a remote luminaire continuously.
4. Battery: Sealed, maintenance-free, **nickel-cadmium** type.
5. Charger: Fully automatic, solid-state, constant-current type.
6. Housing: NEMA 250, Type 1 enclosure listed for installation inside, on top of, or remote from luminaire. Remote assembly shall be located no less than half the distance recommended by the **ballast** manufacturer, whichever is less.
7. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
8. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
9. Remote Test: Switch in handheld remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit

triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

10. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.3 EMERGENCY LIGHTING

A. General Requirements for Emergency Lighting Units: Self-contained units.

B. Emergency Luminaires:

1. As scheduled on Plans.

2. Emergency Luminaires: as indicated on **Drawings** with the following additional features:

   a. Operating at nominal voltage of **120 V ac 277 V ac**.
   b. **Internal** emergency power unit.
   c. Rated for installation in damp locations, and for sealed and gasketed luminaires in wet locations.

2.4 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. As scheduled on Plans.
2. Operating at nominal voltage of **120 V ac 277 V ac**.
3. Lamps for AC Operation: Fluorescent, two for each luminaire; 20,000 hours of rated lamp life.
4. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.
5. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.
6. Master/Remote Sign Configurations:

   a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in **LED power supply** for power connection to remote unit.
   b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery, and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

C. Self-Luminous Signs:

1. As scheduled on Plans.

2. Powered by tritium gas, with universal bracket for flush-ceiling, wall, or end mounting. Signs shall be guaranteed by manufacturer to maintain the minimum brightness requirements in UL 924 for **20** years.
3. Use strontium oxide aluminate compound to store ambient light and release the stored energy when the light is removed. Include universal bracket for flush-ceiling, wall, or end mounting.

2.5 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit relamping without use of tools.
3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:

1. **Clear, UV-stabilized acrylic**.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Acrylic: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
4. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

D. Housings:

1. **Extruded aluminum** housing **and heat sink**.

E. Conduit: **Electrical metallic tubing** minimum 3/4 inch (21 mm) in diameter.

2.6 METAL FINISHES

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Support Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, **12 gage (2.68 mm)**.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire **and emergency power unit** weight.
2. Able to maintain luminaire position when testing emergency power unit.
3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.

E. Wall-Mounted Luminaire Support:

1. **Attached to structural members in walls**.
2. Do not attach luminaires directly to gypsum board.

F. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and **tubing or rod** for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Ceiling Grid Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjustments: Within **12** months of date of Substantial Completion, provide on-site visit to do the following:

1. Inspect all luminaires. Replace lamps, **batteries, signs,** or luminaires that are defective.

   a. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

2. Conduct short-duration tests on all emergency lighting.

END OF SECTION 265219

This page left intentionally blank

SECTION 265613 - LIGHTING POLES AND STANDARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Poles and accessories for support of luminaires.

1.3 DEFINITIONS

A. EPA: Equivalent projected area.

B. Luminaire: Complete lighting fixture.

C. Pole: Luminaire-supporting structure, including tower used for large-area illumination.

D. Standard: See "Pole."

1.4 ACTION SUBMITTALS

A. Product Data: For each pole, accessory, and luminaire-supporting and -lowering device, arranged as indicated.

1. Include data on construction details, profiles, EPA, cable entrances, materials, dimensions, weight, rated design load, and ultimate strength of individual components.
2. Include finishes for lighting poles and luminaire-supporting devices.
3. Anchor bolts.
4. Manufactured pole foundations.

B. Shop Drawings:

1. Include plans, elevations, sections, and **mounting and attachment** details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of **poles and pole accessories**.

4. Foundation construction details, including material descriptions, dimensions, anchor bolts, support devices, and calculations, signed and sealed by a professional engineer licensed in the state of installation.
5. Anchor bolt templates keyed to specific poles and certified by manufacturer.
6. Method and procedure of pole installation. Include manufacturer's written installations.

1.5 INFORMATIONAL SUBMITTALS

A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements according to AASHTO LTS-6-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations signed and sealed by a professional engineer.

B. Qualification Data: For **Installer and testing agency**.

C. Material Test Reports:

1. For each foundation component, by a qualified testing agency.
2. For each pole, by a qualified testing agency.

D. Source quality-control reports.

E. Field quality-control reports.

F. Sample Warranty: Manufacturer's standard warranty.

G. Soil test reports

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For **poles** to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include pole inspection and repair procedures.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Pole repair materials.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for foundation testing.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store poles on decay-resistant skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

B. Retain factory-applied pole wrappings on metal poles until right before pole installation. Handle poles with web fabric straps.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of **pole(s)** that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within a specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs from special warranty period.

1. Warranty Period: **Five** years from date of Substantial Completion.
2. Warranty Period for Corrosion Resistance: **Five** years from date of Substantial Completion.
3. Warranty Period for Color Retention: **Five** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Foundation and pole shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.

1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
2. Component Importance Factor: **1.5**.

B. Structural Characteristics: Comply with AASHTO LTS-6-M.

C. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied according to AASHTO LTS-6-M.

D. Live Load: Single load of 500 lbf (2200 N) distributed according to AASHTO LTS-6-M.

E. Ice Load: Load of 3 lbf/sq. ft. (145 Pa), applied according to AASHTO LTS-6-M for applicable areas on the Ice Load Map.

F. Wind Load: Pressure of wind on pole and luminaire, calculated and applied according to AASHTO LTS-6-M.

1. Basic wind speed for calculating wind load for poles exceeding 50 feet (15 m) in height is **100 mph (45 m/s)**.

a. Wind Importance Factor: **1.0**.
b. Minimum Design Life: **50 years**.
c. Velocity Conversion Factor: **1.0**.

2. Basic wind speed for calculating wind load for poles 50 feet (15 m) high or less is **100 mph (45 m/s)**.

a. Wind Importance Factor: **1.0**.
b. Minimum Design Life: **25 years**.
c. Velocity Conversion Factor: **1.0**.

G. Strength Analysis: For each pole, multiply the actual EPA of luminaires and brackets by a factor of **1.1** to obtain the EPA to be used in pole selection strength analysis.

H. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

2.2 STEEL POLES

A. As indicated on Plans

B. Source Limitations: Obtain poles from single manufacturer or producer.

C. Source Limitations: For poles, obtain each color, grade, finish, type, and variety of pole from single source with resources to provide products of consistent quality in appearance and physical properties.

D. Poles: Comply with ASTM A 500/A 500M, Grade B carbon steel with a minimum yield of 46,000 psig (317 MPa); one-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.

1. Shape: **Square, straight**.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

E. Steel Mast Arms: **Single-arm** type, continuously welded to pole attachment plate. Material and finish same as plate.

F. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adaptor fitting welded to pole, allowing the bracket to be bolted to the pole-mounted adapter, then bolted together with **stainless** steel bolts.
2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire. Match pole material and finish.

G. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

H. Fasteners: **Stainless steel**, size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.

1. Materials: Compatible with poles and standards as well as the substrates to which poles and standards are fastened and shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.

I. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size indicated, and accessible through handhole.

J. Handhole: Oval shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws.

K. Galvanized Finish: After fabrication, hot-dip galvanize according to ASTM A 123/A 123M.

2.3 POLE ACCESSORIES

A. Base Covers: Manufacturers' standard metal units, finished same as pole, and arranged to cover pole's mounting bolts and nuts.

B. Transformer-Type Base: Same material and color as pole. Coordinate dimensions to suit pole's base flange and to accept **indicated accessories**. Include removable flanged access cover secured with bolts or screws.

2.4 MOUNTING HARDWARE

A. Anchor Bolts: Manufactured to **ASTM F 1554, Grade 55,** with a minimum yield strength of 55,000 psi (380,000 kPa).

1. Galvanizing: **Hot dip galvanized according to ASTM A 153, Class C**.
2. Threading: **Uniform National Coarse**. Class 2A.

B. Nuts: ASTM A 563, Grade A, Heavy-Hex

1. Galvanizing: **Hot dip galvanized according to ASTM A 153, Class C**.
2. **Four** nuts provided per anchor bolt **, shipped with nuts pre-assembled to the anchor bolts**.

C. Washers: ASTM F 436, Type 1.

1. Galvanizing: **Hot dip galvanized according to ASTM A 153, Class C**.
2. **Two** washers provided per anchor bolt.

2.5 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine poles, luminaire-mounting devices, lowering devices, and pole accessories before installation. Components that are scratched, dented, marred, wet, moisture damaged, or visibly damaged are considered defective.

C. Examine roughing-in for foundation and conduit to verify actual locations of installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 POLE FOUNDATION

A. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123 M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

B. Pre-Cast Foundations: Factory fabricated, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

3.3 POLE INSTALLATION

A. Alignment: **Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on pole**.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on drawing.

1. Fire Hydrants and Water Piping: **60 inches (1520 mm).**
2. Water, Gas, Electric, Communications, and Sewer Lines: **10 feet (3 m)**.
3. Trees: 15 feet (5 m) from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."

D. Poles and Pole Foundations Set in Concrete-Paved Areas: Install poles with a minimum 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of the adjacent concrete slab. Fill unpaved ring with pea gravel. Insert material to a level 1 inch (25 mm) below top of concrete slab.

3.4 CORROSION PREVENTION

A. Steel Conduits: Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50-percent overlap.

3.5 GROUNDING

A. Ground Metal Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.6 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Special Inspections: **Engage** a qualified special inspector to perform the following special inspections:

1. Inspect poles for nicks, mars, dents, scratches, and other damage.
2. System function tests.

END OF SECTION 265613

This page left intentionally blank

SECTION 265619 - LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
2. Luminaire supports.
3. Luminaire-mounted photoelectric relays.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaire.
4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
5. Photometric data and adjustment factors based on laboratory tests, complying with **IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project**.

a. Manufacturer's Certified Data: Photometric data certified by manufacturer?s laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

6. Wiring diagrams for power, control, and signal wiring.
7. Photoelectric relays.
8. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule: For luminaires and lamps.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Luminaires.
2. Structural members to which luminaires will be attached.
3. Underground utilities and structures.
4. Existing underground utilities and structures.
5. Above-grade utilities and structures.
6. Existing above-grade utilities and structures.
7. Building features.
8. Vertical and horizontal information.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Product Certificates: For each type of the following:

1. Luminaire.
2. Photoelectric relay.

E. Product Test Reports: For each luminaire, for tests performed by **manufacturer and witnessed by a qualified testing agency**.

F. Source quality-control reports.

G. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires **and photoelectric relays** to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.

C. Provide luminaires from a single manufacturer for each luminaire type.

D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

E. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.9 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including luminaire support components.
b. Faulty operation of luminaires and accessories.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: **2** year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.

B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.

1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified.

2.2 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. UL Compliance: Comply with UL 1598 **and listed for wet location**.

E. Lamp base complying with **ANSI C81.61 or IEC 60061-1**.

F. Bulb shape complying with ANSI C79.1.

G. CRI of **minimum 80**. CCT of **4100 K**.

H. L70 lamp life of **50,000** hours.

I. Lamps dimmable from 100 percent to 0 percent of maximum light output.

J. Internal driver.

K. Nominal Operating Voltage: **120 V ac**, **277 V ac**.

L. Lamp Rating: Lamp marked for **outdoor use and in enclosed locations**.

M. Source Limitations: Obtain luminaires from single source from a single manufacturer.

N. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.3 LUMINAIRE TYPES

A. Area and Site:

1. As indicated on Plans

2.4 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: **Stainless steel**. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:

1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch ((3.175 mm)) minimum unless otherwise indicated.

E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

G. Housings:

1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

    a. "USE ONLY" and include specific lamp type.
    b. Lamp diameter, shape, size, wattage and coating.
    c. CCT and CRI for all luminaires.

2.5 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.

D. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

    a. Color: As selected from manufacturer's standard catalog of colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Examine walls, roofs, for suitable conditions where luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Install lamps in each luminaire.

D. Fasten luminaire to structural support.

E. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Support luminaires without causing deflection of finished surface.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

F. Wall-Mounted Luminaire Support:

1. **Attached to structural members in walls**.

G. Wiring Method: Install cables in raceways. Conceal raceways and cables.

H. **Install luminaires level, plumb, and square with finished grade unless otherwise indicated.**

I. Coordinate layout and installation of luminaires with other construction.

J. Adjust luminaires that require field adjustment or aiming. **Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.**

K. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.3 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections **with the assistance of a factory-authorized service representative**:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Verify operation of photoelectric controls.

C. Illumination Tests:

1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):

    a. IES LM-5.
    b. IES LM-50.
    c. IES LM-52.
    d. IES LM-64.
    e. IES LM-72.

2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

D. Luminaire will be considered defective if it does not pass tests and inspections.

E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.6 DEMONSTRATION

A. **Engage a factory-authorized service representative to train** Owner's maintenance personnel to adjust, operate, and maintain luminaires **and photocell relays**.

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within **12** months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to **two** visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 265619

This page left intentionally blank

SECTION 321216

ASPHALT PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Inspection and fine grading of subgrade.
2. Material analysis and tests by testing laboratory.
3. Aggregate base.
4. Bituminous pavement.
5. Quality Control/Quality Assurance.

B. Related Sections:

1. Section 310000 – Earthwork
2. Section 321313 –Sitework Concrete

1.2 QUALITY CONTROL

A. Testing as defined in these specifications shall be performed with the results submitted to the A/E office prior to the pay request for the work performed. Payment for the testing is identified in Division 1 of these specifications.

B. Utilize equipment of proper size and in good working condition to prosecute the work to full completion in a satisfactory manner. Perform work during suitable weather conditions.

C. Utilize experienced personnel familiar with the equipment, methods and procedures for the job.

1.3 SUBMITTALS

A. Submittals must be made in accordance with the requirements of Division 1 and this Section.

B. Report(s) that summarize all pertinent field observations and determinations of material suitability, construction methods and operations, and detailed test reports for testing as required herein, and other applicable testing as determined during the course of construction and approved by the A/E.

C. Greenbook Standards as specified herein.

D. Other, as specified herein.

1.4 REFERENCE STANDARDS AND ABBREVIATIONS

A. ”Greenbook” Standard Specifications for Public Works Construction 2015 Edition by the American Public Works Association.

B. “ASTM”: American Society for Testing and Materials.

C. “AASHTO”: American Association of State Highway and Transportation Officials.

D. “JMF”: Job mix formula

E. “A/E”: Architect/Engineer is equivalent to “Engineer”

PART 2 MATERIALS

2.1 AGGREGATE BASE MATERIAL

A. Aggregate base shall be Crushed Aggregate Base that conforms to Greenbook Section 200-2.2 or Class 2 Aggregate Base that conforms to the gradation and quality requirements of Section 26-1.02A of the Caltrans Standard Specifications.

2.2 ASPHALT CONCRETE

A. Asphalt concrete for private streets, driveways and parking lots shall conform to Greenbook Section 203-6 and the following:

1. Asphalt concrete for base course paving shall conform to B-PG 64-10.
2. Asphalt concrete for finish course paving shall conform to C2-PG 64-10.

2.3 THICKNESS OF MATERIALS

A. Required thickness of pavement sections is designated on the surfacing plans.

PART 3 EXECUTION

3.1 EXAMINATION OF CONDITIONS

A. Review all slopes, elevations, subgrade, and drainage conditions. Notify A/E of significant discrepancies with the plans and specifications before starting work. The start of work constitutes that the Contractor accepts the existing conditions.

B. If subgrade conditions are unsatisfactory, do not proceed with paving until corrections are made.

3.2 CONSTRUCTION OF BASE AND PAVEMENT

A. Sub-grade

1. Verify sub-grade is in accordance with drawings and specifications and provides positive drainage. Sub-grade preparation is specified in Specification Section 312000.
2. Remove minor grade irregularities by fine grading before placing base aggregate.

B. Aggregate Base

1. Provide specified material specified to the minimum thickness noted on the surfacing plans.
2. Provide one sample of aggregate base material to Testing Agency for mechanical analysis AASHTO T27. Submit report to A/E.
3. Place the aggregate base in maximum 4-inch lifts, and compact to 95% standard proctor density, ASTM D1557.
4. Shape base course to provide positive drainage. The minimum specified thickness apply after proper the sub-grade has been obtained.

C. Bituminous Paving

1. Per Greenbook. Compact to a minimum of 95 percent relative compaction per ASTM D2041.

3.3 PARKING STALL AND TRAFFIC LANE PAINTING

A. See Specification Section 321723.

3.4 PAYMENT ADJUSTMENTS

A. Low Density.

1. In the event that the field density for the pavement represented by the test is less than the specified minimum, the area representing the substandard pavement must be designated as the median distance between test locations or outside edges of paving. The substandard area must be delineated on a plan sheet by the Contractor and submitted to the A/E for review.
2. For field densities up to four percent less than the specified minimum, the substandard pavement area will be accepted, but at a reduced price as follows: Field Density as % of maximum theoretical densities (Rice test) //// Pay Percentage.

    a. 90.0 or greater //// 100%.
    b. 89.0 to 89.9 //// 98%
    c. 88.0 to 88.9 //// 95%.
    d. 87.0 to 87.9 //// 90%.
    e. 86.0 to 86.9 //// 85%.
    f. The pay factor will be applied to the substandard pavement area based on the pavement bid price, as determined from the Contract breakdown. The Contractor must supply the Contract breakdown to the A/E for review.

3. For field densities more than four percent below the specified minimum, the A/E will determine what portion of the pavement, if any, may remain in place. The pay percentage for material remaining in place will be 75%. Costs of the re-paving will be borne entirely by the Contractor.
4. If the Contractor believes that the core density results are not representative of the area for which the substandard tests represent, the Contractor may obtain at least two additional cores in the area being question. The cores must be located such that the substandard core and new cores are distributed evenly over the area. The average density of all of the tests for the area in question must be used to determine the penalty as specified above, if still applicable. Costs of re-testing will be borne entirely by the Contractor.
5. If the Contractor believes that the nuclear density results are not representative of the area for which the substandard tests represent, the Contractor may obtain at least two cores per area in question and base density compliance for the area in question on the core results. If this option is used, the cores must be obtained within 24 hours after placement of the bituminous mixture. Costs of re-testing will be borne entirely by the Contractor.

B. Thin Thickness

1. Where the average thickness of all the bituminous cores (base and/or wear course) is ¼-inch less than the minimum design thickness, the owner may elect not accept the bituminous sections. If accepted, payment will be at a reduced price that is

directly proportional to the core thickness as compared to the design thickness. The design thickness given on the surfacing plans are minimum values. No additional payment will be made for pavement that exceeds the design thickness. If the bituminous thickness is more than ½-inch less than the design thickness, the bituminous section will be rejected. Rejection requires that the bituminous pavement be removed and replaced to minimum design thickness.

3.5 MODIFICATIONS

A. “Engineer” is equivalent to the A/E.
B. Acceptance testing must be as specified herein. Acceptance schedules are not part of this specification.
C. Sampling locations and density determinations will be made by the Testing Agency.
D. Core sampling and density requirements are as specified herein. The Owner reserves the right to take companion cores to verify the reliability of the Contractor’s test results and to serve as acceptance tests.
E. Core sampling and testing may be performed without the A/E present.
F. The calibration factor for nuclear gauge testing of bituminous pavement will be made by comparing the mean of 3 cores with the mean of 6 nuclear gauge readings.
G. Density penalties will be as specified herein.
H. Thickness requirements and penalties will be as specified herein.
I. Payment on the basis of unit prices is not part of this specification.

END OF SECTION 321216

SECTION 32 12 43

POUROUS FLEXIBLE PAVEMENT

PART 1 – GENERAL

1.1 DESCRIPTION

A. Section includes porous pavement systems for vehicular and pedestrian load support in grass areas while protecting grass roots from harmful effects of traffic.

B. System shall be complete with polyethylene units for soil confinement, sand fill, bedding sand, gravel or aggregate base course, soil amendments, and grass seed.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 – Record Drawings and Submittals

B. Section 02200 – Earthwork

C. Section 02223 – Trenching, Backfilling and Compacting

D. Section 03000 – General Concrete Construction

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. ASTM C33, Standard Specification for Concrete Aggregates

B. ASTM D638-10, Standard Test Method for Tensile Properties of Plastics

C. ASTM F1951-08, Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment

1.4 CONTRACTOR SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Manufacturer's sample of polyethylene confinement units.

2. Manufacturer’s printed installation instructions. Include methods for maintaining installed products.

3. Material certificates and gradations for base course and sand fill materials.

4. Product certificates signed by the manufacturer certifying material compliance of polyethylene used to make the flexible pavement units.

5. ISO Certificate certifying manufacturer's quality management system is currently registered to ISO 9001:2008 quality standards.

6. Provide documentation of how the requirements of LEED Credit will be met:

   a. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.

   b. Description of function in stormwater design to limit the disruption of natural hydrology by reducing impervious cover, increasing on-site infiltration, reducing or eliminating pollution from stormwater runoff and eliminating contaminants.

   c. Designing elements to limit the disruption and pollution of natural water flows by managing stormwater runoff.

   d. Use of product to reduce heat islands to minimize the impact on microclimates and human and wildlife habitats.

7. Product manufacturer shall have a minimum of 10 years of experience producing products for porous pavement systems for vehicular support.

8. Product manufacturer shall provide certification of compliance with all applicable testing procedures and related specifications upon written request.

9. Substitutions shall meet all areas of this specification without exception including records, data, independent test results, samples, certifications, and documentation deemed necessary by the Owner to prove equivalency.

1.5 WARRANTY

A. Manufacturer shall warrant that all products furnished will be free from defects in material and/or workmanship for a period of five (5) years following the date of shipment.

B. All defective materials shall be refurnished under this warranty, at no charge, excluding re-installation costs providing that a written claim is presented to the manufacturer within the warranty period and after inspection by the manufacturer showing the materials have failed under this warranty.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Invisible Structures, Inc., 1600 Jackson St. Suite 310, Golden, CO 80401. Toll free telephone: 800-233-1510; telephone: 303-233-8383. Product: GrassPave2.

B. Approved equal.

2.2 POROUS FLEXIBLE PAVEMENT UNITS

A. Manufactured in the USA

B. High density polyethylene (HDPE): 100 percent recycled materials.

C. Color: black

D. Carbon Black for ultraviolet light stabilization.

E. Soil amendment and fertilizer, provided by manufacturer.

F. Performance Properties:

1. Maximum Loading Capability: 5,720 psi (39,273 kPA) when filled with sand conforming to this specification section.

2. Wheelchair Access testing for ADA Compliance: Passing ASTM F 1951-08.

3. Wheelchair Access testing for ADA Compliance: Passing Rotational Penetrometer testing.

4. Tensile strength, pull-apart testing: 458 lbf/in from ASTM D638 Modified.

5. System Permeability (paving unit, sand, base course): 10 inches of water per hour.

6. Effective Imperviousness (E.I.): 10%.

G. Dimensions (individual units are assembled and distributed into rolls):

1. Roll Widths: From 3.3 feet (1 m) to 8.2 feet (2.5 m) in 1.6-foot (0.5 m) increments.

2. Roll Lengths: From 32.8 feet (10m) to 65.6 feet (20 m), in 3.3-foot (1 m) increments.

3. Unit Nominal Dimensions: 20 inches by 20 inches (0.5 m by 0.5 m) or 40 inches by 40 inches (1 m by 1 m).

a. Unit Weight: 18 oz. (510 g) or 5 lbs. (2.27 kg).

4. Nominal Depth: 1 inch (2.5 cm).

5. Volume Solid: 8 percent.

2.3 SYSTEM MATERIALS

A. Base Course

1. Class 2 aggregate base conforming to Section 26-1.02B of the Caltrans standard specifications. Recycled materials such as crushed concrete or crushed asphalt are not acceptable.

2. Provide aggregate base material nearly neutral in pH (range from 6.5 to 7.2) to provide adequate root zone development for turf.

3. Alternative size and/or composition of base course materials should be submitted to the pavement system manufacturer for approval.

B. Sand Fill for Polyethylene Confinement Grid

1. Coarse, well-draining sand (concrete sand) conforming to ASTM C33.

C. Turf Conditioner

1. Hydrogrow, soil amendment manufactured by Invisible Structures, Inc., or approved equal.

D. Grass

1. Refer to landscape architect requirements.

2. Sod

a. Use 0.5" thick (soil thickness) rolled sod from a reputable local grower. Species should be wear resistant, free from disease, and in excellent condition. Sod shall be grown in sand or sandy loam soils only. Sod grown in soils of clay, silt, or high organic materials such as peat, will not be accepted.

3. Seed

a. Use seed materials, of the preferred species for local environmental and projected traffic conditions, from certified sources. Seed shall be provided in containers clearly labeled to show seed name, lot number, net weight, % weed seed content, and guaranteed % of purity and germination. Pure Live Seed types and amount shall be as shown on plans.

4. Mulch

a. Mulch is needed only for hydroseeding and shall consist of wood or paper cellulose commercial mulch materials compatible with hydroseeding operations. Mulch depth shall be according to mulch manufacturers' recommendation.

b. Do not use mulch of straw, pine needles or other mulches with low moisture holding capacity.

5. Topsoil

a. Topsoil is needed only for seeding and is recommended for hydroseeding.

b. Obtain specified topsoil for a light “dusting” (no more than 1/2-inch) above rings filled with sand for seeding germination.

PART 3 – EXECUTION

3.1 GENERAL

A. Maintain environmental conditions within limits recommended by the manufacturer for optimum results.

B. Do not begin installation of porous pavements until all hard surface paving adjacent to porous pavement areas is completed.

C. Install turf when an ambient air temperature is at least 55 degrees F (13 degrees C).

D. Do not use frozen materials or materials mixed or coated with ice or frost, and do not build on frozen base or wet, saturated or yielding subgrade.

E. Protect partially completed paving against damage from other construction traffic when work is in progress.

F. Adequately water sod or grass seed to assure germination of seed and growth of root system.

G. Grass coverage on the sand-filled units must be completed within one week.

H. Do not drive equipment or vehicles on the pavement system for the time period specified hereinafter. Pavement system must be accessible by emergency vehicles during and after installation.

3.2 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer’s unopened packaging until ready for installation.

B. Protect units/rolls from damage during delivery and store rolls upright, under tarp, to protect from sunlight when time for delivery to installation exceeds one week.

C. Store soil amendments in a dark and dry location.

D. Protect materials during handling and installation to prevent damage of any kind.

3.3 MAINTENANCE SERVICE

A. Installer is responsible for maintenance of grass including irrigation, fertilizing and mowing for the period specified in the landscape provisions of the Contract Documents.

3.4 INSPECTION

A. Examine the subgrade and base course installed conditions. Do not start porous paving installation until unsatisfactory conditions are corrected. Check for improperly compacted trenches, debris, and improper gradients.

B. Start of installation constitutes acceptance of existing conditions and responsibility for satisfactory performance. If existing conditions are found unsatisfactory, notify the Owner's representative immediately.

3.5 PREPARATION

A. Subgrade Preparation

1. Prepare subgrade as specified in Section 02200. Verify subgrade in accordance with porous paving system manufacturer's instructions.

2. Excavate area allowing for unit thickness, the engineered base depth, and 0.5 inch for depth of sod root zone or topsoil germination area (when applicable).

3. Provide adequate drainage from excavated area. Subgrade soil shall be drained and free from standing water.

4. Uniformly grade the subgrade, clearing the exposed surface of obstructions. Compact subgrade to 90 percent relative compaction.

B. Base Preparation

1. Coordinate subgrade preparation and aggregate base installation with the installation of subdrains shown or specified on the Drawings.

2. If shown on the Drawings, place a geotextile separation layer between the compacted subgrade and the engineered base.

3. Install the specified subdrain and outlet according to construction drawings.

4. Install aggregate base as specified in Section 02200. Verify engineered base is installed in accordance with porous paving system manufacturer's instructions.

5. Coordinate base installation and preparation with irrigation and drip irrigation lines per landscape architect requirements.

6. Place aggregate base in lifts not to exceed 6 inches, compacting each lift separately to 95 percent relative compaction.

7. Place a layer of concrete sand beneath porous paver unit as shown on the construction drawings or 2 inches minimum thickness.

8. Leave 1 inch of depth below final grade for porous paver unit and sand fill and 1/2-inch for depth of sod root zone or topsoil germination area (when applicable).

C. ON-SITE MANUFACTURER'S FIELD REPRESENTATIVE

1. A qualified Manufacturer's field representative shall be available for a pre-construction meeting via phone or in person and will provide installation videos, design details, installation instructions, and the technical specifications.

2. A period of two days shall be allocated for manufacturers' on-site observation and shall be included in the base bid price.

D. SOIL AMENDMENT INSTALLATION

1. Place soil amendment immediately before installing the polyethylene confinement grid at a spreader rate of 10 lbs. per 1,000 sq. ft., evenly over the surface of the base course with a hand-held or wheeled, rotary spreader.

E. POLYETHYLENE CONFINEMENT GRID INSTALLATION

1. Install the units by placing with rings facing up, and using snap-fit connectors, pegs and holes provided to maintain proper spacing and interlock the units. Units can be easily shaped with pruning shears or knife. Units placed on curves, slopes, and high traffic areas shall be anchored to the base course, using 40d common nails with fender washer. Tops of rings shall be between 1/4-inch to 1/2-inch below the surface of adjacent hard-surface pavements or curbs.

2. Install sand in rings as they are laid in sections. Do not drive equipment or vehicles over units that have not been filled and compacted with sand.

3. Spread the sand laterally from the pile using flat bottomed shovels and/or wide "asphalt rakes" to fill the rings. A stiff bristled broom should be used for final "finishing" of the sand. The sand must be "compacted" by using water from hose, irrigation heads, or rainfall, with the finish grade no less than the top of rings and no more than 1/4-inch above top of rings.

F. INSTALLATION OF GRASS

1. Grass coverage on the sand-filled rings must be completed within one week. Sand must be re-installed and leveled and polyethylene paving

units checked for integrity if rings become exposed due to wind, rain, traffic, or other factors.

2. Install thin sod directly over sand filled rings, filled no higher than the top of the rings. Sod strips should be placed with very tight joints. Sodded areas must be fertilized and kept moist during root establishment (minimum of 3 weeks). Do not drive on the system. Sodded areas must be protected from any traffic for a period of 4 weeks or until the root system has penetrated and established well below the paving units.

3. Install grass seed at rates per grass type. A light "dusting" of commercial topsoil mix, not to exceed 1/2-inch will be placed above the rings and seed mix to aid germination rates. Seeded areas must be fertilized and kept moist during development of the turf plants. Do not drive on the system. Seeded areas must be protected from any traffic for a period of 8 weeks, or until the root system has penetrated and established well below the paving units.

4. Adequately water sod or grass seed to assure germination of seed and growth of root system.

G. FIELD QUALITY CONTROL

1. Remove and replace paving units where two or more adjacent rings are broken or damaged, reinstalling as specified, so no evidence of replacement is apparent.

2. Perform cleaning during the installation of work and upon completion of the work. Remove all excess materials, debris, and equipment from the site. Repair any damage to adjacent materials and surfaces resulting from installation of this work.

H. MAINTENANCE

1. Maintain grass in accordance with manufacturer’s instructions and per landscape technical provisions.

2. Normal turf care procedures should be followed, including de-thatching.

3. Do not aerate. Aerator will damage the paving units and is not necessary in a sandy root zone.

END OF SECTION

SECTION 321313
SITEWORK CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cast-in-place concrete, cement, aggregates and admixtures.
   2. Curb and combination curb and gutter.
   3. Concrete sidewalks.
   4. Concrete drives and aprons.
   5. Equipment pads.
   6. Truncated dome detectable warnings for pedestrian curb ramps.
   7. Crushed aggregate base (under concrete drives and aprons).

B. Related Sections:
   1. Section 310000 – Earthwork
   2. Section 032000 - Concrete Reinforcing
   3. Section 031500 - Concrete Accessories.
   4. Section 033000 - Cast-in-Place Concrete (for building construction).
   5. Section 079000 – Joint Protection

1.2 REFERENCES

A. ACI 214 - Recommended Practice for Evaluation of Compression Test Results of Field Concrete.

B. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

C. ACI 305 - Hot Weather Concreting.

D. ACI 306 - Cold Weather Concreting.

E. ACI 309 - Standard Practice for Consolidation of Concrete.

F. ACI 318 – Building Code Requirements for structural concrete

1.3 SAMPLE PANELS OF ABRASIVE BLASTED FINISH

A. Construct 3 sample panels with varying depths of abrasive blasted finish for comparisons and selection of final sample by A/E. Finishes provided must vary from light to medium.

B. Sample panels must be minimum size of 3-feet square and 4-inches thick and must be cast from same concrete mixture as will be used for final construction.

C. Sample panels must be given troweled finish and must be cured minimum of 7-days before commencing abrasive blasting operations.

D. It is the intent that light finish will remove mortar skin and leave considerable exposure of fine aggregate with occasional exposure of coarse aggregate. Reveal of coarse aggregate must be approximately 1/16-inch. Medium finish must expose considerable amount of coarse aggregate with reveal up to ¼-inch.

E. Sample panel selected for final finish must be kept exposed for review as basis for quality of final construction.

F. Sample panels not chosen for final finish must be removed from site.

G. After abrasive blasting work has been completed and accepted by the A/E, selected panel must be removed from site.

1.4 SAMPLE PANELS OF EXPOSED AGGREGATE FINISH

A. Construct three (3) sample panels with varying amounts of exposed aggregate finish for comparison; choice of sample panel applicable to project must be made by A/E.

B. Sample panels must be minimum size of 3-feet square and 4-inches thick, and must be cast from same concrete mixture that will be used for final construction.

C. Aggregate to be exposed must be colorful uniform sized gravel, 1/4-inches to 1/2-inch in size. There must not be any flat or sliver-shaped particles; aggregate must not be reactive with cement when tested in accordance with ASTM C227 standard test methods. Aggregate must be reviewed and accepted by A/E prior to construction of sample panels.

D. Immediately after slab has been screeded and darby or bull floated, selected aggregate must be scattered by hand and evenly distributed so that entire surface is completely covered.

E. Initially embed aggregate by patting with darby or 2x4 lumber until aggregate is thoroughly embedded.

F. As soon as concrete will support weight of workmen on kneeboards, surface must be hand floated using magnesium float or darby until aggregate is entirely embedded and mortar completely surrounds and slightly covers it, leaving no holes in surface.

G. Shortly following floating, surface set retarder may be sprayed or brushed over surface, following manufacturer's recommendations.

H. Aggregate must be exposed by using stiff vegetable fiber brush and hosing of surface with water; this process must commence as soon as work can be done without dislodging aggregate.

I. Kneeboards must be used to move about on surface, exercising care not slid or twist on the surface.

J. Sample panels must be finished in light, medium and heavy degrees of aggregate exposure for selection of desired final finish by A/E. Selected panel must be kept exposed for reference throughout duration of work as basis of quality of final construction.

K. Sample panels not selected for final finish must be removed from site. After exposed aggregate work has been completed and accepted by A/E, selected panel must also be removed from site.

1.5 QUALITY ASSURANCE

A. Use plant mixed concrete mixed in stationary mixers.
   1. Truck mixed concrete is allowed provided procedures in ASTM C94 are followed and documented.

B. Mix and deliver concrete in accordance with ASTM C94.

C. Perform concrete work in accordance with ACI 318, unless specified otherwise.

D. Obtain materials from same source throughout work.

E. Allowable tolerances must be in accordance with Section 031100 - Concrete Forming.

1.6 CONCRETE TESTING SERVICE

A. Reference Division 1 for payment of the Testing Agency (TA). The TA must be experienced in testing, evaluation and design of concrete materials, mixtures, aggregates, curing, additives, ingredients and perform tests on field specimens of concrete.

B. The TA must meet applicable requirements of ASTM E329. The selection of TA is subject to A/E's recommendation.

C. Test normal weight concrete aggregates for compliance with ASTM C33.

D. Submit mix design for each type and strength of concrete. Proportion designs in accordance with ACI 318, Section 5.3, Proportioning on the Basis of Field Experience, Trial Mixtures, or both.

1.7 SUBMITTALS

A. Submit mix design for each type and strength of concrete. Proportion designs in accordance with Proportioning on the Basis of Field Experience and/or Trial Mixtures-inch of ACI 318. Each mix design must contain the following information:
   1. Mix number (which will correspond to mix ticket on trucks delivered to site) and location of concrete on project.
   2. Applicable mix specifications including:
      a. Design strength.
      b. Slump.
      c. Air content.
      d. Unit weight.
   3. Mix ingredients including quantities, ASTM designations, and sources for:
      a. Cementitious materials including fly ash.
      b. Aggregates.
      c. Water.
      d. Admixtures (including manufacturer).
   4. Test results:
      a. Compressive strength results of trail batches or historical test data.
      b. Statistical computations showing required average strength of mix.
      c. Unit weight.
      d. Slump.
      e. Water/cementitious ratio of mix.

f. Air content.

B. TRUNCATED DOME-TACTILE SYSTEMS (for pedestrian curb ramps):
1. Submit manufacturer's literature describing products, installation procedures and routine maintenance.
2. Submit two (2) tile samples minimum 6-inchx8-inch of the kind proposed for use.
3. Submit shop drawings showing fabrication details; composite structural system; plans of tile placement including joints, and material to be used. Include outline of installation procedure.
4. Submit test reports from qualified independent testing laboratory indicating that materials proposed for use are in compliance with requirements and meet the properties indicated. All test reports shall be conducted on a cast-in-place tactile tile system as certified by a qualified independent testing laboratory.
5. Submit copies of manufacturer's specified maintenance practices for each type of tactile tile and accessory as required.
6. Submit written guarantee. Cast-in-place tactile tiles shall be guaranteed in writing for a period of five years from date of final completion. The guarantee must include defective work, breakage, deformation, and loosening of tiles.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cement: ASTM C150, Type I, corresponding to cement on which selection of concrete proportions was based. Use same brand for each required type of concrete.

B. Aggregates for Exterior Horizontal Concrete: Limits of deleterious substances and physical property requirements of fine and coarse aggregates must comply with ASTM C33, and the following additional requirements for exterior horizontal concrete:
1. Amount of deleterious substances in fine aggregate must not exceed following limits:

Item	Total Sample Maximum Weight Percent
Clay lumps and friable particles	0.5.
Material finer than No. 200 sieve	3.0.
Coal, lignite and shale	0.5

2. When fine aggregate is tested for potential reactivity by chemical method in accordance with ASTM C289, relationship between quantity Rc (reduction in alkalinity) and quantity Sc (dissolved silica) must indicate that material is innocuous.
3. Coarse aggregate for exterior concrete must be ASTM C33 size number 67 (3/4-inch to No. 4) and must be 100 percent crushed quarry rock composed of basalt, quartzite, granite, limestone or dolomite. For toppings less than 2 inches in thickness use ASTM C33 size number 8.
4. When subjected to 5 cycles of soundness test using magnesium sulfate in accordance with ASTM C88, coarse aggregate must have loss of not more than 18 percent.
5. Coarse aggregate must have maximum abrasion loss of 40 percent by weight when tested in accordance with ASTM C131, Grading B.
6. The requirements of ASTM C33, Table 3, must apply as to the amount of material in the coarse aggregate having specific gravity lighter than 2.4, including the iron oxide.

C. Aggregates for Exposed Aggregate Finish Concrete: Aggregates must be specially selected for color and size in accordance with sample panels. Unless noted otherwise provide a multi-colored ASTM C33 size number 8 natural river stone. Commonly referenced as “McDonald’s Mix”.

D. Water: Fresh, clean, potable, free from injurious amounts of oils, acids, alkalies, salts, organic materials, or other substances that may be deleterious to concrete or steel.

E. Fly Ash Admixture: ASTM C618, Class C. Addition of fly ash to regular weight and lightweight concrete mixes to reduce amount of cement is permissible as follows:
   1. When used in exposed concrete it must be used throughout for uniform color.
   2. Weight of fly ash added to designed mixes must be greater than reduction of weight of cement, with proportions of cement and fly ash selected for 28 day compressive strengths equal to those specified. Maximum reduction in weight of cement must not exceed 15 percent of specified amount.

F. Admixtures: Admixtures must conform to ASTM C494 or ASTM C260 and must not contain chlorides or thiocyanates.
   1. Water Reducing Admixtures: ASTM C494, Type A. Add to concrete in accordance with manufacturer's instructions. Eucon WR-75 by Euclid Chemical, Pozzolith 220N by Master Builders, Plastocrete 160 by Sika Chemical, Prokrete N by Protex Industries, or WRDA by Grace Construction Products.
   2. Water Reducing, Retarding Admixture: ASTM C494, Type D. Pozzolith 100XR by Master Builders, Plastiment by Sika Chemical, Eucon Retarder-75 by Euclid Chemical, Protard by Protex Industries or Duratard 17 by Grace Construction Products.
   3. High Range Water Reducing Admixture (Superplasticizer): ASTM C494, Type F or G. Sikament by Sika Chemical, Eucon 37 by Euclid Chemical, WRDA or Daracem 100 by Grace Construction Products.
   4. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E, Accelguard 80 by Euclid Chemical, or Daraset by Grace Construction Products.
   5. Air - Entraining Admixtures: ASTM C260. When required air contents are specified, add in accordance with manufacturer's instructions. Protex AES by Protex Industries, Air-Mix by Euclid Chemical, Daravair by Grace Construction Products or Micro-Air by Master Builders.
   6. Color Admixture: L.M. Scofield Chromix Admixtures; color as selected by A/E office from the manufacturer's standard range.
   7. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures effectively containing chloride ions (more than 0.05 percent) are not permitted.

G. Surface Retarder for Exposed Aggregate Concrete: Preco E.A.C.S. by Preco Corporation; Arcal by Areal; or Rugasol C.S. by Sika Chemical.

H. Bonding Compound: applied according to ASTM C1059; Everbond by L & M Construction Chemicals; Acrylset by Master Builders; or Acryl 60 by Thoro. Use to bond toppings to base slab.

I. Underlayment (non-self-leveling): Duratop by L & M; Thoro Underlayment by Thoro System Products; Set Latex Cement by Master Builders; or Sikatop 122 by Sika.

J. Precast Items: Provide 4000 psi concrete. Precast concrete may be job poured or plant produced at Contractor's option.

K. Curing and Sealing Compound: Clear styrene acrylate type, 30% solids content minimum, and have test data from a Testing Agency indicating a maximum moisture loss of 0.030 grams per sq.cm. when applied at a coverage rate of 300 sq.ft. per gallon. Acceptable products are Super-Diamond Clear by the Euclid Chemical Company, Master Kure by Master Builders, or Klear Seal by National Construction Products; Manufacturer's Certification Required.

L. Expansion Joint Fillers (backing for sealant): Flexible, compressible, closed cell polyethylene foam, not less than 10 psi compression deflection.

M. Expansion Joint Fillers (non-sealed): Resilient non-extruding pre-molded bituminous impregnated fiberboard complying with ASTM D1751

N. Expansion Joint Sealant:
   1. Silicone joint sealant, reference related section 07900
   2. Silicone joint sealant, Dow Corning #888. Product available from Construction Materials, Inc., Telephone number 612-929-0431. Polyurethane sealer as per ASTM C920, Type M or S, Class 25, Grade P, polyurethane based, two-part or one-part sealout, self-leveling. Unless specifically noted, either product may be used.

O. Expansion Joint Caps: Plastic joint cap to be utilized in expansion joints must be Contie Inc. plastic joint cap or approved equal.

P. Granular Fill: As specified under Section 312000, Earth Moving.

Q. Crushed Aggregate Base: When indicated, crushed aggregate base must be in accordance with ASTM C33, size number 67 gradation (3/4-inch to #4 materials), unless noted otherwise in the documents.

2.2 NORMAL WEIGHT CONCRETE MIXES

A. General: Manufacture and deliver concrete in accordance with ASTM C94, with exceptions as specified herein.

B. Minimum Compressive Strength: Concrete used for all sitework must have minimum compressive strength of 4000 pounds per square-inch at 28 days of age, unless indicated otherwise on drawings.

C. Air Entrainment: Exterior exposed concrete must contain 6 percent entrained air with maximum tolerance of plus or minus 1.5 percent.

D. Maximum Slump: 4-inches for all mixes, except those containing super plasticizer. Tolerance of up to 1-inch above indicated maximum will be allowed for individual batches, provided average for all batches or most recent 10 batches tested, whichever is fewer, does not exceed maximum limit. Slump must be determined by “Test for Slump of Portland Cement Concrete” (ASTM C143). Where field conditions or workability considerations dictate higher slump, this increased slump must be obtained only by use of super plasticizer. Concrete must arrive at job site with a slump of 2-inches to 3-inches, slump is verified, and super plasticizer then added to increase slump to level indicated on approved mix design.

E. Minimum Slump: 1-inch.

2.3 TRUNCATED DOME (DETECTABLE WARNING) TILES:

A. For use at pedestrian curb ramps and as designated on drawings.

B. Vitrified Polymer Composite (VPC) cast-in-place tiles. Epoxy polymer composition; ultra violet stabilized coating with aluminum oxide particles in the truncated domes.

C. Truncated domes 0.2-inches high, 0.9-inch diameter at base, and 0.4-inch diameter at top; spaced 2.35-inch nominal measured on diagonal and 1.70-inch nominal measured side by side.

D. Provide field area with non-slip surface.

E. "Armor-Tile" as manufactured by Engineered Plastics Inc., (800-682-2525), armor-tile.com or approved equal.

1. Dimensions: Tile Assemblies shall be held within the following dimensions and tolerances:

Length and Width:	24-inch by 48-inch nominal
Depth:	1.400-inch plus or minus 5 percent max.
Face Thickness:	0.1875-inch plus or minus 5 percent max.
Warpage of Edge:	Plus or minus 0.5 percent max.

2. Color: Federal Standard color 3066, brick red, unless designated otherwise by A/E. Color shall be homogeneous throughout tile and contrast with adjacent surface.

F. Delivery, Storage and Handling

1. Tiles must be packaged or crated to prevent damage in shipment or handling. Finished surfaces must be protected by sturdy wrappings, and tile type identified by part number.

G. Extra Stock

1. Furnish new materials from same manufactured lot as materials installed and enclose in protective packaging with appropriate identification for cast-in-place tactile tiles. Furnish not less than 2 percent of the supplied materials for each type, color and pattern installed.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. General: Refer to Section 312000, Earth Moving, for finished subgrade. Subgrade must be tested for grade and cross section with a template. Maintain subgrade in a smooth, compacted condition. Remove loose material from compacted subgrade surface immediately before placing concrete.

B. Prepared Subgrade: If subgrade conditions are unsatisfactory, have corrections made by General Contractor before proceeding. Do not begin paving work until subgrade conditions are acceptable, including specified compaction as verified per compaction tests. See Specification Section 312000, Earth Moving.

3.2 PLACING CONCRETE

A. Place concrete in accordance with ACI 301, Chapter 8. Consolidate concrete in accordance with ACI 309 using high frequency vibrators.

B. Clean forms, reinforcing and accessories; dampen forms immediately prior to placing concrete.

C. Schedule concrete deliveries to ensure that concrete in each load is placed within 90 minutes after mixing water is added.

D. Deposit concrete as near as practicable to its final position to avoid segregation due to rehandling or flowing; place in layers not exceeding 12 -inch in depth, and compact each layer with vibrators.

E. Do not allow concrete to fall freely more than 4 feet. Use tremies, chutes or elephant trunks where necessary.

F. Exercise care to prevent -inchover pouring-inch retaining walls or similar forms. Avoid damaging reinforcing steel during removal of -inchover poured-inch concrete.

G. Do not use concrete that has partially hardened or been contaminated by foreign materials, nor concrete that has been retempered or remixed after initial set.

H. Continue concrete work uninterrupted until completion of run; no concrete must be placed against concrete that has attained its initial set, except at construction joints.

I. Before depositing new concrete on or against concrete that has set at construction joints, clean, wet and apply neat cement slurry to existing surfaces. Tighten forms prior to resuming pouring.

J. Exercise care to prevent splashing of forms or reinforcing with concrete above level of concrete being placed.

K. Clean any reinforcement projecting above or out of concrete immediately after completion of a particular unit of pour.

L. Do not place concrete under adverse weather conditions unless adequate protection is provided. Refer to ACI 301, Article 8.4 for weather and placing temperature restrictions.

M. Conform to ACI 306 when concreting during cold weather. When heating, do not allow carbonation to occur.

N. Exercise care during hot weather to keep mixing and placing time to a minimum. Dispatch transport trucks to avoid delays, and organize work to use concrete promptly.

O. Conform to ACI 305 when concreting during hot weather including avoidance of alkali reactions to hardened surface. Limit maximum concrete temperature to 90 degrees F. prior to placing.

P. The TA must monitor vibrations during pile driving or other periods of potentially damaging vibration to establish minimum distances to be maintained from concreting operations to avoid damage to freshly placed concrete.

Q. Before placing concrete slabs on grade, sprinkle base sufficiently with water to prevent loss of water from concrete; there must not be any free standing water present after sprinkling.

R. Comply with ACI 301 - 11.7.8 for installation of concrete topping mixtures.

S. Bonded concrete toppings over existing concrete slabs must be installed as follows:
   1. Thoroughly clean and dampen top surface of concrete to receive topping; there must not be any standing water present.
   2. Immediately before topping is placed, scrub into surface a coat of bonding grout. Do not allow grout to set or dry before topping is placed. Prepare bonding grout using a mixture of 1 part cement to 1 part fine sand that passes a No. 30 mesh sieve, mixed to consistency of thick cream.
   3. Place, compact, finish and cure topping mixture as specified for other concrete slabs.
   4. Bond concrete toppings must use bonding grout or compound installed in accordance with manufacturer's instructions.
   5. At Contractor's option, approved bonding compound may be used in lieu of bonding grout. Installation must be in accordance with manufacturer's instructions.

T. Forms: Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work so that forms can remain in place at least 24 hours after concrete is placed. Set forms with allowable tolerance of 1/8-inch when checked with a straightedge. Forms must not deviate from true line by more than 1/4-inch at any point. Clean and oil forms at each use. Where curvilinear curbs are shown, form work must be placed/constructed to -inchtrue arc-inch layout. Short tangent form segments are not acceptable.

U. Reinforcing: Locate, place and support reinforcement as indicated or as required to maintain a minimum of 1-1/2-inch concrete cover. Do not extend reinforcing through expansion and contraction joints. Provide doweled joints through expansion and contraction joints with one end of dowels fitted with capping sleeve to allow free movement. Keep reinforcing free of dirt, oil, rust, scale or other substances. Install welded wire fabric in as long lengths as practicable, and offset end laps in adjacent sheets a minimum of two cross wire spacings. Make all end and side lap splices so the overlaps between outermost cross wires of each sheet are not less than 2-inch.

3.3 THICKNESSES/ TOLERANCES

A. Surface Drainage: All concrete surface must be placed so as to drain and prevent water from puddling. Conform to slopes shown on plans; where slopes are not shown, slabs must have a minimum slope of 1/8-inch/per ft. in the direction of drainage as interpretable from contours or spot elevations.

B. The maximum out of plane variance must be a ¼-inch within any 10-foot panel of concrete.

C. All concrete including but not limited to walk, drive and curb edges must be within 1-inch of the plan location unless approved by the A/E office.

D. Normally all surfacing thickness and base requirements are designated on the drawings. If not noted designated on the drawings, sidewalk slabs must be 4-inch thick, and all driveway slabs must be 6-inch thick.

3.4 TRUNCATED DOME TILE INSTALLATION

A. Environmental Conditions and Protection: Maintain minimum temperature of 40 degrees F in spaces to receive tactile tiles for at least 48 hours prior to installations, during installation, and for not less than 48 hours after installation. Store tactile tile material in spaces where they will be installed for at least 48 hours before beginning installation. Subsequently, maintain minimum temperature of 40 degrees F in areas where work is completed.

B. Pour and finish concrete, true and smooth to the required dimensions and slope prior to tile placement. Check that the required slope is achieved.

C. Place tile true and square to the curb edge in accordance with Contract Drawings. Tamp or vibrate into the fresh concrete to ensure that field level of tile is flush to the adjacent concrete surface. Tolerance for elevation differences between tile and adjacent surface is 1/16-inch.

D. Trowel concrete around the tile perimeter to the field level of the tile.

E. Do not walk, lean or apply external forces to tile to cause a void between the underside of tile and concrete.

F. Adjust tile before the concrete sets: place two suitable weights of 25-pounds each on each tile as necessary to ensure solid contact of tile underside to concrete.

G. After concrete is cured, remove protective plastic wrap from the tile face by cutting the plastic with a sharp knife tight to the concrete/tile interface. If concrete bleeding occurs, clean with wire brush.

H. Protect tiles against damage during construction period in accord with manufacturer's specification.

   1. Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.

I. Clean tactile tiles not more than four days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean tactile tile by method specified by tactile tile manufacturer.

3.5 EXPANSION, CONTRACTION AND CONSTRUCTION JOINTS.

A. Expansion Joint location: Expansion joint locations are typically given on the plans for walks and drives and denoted with an "EJ" abbreviation. If the pattern does not provide for a ½-inch thick expansion joint in sidewalks at intervals not to exceed 40 feet, at curb and gutter at intervals not to exceed 60 feet contact the A/E office for direction.

B. Contraction /Control Joint: The terms "Contraction" or "Control" joint terms may be interchanged on the site plans and details. Control joint locations are typically given on the plans for walks and drives as denoted by a line. Unless noted otherwise, it is the Contractor's option of using saw cuts or tooling to form the control joints. Where control joint spacings are not specifically shown, they must be spaced with a maximum spacing between joints in walks at 8-feet, and 12-feet in driveways. Spacing of contraction joints may be increased up to 10-feet for walks and 15-feet for drives, if the short-long side ratio is 1:2. Typically the maximum short-long side ratio must be between 1 to 2 and 1 to 1.

C. Cushion Joint locations: Unless noted otherwise, provide a ½-inch cushion joint where concrete slab on grade abut the building, canopy columns, retaining walls or similar features with frost foundations.

D. Joint patterns:
   1. Jointing for sidewalks and drives is generally shown on the site plans.
   2. Jointing patterns in the support slab under pavers must be installed in coordination with the paver patterns as detailed and specification Section xxxxx. Expansion joints must be doweled and sealed at the support slab and paver level as detailed.
   3. Jointing at proposed to existing concrete interface: The plans show approximate locations for saw cuts and/or jointing of proposed to existing pavements. The design intent is to coordinate proposed to existing joint patterns in a smooth transition without a patch appearance. Remove all existing panels to the nearest joint. In some instances saw cuts will be permitted at mid slab if jointing pattern permits; however, the general approach must be removal to the nearest joint. Submit a sketch at each pavement interface location indicating existing and proposed joints. The patterns must be submitted and approved prior to saw cutting existing concrete.

E. Sawcut Joints: Sawcut control joints in accordance with ACI 301 11.5, to 1/4 the depth of slabs unless shown otherwise. Cut joints to their full depth as soon as condition of concrete will permit. Joints must be cut in two or more passes, with the first cut 1/2-inch deep.

F. Tool Joints: Tooled joints must be 1-1/2-inch deep x 3/8-inch, unless otherwise noted or shown in the documents. Tool edges of joints to have a ¼-inch radius.

G. Construction joints: Provide construction joints required when stoppage of concreting operations occurs for more than 30 minutes. Construction joints may only be located as a substitution for Control joint locations and must either be reinforced (as detailed) or a key joint provided.

H. Continue reinforcing steel across construction joints unless noted or detailed otherwise.

I. Unless detailed otherwise, locate horizontal construction joints in retaining walls only if needed and approved in the shop drawings.

J. Provide ¼-inch rounded edges at construction, control and expansion joints where slab joint will be exposed.

K. Sequencing pours: Pour sections alternately with minimum waiting period of 48-hours between adjacent pours.

3.6 FINISHING

A. Sidewalk Finishing: Unless noted otherwise, broom or burlap belt finish sidewalks and curbs after the concrete has been floated with a coarse transverse scored texture. Slope sidewalks to drain with all water pockets eliminated. All floated or broomed surfaces must be finished to an FL 25 tolerance.

B. Protect finished surfaces from damage. Keep free of abrasive materials.

C. Set screeds by instruments with firm, stable supports, but not mortar mounds. Place concrete to accurate screeds, with screed lines filled.

D. Rotary Finish: Start finishing when concrete has hardened sufficiently to permit use of mechanical rotary finisher; finishing machines must thoroughly compact and level concrete.

E. Smooth finish: Follow the rotary or broom finish with a steel trowel when a smooth finish is designated in the documents.

F. Place and finish slabs so areas will drain and water will not stand in puddles. Conform to slopes shown. Verify elevations of drains to insure drains will be at low points. Where elevations and slopes are not indicated, generally slope 1/8-inch per foot uniformly to drains, unless otherwise directed by A/E.

G. Scratch Finish: Apply scratch finish to monolithic slab surfaces to prepare mortar setting beds for pavers, or other bonded applied cementitious finish flooring material, where indicated. After placing slabs, finish surface to tolerances of F_L13 (floor levelness), measured according to ASTM E 1155. Slope surfaces uniformly to drains and roughen surface before final set with stiff brushes, brooms, or rakes.

H. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish or other finishes as specified; slab surfaces to be covered with elastic waterproofing membrane or sand-bed. After screeding, consolidating and leveling concrete slabs; do not work surface until ready for floating. Begin floating, using float blades or float shoes after surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

I. Trowel Finish: Generally limited to a small border at exterior concrete panels. Begin final troweling when surface produces a ringing sound as trowel is moved across the surface. Consolidate concrete surface by final hand-troweling operation. Surface must be free of trowel marks, uniform in texture and appearance, and finished to tolerances of F_F20 (floor flatness), F_L17 (floor levelness), and F_F20 for elevated slabs, measured according to ASTM E 1155. Grind smooth any surface defects that would telegraph through applied floor covering system.

J. Trowel and Fine Broom Finish: Where pavers or quarry tile are to be installed with thin-set mortar, apply a trowel finish as specified, immediately follow by slightly scarifying the surface with a fine broom.

K. Broom Finish: Apply a nonslip broom finish to all exterior concrete platforms, steps, and ramps, unless noted otherwise. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with A/E office representative before application.

L. Non-Slip Abrasive Finish: Applicable to exterior platforms, ramps, stairs, slabs at entry stoops, and interior ramps or other similar areas indicated on drawings. Blend abrasive aggregate with Portland cement in proportions recommended by manufacturer of aggregate. Float finish concrete surface, applying approximately two-thirds of blended material to surface by method that insures even coverage without segregation. Float surface immediately after material has been embedded. Remainder of blended material must be applied to surface at right angles to previous application. Follow with second floating of embed material and complete with broomed floated trowel finish to expose non-slip aggregate. Rate of abrasive aggregate application must not be less than 25-pounds per 100-square feet.

M. Abrasive Blasted Finish: Provide samples as specified, and establish procedures to be followed for surfaces where this finish is required.

N. Exposed Aggregate Finish: Provide samples as specified, and establish procedures to be followed at those areas where exposed aggregate finish is required.

3.7 MISCELLANEOUS CONCRETE ITEMS

A. Provide miscellaneous concrete items as noted and detailed on drawings.

B. Provide and install reinforcing, anchors and bolts in concrete where directed and required.

C. Provide for installation of inserts, hangers, metal ties and other fastening devices required for attachment of other work.

D. Properly locate fastening devices in cooperation with other trades, and secure in position before concrete is placed.

3.8 REPAIR OF SURFACE DEFECTS AND PATCHING

A. If objectionable air holes, honeycombed areas or other surface defects occur, as determined by A/E, repair defects in accordance with ACI 301, Chapter 9, unless other materials and methods are permitted by A/E.

B. At unexposed surfaces, fill tie holes in accordance with ACI 301, Chapter 9.

C. At exposed surfaces, any patching required and permitted by A/E must comply with ACI 301, Article 13.6.

D. At exposed surfaces, plugging of tie holes, blemish repairs and removal of stains must be performed as described in ACI 301, Chapter 10. A/E will select materials and methods for plugging of tie holes from alternates described therein.

E. Concrete containing surface defects that are not repairable or cannot be patched to produce required finishes, or exceed permissible tolerances as determined by A/E, must be removed and replaced.

F. Patch existing concrete where noted and where affected by new construction.

3.9 CURING AND PROTECTION

A. Provide curing and protection immediately after placement in accordance with ACI 301, Chapter 12.

B. Continue curing and protection period as required by ACI 301. Cure period must be at least 7-days for all concrete, except high-early strength concrete for which period must be at least 3-days.

C. If forms are removed during curing period, immediately employ one of the accepted curing materials or methods specified for concrete surfaces not covered by forms, and continue for remainder of curing period.

D. At concrete with moist type cure, cover with moisture-proof covering. Remove and wet concrete as often as required to keep damp for entire curing period. Provide continuous curing with no dryouts during entire period.

3.10 ABRASIVE BLASTING OF CONCRETE

A. Comply with Portland Cement Association Publication IS180T.

B. Protection: Confine abrasive blasting to concrete surfaces noted on plans. Cover and protect adjacent surfaces.

C. Dust-tight Barricades: Cover and seal openings into building in vicinity of abrasive blasting as required to prevent infiltration of abrasive material and dust.

D. Responsibility: Be responsible for safety measures; damage, cleaning and replacement costs of adjacent surfaces and materials from sand, dust and over spray.

E. Blasting Abrasives: Provide abrasive gradations for selected use to produce an approved job site sample.

F. Safety Measures: Each blaster must be equipped with air fed helmet, appropriate nozzle type, pressure, blasting techniques and timing required to insure safety and produce desired results.

3.11 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. The Testing Agency (TA), as retained under Division 1, must conduct laboratory and field testing as noted below, and as outlined per Article 1.4 above.

B. Contractor must cooperate with the TA; TA to make, cure and determine strength of concrete test cylinders cast in field. Procedures and methods must be performed in accordance with ASTM C172 - Method of Sampling Freshly Mixed Concrete, ASTM C31 - Method of Making and Curing Complete Test Specimens in Field and ASTM C39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens. Evaluation and acceptance of concrete must be in accordance with Section 4.7 of ACI 318 with following exceptions:

1. Make 1 set of cylinders for each day's operation and each type of concrete where less than 50-cubic yards is placed, plus additional set for each 50 cubic yards (or fraction thereof) over and above first 50-cubic yards of each type. Test sets must consist of 4 cylinders with fourth cylinder to be field-cured specimen. For slabs placed when temperatures are expected to fall below 32-degrees F within 72-hours of placement, cast in place (pop out) cylinders must be used. These cylinders must be placed close actual areas poured.

2. Store field-cured cylinder as near as possible to location of concrete represented by sample, and give cylinder, insofar as practicable, same protection and curing as adjacent concrete. Keep the other 3 cylinders covered with plastic or wet burlap and in 60 to 80-degrees F. temperature range for 24-hours, allowing no injury to cylinders. After this period, and prior to and age of 48-hours, deliver 3 cylinders to laboratory for additional curing, taking care not to freeze, crack or damage specimens.
3. Deliver field-cured cylinder to laboratory at 28-days of age for testing to check adequacy of curing and protection as described in Article 4.7.3 of ACI 318.
4. Test other 3 cylinders, laboratory cured, as follows: 1 at 7-days of age for projecting probable 28-day strength and 2 cylinders at 28-days for acceptance of average strength as described in Article 4.7.1 of ACI 318.
5. If additional field cured specimens are required to verify early strength of concrete, contractor must pay for additional testing.

C. Determine slump of concrete in accordance with ASTM C143 - Standard Test Method for Slump of Portland Cement Concrete. Perform 1 test for each set of test cylinders.

D. Determine air content of fresh concrete in accordance with ASTM C173 or ASTM C231. Where placement is by pump, air content must be measured at location of placement. For concrete exposed to freezing and thawing, concrete from each truck must be tested and concrete not meeting specified percentages must not be placed. Concrete used in performing air content test must not be used in fabricating test specimens.

E. Mark each test cylinder with job name, Contractor's name, mix number, date, location of pour and measured slump. In addition, mark measured air content when air-entraining admixture is specified.

F. The TA must submit copies of test results to Owner, A/E and Contractor as soon as practicable after they are made.

3.12 EVALUATION OF TEST RESULTS AND FAILURE TO MEET STRENGTH REQUIREMENTS

A. Test results: Evaluate in accordance with ACI 214.

B. Evaluations must be valid only if samples have been taken and tests have been conducted in accordance with ACI and ASTM specifications and methods as applicable.

C. If strength tests performed on concrete cylinders fail to meet specified 28-day values, or if samples have not been taken and tests conducted as specified, concrete represented by such samples and tests must be considered questionable and must be subject to further testing at expense of Contractor.

D. Additional tests of questionable concrete must be performed by an Testing Agency acceptable to A/E, and must be conducted in accordance with ASTM C42. Concrete cores may be obtained in field, or load tests conducted and results evaluated in accordance with ACI 318, Chapter 20.

E. Test results obtained by use of impact hammer or sonoscope, unless correlated with other data, will not be considered conclusive in evaluating strengths of concrete.

F. If additional testing fails to demonstrate strengths adequate for intended purpose, remove questionable concrete and replace with concrete meeting specifications.

END OF SECTION

SECTION 321343

PORTLAND CEMENT PERVIOUS CONCRETE PAVEMENT

PART 1 – GENERAL

1.1 DESCRIPTION

A. The Work to be completed under this contract includes the furnishing of all labor, materials and equipment necessary for construction of Portland Cement Pervious Concrete Pavement for parking areas and/or pedestrian walkways in conformance with the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 – Record Drawings and Submittals

B. Section 02200 – Earthwork

C. Section 02223 – Trenching, Backfilling and Compacting

D. Section 03000 – General Concrete Construction

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. American Concrete Institute

1. Concrete Field Testing Technician Grade I

B. American Society for Testing and Materials

1. ASTM C29 “Test for Bulk Density (Unit Weight) and Voids in Aggregate”

2. ASTM C33 “Specification for Concrete Aggregates”

3. ASTM C94 “Specification for Ready-Mixed Concrete”

4. ASTM C150 “Specification for Portland Cement”

5. ASTM C260 “Specification for Air-Entraining Admixtures for Concrete”

6. ASTM C494 “Specification for Chemical Admixtures for Concrete”

7. ASTM C595 “Specification for Blended Hydraulic Cements”

8. ASTM C618 “Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.”

9. ASTM C685 “Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing”

10. ASTM C989 “Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.”

11. ASTM C1438 “Standard Specification for Latex and Powder Modifiers for Hydraulic Cement Concrete and Mortar.”

12. ASTM C1602 “Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete”

13. ASTM C1688 “Standard Test Method for Density and Void Content of Freshly Mixed Pervious Concrete”

14. ASTM C1701/C1701M “Standard Test Method for Infiltration Rate of In Place Pervious Concrete”

15. ASTM C1751 “Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

16. ASTM C1752 “Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.”

17. ASTM D994 “Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)”

18. ASTM E329 “Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.”

C. National Ready Mixed Concrete Association (NRMCA)

1. Text Reference for Pervious Concrete Contractor Certification

1.4 QUALITY ASSURANCE

A. The Contractor shall submit:

1. Evidence of two successful pervious concrete pavement projects of similar scope and size including: the project name and address, owner’s name, contact information and size of each project.

2. Verification of current NRMCA Certification requirements described below:

B. Shall meet, at the time of bidding, one of the following criteria for the minimum certification for each placement crew and submit verification of NRMCA Pervious Concrete Certification with the bid. (http://www.nrmca.org/Education/Certifications/Pervious_Contractor.htm)

1. The pervious concrete subcontractor shall employ no less than one (1) NRMCA Certified Pervious Concrete Craftsman who must be onsite,

actively guiding and working with each placement crew during all pervious concrete placement.

2. The pervious concrete subcontractor shall employ no less than three (3) NRMCA Certified Pervious Concrete Installers who must be onsite, actively guiding and working with pervious concrete for projects.

3. The pervious concrete subcontractor shall employ no less than three (3) NRMCA Pervious Concrete technicians and one (1) Pervious Installer who shall be onsite, actively guiding and working with each placement crew during all pervious concrete placement.

C. Test Panel:

1. Construct test panel(s) to meet requirements of contract documents. Place a minimum one 225 sq. ft panel. Coordinate location of test panels with Owner and Architect/Engineer. Provide joints and curing using materials, equipment, and personnel proposed for the project.

2. The test panel shall be tested for acceptance in accordance with Part 3 of this Section.

3. Test panels must meet the requirements for surface finish, void content, thickness, and joints.

4. Take 3 core samples from each panel. The void content of each core must be within the specified range.

5. An approved test panel will be used as quality control for the project and may be incorporated into the project if the panel is of acceptable quality at the sole discretion of the Owner. Approved test panels must remain in place until all pervious concrete pavement is completed.

6. Remove and legally dispose of all materials used for test panels not approved or incorporated into the project and all excess materials.

7. If the Owner rejects the test panels, construct new test panels.

D. Plastic Concrete Testing:

1. For each day of paving, test pervious concrete for unit weight under ASTM C 1688 at least once for each 150 cubic yards placed or fraction thereof. Unit weight must be within 5 lb/cu ft of the submitted mixture proportions.

E. Cores:

1. For each day of paving, core 3 samples for each 10,000 square feet or fraction thereof. The Engineer determines coring locations.

F. Void Content:

1. Test for void content. The void content must be 22 percent or less.

G. Infiltration Rate

1. Upon completion of the initial curing, test the infiltration rate under ASTM C1701. Perform 3 tests in areas up to 10,000 square feet. Conduct one test for each additional 10,000 sf. Separate each test location by at least 40 feet. The infiltration rate must be at least 100 inches/hour.

2. Do not perform tests (1) if there is standing water on the pavement surface or (2) less than 24 hours after 1/4 inch or more of rain.

1.5 CONTRACTOR SUBMITTALS

A. Submit the following in accordance with Section 01300 prior to starting the work of this Section:

1. Concrete materials:

a. Proposed concrete mixture proportions including all material weights, volumes, density (unit weight), water / cementitious ratio, and void content. The mix design shall not specify a compressive or flexural strength.

b. Aggregate type, source and gradation.

c. Cement, fly ash, ground granulated blast-furnace slag and admixture manufacturer certifications.

2. Qualifications: Evidence of qualifications listed under Quality Assurance.

3. Construction schedule, procedures and quality control plan.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Cement

1. Portland cement Type II or V conforming to ASTM C150 or Portland cement Type IP or IS conforming to ASTM C595.

B. Supplementary Cementitious Materials

1. Class F Fly Ash: ASTM C618

2. Ground Granulated Blast-Furnace Slag: ASTM C989

C. Chemical Admixtures

1. Air entraining agents shall comply with ASTM C260.

2. Chemical Admixtures shall comply with ASTM C494.

3. Latex bonding agents shall comply with ASTM C1438.

D. Coarse Aggregate

1. Aggregate shall conform to ASTM C33. The maximum size aggregate for the pavement surface must not exceed ½-inch.

2. The maximum size and gradation shall meet the project criteria for surface appearance and void content.

3. When aggregate is used under pervious concrete for water storage, the aggregate shall be composed of uniform sized aggregate conforming to ASTM C33, minimum size 6. Minimum void content shall be 30 percent.

E. Water

1. ASTM C1602.

F. Isolation Joint Material

1. Shall comply with ASTM D994, D1751, or D1752.

2.2 MIXTURE PROPORTIONS

A. The composition of the proposed concrete mixtures shall be submitted to the Owner's representative for review and shall comply with the following provisions unless an alternative composition is demonstrated to comply with the project requirements. Conform to all requirements of agencies having jurisdiction for pavements and walkways.

1. Cementitious Content: Determine the minimum cementitious material content. The cementitious material content must not exceed 590 lbs./cu. yd. Production pervious concrete shall conform to the approved mix design.

B. Supplementary cementitious content:

1. Fly ash: 25% maximum of the total cementitious material or in accordance with approved mix design.

2. Slag: 40% maximum of the total cementitious material or in accordance with approved mix design.

C. Water / Cementitious Ratio shall range between 0.27 lb/lb and 0.31 lb/lb. or in accordance with approved mix design.

D. Aggregate Content: Per the approved mix design.

E. Admixtures: Use in accordance with approved mix design.

F. Mix Water: as appropriate for approved mix design.

G. Color: Pigments to be selected by the architect. Submittal required.

PART 3 – EXECUTION

3.1 SUBGRADE

A. Verify subgrade preparation, grade, and conduct permeability and density tests for conformance to project requirements and is acceptable for installation of pervious concrete.

B. Install pavement subdrains as shown on the Drawings. Use perforated pipe of the type and size indicated, and tight line with solid pipe to a suitable drainage facility.

C. Immediately before placing pavement, grade and finish the subgrade. The subgrade must:

1. Comply with the specified compaction and grading

2. Be free of loose and extraneous material

3. Be uniformly moist and free of standing or flowing water

D. The finished subgrade surface must not project into the pavement cross-section at any point. Fill areas of subgrade lower than the required grade with pervious concrete pavement. No payment is made for pavement used to fill these low areas.

3.2 FORMWORK

A. Cast pervious concrete against concrete curbs, gutters or asphalt concrete pavements.

B. Other form materials shall be approved by the Engineer and shall be of sufficient strength and stability to support mechanical equipment without deformation of plan profiles following spreading, strike-off and compaction operations.

3.3 MIXING AND HAULING

A. Production: Pervious concrete shall be manufactured and delivered in accordance with applicable sections of ASTM C94 or ASTM C685.

B. Mixing: Pervious concrete shall be produced in central mixers, transit mixers or in volumetric mixers.

C. Delivery: Deliver pervious concrete directly from the mixer by means of conveyer as close as possible to final position. Pumping through hoses shall not be allowed.

D. Discharge: Each truckload will be visually inspected for consistency of concrete mixture. Job site water additions are permitted to obtain and maintain the required mix consistency throughout the discharge. Discharge shall be a continuous operation. Concrete shall be deposited as close to its final position as practical and such that discharged concrete is incorporated into previously placed plastic concrete.

3.4 PLACING AND FINISHING

A. Shall comply with the content of the National Ready Mixed Concrete Association's 'Text Reference for Pervious Concrete Contractor Certification' with the following provisions:

1. Internal vibration shall not be permitted. Use mechanical screed equipment. Do not use hand screeds except in confined and small areas. Cross roll compacted concrete to remove any screed or compaction marks on the concrete surface.

2. Compact to the required cross-section with no more than +3/8-inch in 10 feet deviation from profile grade.

3.5 JOINTING

A. Joints shall be installed at locations and to depths shown on the project plans.

B. Control (contraction) joints shall be installed at regular intervals not to exceed 1.5 times the width of the placement or 20 feet, or in accordance with approved joint placement plan. The control joints shall be installed at 1/4 the thickness of the pavement but not to exceed 1-1/2 inches. These joints can be installed in the plastic concrete or saw cut after the concrete has hardened. New joints in plastic concrete or recently hardened concrete shall align with joints in older concrete. Joints abutting curbs and other fixed concrete shall be installed within 10 degrees of perpendicular to the older concrete as possible.

C. Install joints to match approved sample.

D. Transverse construction joints: Install whenever placing is suspended for 20 minutes or whenever concrete is no longer workable.

E. Do not dowel longitudinal joints between successive placements.

F. Isolation joints: Use when abutting fixed vertical structures. Place isolation material before pervious concrete is placed and to a minimum depth equal to the pervious concrete pavement layer.

3.6 CURING

A. Final curing procedures shall begin no later than 20 minutes after the concrete has been discharged from the mixer. The pavement surface shall be covered with a minimum of six (6) mil thick white or clear polyethylene sheet or other approved covering material. In cold weather, black plastic may be used to aid in

heat retention. The cover shall prevent air infiltration to the fresh concrete and shall overlap all exposed edges and shall be secured to prevent dislocation due to winds or adjacent traffic conditions.

B. The curing cover shall remain securely in place for a minimum of 7 days. No vehicular traffic shall be permitted on the pavement until curing is complete and no truck traffic shall be permitted for at least 14 days.

3.7 QUALITY CONTROL

A. The Owner shall employ a testing laboratory that conforms to the requirements of ASTM E329 and ASTM C1077. Personnel engaged in testing shall be certified by the American Concrete Institute as ACI Concrete Field Technicians or equivalent. At Owner's option, personnel shall be certified by NRMCA as a Pervious Concrete Technician.

B. Prior to each placement, the formed thickness shall be at least the design thickness testing within -0" to +3/4".

C. Plastic concrete shall be sampled in accordance with ASTM C172 and density (unit weight) measured in accordance with ASTM C1688. The density (unit weight) of the delivered concrete shall be +/- 5 pcf of the design density (unit weight).

D. Plastic void content shall be calculated as per ASTM C1688 Gravimetric Air Determination and compared to the void percentage required by the hydraulic design.

E. Upon completion of initial curing, the pervious concrete shall be tested for a baseline infiltration rate using ASTM C1701.

END OF SECTION

SECTION 321373

CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Division 1 applies to this Section. This Section covers calking of the openings and joints indicated, specified, and required to make the entire building weatherproof and watertight, covers calking requirements for the entire Work, and pertain to any Section requiring calking, unless specified otherwise.

1.2 SUBMITTALS

A. Refer to Section 01330 for procedures.

B. Samples and Data: Submit the following:

1. Samples of cured sealants showing full range of designated colors; obtain color instructions from Architect prior to submittal.
2. Technical data by manufacturers of proposed materials.
3. Material manufacturers' printed preparation and application instructions; when approved, furnish copies to other trades.

C. Calking- and Sealant-Substrate Compatibility: Submit a list of proposed products for each type of substrate in the Work; include manufacturer's recommendations for each substrate verifying that product is recommended by the manufacturer for that specific substrate. Where a product is scheduled to contact dissimilar materials, submit verification such product is recommended by the sealant manufacturer for each scheduled substrate.

D. Site Samples: After approval of above Samples and Data, at site prepare a Sample installation of each type of joint in exterior surfaces to be caulked in accordance with this Section. Arrange for sealant manufacturer's technical representative to be present and to assist in correct installation of site Samples.

E. Provide Product Data: Manufacturer’s descriptive technical data, and illustrations, Material Safety Data Sheet (MSDS) indicating the VOC (Volatile Organic Compound) limit is less then the VOC limits of SCAQMD South Coast Air Quality Management District Rule #1168 and all sealants used as fillers must meet or exceed the requirements of the Bay Area Air Quality District Regulation 8, Rule 51.

F. Submit material cost data for all materials required to construct the work in place. The cost data should be as marked up to the General Contractor. If the work is self-performed the material cost shall reflect the actual cost of material without mark up.

1.3 QUALITY ASSURANCE

A. Employ a specialist calking contractor having not less than 5 years experience in calking installations of size and complexity required for the Work. Prior to award of subcontract for calking, submit qualifications and project history of the proposed Calking Subcontractor.

B. Manufacturers' Tests of Sealants: Deliver to sealant manufacturer Samples of all relevant substrates to receive sealants, including finished aluminum, painted aluminum, bronze, coated glass and brackets. Label all such Samples for this Project.

1. Sealant manufacturer shall perform tests to verify adhesion and chemical compatibility. Use sealants and substrates only in combinations for which favorable adhesion and compatibility results have been obtained.
2. Submit, for record purposes only, sealant manufacturer's written test reports and recommendations regarding cleaning, preparation, and priming.
3. Silicone sealant manufacturers inspections required for long term warranties shall be made by the manufacturer and approved inspectors.

1.4 TECHNICAL ASSISTANCE

A. Furnish the sealant manufacturer's technical field assistance to ensure proper use of sealants, preparation, and application. Include a pre-construction meeting. Manufacturer's representative shall visit the site weekly whenever sealant calking is in progress.

1.5 PRODUCT DELIVERY

A. Deliver all calking and sealant materials to the site in sealed factory-labeled containers, labels bearing statement of conformance to standards specified for each material.

1.6 WARRANTY

A. Refer to Section 01787. Furnish a written warranty against defects in sealant application and sealant materials for 20 years for silicones and 10 years for urethanes covering, without limitation, loss of adhesion or cohesion, leaking, deterioration, color changes, and other defects.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Furnish sealants meeting following in-service requirements: Normal curing schedules are acceptable; non-staining, color fastness (resistance to color change), and durability when subjected to intense actinic (ultraviolet) radiation are required. Furnish the products of only one manufacturer unless otherwise approved, sealant colors as selected to match the adjoining surfaces; special colors may be required.

B. A.Sealant and Primer: Non-sagging 1-part sealant conforming to Fed Spec TT-S-00230C(2), "Sealing Compound; Elastomeric Type, Single Component", or Fed Spec TT-S-001543A, "Sealing Compound, Silicone Rubber Base", with sealant manufacturer's recommended primer. Non-silicone self-leveling sealant may be furnished for joints in horizontal surfaces.

C. B.Exception: Furnish multi-component non-tracking sealant having Shore "A" Hardness range of 40 to 55 where exposed to pedestrians or vehicles, conforming to Fed Spec TT-S-00227E(3), "Sealing Compound, Elastomeric Type, Multi-Component".

D. C.Joint Backing: Type approved by sealant manufacturer as both physically and chemically compatible with primer and sealant. Oakum, jute, cotton tape, and vegetable base materials are not acceptable. Furnish uncoated untreated fibrous glass rope or polyethylene, vinyl, silicone, or urethane type polymer sponge or tubing of medium to firm density, not containing oil, butyl, asphalt loading, or neoprene. Use polyethylene film or tape, or aluminum foil for bond breaker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Report to Architect in writing all conditions that interfere with or prevent correct installation of Work of this Section or prevent the correct preparation, priming, and calking installation.

3.2 PREPARATION AND PROTECTION

A. Conform to sealant manufacturer's directions and apply materials to clean dry surfaces free of grease, oils, waxes, or other matter that destroys or impairs adhesion. Remove lacquer coatings on aluminum contacting sealants. Protect all adjoining surfaces and apply temporary masking tape on both sides of joints where surface staining may occur. Fill joints with joint backing material until the joint depth does not exceed 50% of joint width. Provide bond breaker to prevent bonding of sealant to backing material wherever joints exceed 1/2" width, or joint width is shown or required to exceed depth. Prime surfaces as required by manufacturer's instructions.

3.3 APPLICATION

A. Maximum 3/8" sealant depth unless otherwise shown. Minimum joint width is 1/8" for metal to metal joints and maximum 3/4" width elsewhere unless otherwise shown. Apply sealant under sufficient pressure to fill voids. Finish exposed joints smooth and flush with adjoining surface unless recessed joints are shown. Remove temporary masking as soon as joint is completed.

3.4 CLEANING

A. Conform to Section 01741. Clean material from surfaces not to receive sealant and restore finish as required. If surfaces adjoining joints are stained and cleaning is not acceptable, remove the affected Work and provide new Work as directed and approved, at no extra cost to Owner.

END OF SECTION 321373

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 321440

DECOMPOSED GRANITE PAVING

PART 1 – GENERAL

1.1 SUMMARY

A. Related Documents

1. Drawings and general provisions of Contract, Planting Specification sections, may apply to work of this section.

B. Description of Work

1. Extent of decomposed granite paving work is shown on drawings.

2. Decomposed granite paving will have stabilizer binder additive as shown on the plans.

1.2 QUALITY ASSURANCE

A. Installer Qualifications

1. Upon request, the installer shall provide a list of projects (project name, year completed, area of decomposed granite, contact name and phone number) where their company was responsible for installing decomposed granite paving containing a stabilizer binder additive.

B. Source Limitations

1. Each material shall be obtained from a single source from a single manufacturer.

1.3 SUBMITTALS

A. Material Certificates

1. Provide copies of materials a certificate signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements. Additionally, provide “cut sheets” or product literature on all products to be used.

1.4 JOB CONDITIONS

A. Do not install decomposed granite paving during rainy conditions.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Base Course Aggregate

1. Class 2 aggregate - 3/4” maximum.

B. Decomposed Granite

1. The decomposed granite material shall be produced from a virgin source of granite rock deposits and free of serpentine and deleterious or hazardous material.

Sieve Size		Percent Passing
½”	12.5 mm	100%
3/8”	9.5 mm	100%
#4	4.75 mm	100%
#8	2.36 mm	89%
#16	1.18 mm	72%
#30	600 um	54%
#50	300 um	38%
#100	150 um	26%
#200	0.075 um	16.8%

C. Stabilizer

1. Stabilizer to be patented, non-toxic, organic binder that is a colorless and odorless concentrated powder that binds decomposed granite together to produce a firm surface.

PART 3 – EXECUTION

3.1 PREPARATION

A. Herbicide Treatment

1. Apply chemical weed control agent, “Ronstar G” or approved equal, in strict compliance with manufacturer's recommended dosages and application instructions. Apply “Ronstar G” prior to installation of Class II base rock.

3.2 INSTALLATION OF DECOMPOSED GRANITE

A. Base Course

1. Install Class II Aggregate to thickness shown in the drawings.

B. Stabilizer

1. Blend 12 – 16 lbs. of Stabilizer per (1) ton of decomposed granite per manufacturer’s instructions. It is critical that Stabilizer be thoroughly and uniformly mixed throughout decomposed granite.

C. Placement of Decomposed Granite Screenings

1. Upon thorough moisture penetration, compact aggregate screenings to 95% relative compaction by compaction equipment such as; double drum roller (2-4 ton) or single drum roller (1000 lbs.) vibratory plate tamp. Do not begin compaction for 6 hours after placement and up to 48 hours. Take care in compacting decomposed granite when adjacent to planting and irrigation systems.

3.3 REPAIRS AND PROTECTION

A. Remove and replace decomposed granite paving that is damaged, defective or does not meet the requirements of this section.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 32 14 13

PERMEABLE INTERLOCKING CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Work consists of furnishing and installing a Permeable Interlocking Concrete Pavement (PICP) System in accordance with these specifications and in general conformance with the lines, grades, design, and dimensions shown on the plans.
2. Installation work includes:
   a. Verifying subgrade elevations and slope generally conform to the lines, grades, infiltration rate, density, and site conditions depicted in the construction documents;
   b. Furnishing and installing geotextile and/or geomembrane liner (where required), horizontal drainage piping (where required), subbase course, base course, bedding course, edge restraint, concrete pavers and permeable joint material in general conformance to the lines and grades shown on the construction documents.

B. Related Requirements:

1. Section 02200 – Earthwork (OMWD Standard Specification)

2. Section 033000 – Cast-in-Place Concrete

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM C33 Standard Specification for Concrete Aggregates
2. ASTM C94 Standard Specification for Ready-Mixed Concrete
3. ASTM C131 Standard Test Method for Resistance to Degradation of Small-Sized Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
4. ASTM C136 Standard Test Method for Sieve Analysis of Fine and Coarse-Grained Aggregates
5. ASTM C140 Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
6. ASTM C936 Standard Specification for Solid Concrete Interlocking Paving Units
7. ASTM C979 Standard Specification for Pigments for Integrally Colored Concrete

8. ASTM C1645 Standard Test Method for Freeze-thaw and De-icing Salt Durability of Solid Interlocking Paving Units
9. ASTM C1781 Standard Test Method for Surface Infiltration Rate of Permeable Unit Pavement Systems
10. ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
11. ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
12. ASTM D3034 Standard Specification for Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
13. ASTM D3350 Standard Specification for Polyethylene Plastic Pipe and Fittings Materials
14. ASTM D4873 Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples
15. ASTM E2835 Standard Test Method for Measuring Deflections using a Portable Impulse Plate Load Test Device

B. Interlocking Concrete Pavement Institute (ICPI)
1. Permeable Interlocking Concrete Pavement manual (latest edition)
2. Permeable Design Pro software for hydrologic and structural design
3. Tech Specs and Technical Bulletins

C. Standard Specifications for Public Works Construction (Greenbook), latest edition

1.3 SUBMITTALS

A. Contractor shall submit to the owner for approval a minimum of four full-size samples of each concrete paver type/size/thickness/color/finish specified. The samples shall represent the range of shape, texture, and color permitted for the respective type. Color(s) will be selected by the Owner from Manufacturer's standard colors.

B. Prior to delivery of the associated material to the site, the Contractor shall submit the following product-specific documentation for approval:
1. Aggregates
   a. Sieve analysis per ASTM C136 for subbase, base, bedding and joint aggregate materials
   b. Minimum 3 lb. sample of each material for independent testing.
2. Concrete Pavers:
   a. Test results from an independent testing laboratory for compliance to ASTM C936.
   b. Safety Data Sheets (SDS).

1.4 QUALITY ASSURANCE

A. Contractor Qualifications:
1. Contractor shall submit a list of five (5) previously constructed projects of similar size and magnitude prior to the bid date to be qualified. Contact

names, telephone numbers, and date of completion shall be listed for each project.

2. The Contractor's site foreman shall hold a PICP Specialist Designation from the Interlocking Concrete Pavement Institute (ICPI). The site foreman shall be onsite for the entire installation.
3. Contractor shall conform to all local, state/provincial licensing and bonding requirements.

B. Mockups: Build mockups to verify selections made under submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Install a 10 ft x 10 ft paver area following the installation practices described in Article 3.2 to 3.4. This area shall be used to verify joint sizes; lines; laying pattern(s); stitching details (for mechanical installation); color(s); and, texture of the job.
2. To provide a proper representation of color blend, blending during installation of sample mock-up will be pulled from a minimum of 3 cubes.
3. This area shall be the standard from which the work will be judged.
4. Subject to approval by the Owner, the mock-up may be retained as part of the finished work. If mock-up is not retained, remove and dispose of mock-up at the completion of the project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Contractor shall coordinate delivery and paving schedule to minimize interference with normal use of buildings adjacent to paving.

B. Contractor shall check all materials upon delivery to assure that the proper materials have been received and are in good condition before signing off on the manufacturer's packing slip.

C. Contractor shall protect all materials from damage or contamination due to job site conditions and in accordance with manufacturer's recommendations. Damaged or contaminated materials shall not be incorporated into the work.

D. Concrete pavers shall be delivered to the site in steel banded, plastic banded, or plastic wrapped cubes capable of transfer by forklift or clamp lift. Unload and store concrete pavers at the job site in such a manner that no damage occurs to the product.

E. Contractor shall handle and transport aggregates to avoid segregation, contamination, and degradation and keep different materials sufficiently separated as to prevent mixing. The material shall not be dumped or stored one material on top of another unless it is part of the installation process. Materials shall be covered to prevent removal by wind.

F. Geosynthetics shall be delivered, stored and handled in accordance with ASTM D4873.

1.6 ENVIRONMENTAL CONDITIONS

A. Pavers shall not be installed during heavy rain, freezing conditions or snowfall.

B. Pavers shall not be installed on frozen soil subgrade or aggregates.

1.7 MAINTENANCE MATERIALS

A. Provide 25 square feet additional paver material for use by Owner for maintenance and repair.

B. Store extra paver materials in Owner-designated location.

PART 2 - PRODUCTS

2.1 PERMEABLE INTERLOCKING CONCRETE PAVERS

A. Permeable Interlocking Concrete Pavers Basis-of-Design:
   1. Paver Name: Belgard, Aqua Roc
      a. Thickness: 3-1/8 inches (80 mm)
      b. Color: Local Color, selected by Owner
      c. Finish: Shot Blast or Antiqued, selected by Owner

B. Pavers shall meet the minimum material and physical properties set forth in ASTM C 936, Standard Specification for Interlocking Concrete Paving Units.
   1. Measured length or width of test specimens shall not differ by more than +/- 0.063 in, while measured thickness shall not differ by more than +/- 0.125 in.
   2. Average compressive strength of 8,000 psi (55 MPa) with no individual unit under 7,200 psi (50 MPa) when tested in accordance with ASTM C140.
   3. Average absorption of 5% or less with no unit greater than 7% when tested in accordance with ASTM C140.
   4. Efflorescence shall not be a cause for rejection.
   5. Pigment in Concrete Pavers shall conform to ASTM C979.

2.2 AGGREGATE MATERIALS

A. General Requirements:
   1. Clean, non-plastic aggregate, free from deleterious or foreign matter, manufactured from crushed rock. Recycled aggregates shall not be used.
   2. Percent of angular and sub-angular particles greater than 90%. Rounded river gravel shall not be used.
   3. LA Abrasion of the aggregate used shall be less than 40 as per ASTM C131.

4. All aggregates shall be washed and have less than 2% passing the No. 200 (0.075 mm) sieve.
5. All aggregate material gradations shall be tested in accordance with ASTM C136.

B. Bedding Course/Joint Fill Material – open-graded aggregate conforming to the following gradation:

ASTM C33 size No. 8

Sieve Size	Percent Passing
1/2 in. (12.5 mm)	100
3/8 in. (9.5 mm)	85 to 100
No. 4 (4.75 mm)	10 to 30
No. 8 (2.36 mm)	0 to 10
No. 16 (1.18 mm)	0 to 5
No. 200 (0.075 mm)	0 – 2

C. Base Course Material - open graded aggregate conforming to the following gradation:

ASTM C33 size No. 57

Sieve Size	Percent Passing
1-½ in. (37.5 mm)	100
1 in. (25 mm)	95 to 100
1/2 in. (12.5 mm)	25 to 60
3/8 in. (9.5 mm)	0 to 10
No. 4 (4.75 mm)	0 to 5
No. 200 (0.075 mm)	0 - 2

D. Subbase Course Material – open-graded aggregate conforming to the following gradation:

ASTM C33 size No. 2

Sieve Size	Percent Passing
3 in. (75 mm)	100
2- ½ in. (63 mm)	90 to 100
2 in. (50 mm)	35 to 70
1-½ in. (37.5 mm)	0 to 15
¾ in. (19 mm)	0 to 5
No. 200 (0.075 mm)	0 – 2

2.3 EDGE RESTRAINTS

A. Edge restraints shall be cast in place concrete curbs in general conformance with the specifications and dimensions in the construction documents

2.4 PIPE UNDERDRAINS

A. Where shown on the plans, pipe underdrains shall be perforated or slotted PVC pipe manufactured in accordance with ASTM D3034 or corrugated HDPE pipe manufactured in accordance with ASTM D3350.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to commencement of any work, the Contractor shall conduct a pre-construction meeting with the Owner, Designer, and affected sub-trades. The pre-construction meeting should establish contractor responsibilities and at a minimum verify:
   1. The location of the mock-up, and whether it will be part of the final construction or need to be removed.
   2. The site layout is in general conformance to the construction documents. In particular, the location and elevation of discharge points (if any) of the pipe underdrains.
   3. The subgrade lines and elevations are in general conformance with the construction documents. The subgrade elevations shall be within +/- 0.1 ft of the specified grades.
   4. The minimum slope of subgrade shall be at least 0.5% or as specified in the design.
   5. Subgrade soil conditions and grades meet the requirements in the construction documents.
   6. Locations of any protrusions through a membrane liner where boots are required.

B. Proof-roll prepared subgrade according to requirements in Section 02200 to identify soft pockets and areas of excess yielding. Proceed with subbase installation only after deficient subgrades have been corrected. Scarify subgrade surface following any stabilization efforts before installing subbase course.

C. Contractor shall verify compaction of the subgrade is in general conformance with the construction documents prior to placing subbase materials.

D. Once the Contractor has confirmed the subgrade conditions are in general conformance with the requirements in the construction documents, the Contractor shall begin installing the subbase material. By initiating installation of the subbase material, the Contractor acknowledges acceptance of the subgrade.

3.2 INSTALLATION OF SUBBASE AND BASE COURSES

A. Keep the area where the pavement is to be constructed free from sediment during the entire job. Any materials contaminated with sediment shall be removed and replaced with clean material.

B. Install membrane liner and geotextiles in accordance with the manufacturer's recommendations and as shown on the Drawings. Allow for enough membrane liner to exceed the final elevation of the surface. After completion of the surface, the excess liner should be cut flush with the finished grade. Membrane lines shall be welded together and boots installed around all protrusions.]

C. Install geotextiles as required in accordance with the specifications and drawings. The geotextile is applied to the bottom and sides of the excavation with overlapping joints a minimum of 12 inches. Overlaps to be constructed to "shingle" moisture from upstream panel to downstream panel. Allow for enough geotextile to exceed the final elevation of the surface. After completion of the surface, the excess geotextile should be cut flush with the finished grade.]

D. Install the subbase course and base course at the thicknesses, compaction rates, surface tolerances, and elevations outlined below.
   1. Place and spread the first layer of subbase without displacing or damaging the geosynthetics (if used). To prevent damage, tracked vehicles shall not be allowed directly on the geotextiles or geomembranes during the initial spreading process of the subbase layer.
   2. The aggregate should be spread and compacted in uniform layers not exceeding 6-inch loose thickness. Compaction is performed using either a 10 T (10 ton) vibratory roller or a minimum 13,500 lb-f centrifugal force reversible vibratory plate compactor. For each lift, make at least two passes in the vibratory mode and at least two passes in the static mode and continue compaction until there is no visible movement in the materials.
   3. At the specified elevation(s), install the pipe underdrains in accordance with the manufacturer's recommendations. Ensure the pipes are sloped to provide proper drainage to the outlets. Pipes shall be surrounded by a minimum of 3 inches of base course material to prevent damage during compaction. Care must be taken not to damage pipe underdrains during subsequent aggregate installation.
   4. Final subbase surface tolerance shall be plus or minus 0.1 ft over a 10-foot straight edge laid in any direction.
   5. Final base surface tolerance shall be plus or minus 3/4 inch over a 10-foot straight edge laid in any direction.
   6. Provide proper compaction near curbs, grade beams, concrete collars around utility structures, lights standards, tree wells, building edges and other protrusions as applicable to the project.

3.3 INSTALLATION OF EDGE RESTRAINTS

A. All concrete edge restraints shall be constructed to dimensions and grades in general conformance with the construction documents and shall be supported on a compacted base not less than 6-inch thick and meet the requirements of the Greenbook. All concrete shall be in accordance with ASTM C94 requirements.

3.4 INSTALLATION OF BEDDING COURSE, PAVERS, AND JOINT MATERIAL

A. Spread the bedding course evenly over the base course and screed to a nominal 2 in. thickness utilizing an approved mechanical spreader or by screed rails and boards. Do not use the bedding material to fill depressions in the base course surface. Surface tolerances shall be +/- 3/8 inch over a 10-foot straight edge.

B. Ensure that concrete pavers are free of foreign material before installation. Concrete pavers shall be inspected for color distribution and all chipped, damaged, or discolored concrete pavers shall be replaced. Initiation of concrete paver placement shall be deemed to represent acceptance of the pavers.

C. Lay the concrete pavers in the pattern(s) shown on the drawings. Maintain straight pattern lines. For mechanical installations, follow the stitching details as submitted and verified during the mock-up.

D. Paving units shall be installed simultaneously from a minimum of 3 bundles for hand installations, and 6 bundles for mechanical installations to provide proper color blending.

E. Joints between the individual concrete pavers shall be uniformly maintained and installed in accordance with the in-place dimensions

F. Fill gaps at the edges of the paved area with cut pavers or edge units. Do not install cut pavers smaller than one-third of a whole paver along edges subject to vehicular traffic – trim two pavers to fit.

G. Cut pavers using a masonry saw or splitting device. Upon completion of cutting, the area must be swept clean of all debris.

H. Using a low amplitude plate compactor capable of at least 5,000 lbs. (22 kN) compaction at a frequency of 75 Hz –100 Hz, compact and seat the concrete pavers into the bedding course.

I. The pavers shall be compacted to achieve consolidation of the bedding course and brought to level and profile by not less than three passes. Initial compaction should proceed as closely as possible following the installation of the paving units and prior to the acceptance of any traffic.

J. Any units that are structurally damaged during compaction shall be immediately removed and replaced.

K. Apply the joint material to the surface and sweep into the joints and voids. Fill joints and voids then sweep off excess material before vibrating the material down into the joints using a plate compactor. This will typically require two to three passes with the plate compactor.

L. Do not compact within 6 feet of unrestrained edges of the paving units.

M. All work to within 6 feet (1 m) of the laying face must be left fully compacted at the end of each day.

N. Sweep off excess aggregate when the job is complete.

3.5 AS-BUILT CONSTRUCTION TOLERANCES

A. Final inspection shall be conducted to verify conformance to the drawings after removal of excess aggregate. All pavements shall be finished to lines and levels to ensure positive drainage at all drainage outlets and channels.

B. The final surface elevations shall not deviate more than +/- 3/8 inch under a 10 ft long straight edge.

C. Lippage shall be no greater than 1/8-inch difference in height between adjacent pavers.

D. Bond lines for the pavers shall be +/- 1/2-inch over a 50-foot string ling.

E. Verify the in-situ surface infiltration rate of the permeable pavement is a minimum of 100 in/hour using ASTM C1781.

3.6 MAINTENANCE AND PROTECTION

A. At the completion of the work, the Contractor shall provide the Owner with the manufacturer’s PICP System Operation and Maintenance Guidelines.

B. The Contractor shall return to the site after 6 months from the completion of the work and conduct an inspection of the PICP System with the Owner in accordance with the PICP System Operation and Maintenance Guidelines.

END OF SECTION 321413

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 321723

PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Parking stripes, markings and accessibility symbols, as indicated.
2. Athletic court markings.
3. Playground markings.
4. Fire lane “No Parking.”
5. Curb marking and red curbs.

1.02 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings, indicating location, extent, color and texture of markings.

B. Material Samples: Submit color Samples.

1.03 PROJECT CONDITIONS

A. Do not install markings when adverse weather conditions are forecasted.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Paint: Water emulsion-based traffic paint must be approved by ELAC

1. Dunn Edwards
2. ICI Paints
3. Fine Line Paint Corporation
4. PAR Paint Company
5. Pervo Paint Company
6. Sherwin Williams
7. Vista Paint Corporation
8. Cal Western Paints

PART 3 - EXECUTION

3.01 PAVEMENT MARKINGS

A. Application of Paint:

1. Prior to application of paint, allow the pavement to properly cure. Clean and prepare in accordance with paint manufacturer's written recommendations.
2. Provide mechanical equipment to install paint in a uniform, straight or curved pattern, without holidays and other defects.
3. Do not permit traffic until paint has completely cured.
4. Install 2 coats in thickness recommended by manufacturer.
5. Playground Markings: Submit Samples to Architect for review. Limited color palettes may be submitted.

B. Marking Width and Color: Unless indicated otherwise, marking width and color are as follows:

Location	Width	Color
Parking stall lines	4 inches	White
Traffic markings		
Striping:	4 inches	Yellow
General	4 inches	Yellow
Disabled	4 inches	*Blue
Disabled emblem	2 inches	White on blue background
Athletic Court Lines:		
Letters and numbers:	2 inches	**White

* Pavement Markings:Painted lines and makings on pavement shall be 3” minimum wide and blue in color equal to Color No. 15090 per Federal Standard 595B. Parking spaces for the disabled shall be marked according to CBC Section 1129B.4. Tactile warning lines shall be in conformance to CBC Section 1133B.8.3 and 1133B.8.4.

**Where 2 sets of lines overlap, one set shall be white and the other set shall be yellow.

3.02 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.03 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 321726

TACTILE WARNING SURFACE

PART 1 - GENERAL

1.1 SUMMARY

A. Requirements for furnishing and installing surface applied detectable warning, in an inline dome pattern on curb ramps and walking surfaces.

B. Americans with Disabilities Act (ADA), California Building Code (CBC), Uniform Federal Accessibility Standards (UFAS).

1.2 SUBMITTALS

A. Product data for each specified product.

B. Material Test Reports: Submit test reports from qualified independent testing laboratory indicating that materials proposed for use are in compliance with requirements and meet the properties indicated. All test reports shall be conducted on a cast-in-place tactile panel system as certified by a qualified independent testing laboratory.

C. Maintenance Instructions: Submit copies of manufacturer's specified maintenance practices for each type of tactile tile and accessory as required.

D. Warranty Certificate.

1.3 INSTALLATION

A. Installed tiles shall be warranted for a minimum of five (5) years against failure of adhesives, fasteners and sealants.

1.4 PRODUCTS

A. Surface Applied Tiles: Acceptable Products:

1. "Armor-Tile" as manufactured by Engineered Plastics Inc.

2. ADA Solutions, Inc.: Surface Applied Composite Panel

3. Material: Vitrified Polymer Composite (VPC) with an ultra violet stabilized coating employing aluminum oxide particles in the truncated domes.

4. Tiles: ADA, UFAS, and CBC compliant. The tile shall incorporate an in-line dome pattern of UFAS truncated domes 0.2" in height, 0.9" diameter at the base, and 0.4" diameter at top of dome spaced 2.35" nominal as measured on a diagonal and 1.70" nominal as measured side by side. The tile shall have with twelve countersunk fastening

holes, and perimeter beveled edges. For wheelchair safety the field area shall consist of a non-slip surface with a minimum of 40 - 90º raised points 0.045” high, per square inch.

5. Color: Gray, colorfast, UV stabilized coating.

6. Size: 36”x48”x3/16” nominal.

B. Performance: Tiles shall meet or exceed the following criteria:

1. Water Absorption: 0.35% maximum, when tested in accordance with ASTM D570.

2. Slip Resistance: 0.90 minimum combined wet/ dry static coefficient of friction on top of domes and field area, when tested in accordance with ASTM C1028.

3. Compressive Strength: 18,000 psi minimum, when tested in accordance with ASTM D695.

4. Tensile Strength: 10,000 psi minimum, when tested in accordance with ASTM D638.

5. Flexural Strength: 24,000 psi minimum, when tested in accordance with ASTM C293.

6. Gardner Impact: 450 inch-pounds per inch minimum, when tested in accordance with Geometry “GE” of ASTM D5420.

7. Chemical Stain Resistance: No reaction to 1% hydrochloric acid, urine, calcium chloride, stamp pad ink, gum and red aerosol paint, when tested in accordance with ASTM D543.

8. Wear Depth: 0.03” maximum, after 1000 abrasion cycles of 40 grit Norton Metallite sandpaper, when tested in accordance with ASTM D2486-Modified.

9. Flame Spread: 25 maximum, when tested in accordance with ASTM E84.

10. Accelerated Weathering: No deterioration, fading or chalking for 2000 hours, when tested in accordance with ASTM D2565.

11. Tactile warning tiles adhered to concrete shall meet or exceed the following performance criteria:

12. Accelerated Aging and Freeze Thaw of Adhesive System: No cracking, delamination, warping, checking, blistering, color change, loosening, etc. when tested in accordance with ASTM D1037.

13. Salt and Spray Performance: No deterioration after 100 hours of exposure, when tested in accordance with ASTM B117.

C. Accessories:

1. Fasteners: Color matched, corrosion resistant, flat head drive anchor provided by manufacturer.

2. Adhesive:
   a. Armor Tile product: Armor Bond Urethane elastomeric adhesive as supplied with product.
   b. ADA Solutions product: Bostik Hydroment Ultra-Set Advanced and D-818 Adhesives.
3. Sealants:
   a. Armor Tile product: Armor Seal by Engineered Plastics.
   b. ADA Solutions product: Sonolastic NP1.

1.5 EXECUTION PREPARATION:

A. Transmit submittals and deliverables required by this Section.

B. Ensure substrates are in suitable condition to receive work of this Section.

1.6 INSTALLATION:

A. Work with the Contractor to ensure that the surfaces being prepared and fabricated to receive the tiles are constructed correctly and adequately for tile installation.

B. Surface Applied Tiles:

1. The surface to receive the detectable warning surface tile is to be mechanically cleaned with a diamond cup grinder or shot blaster to remove any dirt or foreign material.

2. Immediately prior to installing the detectable warning surface tile, the concrete surfaces must be inspected to ensure that they are clean, dry, free of voids, curing compounds, projections, loose material, dust, oil, grease, sealers and determined to be structurally sound with a minimum 30 day concrete cure period.

3. After wiping tile and concrete with acetone apply adhesive on the backside of the tile following the perimeter and internal cross pattern established by the tile manufacturer. Sufficient adhesive must be placed on the prescribed areas to have full coverage across the 2” width of the adhesive locator.

4. Set the tile true and square to the curb ramp area.

5. Drill holes true and straight to a depth of 3 1/2” using the recommended bit. The countersunk holes are located in the molded recess provided in the tile.

6. Mechanically fasten tiles to the concrete substrate using a dead blow / rubber mallet to set the drive anchors. Ensure the fastener has been set to full depth, straight and true. Care should be taken when setting the fastener to avoid any advertent blows with the hammer to the tile surface or overdriving the fastener.

7. Following the installation of the tiles, urethane elastomeric sealant should be applied to the perimeter edge. Tape all perimeter edges of the tile and adjoining substrate 1/2” apart to allow for tooling the sealant. Follow the manufacturer’s recommendations when applying

the sealant in a cove type profile to blend and seal the tile edge to the adjoining surfaces.

8. Do not allow foot traffic on installed tiles until the perimeter edge sealant has cured sufficiently to avoid tracking.

END OF SECTION 321726

SECTION 323100

FENCES AND GATES

PART 1 – GENERAL

1.01 DESCRIPTION

This section includes materials and installation of welded steel fence systems.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Olivenhain Municipal Water District Standard Specifications:

A. Section 01300 – Record Drawings and Submittals

B. Section 02200 – Earthwork

C. Section 03000 – Concrete

1.03 REFERENCE

A. American Society for Testing and Materials (ASTM)

1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.
3. ASTM D523 - Test Method for Specular Gloss. 0020
4. ASTM D714 - Test Method for Evaluating Degree of Blistering in Paint.
5. ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
6. ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
7. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
8. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
9. ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.
10. ASTM F2408 – Ornamental Fences Employing Galvanized Steel Tubular Pickets.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Section 01300.

B. Submit manufacturer’s descriptive catalog data and descriptive literature. Submit dimensional drawings.

C. Submit manufacturer's installation and maintenance data and dimensional drawings for gate operators.

1.05 QUALITY ASSURANCE

A. The contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and materials and techniques specified.

1.06 PRODUCT HANDLING AND STORAGE

A. Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

PART 2 – MATERIALS

2.01 MANUFACTURERS

Ameristar Fence Products, Inc., Tulsa, Oklahoma, or approved equal.

2.02 FENCE DESIGN

The manufacturer shall supply a total fence system consisting of Montage Plus® Genesis™. The system shall include all components (i.e., panels, posts, gates and hardware) required for a complete installation.

2.03 PANELS AND POSTS

Steel material for fence panels and posts shall conform to the requirements of ASTM A653/A653M, with a minimum yield strength of 45,000 psi (310 MPa) and a minimum zinc (hot-dip galvanized) coating weight of 0.60 oz/sf (184 g/square meter), Coating Designation G-60. A minimum of 62% of the steel material shall be derived from recycled scrap metal.

2.04 PICKETS

Material for pickets shall be 3/4" square x 17 Ga. tubing. The rails shall be steel channel, 1.5" x 1.4375" x 14 Ga. Picket holes in the rail shall be spaced 4.675" on center (o.c.). Fence posts and gate posts shall meet the minimum size requirements of Table 1. Fabricate guides of steel structural angles not less than 3/16-inch thick. Provide wind bars.

Table 1 – Minimum Sizes for Montage Plus Posts

Fence Posts	Panel Height
2-1/2" x 16 Ga.	Up to & Including 6' Height

	Gate Height	
Gate Leaf	Up to & Including 4'	Over 4' Up to & Including 6'

Up to 4’	2-1/2” x 14 Ga.	3” x 12 Ga.
4’1” to 6’	3” x 12Ga.	3” x 12 Ga.
6’1” to 8’	3” x 12 Ga.	4” x 12 Ga.

2.05 FABRICATION

A. Pickets, rails and posts shall be pre-cut to specified lengths. Rails shall be pre-punched to accept pickets.

B. Pickets shall be inserted into the pre-punched holes in the rails and shall be aligned to standard spacing using a specially calibrated alignment fixture. The aligned pickets and rails shall be joined at each picket-to-rail intersection by Ameristar’s proprietary fusion welding process, thus completing the rigid panel assembly (Note: The process produces a virtually seamless, spatter-free good-neighbor appearance, equally attractive from either side of the panel).

C. The manufactured panels and posts shall be subjected to an in-line electrode position coating (E-Coat) process consisting of a multi-stage pretreatment/wash (with zinc phosphate), followed by a duplex application of an epoxy primer and an acrylic topcoat. The minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils (0.058 mm). The color shall be Black. The coated panels and posts shall be capable of meeting the performance requirements for each quality characteristic shown in Table 2 (Note: The requirements in Table 2 meet or exceed the coating performance criteria of ASTM F2408).

Table 2 – Coating Performance Requirements

Quality Characteristics	ASTM Test Method	Performance Requirements
Adhesion	D3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117, D714 & D1654	Corrosion Resistance over 1,500 hours (Scribed per D1654; failure mode is accumulation of 1/8” coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625” ball).
Weathering Resistance	D822 D2244, D523 (60˚ Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

D. The manufactured fence system shall be capable of meeting the vertical load, horizontal load, and infill performance requirements for Industrial weight fences under ASTM F2408.

E. Gates shall be fabricated using fusion welded ornamental panel material and 1-3/4” sq. x 14 ga. gate ends. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding.

2.06 GATE OPERATORS

A. Gate operators shall conform to UL325 Installation Classification Class II.

B. Motors assemblies for operators shall consist of a single motor, 120V AC, 4 amp.

C. Manufacturers: Chamerlain Elite, or approved equal

1. Slide gate operators: SL3000UL
2. Swing gate operators: CSW200UL

PART 3 – EXECUTION

3.01 PREPARATION

A. All new installation shall be laid out by the contractor in accordance with the construction plans.

3.02 INSTALLATION

A. Fence post shall be spaced according to Table 3, plus or minus ½". For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels shall be attached to posts with brackets supplied by the manufacturer.

Table 3 – Montage Plus – Post Spacing By Bracket Type

Span	For CLASSIC, GENESIS, & MAJESTIC 8' Nominal (91.95" Rail)					
Post Size	2-1/2"	2-1/2"	2-1/2"	3"	2-1/2"	3"
Bracket Type	Montage Commercial Universal (BB112)	Montage Commercial Line Blvd. (BB114)	Montage Commercial Flat Mount (BB111)		Montage Commercial Swivel (BB113)*	
Post Settings ± ½" O.C.	95-1/2"	95-1/2"	95-1/2"	96"	*95-1/2"	*96"

*Note: When using BB113 swivel brackets on either or both ends of a panel installation, care must be taken to ensure the spacing between post and adjoining pickets meets applicable codes. This will require trimming one or both ends of the panel.

B. Posts shall be set in concrete footings having a minimum depth of 30". The "Earthwork" and "Concrete" sections of this specification shall govern material requirements for the concrete footer. Posts setting by other methods such as plated posts or core-drilled and grouted footings are permissible only if shown by calculations to provide equivalent strength as conventional footings.

3.03 FENCE INSTALLATION AND MAINTENANCE

A. When cutting/drilling rails or posts, adhere to the following steps to seal the exposed steel surfaces;

1. Remove all metal shavings and burrs from cut area.
2. Apply zinc-rich primer to thoroughly cover cut edge and/or drilled hole; let dry.
3. Apply 2 coats of custom finish paint matching fence color. Failure to seal exposed surfaces per steps 1-3 above will negate warranty. Ameristar spray cans or paint pens shall be used to prime and finish exposed surfaces; it is recommended that paint pens be used to prevent overspray. Use of non-Ameristar parts or components will void the manufactures' warranty.

3.04 GATE INSTALLATION

A. Gate posts shall be spaced according to the manufacturers' gate drawings and standard out-to-out gate leaf dimensions and gate hardware. Type and quantity of gate hinges shall be based on the application; weight, height, and number of gate cycles. The manufacturers' gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacture of the gate and shall be installed per manufacturer's recommendations.

B. All gates shall be adjusted for proper operation. Where gate operators are shown or specified, adjust gates to provide for proper functioning with gate operators.

3.05 CLEANING

A. The contractor shall remove excess or waste materials from the job site; post-hole excavations shall be scattered uniformly away from posts.

3.06 GATE OPERATORS

A. Gates shall be installed and adjusted to work freely in both directions prior to the installation of gate operators.

B. Concrete pads for gate operators shall be installed to the minimum dimensions shown on the Drawings or to the minimum dimensions shown on the manufacturer's installation drawings. Concrete for operator pads shall conform to the requirements of the OMWD Standard Specifications for structural concrete.

C. Gate operators shall be installed and adjusted in accordance with the manufacturer's installation specifications. Installation shall include all components of the gate operator system, including safety signage.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 323113

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Galvanized coated chain link fencing, gates and accessories

1.2 RELATED SECTIONS

A. Section 32 12 66, Asphalt Paving

B. Section 32 13 13, Concrete Paving

1.3 SUBMITTALS

A. Designer shall require appropriate samples, catalog cuts and shop drawings to assure compliance with approved plans.

PART 2 – PRODUCTS

2.1 STEEL FENCE FRAMING

A. Steel pipe – Type I: ASTM F 1083, standard weight schedule 40; minimum yield strength of 30,000 psi Hot-dipped galvanized with minimum average 1.8 oz/ft^2 of coated surface area.

B. Steel pipe – Type II: Cold formed and welded steel pipe complying with ASTM F 1043, Group IC, with minimum yield strength of 50,000 psi. Protective coating per ASTM F 1043, external coating Type B, zinc with organic overcoat, 0.9 oz/ft^2 minimum zinc coating with chromate conversion coating and verifiable polymer film. Internal coating Type B, minimum 0.9 oz/ft^2 zinc or Type D, zinc pigmented 81% nominal coating, minimum 3 mils thick.

C. Formed steel (“C”) sections: Roll formed steel shapes complying with ASTM F 1043, Group II 45,000 psi minimum yield strength steel. External coating per ASTM F 1043, type A, minimum average 2.0 oz/ft^2 of zinc per ASTM A 123, or 4.0 oz/ft^2 per ASTM A 525.

D. Steel square sections: Steel having minimum yield strength of 40,000 psi). Hot-dipped galvanized with minimum 1.8 oz/ft^2 of coated surface area.

E. End, corner, Line Posts and Rails and Braces to be sized to support fence as designed.

2.2 CHAIN LINK SWING GATES

A. Gate frames: Fabricate chain link swing gates in accordance with ASTM F 900 using galvanized steel tubular members, 2" square, weighing 2.60 lb/ft. Fusion or stainless steel welded connections forming rigid one-piece unit. Polyolefin coated frames (if used) must be thermally fused with minimum 10 miles per ASTM 1043 (after fabrication). Coating before fabrication will not be allowed. For gates over 8' high or 15' wide, provide minimum 1-1/12" square additional horizontal and vertical interior members to ensure proper strength.

B. Chain link fence fabric: Galvanized steel or poly coating thermally fused to metallic coated steel wire, ASTM F 668, Class 2b, mesh and gage to match fence. Install fabric with hook bolts and tension bars at all 4 sides (no substitution). Attach to gate frame at not more than 15" on center.

C. Hardware materials: Hot dipped galvanized steel or malleable iron shapes to suit gate size.

D. Hinges: Structurally capable of supporting gate leaf and allow opening and closing without binding. Non-lift-off type hinge design shall permit gate to swing 180 degrees inward or outward.

E. Latch: forked type capable of retaining gate in closed position and have provision for padlock. Latch shall permit operation from either side of gate.

F. Keeper: Provide keeper for each gate leaf over 5' wide. Gate keeper shall consist of mechanical device for securing free end of gate when in full open position.

G. Double gates; Provide drop rod to hold inactive leaf. Provide gate stop pipe to engage center drop rod. Provide locking device and padlock eyes as an integral part of latch, requiring one padlock for locking both gate leaves.

H. Barbed wire top (prohibited unless requested by State): Incorporate provisions for barbed extensions by extending vertical members 13" to accommodate three strands of barbed wire.

I. Gate posts: Steel pipe ASTM F 1083 standard weight schedule 40: minimum yield strength of 25,000 psi or Steel square sections (ASTM A 500, Grade B) having minimum yield strength of 40,000 psi. Hot-dipped galvanized with

minimum 1.8 oz/ft^2 of zinc or respective material finished in accordance with ASTM F 1043.

2.3 ACCESSORIES

A. Chain link fence accessories: Provide items required to complete fence system. Galvanize each ferrous metal item and finish to match framing. Fitting manufacturer shall match manufacturer of other metal components.

B. Post caps: Formed steel or cast malleable iron weather-tight closure cap for tubular posts. Provide one cap for each post. Cap to have provision for barbed wire when necessary. “C” shaped line post without top rail or barbed wire supporting arms do not require post caps. (Where top rail is used, provide tops to permit passage of top rail.)

C. Top rail and rail ends: Pressed steel per ASTM F626, for connection of rail and brace to terminal posts.

D. Top rail sleeves: 7” expansion sleeve with a minimum .137” wire diameter and 1.80” length spring, allowing for expansion and contraction of top rail.

E. Center Rails (for fabric height 12’ and over). Install mid rails between posts with fittings and accessories.

F. Wire ties: 9 gauge galvanized steel wire for attachment of fabric to line posts. Double wrap 13 gauge for rails and braces. Hog ring ties of 12-14/2 gauge for attachment.

G. brace and tension (stretcher bar) bands: Pressed steel, minimum 300 degree profile curvature for secure fence post attachment. At square post provide tension bar clips.

H. Tension (stretcher) bars: One piece lengths equal to 2 inches less than full height of fabric with a minimum cross-section of 3/16” x ¾”. Provide tension (stretcher) bars where chain link fabric meets terminal posts.

I. Tension wire: Galvanized coated 6 gauge steel wire with tensile strength of 75,000 psi.

J. Truss rods & tightener: Steel rods with minimum diameter of 5/16” capable of withstanding a tension of minimum 2,000 lbs.

K. Barbed wire prohibited.

L. Nuts and bolts are galvanized.

2.4 SETTING MATERIALS

A. Concrete: minimum 28 day compressive strength of 3,000 psi.

B. Drive Anchors: Galvanized angles, ASTM A 36 steel 1” x 1” x 30” galvanized shoe clamps to secure angles to posts.

PART 3 – EXECUTION

3.1 CHAIN LINK SWING GATE POST INSTALLATION

A. Install gate posts in accordance with manufacturer’s instructions.

B. Concrete set gate posts: Holes shall have diameter 4 times greater than outside dimension of post, and depths approximately 6” deeper than post bottom. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads. Set post bottom 36” below surface when in firm, undisturbed soil. Place concrete around posts in a continuous pour. Trowel finish around post and slope to direct water away from posts.

C. Gate posts and hardware: Set keeper, stops, sleeves into concrete. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.

3.2 CHAIN LINK FENCE FRAMING INSTALLATION

A. Install chain link fence in accordance with ASTM F 567 and manufacturer’s instructions.

B. Locate terminal post at each fence termination and change in horizontal or vertical direction of 30 degrees or more.

C. Bracing: Install horizontal pipe brace at mid-height for fences 6’ and over, on each side of terminal posts.

D. Tension wire: Provide tension wire at bottom of fabric and at top, if top rail is not specified.

E. Center Rails (for fabric height 12’ and over). Install mid rails between posts with fitting and accessories.

3.3 CHAIN LINK FABRIC INSTALLATION

A. Fabric: Install fabric on security side and attach so that fabric remains in tension after pulling force is released.

B. Tension (stretcher) bars: Pull fabric taut; thread tension bar through fabric and attach to terminal posts with bands or clips spaced maximum of 15” on center.

3.4 ACCESSORIES

A. Tie wires: Bend ends of wire to minimize hazard to persons and clothing.

B. Fasteners: Install nuts on side of fence opposite fabric side for added security.

C. Barbed wire: Prohibited unless requested by District.

D. Slats: Prohibited unless requested by District.

3.5 FENCES, GATES AND HARDWARE

A. Gates that are part of the accessible route shall meet all the requirements of an accessible door in compliance with CBC Section 11B-404

B. The lever of lever actuated latches or locks for an accessible gate shall be curved with a return to within ½” of the (face of) gate to prevent catching on the clothing or persons. California Referenced Standards code. T-24 Part 12, Section 12-10-202, Item (F).

C. Swing doors and gate surfaces within 10” of the finish floor or ground shall have a smooth surface on the push side extending the full width of the door or gate. Parts creating horizontal or vertical joints in these surfaces shall be within 1/16” of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plates shall be capped. CBC Section 11B-404.2.10

END OF SECTION 323113

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 328113

SOIL PREPARATION

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Provide and incorporate appropriate soil amendments and fertilizer, finish grading, plant pit backfill, finish mulching and all miscellaneous items.

1.2 REFERENCES

A. American Association of Nurserymen, 1250 Eye Street NW, Washington D.C. 20005, (202)-789-1900.

1. American Standard for Nursery Stock, ANSI-Z60.1
2. California Association of Nurserymen.

1.3 SUBMITTALS

A. Appropriate samples and analyses shall be provided to assure compliance with these specifications.

B. Soil Test and Analysis: A soil fertility test and report shall be provided by a qualified soils lab. Soil amendments shall be specified according to those recommendations. Soil samples for testing shall be collected of the existing soil conditions in sufficient numbers (not less than 6 from different representative locations of the site) to account for any soil variations that may be present on the site. At a minimum, the following shall be tested for complete soil evaluation:
   1. Soil Saturation percent
   2. Soil Texture
   3. Infiltration Rate
   4. pH, including sulfur or lime requirements
   5. Organic Matter
   6. Conductivity, Total Dissolved Salts and CEC
   7. Potassium, Sodium, Calcium, Magnesium, Nitrate and Phosphate

C. Appropriate documentation from installer to confirm to the State that specified materials and quantities have been delivered and installed, and that installer has complied with all local, state and federal documentation requirements.

1.4 SITE REVIEWS

A. Appropriate site reviews to assure compliance with these specifications shall be provided.

1.5 DELIVERY, STORAGE AND HANDLING

A. Assure that all materials are delivered, stored and handled in a legal manner, that containers are disposed of legally and that all reporting requirements are met.

1.6 QUALITY ASSURANCE

A. Appropriate site reviews to assure compliance with approved specifications shall be provided.

1.7 WARRANTY/GUARANTY

A. Designer shall require an appropriate maintenance and warranty period to meet the requirements of Section 01 78 36.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Import Topsoil: All import soil shall be free of harmful physical or chemical materials, roots, rocks or other debris larger than 2" in any direction, and any living weed material. Import topsoil shall not vary significantly from existing site topsoil.

B. Fertilizer: Fertilizer shall be provided at the rate indicated by the Soil Test and Analysis.
   1. Lime: Ground limestone, if required, containing not less than 85% carbonates: 50% passing 100 mesh sieve and 90% passing 20 mesh sieve.

C. Organic Amendments, if required: Treated wood or sawdust; pine sawdust derived from wood or pine. Organic amendment must meet the following specifications:

   1. Physical Properties:
      a. 95% - 100% passing, sieve size 6.35mm, (14');
      b. 80%-100% passing sieve size 2.38mm. (no.8 mesh);
      c. 0%-30% passing, sieve size 50 micron (no 35, 32 mesh)
   2. Chemical Properties:

a. Nitrogen content (dry weight basis): 0.4 %-0.6%: Iron content: minimum 0.8% dilute acid soluble Fe on dry weight basis.
b. Soluble salt; Maximum 3.5 millimhos/cm @ 25 C. as determined by saturation extract method
c. Ash: Maximum, 0.6%

D. Herbicides:

1. Contractor shall keep the disturbed area in a weed free condition by Contractor's choice of methods. If herbicides are used conform to all national, state, county and city reporting requirements.

E. Planter Mulch:

1. Mulch shall be screened wood chips, uniform color, clean and free of impurities. Maximum size 1 ¼". Recycled construction material is acceptable in outlying areas not directly adjacent to the building or turf use areas. Recycled materials may not be used in areas used by residents, staff or visitors unless specifically approved by the State based on submittal of a sample not smaller than 1 gallon.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clearing and scarifying: Installer shall install planting and irrigation on a clean site with positive drainage away from buildings and walks.

B. Rough grading: Created landforms shall be integrated into the existing site providing naturalized contouring to integrate newly graded areas with the natural topography.

C. Soil preparation and final grading shall not be conducted when soil is frozen, muddy or exceeds Field Capacity.

3.2 FERTILIZER AND AMMENDMENT PLACEMENT:

A. Fertilizer and amendments shall be installed per the manufacturer's published instructions including those instructions published by turf sod and seed vendors.

B. Amendments shall be tilled into the top 4" of soil.

C. Plant pits shall have no more than 50% nor less than 25% amendment in backfill.

D. Soil under the dripline of the oaks shall not receive fertilizer and shall not be tilled or cultivated. Organic or inorganic mulch may be applied under the dripline of the oaks.

3.3 FINISH GRADING:

A. Finish grade after installation of irrigation and planting shall maintain a minimum 2 percent slope away from buildings. Soil finish grades below finish grade of walks, pavements, and curbs shall be specified.

END OF SECTION 328113

SECTION 328400

LANDSCAPE IRRIGATION

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2. REQUIREMENTS:

A. All work and materials shall be in accordance with the uniform plumbing code published by the Western Plumbing officials association, all state and local codes and regulations. Should the construction documents or instructions be at variance with the aforementioned rules and regulations, notify the municipal water district and await their instructions before proceeding with the work effected.

B. Manufacturer's directions: Manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturer or articles used in this contract furnish directions covering points not shown in the drawings and specifications.

C. Manufacturer's Warranties: Manufacturer's warranties shall not relieve liabilities under guarantee.

D. All work called for on the drawings by notes shall be furnished and installed whether or not specifically noted in the specifications. Do not willfully install the sprinkler system as indicated on the drawings when it is obvious in the field that unknown obstructions or grade differences exist that might not have been considered in the irrigation design, or if discrepancies in the construction details, legend, or specific notes are discovered. All such obstructions or discrepancies shall be brought to the attention of the Landscape Architect. In the event that this is not done, the Contractor shall assume full responsibility for the necessary revisions.

E. Due to the scale of drawings, it is not possible to indicate all offsets, fittings, sleeves, etc. which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all of his work and plan his work accordingly, furnishing such fittings, etc., as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting and architectural features.

1.3. PROTECTION AND DAMAGE:

A. Protect work and materials from damage during construction and storage. PVC pipe and fittings shall be protected from direct sunlight.

B. Assume all responsibility for damage to existing construction and restore to its original condition should damage occur as a result of this work.

C. Contractor shall securely cover openings into system and cover apparatuses, equipment, and appliances both before and after being set in place to prevent obstruction in the pipes and prevent breakage, misuse, or disfigurement of the apparatuses, equipment or appliances.

1.4. DESCRIPTION OF WORK:

A. The work consists of furnishing labor, tools, machinery, materials, and processes required to complete the sprinkler irrigation system described herein and shown on the drawings.

B. The intent of the drawings and specifications is to indicate and specify a complete sprinkler system, installed ready for use without further cost in labor or materials to the Owner.

1.5. QUALITY ASSURANCE:

A. Subcontract work to a single firm specializing in irrigation work. Contractor shall possess all licenses and permits required to perform the work of this contract including a C-27 landscaping license.

1.6. SUBMITTALS:

A. The Contractor shall furnish the articles, equipment, materials or processes specified by name in the drawings and specifications. No substitution will be allowed without prior written approval by the Landscape Architect, or the Owner's authorized representative.

B. The Contractor shall submit to the Landscape Architect catalog data and full descriptive literature for approval of items different than those specified.

C. Equipment or materials installed or furnished without the prior approval of the Landscape Architect may be rejected and the Contractor may be required to remove such materials from the site at his own expense.

D. Approval of any item, alternate or substitute indicates only that the product(s) apparently meet the requirements of the drawings and specifications on the basis of the information or samples submitted.

E. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranty shall only supplement the guarantee.

1.7. GUARANTEE:

A. Furnish guarantee in accordance with the General Conditions, for a period of one (1) year from the date of final acceptance - at the conclusion of the Maintenance Period - on complete water irrigation system, including non-settling of the backfill in trenches, which, if occurs, shall be corrected, including repairs and/or replacement of any material damaged thereby or there from.

B. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranty shall only supplement the guarantee.

PART 2 - PRODUCTS

2.1. MATERIALS:

A. Pressure Pipe: Comply with the following:

1. PVC Plastic Pressure Lines: For piping upstream of remote control valves and quick couplers. All two (2) inches and larger shall be Class 315 Polyvinyl Chloride (PVC) Simpson or approved equal. All one and one-half (1-1/2) inches and smaller shall be Type I, Grade 2, designated as PVC 1220, Schedule 40.

2. Non-pressure Pipe: (downstream from remote control valves): Comply with following:

B. Plastic Non-Pressure Lines: For piping downstream of remote control valves, Type 1, Grade 2 (Impact Modified), as designated as PVC 1220, Class 200, (SDR21), conforming to Commercial Standards CS256-63.

C. Polyethylene Non-Pressure Tubing: For piping downstream of remote control drip valves, conforming to ASTM D-2239 requirements for SIDR 19, NSF listed.

D. Pipe sleeves shall be PVC schedule 40.

E. Identification: Furnish plastic pipe continuously and permanently marked with following information: Manufacturer's name or trade mark, size, class and type of pipe, working pressure at 73.4 degrees F., and National Sanitation Foundation (NSF) rating.

F. Brass Pipe: Brass pipe shall be IPS Standard weight 125 pounds, 85% yellow brass.

G. Pipe Fittings and Connections: Comply with following:

2.2. FITTINGS AND CONNECTIONS:

A. Polyvinyl Chloride Pipe Fittings and Connections: Type II, Grade 1, Schedule 40, high impact molded fittings, manufactured from virgin compounds as specified for piping tapered socket or molded thread type, suitable for either solvent weld or screwed connections. Machine threaded fittings and plastic saddle and flange fittings are not acceptable. Furnish fittings permanently marked with following information: Nominal pipe size, type and schedule of material, and National Sanitation Foundation (NSF) seal of approval. PVC fitting shall conform to ASTM D2464 and D2466.

1. All PVC threaded nipples shall be standard weight Schedule 80 with molded threads and shall conform to ASTM D1785:

B. Compression Fittings shall be molded from UV-resistant ABS material and shall accept all polyethylene tubing sizes as specified on the plans providing a leak-free compression fit.

C. Brass Pipe Fittings and Connections: Standard 125 pound class 85% yellow brass fittings and connections.

D. For copper tubing, ANSI B 16.22 wrought copper or cast brass, recessed solder joint type fittings.

E. Flexible tubing shall be of line size IPS, PVC plastic barb adaptors securely held to heavy-duty PVC flex tubing, pressure rated to 150 pound minimum. Hunter or approved equal.

F. Triple Swing Assembly shall be made of hi-impact type II material with EPDM O'rings, pressured rated to 315 PSi. King Bros. or approved equal.

G. Solvent cements shall comply with ASTM D2564. Socket joints shall be made per recommended procedures for joining PVC plastic pipe and fittings with PVC solvent cement by the pipe and fitting manufacturer and procedures outlined in the Appendix of ASTM D2564.

H. Thread lubricant shall be Teflon ribbon-type, or approved equal, suitable for threaded installations as per manufacturer's recommendations.

2.3. VALVES: Manufacturer's standard, of type and size indicated, and as follows:

A. Remote control valves shall be of the manufacturer size, and type indicated on the plans. Valve shall be operable manually without electricity.

B. Quick coupler valves shall be of the manufacturer size, and type indicated on the plans.

1. Quick coupler key shall be of brass/bronze with a hose bib assembly.

Supply two (2) hose bib assemblies.

C. Ball and Gate valves shall be of the manufacturer size, and type indicated on the plans.

D. Manual control valves shall be of the manufacturer size, and type indicated on the plans.

2.4. SPRINKLER HEADS:

A. Sprinkler heads shall be of the types and sizes with diameter (or radius) of throw, pressure, nozzle discharge and/or other designations indicated on the drawings. All sprinkler heads of the same type and size shall be of the same manufacturer.

2.5. VALVE BOXES:

A. For remote control valves: green standard 12" nom. plastic valve box shall be manufactured by Carson, tan in color.

B. For electrical pull box, ball or gate valve: green 10" round diameter plastic valve box shall be manufactured by Carson, tan in color.

C. For drip assembly valve: green jumbo plastic valve box shall be manufactured by Carson, tan in color.

D. For multi-outlet drip emitter: green 6" diameter valve box shall be manufactured by Carson, tan in color.

2.6. CONCRETE THRUST BLOCK AND SUPPORTS:

A. All concrete work shall be 2,000 PSi minimum compressive strength at twenty-eight (28) days, 5 sack mix, tool finished on exposed surfaces.

2.7. AUTOMATIC CONTROL WIRE:

A. Electric wiring runs from Controller to the automatic control valves shall be solid, single conductor, copperwire, 4/64 in. insulation, 4/64 in. neoprene jacket, Style DB (Direct Burial) or equal, color code wires to each valve, common wire shall be black. (Except as noted on Drawings for City standard requirements). Wires shall conform to federal specification JC-30.

B. Provide check valves and/or anti-drain valves as required/needed to prevent drainage of irrigation water from sprinkler system due to changes in elevation.

PART 3 - EXECUTION

3.1. SYSTEM DESIGN:

A. All scaled dimensions are approximate. The Contractor shall check and verify all dimensions on the site prior to proceeding with work under this Contract.

B. The Contractor shall locate and mark all existing utilities such as power, telephone, domestic water, water, and tile drains. Extreme care shall be taken by the Contractor when excavating or working in these areas, and coordination and cooperation between the Owner's representative and the Contractor is required as the work progresses to the area. Contractor shall give 24 hours notice to representative as work progresses of underground utility areas. Contractor shall be responsible for damage to any utilities.

C. Should utilities not located or marked be found during excavation, the Contractor shall promptly notify the Owner and shall discontinue with work in the area, except for necessary emergency work, to repair or prevent damage until instructions are given to the Contractor by the Owner's representative.

D. Failure to notify the Owner of discovery of such utilities or damage thereto will result in the Contractor being liable for any and all damage caused to the utilities as a result of his actions.

E. The Contractor shall, before starting work on the sprinkler system, carefully note all finish grades in order to satisfy himself that he may proceed with the work, and to restore finish grades to original contours before completion.

F. The installation of all irrigation materials, including pipe, shall be coordinated with the landscape drawings to avoid interfering with the trees, shrubs, or other planting.

G. Lay out sprinkler heads and make any minor adjustments required due to difference between site and drawings. Any such deviations in layout shall be within the intent of the original drawings, and without additional cost to the Owner. When directed by the Owner, the layout shall be approved before installation.

H. Do not willfully install the irrigation system as indicated on the drawing when it is obvious in the field that previously unknown obstructions or grade differences exist, that might not have been considered in the engineering. Such obstructions or differences should be brought to the attention of the Landscape Architect.

I. Water Supply: The Contractor shall connect to the water source as indicated on the drawings. The Contractor shall verify static pressure as stated on the plans prior to beginning work. If static pressure or point of connection differ from that shown on the plans, the Contractor will promptly notify Landscape Architect before starting work.

J. Workmanship and Procedure: The routing of the pressure supply lines as indicated on the drawings is diagrammatic. Locate all pressure supply lines in planting areas. Cross perpendicular under pavement in a sleeve as described in these specifications.

3.2 INSTALLATION:

A. General: Unless otherwise indicated, comply with requirements of Uniform Plumbing Code.

1. Excavation of Trenches: Excavate trenches, prepare subgrade, and backfill to line and grade with sufficient room for pipe fittings, testing and inspecting operations. Do not backfill until the pipe system has been subjected to a hydrostatic test as specified.

2. Depth of Trench:

a. Polyvinyl Chloride Pressure Line	18" min.
b. Polyvinyl Chloride Non-Pressure Line	12" min.

3. Subsoil shall be free of all rocks over one (1) inch diameter, debris, and litter prior to use as backfill.

4. Repair any leaks and replace all defective pipe or fittings until lines meet test requirements. Do not cover any lines until they have been checked and approved for tightness, quality of workmanship and materials.

5. Backfill trenches, after approval of piping, with suitable and approved material, tamping soil around pipe and thoroughly compacting all trench fills until 90% compaction has been achieved.

6. Backfill material shall be an approved soil, free from rocks and clods. Provide backfill under, around and above top of pipe for PVC plastic pipe and brass piping.

7. Or backfill with sand if existing soil is very rocky. Check backfill detail to verify which backfill is indicated.

8. Backfill material shall be sand as indicated on the plans. Provide backfill under, around and above top of pipe for PVC plastic pipe and brass piping.

9. Pipes installed in common trench shall have a 4” minimum space between pipes.

B. Installation of Polyvinyl Chloride Pipe:

1. Because of the nature of plastic pipe and fittings, exercise caution in handling, loading and storing, to avoid damage.

2. The pipe and fittings shall be stored under cover until using, and shall be transported in a vehicle with a bed long enough to allow the length of pipe to lay flat so as not be subjected to undue bending or concentrated external load at any point.

3. Any pipe that has been dented or damaged shall be discarded unless such dent or damaged section is cut out and pipe rejoined with a coupling.

4. Trench depth shall be as specified above from the finish grade to the top of the pipe. The bottom of the trench shall be free of rocks, clods, and other sharp-edged objects.

5. Pipe ends and fittings shall be wiped with "MEK" primer, or approved equal, before welding solvent is applied. Welded joints shall be given a minimum of 15 minutes to set before moving or handling. All field cuts shall be beveled to remove burrs and excess material before fitting and gluing together.

6. Pipe shall be snaked from side-to-side of trench bottom to allow for expansion and contraction.

7. Center load pipe with small amount of backfill to prevent arching and slipping under pressure. Leave joints exposed for site observation during testing.

8. No water shall be permitted in the pipe until site observation has been completed and a period of at least 24 hours has elapsed for solvent weld setting and curing.

9. Plastic to metal joints shall be made with plastic male adapters, metal nipple hand tightened, plus one turn with a strap wrench.

10. All threaded Plastic to Plastic connections shall be assembled using Teflon tape.

11. Solvent-Weld Joints: Assemble per manufacturer's recommendations.

12. Pipe sleeve under existing or future paving shall be installed prior to paving or re-paving and shall extend 12” beyond each side of paving edge. Sleeve shall be a minimum of two times than pipe or wire bundle it encloses. Install only one pipe per sleeve.

C. Installation of Polyethylene Pipe:

1. Because of the nature of plastic pipe and fittings, exercise caution in handling, loading and storing to avoid damage.

2. Any pipe that has been damaged shall be discarded unless such dent or damaged section is cut out and pipe rejoined with a coupling.

3. Trench depth shall be as specified above from the finish grade to the top of the pipe. The bottom of the trench shall be free of rocks, clods and sharp-edged objects.

D. Remote Control Wiring:

1. Direct Burial Control Wire Sizes: As shown and specified herein before.

2. Provide one control wire and one common ground wire to service each valve in system. Provide 4 foot minimum expansion loop at each valve to permit removal and maintenance of valves.

3. Install control wires at least 12" below finish grade and minimum of 4" from any pipe or fittings except at terminal points. All wire shall follow the pressure main insofar as possible.

4. Install control wires and irrigation piping in common trenches wherever possible.

5. In case of damage to any common or control wire, contractor is to run an extra common and control wire on each leg of mainline to the farthest RCV back to the controller.

6. Control Wire Splices: Allow only on runs of more than 300-feet, splices as follows:

    a. Strip off minimum of 2-1/2" of insulation from each wire.
    b. Twist on Scotchlok electrical spring connector, minimum four complete turns.
    c. Seal connector in epoxy resin.
    d. Tape completed splice with Scotch 33 electrical tape.

7. Numbering and Tagging: Identify direct burial control wires from automatic valves to terminal strips of controller at terminal strip by tagging wire with number of connected valves.

E. Remote Control Valves:

1. Install remote control valves in locations approximately as shown on the drawings, with a cover of 8 inches minimum over top of flow control stem. Fit with plastic valve box and cover.

F. Valve Box:

1. Install valve boxes as shown on detail. Install no more than one valve per box. Valve boxes shall be located in shrubs areas wherever possible**.**

G. Sprinkler Heads:

1. All sprinkler heads shall be installed as per details shown**.**

2. Nozzle size of all heads shall be adjusted to suit any particular conditions of the area. This shall be done after the system has been thoroughly tested, immediately after written notification by the Landscape Architect to do so**.**

H. Quick Coupler Assembly:

1. Install all quick couplers as indicated on drawings. Set all valves plumb and true to finish grade and a maximum of 12 inches from paving, walks, headers or curbs, and as shown on plans and as directed**.**

I. Thrust Blocks and Footings:

1. Thrust blocks and footings shall be placed on ninety-percent (90%) minimum compacted or undisturbed subgrade. Construct to shapes specified and parallel to walkways. Tool finish exposed surface.

2. Backflow Preventer Enclosure shall be installed as shown on plans and per the manufacturer's requirements.

J. Check Valves:

1. Unless designed as an integral part of the irrigation head, anti-drain valves will be installed under every head. The anti-drain valve will be the same diameter as the riser and integral to the riser assembly.

3.3 FLUSHING AND TESTING OF SYSTEMS:

A. After piping and risers are in place, but prior to the installation of the sprinkler heads, a full head of water shall be used to flush out the system. After system is thoroughly flushed, cap all risers:

B. Testing:

1. General: Notify Landscape Architect in writing when testing will be conducted. Conduct tests in presence of Landscape Architect.

C. Pressure Test:

1. All pressure lines shall be tested under hydrostatic pressure of 125 lbs. per square inch and all non-pressure lines shall be tested under the existing static pressure and both be proven watertight. (Contractor to supply all equipment needed for testing.) .

2. Pressure shall be sustained in the lines for not less than four hours. If leaks develop, the joints shall be replaced and the test repeated until the entire system is proven watertight.

3. Tests shall be observed and approved by the Landscape Architect and/or Owner prior to backfill. Backfilling trenches prior to inspection will not be allowed and all prematurely filled trenches shall be subject to reopening as directed by the Landscape Architect.

D. Coverage Testing: Perform operational testing after hydrostatic testing is completed, backfill is in place, and sprinkler heads adjusted to final position:

1. After completion of landscape work, carefully adjust heads so they will be flush with lawn areas or not more than 1/2" above finish grade or top of mulch in groundcover area.

3.4 SITE OBSERVATION VISITS BY THE ARCHITECT:

A. In all cases where site observation visits of the irrigation system work is required and/or where portions of the work are specified to be performed under the direction and/or site observation of the Architect or his representative, the Contractor shall notify the Architect at least three (3) working days in advance of the time such site observation and/or direction is required:

B. Site observation will be required for the following parts of the work:

1. Upon installation and testing of main lines and lateral lines; when pipes are laid and are to be submitted to pressure tests. Do not cover any lines until they have been checked and approved.

2. Upon installation and testing of valves, quick couplers, devices, automatic controllers, and control valves and wires.

3. When the sprinkler system is completed prior to planting, the Contractor, in the presence of the Architect, shall perform a coverage test to determine if the coverage of water afforded the lawn and planting areas is complete and adequate. The Contractor shall furnish all materials and perform all work required to correct any inadequacies.

4. Final site observation visit by the Architect and performance test shall be at the same time as the final site observation of the specified landscape maintenance period work.

3.5 RECORD DRAWINGS:

A. Before final acceptance of work, the Contractor shall provide a “redline” record set of drawings showing the sprinkler system work:

B. Any changes in location of items or type of installations from that shown on drawings shall be so indicated on the record drawings:

C. Valves shall be numbered and corresponding numbers shall be shown on the record drawings:

D. All remote control valves, shut-off valves, quick coupler valves shall be located by measured dimensions. Dimensions shall be given to permanent objects and shall be to the nearest one-half foot:

E. On the inside surface of the cover of each Automatic Controller, prepare and mount a color-coded chart showing the valves, mainline, and sprinkler heads serviced by that particular Controller. All valves shall be numbered to match the operation schedule and the drawings. Only those areas controlled by that Controller shall be shown. This chart shall be a plot plan, entire or partial, showing building, walks, roads and walls. A photostatic print of this plan, reduced as necessary and legible in all details, shall be made to a size that will fit into the Controller cover. This print shall be approved by the Landscape Architect and shall be hermetically sealed by plastic. This plan shall then be secured to the back of the enclosure door:

F. Immediately upon the installation of any buried pipe or equipment, the Contractor shall indicate on the drawings the locations of said equipment. Dimensions shall be given from permanent objects such as buildings, sidewalks, curbs and driveways:

END OF SECTION 328400

SECTION 329400

LANDSCAPE PLANTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUMMARY

A. This Section includes provisions for the following items:

1. Shrubs
2. Groundcover
3. Soil Amendments
4. Finish Grading
5. Maintenance Period

B. Related sections and reference documents: The following sections and reference documents contain requirements that relate to this section.

C. Underground sprinkler system is specified in Division 2 Section 329400, "Irrigation System."

D. Reference Documents:

1. American Joint Committee on Horticulture Nomenclature (AJCHN), standardized plant names, Latest Edition.
2. American Association of Nurserymen, Inc. (AAN), American Standard for Nursery Stock, Latest Edition.
3. Standard Specifications for Public Works Construction.
4. Agricultural Code of California.

1.3. QUALITY ASSURANCE

A. Subcontract landscape work to a single firm specializing in landscape work. The Contractor shall possess all licenses and permits required to perform the work including a C-27 landscaping license.

B. Source Quality Control:

1. General: Ship landscape materials with certificates of inspection required by governing authorities. Comply with regulations applicable to landscape materials.

2. Do not make substitutions. If specified landscape material is not obtainable, submit proof of non-availability to Landscape Architect, together with proposal for use of equivalent material.

3. Analysis and Standards: Package standard products with manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.

4. Shrubs, and Plants: Provide trees, shrubs, and plants of quantity, size, genus, species, and variety shown and scheduled for landscape work and complying with recommendations and requirements of ANSI Z60.1 "American Standard for Nursery Stock". Provide healthy, vigorous stock, grown in recognized nursery container sizes, in accordance with good horticultural practice and free of disease, insects, eggs, larvae, and defects such as knots, sun-scald, injuries, abrasions, or disfigurement.

5. Label each shrub with securely attached waterproof tag bearing legible designation of botanical and common name.

6. Where formal arrangements or consecutive order of trees or shrubs are shown, select stock for uniform height and spread, and label with number to assure symmetry in planting.

7. Selection: The Landscape Architect may check shrubs either at place of growth or at site before planting, for compliance with requirements for genus, species, variety, size, and quality. The Contractor shall submit photographs to Landscape Architect of typical trees (15 gal. and larger container sizes) for landscape work. Landscape Architect retains right to further check trees and shrubs for size and condition of root ball root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of work. Contractor shall remove rejected trees or shrubs immediately from project site upon request.

1.4. SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Plant and Material Certifications:

1. Certificates of inspection as required by local municipality and/or governmental authorities.

2. Manufacturer's or vendor's certified analysis for soil amendments and fertilizer materials.

3. Label data substantiating that plants, trees, shrubs and planting materials comply with specified requirements.

4. Seed vendor's certified statement for each seed mixtures required, stating botanical and common name, percentages by weight, and percentages of purity, germination, and weed seed for each seed species.

C. LEED Submittals:

1. Provide the overall cost of materials and separate cost breakout for materials that contribute to Materials and Resources credits on LEED Worksheets.

2. Credit MRc5 – Regional Materials: Materials extracted and manufactured within 500 miles of the project site are qualified as Regional Materials. Provide distance between the project and these sites.

3. Provide manufacturer literature verifying compliance with Regional Materials.

1.5. DELIVERY, STORAGE AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

B. Shrubs: Do not prune prior to delivery unless otherwise approved by Landscape Architect. Do not bend or bind-tie trees or shrubs in such manner as to damage bark, break branches, or destroy natural shape. Provide protective covering during delivery.

C. Do not remove container-grown stock from containers until planting time.

D. Contractor shall provide complete care to all on-site storage of container-grown stock. All container-grown stock found to be damage during storage shall be removed and replaced at no additional cost.

1.6. JOB CONDITIONS

A. Utilities: Determine location of underground utilities and perform work in a manner, which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.

B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Landscape Architect before planting.

1.7. SEQUENCING AND SCHEDULING

A. Planting Time: Proceed with, and complete landscape work as rapidly as portions of site become available, and shall be performed during those periods when weather and soil conditions are suitable in accordance with locally accepted horticultural practice.

B. Coordination with Groundcovers: Plant shrubs after final grades are established and prior to planting of groundcovers and lawns, unless otherwise acceptable by Landscape Architect. If planting of trees and shrubs occurs after groundcover and lawn work, protect groundcover and promptly repair damage to groundcovers and lawns resulting from planting operations.

1.8. SPECIAL PROJECT WARRANTY

A. Warranty groundcovers through specified maintenance period and until final acceptance.

B. Warranty shrubs for a period of 90 days after date of final acceptance.

C. Contractor shall remove and replace shrubs, or other plants found to be dead or in an unhealthy condition during warranty period. Make replacements within 14 calendar days. Replace trees and shrubs, which are in doubtful condition at end of warranty period; unless, in opinion of Landscape Architect, it is advisable to extend warranty period for a full growing season.

D. Another warranty site observation visit will be conducted at end of extended warranty period, if any, to determine acceptance or rejection. Replacement shall be the plants used for same kind and size as specified for landscape work. Replacements shall be furnished, and planted as originally specified by the contractor.

PART 2 – PRODUCTS

2.1 SOIL AMENDMENTS

A. Commercial Fertilizer: Complete fertilizer of neutral character, with some elements derived from organic sources and containing the following percentages of available plant nutrients:

1. Pre-plant Fertilizer: Provide fertilizer with not more than 6 percent total nitrogen; and not less than 20 percent available phosphoric acid and 20 percent soluble potash.

2. Post-plant Fertilizer: Provide fertilizer with percentage of nitrogen required to provide not less than 6 pounds of actual nitrogen, 2 percent phosphoric acid, 4 percent potassium, 5 percent Sulfur, 20% Humic Acids (from Leonardardite) and 75% Humate (Minerals/organic matter/carbon). Post-plant fertilizer shall be Tri-C 6-2-4 or approved equal.

3. Mycorrhizal Inoculum Paks, Tri-C Myo Paks

4. Iron Sulphate, iron shall be expressed as metallic-derived from sulfate-deep green ($FeSO_4 \cdot H_2O$) a minimum analysis of 200% and 98.3% retained on a 10 mesh screen.

5. Gypsum, agricultural grade gypsum shall be a ($CaSO_4 \cdot H_2O$) calcium sulfate 94.3%. 90% shall pass a 50 mesh screen.

6. Organic Soil Conditioner, shall be a product that aids the structure of the soil consisting of rapidly decaying slowly decaying, and non-decaying material. Nitrogen (organic or ammonic) 0.5% to 0.8%, pH between 5.5 to 6.5 salinity ($EC_e \times 10^3$ at 25° C) = 2.5, organic matter more than 87% (dry weight basis). The commercial grade product used shall be Numex Lif, Loamex, or Forest Humus or approved equal by Landscape Architect.

7. Soil Conditioner, granular, Tri-C Humate Plus, shall contain 25% Humic Acids. It shall be free flowing, suitable for application with approved equipment and shall contain the minimum available percentages of 7% calcium and 5% sulphur.

8. Planting Backfill, shall be a thoroughly blended mixture of excavated soil from the pits and soil amendments at the following mixture soil conditioner:

1)	Organic Soil Conditioner	50%
2)	On Site Soil	50%
3)	Soil Conditioner	8 lbs per cubic yard mix
4)	Pre-plant Fertilizer	2 lbs per cubic yard mix

2.2. PLANT MATERIALS

A. Quality: Provide trees, shrubs, and other plants of size, genus, species, and variety shown and scheduled for landscape work and complying with recommendations and requirements of ANSI Z60.1 "American Standard for Nursery Stock."

B. Container stock (1 gal., 5 gal., 15 gal.) shall have been grown in container for at least six months, but not over two years. No container plants that have cracked or broken balls of earth when taken from the container shall be planted, expect upon special approval. No trees with damaged roots or broken balls shall be planted.

C. Shrubs: Provide shrubs of the height and width shown or listed as required by ANSI Z60.1 for type and height of shrub required.

2.3. GROUNDCOVER MATERIALS

A. Bark Mulch: A 3-inch minus blend created from clean and landscape trimmings. Bark mulch shall be dark colored product recommended for mulching in shrub beds. Bark mulch shall be Plant Choice Brush Mulch, Organic Recycling West Brush Mulch, or AJ Ecology Ecohumus Compost or approved equal by Landscape Architect.

2.6 WEED CONTROL

A. Pre-planting herbicide: Roundup or equal

B. Pre-emergent weed control: Oxadiazon-2G-G, Treflan, Eptam, Vegitex, or equal, as recommended by licensed pest control applicator.

PART 3 – EXECUTION

3.1 PREPARATION – GENERAL

A. Lay out planting areas shall mean all areas to be planted with trees, shrubs, groundcovers and areas for multiple plantings. Stake locations and outline areas and secure Landscape Architect's acceptance before start of planting work. Make minor adjustments as may be required.

B. All rock and other growth or debris accumulated during the duration of the project shall be removed from the site. Upon completion of all grading operations, soil samples (3 locations min.) with identify reference shall be taken by the Contractor and analyzed by a soil laboratory. The results of these tests are to be reviewed by the Landscape Architect for any required modifications to specified soil preparation.

C. Grading and soil preparation work shall be performed only during the period when beneficial and optimum results may be obtained. If the moisture content of the soil should reach such a level that working it would destroy soil structure, spreading and grading operations shall be suspended until the moisture content is increased or reduced to acceptable levels and the desired results are likely to be obtained.

D. All scaled dimensions are approximate. Before proceeding with any work, carefully check and verify all dimensions and immediately inform the Landscape Architect of any discrepancy between the drawings and/or specifications and actual conditions.

E. Quantities for plant materials are shown for convenience only, and not guaranteed. Check and verify count and supply sufficient number to fulfill intent of drawings. Certify any clarifications with the Landscape Architect. Adequately stake, barricade, and protect all irrigation equipment, manholes, utility lines, and other existing property during all phases of the soil amending planting and grading operations.

F. Upon delivery of material and/or completion of all soil conditioning and grading but prior to initiating planting operations, the Landscape Architect with the heretofore specified signed copies of required certificates, trip slips, and invoices for soil preparation materials, shall invoice such material, comparing the total quantities of each material furnished against the total area to each operation. If the minimum rates of application have not been met, the Landscape Architect will require the distribution of additional quantities of these materials to fulfill the minimum application requirements specified at no cost to owner.

3.2 FINISH GRADING

A. Finish Grading: Finish grades shall be as indicated on the Civil Engineer's drawings and landscape drawings.

B. Finish grades shall be measured as the final water compacted and settled surface grades; and shall be within plus or minus 0.1 foot of the spot elevations and grade lines indicated on the drawing.

C. Finish grades shall be measured at the top surface of surface materials.

D. Molding and rounding of the grades shall be provided at all changes in slope.

E. All undulations and irregularities in the planting surfaces resulting from tillage, rototilling and all other operations shall be leveled and floated out before planting operations are initiated.

F. The Contractor shall take every precaution to protect and avoid damage to sprinkler heads, irrigation lines, and other underground utilities during his grading and conditioning operations.

G. Final finish grades shall insure positive drainage of the site with all surface drainage away from buildings, walls, and toward roadways, drains and catch basins.

H. Final grades shall be acceptable to the Landscape Architect before planting operations will be allowed to begin.

I. Planting surfaces shall be graded with no less than 2 percent surface slope for positive drainage unless otherwise noted on plans.

3.3 PREPARATION FOR SLOPE PLANTING

A. Soil Conditioning & Fertilizing: After the planting areas have been graded, apply soil amendments and initial fertilizers as specified.

B. Apply specified soil amendment and commercial fertilizer at rates specified.

C. "Schedule of planting soil mixture:

1. Iron Sulphate: 20 lbs per 1,000 sq. ft.

2. Gypsum: 120 lbs per 1,000 sq. ft.

3. Pre-Plant Fertilizer: 20 lbs per 1,000 sq. ft.

4. Schedule of Planting Soil Mixture is for bidding purposes only. Soil test may reduce or increase total soil amendment yardage. Adjustment (plus or minus) may be necessary. Contractor shall obtain at least three soil tests of final grade at site and submit results to Landscape Architect for interpretation and recommendation. Soil analysis services shall be provided by Sunland Analytical Labs and soil analysis kits are available by calling 800-927-3311. Contractor shall submit, in addition to his base bid; unit cost for each schedule of planting soil mixture.

3.4 DEEP WATERING AND WEED CONTROL:

A. After complete installation and testing of the irrigation system and preparation of planting areas, all planting areas shall be deep watered and compacted and settled by continuous application of irrigation water until the soil is moist to a minimum depth of 8".

B. Care shall be taken that the rate of application of water does not cause erosion or sloughing of soils.

C. All depressions, voids, erosion scars and settled trenches generated by the deep watering shall be filled with conditioned topsoil and brought to finish grade.

D. Weed Control:

1. Manually remove all existing weeds and grasses and remove from site.

2. Apply 200 lbs/acre commercial fertilizer to all planting areas. Irrigate 4 times per day during the summer season and 2 times per day during other seasons for 3 weeks to germinate seeds.

3. Discontinue irrigation for 2 days and apply a non-selective contact herbicide, per manufacturer's direction, to eradicate germinated weeds and grasses. Allow herbicide to kill weeds and grasses. Manually remove weeds and grasses from site. Minimize soil disturbance on sloped areas of the site.

4. If weeds and grasses still exist, irrigate 2 or 4 times per day, as above, for 2 weeks or until new growth appears. Reapply herbicide per manufacturer's direction. Allow herbicide to kill weeds and grasses. Manually remove weeds and grasses from the site.

5. No pre-emergent herbicide shall be used in landscape areas to be seeded.

6. Contractor shall obtain approval by the owner to apply any herbicide, insecticide, fungicide, or other chemicals to be used onsite. Contractor shall abide by all applicable governmental standards regulating the application of any chemicals, and shall follow all manufacturer's recommendations. All workers applying such chemicals shall be licensed if required by law.

3.5 EXCAVATION FOR SHRUBS

A. Container grown stock in cans shall be cut on two sides with an approved can cutter. Stock grown in boxes shall have bottoms removed. All used containers shall be removed to the storage areas or from the site. Each tree and shrub shall be placed in the center of the hole and shall be set plumb, remove sides of boxes where required, and held rigidly in position until the planting backfill has been tamped from around each root ball.

B. For container grown stock, excavate as specified for size of container width and depth.

C. Dispose of excess subsoil removed from planting excavations.

D. Fill excavations for trees and shrubs with water and allow water to percolate out prior to planting.

3.6 PLANTING SHRUBS

A. Set container grown stock as specified, cut cans on 2 sides with an approved can cutter; remove bottoms of wooden boxes after partial backfilling so as not to damage root balls. All used containers shall be removed to the storage areas or from the site. Each tree and shrub shall be placed in the center of the hole and shall be set plumb and held rigidly in position until the planting backfill has been tamped from around each root ball.

B. All plants shall be set at such a level that after settling, they bear the same relationship to the surrounding finish grade as they bore to the soil line grade in the container.

C. Planting paks shall be placed in each shrub planting hole at the following rate:

1. 1-pak per 1 gallon container.
2. 3-paks per 5 gallon container.
3. 8-paks per 15 gallon container.

D. No plant will be accepted if the root ball is broken or cracked; either before, during or after the process of installation.

E. Water basin shall be formed around each tree and shrub per detail. All plants shall be thoroughly watered into the full depth of each plant hole immediately after planting.

F. Prune, thin out, and shape trees and shrubs in accordance with standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed by Landscape Architect, do not cut tree leaders, and remove only injured or dead branches from flowering trees, if any. Prune trees and shrubs to retain natural character.

G. Remove and replace excessively pruned or malformed stock resulting from improper pruning.

3.7 PLACEMENT OF BARK MULCH

A. Bark mulch shall be spread evenly throughout shrub beds as indicated on the plans. Contractor shall subgrade area adjacent to paving so that bark mulch will be flush with top of adjacent edge of paving. Provide not less than following thickness of bark mulch in planting areas specified.Provide a 3-inch thickness of bark mulch.

3.8 POST FERTILIZATION

A. Post Fertilization for all lawn and ground cover areas (Tri-C 6-2-4) shall occur 45 days after planting at a rate of 10 lbs. per 1,000 sq. ft.

B. Post Fertilization for all shrubs and trees (Tri-C 6-2-4) shall occur 45 days after planting at a rate of 10 lbs. per 1,000 sq. ft.:

C. Shrubs: Sprinkle ¼ cup evenly around dripline and work into top 1 inch of soil.

3.9 MAINTENANCE PERIOD

A. The Maintenance Period begins on the first day after all landscape and irrigation work and all other indicated or specified work on this project is complete, checked, accepted and written approval from the Landscape Architect is given to begin the Maintenance Period.

B. The Contractor shall continuously maintain all involved areas of the Contract during the progress of the work and during the Maintenance Period until the Final Acceptance of the work.

C. Regular planting maintenance operations shall begin immediately after each plant or lawn is planted. Plants and lawns shall be kept in a healthy, growing condition and in a visually pleasing appearance by watering, pruning, mowing, rolling, trimming, edging, fertilizing, re-staking, pest and disease control, spraying, weeding, cleaning-up and any other necessary operation.

D. The maintenance period shall continue until final acceptance, but under no circumstances less than following period:

E. 90 days after substantial completion of planting.

F. The Contract completion date of the Contract Maintenance Period will be extended when in the opinion of the Landscape Architect, improper maintenance and/or possible poor or unhealthy condition of planted material or unestablished, non-covering lawns are evident at the termination of the scheduled Maintenance Period. The Contractor shall be responsible for additional maintenance of the work at no change in Contract price until all of the work is completed and acceptable.

G. The Contractor shall be responsible for maintaining adequate protection of the areas. Damaged areas shall be repaired immediately at the Contractor's expense.

H. Maintain shrubs, and other plants by pruning, cultivating, and weeding as required for healthy growth. Restore planting water basins. Tighten and repair stake and guy supports and reset trees and shrubs to proper grades or vertical position as required. Spray as required to keep trees and shrubs free of insects and disease.

I. Permanent post construction BMP devices shall not be removed or modified without the approval of the Landscape Architect.

3.10 CLEANUP AND PROTECTION

A. During landscape work, keep pavements clean and work area in an orderly condition.

B. Protect landscape work and materials from damage due to landscape operations, operations by other Contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

C. Contractor shall provide and incorporated all Best Management Practices (BMP), Storm Water Pollution Prevention Plan (SWPPP) and erosion and sediment control as described in the project conditions or required by local and state requirement.

3.11 SITE OBSERVATION VISITS:

A. Site observation visits herein specified shall be made by the Landscape Architect. The Contractor shall request site observation a minimum of 24 hours in advance.

B. Site observation will be required for the following parts of the work:

1. Incorporation of soil conditioner and fertilizer into the soil

2. Upon completion of finish grading prior to planting

3. Approval of plant materials

4. When trees and shrubs are spotted in place for planting, but before planting holes are excavated.

5. When planting, and all other indicated or specified work, except the Maintenance Period, has been completed. Acceptance and written approval shall establish beginning of the Maintenance Period.

6. Final site observation visit at the completion of the Maintenance Period. This site observation visit shall establish the beginning date for the warranty period of plant material.

C. Acceptance: Upon completion of the final site observation visit and the work of this section, the Contractor will be notified in writing (1) whether the work is acceptable; (2) of any requirements necessary for completion and acceptance.

D. This Contractor or his authorized representative shall be onsite at the time of each site observation visit by the Landscape Architect.

END OF SECTION 329400

THIS PAGE INTENTIONALLY LEFT BLANK.

APPENDIX A

STORM WATER POLLUTION PREVENTION PLAN

STORMWATER POLLUTION PREVENTION PLAN

Olivenhain Municipal Water District -
New and Remodeled Operations & Administration Facilities
Project ID: SDP 16-07 / GR2017-0019
WDID: _____

Prepared for:

Olivenhain Municipal Water District

Legally Responsible Person (LRP):

Olivenhain Municipal Water District
1966 Olivenhain Road, Encinitas, CA 92024
Tel. (760) 753-6466

Approved Signatory:

Approved Signatory designated by LRP: _____
Tel. (760) 753-6466

Project Address:

1966 Olivenhain Road, Encinitas, CA 92024

SWPPP Prepared by:

Infrastructure Engineering Corporation
14271 Danielson Street, Poway, CA 92064
David Padilla, P.E. 55974, QSD: 00875

SWPPP Preparation Date

January 2, 2018

Estimated Project Dates:

Start of Construction: June 2018 Completion of Construction: February 2020

Table of Contents

Table of Contents ..... **i**
Qualified SWPPP Developer **1**
Legally Responsible Person **3**
Amendment Log **4**
Section 1 SWPPP Requirements **5**
1.1 Introduction 5
1.2 Permit Registration Documents 5
1.3 SWPPP Availability and Implementation 6
1.4 SWPPP Amendments 6
1.5 Retention of Records 7
1.6 Required Non-Compliance Reporting 7
1.7 Annual Report 8
1.8 Changes to Permit Coverage 8
1.9 Notice of Termination 8
Section 2 Project Information **9**
2.1 Project and Site Description 9
2.1.1 Site Description 9
2.1.2 Existing Conditions 9
2.1.3 Existing Drainage 9
2.1.4 Geology and Groundwater 10
2.1.5 Project Description 10
2.1.6 Developed Condition 10
2.2 Permits and Governing Documents 11
2.3 Stormwater Run-On from Offsite Areas 11
2.4 Findings of the Construction Site Sediment and Receiving Water Risk Determination 12
2.5 Construction Schedule 13
2.6 Potential Construction Activity and Pollutant Sources 13
2.7 Identification of Non-Stormwater Discharges 13
2.8 Required Site Map Information 15
Section 3 Best Management Practices **16**

3.1 Schedule for BMP Implementation 16
3.2 Erosion and Sediment Control 17
3.2.1 Erosion Control 18
3.2.2 Sediment Controls 21
3.3 Non-Stormwater Controls and Waste and Materials Management 24
3.3.1 Non-Stormwater Controls 24
3.3.2 Materials Management and Waste Management 27
3.4 Post construction Stormwater Management Measures 30
Section 4 BMP Inspection, Maintenance, and Rain Event Action Plans 31
4.1 BMP Inspection and Maintenance 31
4.2 Rain Event Action Plans 31
Section 5 Training 32
Section 6 Responsible Parties and Operators 33
6.1 Responsible Parties 33
6.2 Contractor List 33
Section 7 Construction Site Monitoring Program 34
7.1 Purpose 34
7.2 Applicability of Permit Requirements 34
7.3. Weather and Rain Event Tracking 35
7.3.1 Weather Tracking 35
7.3.2 Rain Gauges 35
7.4 Monitoring Locations 35
7.5 Safety and Monitoring Exemptions 35
7.6 Visual Monitoring 36
7.6.1 Routine Observations and Inspections 37
7.6.1.1 Routine BMP Inspections 37
7.6.1.2 Non-Stormwater Discharge Observations 37
7.6.2 Rain-Event Triggered Observations and Inspections 38
7.6.2.1 Visual Observations Prior to a Forecasted Qualifying Rain Event 38
7.6.2.2 BMP Inspections during an Extended Storm Event 38
7.6.2.3 Visual Observations Following a Qualifying Rain Event 38
7.6.3 Visual Monitoring Procedures 39

7.6.4 Visual Monitoring Follow-Up and Reporting 39
7.6.5 Visual Monitoring Locations 39
7.7 Water Quality Sampling and Analysis 40
7.7.1 Sampling and Analysis Plan for Non-Visible Pollutants in Stormwater Runoff Discharges 40
7.7.1.1 Sampling Schedule 40
7.7.1.2 Sampling Locations 41
7.7.1.3 Monitoring Preparation 41
7.7.1.4 Analytical Constituents 42
7.7.1.5 Sample Collection 45
7.7.1.6 Sample Analysis 45
7.7.1.7 Data Evaluation and Reporting 47
7.7.2 Sampling and Analysis Plan for pH and Turbidity in Stormwater Runoff Discharges 47
7.7.3 Sampling and Analysis Plan for pH, Turbidity, and SSC in Receiving Water 47
7.7.4 Sampling and Analysis Plan for Non-Stormwater Discharges 47
7.7.5 Sampling and Analysis Plan for Other Pollutants Required by the Regional Water Board 49
7.7.6 Training of Sampling Personnel 49
7.7.7 Sample Collection and Handling 49
7.7.7.1 Sample Collection 49
7.7.7.2 Sample Handling 50
7.7.7.3 Sample Documentation Procedures 51
7.8 Active Treatment System Monitoring 52
7.9 Bioassessment Monitoring 52
7.10 Watershed Monitoring Option 52
7.11 Quality Assurance and Quality Control 52
7.11.1 Field Logs 52
7.11.2 Clean Sampling Techniques 52
7.11.3 Chain of Custody 53
7.11.4 QA/QC Samples 53
7.11.4.1 Field Duplicates 53
7.11.4.2 Equipment Blanks 53

7.11.4.3 Field Blanks 53
7.11.4.4 Travel Blanks 54
7.11.5 Data Verification 54
7.12 Records Retention 55
CSMP Attachment 1: Weather Reports 56
CSMP Attachment 2: Monitoring Records 58
CSMP Attachment 3: Example Forms 60
CSMP Attachment 4: Field Meter Instructions 70
CSMP Attachment 5: Supplemental Information 72
Section 8 References 74
Appendix A: Calculations
Appendix B: Site Maps
Appendix C: Permit Registration Documents
Appendix D: SWPPP Amendment Certifications
Appendix E: Submitted Changes to PRDs
Appendix F: Construction Schedule
Appendix G: Construction Activities, Materials Used, and Associated Pollutants
Appendix H: Contractors and Subcontractors
Appendix I: BMP Inspection Form
Appendix J: Project Specific Rain Event Action Plan Template
Appendix K: Training Reporting Form
Appendix L: Responsible Parties
Appendix M: CASQA Stormwater BMP Handbook Portal: Construction Fact Sheets
Appendix N: Construction General Permit

Qualified SWPPP Developer

Approval and Certification of the Stormwater Pollution Prevention Plan

Project Name:	Olivenhain Municipal Water District - New and Remodeled Operations & Administration Facilities
Project Number/ID:	SDP 16-07 / GR2017-0019

"This Stormwater Pollution Prevention Plan and Attachments were prepared under my direction to meet the requirements of the California Construction General Permit (SWRCB Order No. 2009-009-DWQ as amended by Order 2010-0014-DWQ and Order 2012-0006-DWQ). I certify that I am a Qualified SWPPP Developer in good standing as of the date signed below."

QSD Signature	*Date*
David Padilla	00875
QSD Name	*QSD Certificate Number*
Project Engineer	858-413-2400
Title and Affiliation	*Telephone No.*
dpadilla@iecorporation.com	
Email	

(Attach copy of QSD certification)

Legally Responsible Person

Approval and Certification of the Stormwater Pollution Prevention Plan

Project Name: Olivenhain Municipal Water District - New and Remodeled Operations & Administration Facilities

Project Number/ID: SDP 16-07 / GR2017-0019

"I certify under penalty of law that this document and all Attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, to the best of my knowledge and belief, the information submitted is, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Olivenhain Municipal Water District
Legally Responsible Person

Signature of Authorized Representative of Legally Responsible Person/Approved Signatory	Date
Name of Authorized Representative of Legally Responsible Person/Approved Signatory	(760) 753-6466 Telephone No.

Amendment Log

Project Name: Olivenhain Municipal Water District - New and Remodeled Operations & Administration Facilities

Project Number/ID: SDP 16-07 / GR2017-0019

Amendment No.	Date	Brief Description of Amendment (include section and page number)	Prepared and Approved By
			Name: QSD#
			Name: QSD#
			Name: QSD#
			Name: QSD#
			Name: QSD#
			Name: QSD#
			Name: QSD#

Section 1 SWPPP Requirements

1.1 INTRODUCTION

The New and Remodeled Operations & Maintenance Facilities project comprises approximately 2.2 acres and is located at 1966 Olivenhain Road in Encinitas, California. The property is owned by the Olivenhain Municipal Water District and is being developed by the Olivenhain Municipal Water District. The project location is shown on the Site Map in Appendix B.

This Stormwater Pollution Prevention Plan (SWPPP) is designed to comply with California's General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities (General Permit) Order No. 2009-0009-DWQ as amended in 2010 and 2012 (NPDES No. CAS000002) issued by the State Water Resources Control Board (State Water Board). This SWPPP has been prepared following the SWPPP Template provided on the California Stormwater Quality Association Stormwater *Best Management Practice Handbook Portal: Construction* (CASQA, 2012). In accordance with the General Permit, Section XIV, this SWPPP is designed to address the following:

- Pollutants and their sources, including sources of sediment associated with construction, construction site erosion and other activities associated with construction activity are controlled;
- Where not otherwise required to be under a Regional Water Quality Control Board (Regional Water Board) permit, all non-stormwater discharges are identified and either eliminated, controlled, or treated;
- Site BMPs are effective and result in the reduction or elimination of pollutants in stormwater discharges and authorized non-stormwater discharges from construction activity to the Best Available Technology/Best Control Technology (BAT/BCT) standard;
- Calculations and design details, as well as BMP controls, are complete and correct. Calculations are included in Appendix A.

1.2 PERMIT REGISTRATION DOCUMENTS

Required Permit Registration Documents (PRDs) shall be submitted to the State Water Board via the Stormwater Multi Application and Report Tracking System (SMARTS) by the Legally Responsible Person (LRP), or authorized personnel (i.e., Approved Signatory) under the direction of the LRP. The project-specific PRDs include:

1. Notice of Intent (NOI);
2. Risk Assessment (Construction Site Sediment and Receiving Water Risk Determination);
3. Site Map;
4. Annual Fee;
5. Signed Certification Statement (LRP Certification is provided electronically with SMARTS PRD submittal); and
6. SWPPP.

A copy of the submitted PRDs shall also be kept in Appendix C along with the Waste Discharge Identification (WDID) confirmation.

1.3 SWPPP AVAILABILITY AND IMPLEMENTATION

The discharger shall make the SWPPP available at the construction site during working hours (see Section 7.5 of CSMP for working hours) while construction is occurring and shall be made available upon request by a State or Municipal inspector. When the original SWPPP is retained by a crewmember in a construction vehicle and is not currently at the construction site, current copies of the BMPs and map/drawing will be left with the field crew and the original SWPPP shall be made available via a request by radio/telephone. (CGP Section XIV.C)

The SWPPP shall be implemented concurrently with the start of ground disturbing activities.

1.4 SWPPP AMENDMENTS

The SWPPP should be revised:

- If there is a General Permit violation.
- When there is a reduction or increase in total disturbed acreage (General Permit Section II Part C).
- BMPs do not meet the objectives of reducing or eliminating pollutants in stormwater discharges.

Additionally, the SWPPP shall be amended:

- If there is a change in construction or operations which may affect the discharge of pollutants to surface waters, groundwater(s), or a municipal separate storm sewer system (MS4);
- When there is a change in the project duration that changes the project's risk level; or
- When deemed necessary by the QSD. The QSD has determined that the changes listed in Table 1.1 can be field determined by the QSP. All other changes shall be made by the QSD as formal amendments to the SWPPP.

The following items shall be included in each amendment:

- Who requested the amendment;
- The location of proposed change;
- The reason for change;
- The original BMP proposed, if any; and
- The new BMP proposed.

Amendment shall be logged at the front of the SWPPP and certification kept in Appendix D. The SWPPP text shall be revised replaced, and/or hand annotated as necessary to properly convey the amendment. SWPPP amendments must be made by a QSD. The following changes have been designated by the QSD as "to be field determined" and constitute minor changes that the QSP may implement based on field conditions.

Table 1.1 List of Changes to be Field Determined

Candidate changes for field location or determination by QSP[(1)]	Check changes that can be field located or field determined by QSP
Increase quantity of an Erosion or Sediment Control Measure	*X*
Relocate/Add stockpiles or stored materials	*X*
Relocate or add toilets	*X*
Relocate vehicle storage and/or fueling locations	*X*
Relocate areas for waste storage	*X*
Relocate water storage and/or water transfer location	*X*
Changes to access points (entrance/exits)	
Change type of Erosion or Sediment Control Measure	*X*
Changes to location of erosion or sediment control	*X*
Minor changes to schedule or phases	*X*
Changes in construction materials	*X*
(1) Any field changes not identified for field location or field determination by QSP must be approved by QSD	

1.5 RETENTION OF RECORDS

Paper or electronic records of documents required by this SWPPP shall be retained for a minimum of three years from the date generated or date submitted, whichever is later, for the following items:

- Refer to the General Permit, Attachment C, Section I.9 for records retention requirements.

These records shall be available at the Site until construction is complete. Records assisting in the determination of compliance with the General Permit shall be made available within a reasonable time, to the Regional Water Board, State Water Board or U.S. Environmental Protection Agency (EPA) upon request. Requests by the Regional Water Board for retention of records for a period longer than three years shall be adhered to.

1.6 REQUIRED NON-COMPLIANCE REPORTING

If a General Permit discharge violation occurs, the QSP shall immediately notify the LRP. The LRP shall include information on the violation with the Annual Report. Corrective measures will be implemented immediately following identification of the discharge or written notice of non-compliance from the Regional Water Board. Discharges and corrective actions must be documented and include the following items:

- The date, time, location, nature of operation and type of unauthorized discharge.

- The cause or nature of the notice or order.
- The control measures (BMPs) deployed before the discharge event, or prior to receiving notice or order.
- The date of deployment and type of control measures (BMPs) deployed after the discharge event, or after receiving the notice or order, including additional measures installed or planned to reduce or prevent re-occurrence.

1.7 ANNUAL REPORT

The General Permit requires that permittees prepare, certify, and electronically submit an Annual Report no later than September 1st of each year. Reporting requirements are identified in Section XVI of the General Permit. Annual reports will be filed in SMARTS and in accordance with information required by the on-line forms.

1.8 CHANGES TO PERMIT COVERAGE

The General Permit allows for the reduction or increase of the total acreage covered under the General Permit when: a portion of the project is complete and/or conditions for termination of coverage have been met; when ownership of a portion of the project is purchased by a different entity; or when new acreage is added to the project.

Modified PRDs shall be filed electronically within 30 days of a reduction or increase in total disturbed area if a change in permit covered acreage is to be sought. The SWPPP shall be modified appropriately, shall be logged at the front of the SWPPP and certification of SWPPP amendments are to be kept in Appendix D. Updated PRDs submitted electronically via SMARTS can be found in Appendix E.

1.9 NOTICE OF TERMINATION

A Notice of Termination (NOT) must be submitted electronically by the LRP via SMARTS to terminate coverage under the General Permit. The NOT must include a final Site Map and representative photographs of the project site that demonstrate final stabilization has been achieved. The NOT shall be submitted within 90 days of completion of construction. The Regional Water Board will consider a construction site complete when the conditions of the General Permit, Section II.D have been met.

Section 2 Project Information

2.1 PROJECT AND SITE DESCRIPTION

2.1.1 Site Description

The New and Remodeled Operations & Maintenance Facilities project comprises approximately 2.21 acres and is located at 1966 Olivenhain Road in Encinitas, California. The project site is located at the southwest corner of the Rancho Santa Fe Road and Olivenhain Road intersection and north of Encinitas Creek.

The project site is identified on the Site Map in Appendix B. Site coordinates are as follows:

Latitude 33° 4'4.55"N

Longitude 117°14'46.89"W

2.1.2 Existing Conditions

As of the date of this SWPPP, the project site is developed with existing one and two story buildings for office space, landscape areas, and impervious parking areas. Site improvements include water, sewer, storm drain electric, and telecommunication utilities. Access to the site is provided by existing paved streets and driveways.

There are no known historic sources of contamination at the site.

2.1.3 Existing Drainage

The project site is divided by Old Olivenhain Road which is now vacated as a public road and serves as the main driveway. North of this private street, the topography slopes downward from northwest to southeast at less than 5% slope, concentrating in the paved roadway (OMWD driveway) and flowing east to the intersection of OMWD driveway and Rancho Santa Fe Road. There are no drainage facilities along the OMWD driveway other than asphalt concrete berm and a Portland cement cross gutter at the Rancho Santa Fe Road intersection. Once the runoff reaches Rancho Santa Fe Road, it flows south to an existing catch basin which intercepts the runoff and conveys it to Encinitas Creek via an underground storm drain.

South of the OMWD driveway, the topography slopes downward from northwest to southeast.

- The existing, paved access road leading to the existing Operations Building captures the runoff from the western, approximately two-thirds of the southern portion of the site and directs it to two, existing bioretention basins. These basins are located on the west and east sides of the existing Operations Building. The emergency overflow outlets from the basins are piped via an underground storm drain to a headwall structure at the south property line, east of the Operations Building. The discharge eventually surface flows to Encinitas Creek.
- The remaining, eastern, one-third of the southern portion of the site drains south across the lot via sheet flow toward the south property line. There are no storm drain improvements on the eastern portion of the southern portion of the site.

North and east of the site, Olivenhain Road and Rancho Santa Fe Road, respectively, are improved with curb and gutter and underground storm drains and there is no off-site runoff that enters the project site.

Site elevations vary across the site from 125 feet mean sea level at the north to 112 feet at the south portion of the site. Average slope across the site is 4 percent downward from north to south and approximately 2 percent downward from west to east.

The project discharges to Encinitas Creek, which is not impaired for sediment on the most recent 303(d) list. Impairments are listed in the 303(d) list included in Appendix A.

2.1.4 Geology and Groundwater

The site is underlain by young alluvial flood plain deposits which are underlain by Santiago Formation. The alluvial deposits consist of loose to dense silty sand to clayey sand and very stiff sandy fat clay. The Santiago Formation at depth consists of dense to very dense, weakly cemented silty to clayey sandstone and hard claystone. Groundwater was encountered at depths ranging between about 11½ and 15 feet below the existing ground surface. (SCST, March 3, 2016). The groundwater gradient is presumed to be southward toward Encinitas Creek.

2.1.5 Project Description

Land disturbance will occur on approximately 2.6 acres of the project site, which comprises approximately 25% percent of the total area. The limits of grading are shown on the project plans in Appendix B. Construction activities will be phased as follows:

- Phase 1.1 will grade the new building pad and the parking area east of the new building pad.
- Phase 1.2 will construct curb, gutter, sidewalk, and paving improvements along OMWD driveway, and landscape improvements in the northern portion of the site.

Grading will include both cut and fill activities. Excavated materials are expected to be reused onsite as fill with some materials generated from pavement demolition activities being hauled away. Excavated soil will be temporarily stockpiled within graded areas prior to reuse or prior to export (if surplus).

Estimated grading quantities (cubic yards):

Total graded material:	400	cut	2450	fill
Imported material:	2300			

2.1.6 Developed Condition

Post construction surface drainage will preserve the existing and prevailing drainage patterns (refer to the Water Pollution Control Drawings):

- Surface drainage and drainage from new and existing building roofs will be directed to the proposed stormwater treatment and detention basins. The basins will outlet into new storm drains which will discharge to the existing runoff concentration points: 1) to an existing curb outlet on the west curb of Rancho Santa Fe Road and north of OMWD

driveway; and 2) to a new curb outlet in the north curb of OMWD driveway just east of Rancho Santa Fe Road.

- Street flow in OMWD driveway will sheet flow to the east where it concentrates at the southwest corner of OMWD driveway and Rancho Santa Fe Road. From this point, gutter flow continues south along the west curb of Rancho Santa Fe Road until draining into an existing, public (City of Carlsbad) curb inlet located some 40 feet south of OMWD driveway. Flows are then conveyed in a public storm drain which outlets into the north bank of Encinitas Creek.
- Runoff from the proposed graded and improved driveway area south of OMWD driveway will sheet flow to the south as in the existing condition. The street flow will drain into an existing bioretention basin. Runoff from the remaining area south of OMWD driveway will surface flow overland until it ultimately reaches the north bank of Encinitas Creek.

Table 2.1 Construction Site Estimates

Construction site area:	2.64	acres
Percent impervious before construction:	80	%
Runoff coefficient before construction:	0.79	
Percent impervious after construction:	55	%
Runoff coefficient after construction:	0.67	

2.2 PERMITS AND GOVERNING DOCUMENTS

In addition to the General Permit, the following documents have been taken into account while preparing this SWPPP

- Regional Water Board requirements
- City of Carlsbad BMP Design Manual
- San Diego Region Municipal MS4 Permit, Order No. R9-2013-0001, as amended by R9-2015-0001 and R9-2015-0100, NPDES No. CAS0101266
- Contract Documents

2.3 STORMWATER RUN-ON FROM OFFSITE AREAS

There is no anticipated offsite run-on to this construction site because the site is bounded to the north by Olivenhain Road and to the east by Rancho Santa Fe Road, both having curb and gutter improvements to preclude run-on onto the project site. Along the west and south boundaries of

the project site, runoff is not directed toward the project boundary but rather flows away or around the project site.

2.4 FINDINGS OF THE CONSTRUCTION SITE SEDIMENT AND RECEIVING WATER RISK DETERMINATION

A construction site risk assessment has been performed for the project and the resultant risk level is:

Risk Level 1

The risk level was determined through the use of the Risk Determination Worksheet based on the R, K, and LS factors provided in SMARTS, a site specific analysis). The risk level is based on project duration, location, proximity to impaired receiving waters and soil conditions. A copy of the Risk Level determination submitted is included in Appendix C.

Table 2.2 and Table 2.3 summarize the sediment and receiving water risk factors and document the sources of information used to derive the factors.

Table 2.2 Summary of Sediment Risk

RUSLE Factor	Value	Method for establishing value
R	62.6	U.S. E.P.A. rainfall erosivity calculator
K	0.4	Site specific soil data and erodibility value triangular nomograph
LS	0.57	Site specific topographic data from site survey
Total Predicted Sediment Loss (tons/acre):		**14.4**
Overall Sediment Risk: Low Sediment Risk < 15 tons/ acre Medium Sediment Risk >= 15 and < 75 tons/acre High Sediment Risk >= 75 tons/acre		☒ **Low** ☐ **Medium** ☐ **High**

Runoff from the project site discharges into Encinitas Creek which has grade control structures, culvert crossings beneath roadways, and improved channels downstream of the project site. Encinitas Creek eventually discharges into Batiquitos Lagoon and ultimately to the Pacific Ocean.

Table 2.3 Summary of Receiving Water Risk

Receiving Water Name	303(d) Listed for Sediment Related Pollutant[(1)]	TMDL for Sediment Related Pollutant[(1)]	Beneficial Uses of COLD, SPAWN, and MIGRATORY[(1)]
Encinitas Creek	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No
Batiquitos Lagoon	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No
Overall Receiving Water Risk			☒ **Low** ☐ **High**

Table 2.3 Summary of Receiving Water Risk

Receiving Water Name	303(d) Listed for Sediment Related Pollutant(1)	TMDL for Sediment Related Pollutant(1)	Beneficial Uses of COLD, SPAWN, and MIGRATORY(1)
(1) If yes is selected for any option, the Receiving Water Risk is High			

Risk Level 1 sites are subject to the narrative effluent limitations specified in the General Permit. The narrative effluent limitations require stormwater discharges associated with construction activity to minimize or prevent pollutants in stormwater and authorized non-stormwater through the use of controls, structures, and best management practices. This SWPPP has been prepared to address Risk Level 1 requirements (General Permit Attachment C).

2.5 CONSTRUCTION SCHEDULE

The estimated Construction Schedule for planned work can be found in Appendix F. The site sediment risk determination is based on an assumed 20-month schedule for land disturbing activities taking place from June 2018 through the end of February 2020. Note that this assumed schedule (for sediment risk determination) is longer than the duration estimated for land disturbance activities in the Construction Schedule, Appendix F.

Modification or extension of the schedule (start and end dates) may affect risk determination and permit requirements. The LRP shall contact the QSD if the actual schedule is expected to exceed the schedule assumed for sediment risk determination.

2.6 POTENTIAL CONSTRUCTION ACTIVITY AND POLLUTANT SOURCES

Appendix G includes a list of construction activities and associated materials that are anticipated to be used onsite. These activities and associated materials will or could potentially contribute pollutants, other than sediment, to stormwater runoff.

The anticipated activities and associated pollutants were used in Section 3 to select the Best Management Practices for the project. BMP locations are show on the Site Map in Appendix B.

For sampling requirements for non-visible pollutants associated with construction activity, refer to Section 7.7.1. For a full and complete list of onsite pollutants, refer to the Material Safety Data Sheets (MSDS), which are retained onsite at the construction trailer.

2.7 IDENTIFICATION OF NON-STORMWATER DISCHARGES

Non-stormwater discharges consist of discharges which do not originate from precipitation events. The General Permit provides allowances for specified non-stormwater discharges that do not cause erosion or carry other pollutants.

Non-stormwater discharges into storm drainage systems or waterways, which are not authorized under the General Permit and listed in the SWPPP, or authorized under a separate NPDES permit, are prohibited.

Non-stormwater discharges that are authorized from this project site may include the following:

- De-chlorinated potable water sources such as: fire hydrant flushing, pipe flushing and testing
- Water to control dust
- Irrigation of vegetative erosion control measures
- Uncontaminated groundwater dewatering
- Other discharges not subject to a separate general NPDES permit adopted by the region

These authorized non-stormwater discharges will be managed with the stormwater and non-stormwater BMPs described in Section 3 of this SWPPP.

Activities at this site that may result in unauthorized non-stormwater discharges include:

- Vehicle and equipment cleaning, fueling and maintenance operations;
- Vehicle and equipment wash water, including concrete washout water;
- Slurries from concrete cutting and coring operations, PCC grinding or AC grinding operations;
- Slurries from concrete or mortar mixing operations;
- Slurries from drilling or boring operations;
- Residue from high-pressure washing of structures or surfaces;
- Wash water from cleaning painting equipment;
- Runoff from dust control applications of water or dust palliatives;
- Sanitary and septic wastes;
- Chemical leaks and/or spills of any kind including but not limited to petroleum, paints, cure compounds, etc.;
- Discharges of construction materials and wastes, such as fuel or paint, resulting from dumping, spills, or direct contact with rainwater or stormwater runoff.

Steps will be taken, including the implementation of appropriate BMPs, to ensure that unauthorized discharges are eliminated, controlled, disposed, or treated on-site.

2.8 REQUIRED SITE MAP INFORMATION

The construction project's Site Map(s) showing the project location, surface water boundaries, geographic features, construction site perimeter and general topography and other requirements identified in Attachment B of the General Permit is located in Appendix B. Table 2.5 identifies Map or Sheet Nos. where required elements are illustrated.

Table 2.5 Required Map Information

Included on Plan Sheet No. (1)	Required Element
EC-1	The project's surrounding area (vicinity)
EC-1	Site layout
EC-2, 3	Construction site boundaries
EC-2, 3	Drainage areas
EC-2, 3	Discharge locations
EC-2, 3	Sampling locations
EC-2, 3	Areas of soil disturbance (temporary or permanent)
EC-2, 3	Active areas of soil disturbance (cut or fill)
EC-2, 3	Locations of runoff BMPs
EC-2, 3	Locations of erosion control BMPs
EC-2, 3	Locations of sediment control BMPs
N/A	ATS location (if applicable)
EC-2, 3	Locations of sensitive habitats, watercourses, or other features which are not to be disturbed
EC-2, 3	Locations of all post construction BMPs
EC-2, 3	Waste storage areas
EC-2, 3	Vehicle storage areas
EC-2, 3	Material storage areas
EC-2, 3	Entrance and Exits
EC-2, 3	Fueling Locations

Notes: (1) Indicate maps or drawings that information is included on (e.g., Vicinity Map, Site Map, Grading Plan, Erosion Control Plan, Progress Maps, etc.)

Section 3 Best Management Practices

3.1 SCHEDULE FOR BMP IMPLEMENTATION

Table 3.1 BMP Implementation Schedule

BMP	Implementation	Duration
Erosion Control		
EC-1, Scheduling	Prior to construction	Entirety of Project
EC-2, Preservation of Existing Vegetation	Start of construction	Entirety of Project
EC-3, Hydraulic Mulch	Not Used	N/A
EC-4, Hydroseed	Not Used	N/A
EC-5, Soil Binders	Exposed soil areas, inactive graded areas and stockpiles requiring temporary protection	Entirety of project
EC-6, Straw Mulch	Not used	N/A
EC-7, Geotextiles and Mats	Exposed soil areas, inactive graded areas and stockpiles requiring temporary protection. At completion of grading for permanent BMPs.	Entirety of project
EC-8, Wood Mulching	After finish grading	Entirety of project
EC-9, Earth Dike and Drainage Swales	Prior to forecast rain event with 50% chance of precip.	Entirety of project
EC-10, Velocity Dissipation Devices	Upon completion of sediment traps, sediment basins or exposed soil areas subject to runoff.	Entirety of project
EC-11, Slope Drains	Not used	N/A
EC-12, Stream Bank Stabilization	Not used	N/A
EC-13, Compost Blankets	Exposed soil areas and inactive graded areas requiring temporary protection. At completion of grading in landscape areas.	Entirety of project
EC-14, Soil Preparation-Roughening	Exposed soil areas and inactive graded areas requiring temporary protection.	Entirety of project
EC-15, Non-Vegetated Stabilization	Exposed soil areas, inactive graded areas and stockpiles requiring temporary protection.	Entirety of project
WE-1, Wind Erosion Control	Exposed soil areas, inactive graded areas and stockpiles requiring temporary protection.	Entirety of project
Sediment Control		
SE-1, Silt Fence	Prior to disturbance of soil areas draining to the BMP	Entirety of project
SE-2, Sediment Basin	Not used	N/A

Table 3.1 BMP Implementation Schedule

BMP	Implementation	Duration
SE-3, Sediment Trap	Prior to disturbance of soil areas draining to the BMP	Entirety of project
SE-4, Check Dams	Prior to forecast rain event with 50% chance of precip.	Entirety of project
SE-5, Fiber Rolls	Prior to disturbance of soil areas draining to the BMP	Entirety of project
SE-6, Gravel Bag Berm	Prior to disturbance of soil areas draining to the BMP. Prior to construction at drain inlets.	Entirety of project
SE-7, Street Sweeping	Beginning of land disturbance or pavement grinding/cutting operations	Entirety of project
SE-8, Sandbag Barrier	Prior to forecast rain event with 50% chance of precip.	Entirety of project
SE-9, Straw Bale Barrier	Not used	N/A
SE-10, Storm Drain Inlet Protection	Prior to construction	Entirety of project
SE-11, ATS	Not used	N/A
SE-12, Manufactured Linear Sediment Controls	Prior to disturbance of soil areas draining to the BMP	Entirety of project
SE-13, Compost Sock and Berm	Not used	N/A
SE-14, Biofilter Bags	Prior to disturbance of soil areas draining to the BMP. Prior to construction at drain inlets.	Entirety of project
Tracking Control		
Stabilized Construction Entrance and Exit	Prior to construction	Entirety of project
Stabilized Construction Roadway	Prior to use of unpaved roadways	Entirety of project
Entrance/Outlet Tire Wash	Not used	N/A
Wind Erosion		
WE-1, Wind Erosion Control	Exposed soil areas, inactive graded areas and stockpiles requiring temporary protection.	Entirety of project

3.2 EROSION AND SEDIMENT CONTROL

Erosion and sediment controls are required by the General Permit to provide effective reduction or elimination of sediment related pollutants in stormwater discharges and authorized non-stormwater discharges from the Site. Applicable BMPs are identified in this section for erosion control, sediment control, tracking control, and wind erosion control.

3.2.1 Erosion Control

Erosion control, also referred to as soil stabilization, consists of source control measures that are designed to prevent soil particles from detaching and becoming transported in stormwater runoff. Erosion control BMPs protect the soil surface by covering and/or binding soil particles.

This construction project will implement the following practices to provide effective temporary and final erosion control during construction:

1. Preserve existing vegetation where required and when feasible.
2. The area of soil disturbing operations shall be controlled such that the Contractor is able to implement erosion control BMPs quickly and effectively.
3. Stabilize non-active areas within 14 days of cessation of construction activities or sooner if stipulated by local requirements.
4. Control erosion in concentrated flow paths by applying erosion control blankets, check dams, erosion control seeding or alternate methods.
5. Prior to the completion of construction, apply permanent erosion control to remaining disturbed soil areas.

Sufficient erosion control materials shall be maintained onsite to allow implementation in conformance with this SWPPP.

The following temporary erosion control BMP selection table indicates the BMPs that shall be implemented to control erosion on the construction site. Fact Sheets for temporary erosion control BMPs are provided in Appendix M.

Table 3.2 Temporary Erosion Control BMPs

CASQA Fact Sheet	BMP Name	Meets a Minimum Requirement[1]	BMP Used		If not used, state reason
			YES	NO	
EC-1	Scheduling	✓	☒	☐	
EC-2	Preservation of Existing Vegetation	✓	☒	☐	
EC-3	Hydraulic Mulch	✓[2]	☐	☒	Use permanent landscaping and EC-8.
EC-4	Hydroseed	✓[2]	☐	☒	Use permanent landscaping and EC-8.
EC-5	Soil Binders	✓[2]	☒	☐	
EC-6	Straw Mulch	✓[2]	☐	☒	Use permanent landscaping and EC-8.
EC-7	Geotextiles and Mats	✓[2]	☒	☐	
EC-8	Wood Mulching	✓[2]	☒	☐	
EC-9	Earth Dike and Drainage Swales	✓[3]	☒	☐	
EC-10	Velocity Dissipation Devices		☒	☐	
EC-11	Slope Drains		☐	☒	Not applicable for proposed slope heights.
EC-12	Stream Bank Stabilization		☐	☒	No work along streams.
EC-14	Compost Blankets	✓[2]	☒	☐	
EC-15	Soil Preparation-Roughening		☒	☐	
EC-16	Non-Vegetated Stabilization	✓[2]	☒	☐	
WE-1	Wind Erosion Control	✓	☒	☐	
Alternate BMPs Used:					**If used, state reason:**

[1] Applicability to a specific project shall be determined by the QSD.
[2] The QSD shall ensure implementation of one of the minimum measures listed or a combination thereof to achieve and maintain the Risk Level requirements.
[3] Run-on from offsite shall be directed away from all disturbed areas, diversion of offsite flows may require design/analysis by a licensed civil engineer and/or additional environmental permitting

These temporary erosion control BMPs shall be implemented in conformance with the following guidelines and as outlined in the BMP Fact Sheets. If there is a conflict between documents, the Site Map will prevail over narrative in the body of the SWPPP or guidance in the BMP Fact Sheets. Site specific details in the Site Map prevail over standard details included in the Site Map. The narrative in the body of the SWPPP prevails over guidance in the BMP Fact Sheets.

EC-1, Scheduling

Use scheduling to procure materials for BMP deployment and to plan and conduct land disturbing activities outside of the rainy season to the extent practical.

EC-2, Preservation of Existing Vegetation

Preserve existing vegetation with the use of temporary construction fences around trees and landscape areas that are not to be disturbed by construction.

EC-3, Hydraulic Mulch

Not used. Typically used for large areas of exposed soil. Use where permanent landscaping and wood mulch is not provided or will be installed at a later date.

EC-4, Hydroseed

Not used. Typically used for large slopes or exposed soil areas.

EC-5, Soil Binders

Use for exposed soil areas not subject to foot or equipment traffic and for temporary soil stockpiles. Reapply as needed to maintain protection.

EC-6, Straw Mulch

Not used. Use EC-7 or EC-8 as alternatives to straw mulch.

EC-7, Geotextiles and Mats

Use for temporary cover of exposed soil areas and as an alternative to EC-5.

EC-8, Wood Mulching

Use in permanent landscape areas upon completion of finish/precise grading.

EC-9, Earth Dike and Drainage Swales

Use to direct runoff to sediment basins or sediment traps and to divert runoff away from exposed soil areas.

EC-10, Velocity Dissipation Devices

Use at discharge points that are unpaved or unprotected from erosion, such as pipes or swales discharging into sediment basins or sediment traps or at the toe of slope drains.

EC-11, Slope Drains

Not used. Typically used where runoff is concentrated at the tops of slopes and conveyed to the toe of slopes.

EC-12, Stream Bank Stabilization

Not used.

EC-14, Compost Blankets

May be used as an alternative to EC-7 or EC-8.

EC-15, Soil Preparation-Roughening

Use in graded areas that are not subject to traffic to promote infiltration. May be used as an alternative to EC-7.

EC-16, Non-Vegetated Stabilization

Use in exposed soil areas. See EC-5, EC-7, EC-8 and EC-14 for methods of non-vegetated stabilization.

WE-1, Wind Erosion Control

Apply to exposed soil areas and temporary stockpiles. See EC-5, EC-7, EC-8 and EC-14 for methods.

3.2.2 Sediment Controls

Sediment controls are temporary or permanent structural measures that are intended to complement the selected erosion control measures and reduce sediment discharges from active construction areas. Sediment controls are designed to intercept and settle out soil particles that have been detached and transported by the force of water.

The following sediment control BMP selection table indicates the BMPs that shall be implemented to control sediment on the construction site. Fact Sheets for temporary sediment control BMPs are provided in Appendix M.

Table 3.3 Temporary Sediment Control BMPs

CASQA Fact Sheet	BMP Name	Meets a Minimum Requirement[1]	BMP used		If not used, state reason
			YES	NO	
SE-1	Silt Fence	✓[2] [3]	☒	☐	
SE-2	Sediment Basin		☐	☒	Tributary areas are too small to warrant their use.
SE-3	Sediment Trap		☒	☐	
SE-4	Check Dams		☒	☐	
SE-5	Fiber Rolls	✓[2][3]	☒	☐	
SE-6	Gravel Bag Berm	✓[3]	☒	☐	
SE-7	Street Sweeping	✓	☒	☐	
SE-8	Sandbag Barrier		☒	☐	
SE-9	Straw Bale Barrier		☐	☒	Use SE-6 or SE-8.
SE-10	Storm Drain Inlet Protection	✓ RL2&3	☒	☐	
SE-11	ATS		☐	☒	Use traditional BMPs.
SE-12	Manufactured Linear Sediment Controls		☒	☐	
SE-13	Compost Sock and Berm	✓[3]	☐	☒	Use SE-5 or SE-1.
SE-14	Biofilter Bags	✓[3]	☒	☐	
TC-1	Stabilized Construction Entrance and Exit	✓	☒	☐	
TC-2	Stabilized Construction Roadway		☒	☐	
TC-3	Entrance/Outlet Tire Wash		☐	☒	Use TC-2 and SE-7. No suitable areas for a tire wash.
Alternate BMPs Used:					**If used, state reason:**

[1] Applicability to a specific project shall be determined by the QSD
[2] The QSD shall ensure implementation of one of the minimum measures listed or a combination thereof to achieve and maintain the Risk Level requirements
[3]Risk Level 2 &3 shall provide linear sediment control along toe of slope, face of slope, and at the grade breaks of exposed slope

These temporary sediment control BMPs shall be implemented in conformance with the following guidelines and in accordance with the BMP Fact Sheets provided in Appendix M. If there is a conflict between documents, the Site Map will prevail over narrative in the body of the SWPPP or guidance in the BMP Fact Sheets. Site specific details in the Site Map prevail over standard details included in the Site Map. The narrative in the body of the SWPPP prevails over guidance in the BMP Fact Sheets.

SE-1, Silt Fence

Install at the downslope perimeter of disturbed soil areas and slopes.

SE-2, Sediment Basin

Not used.

SE-3, Sediment Trap

Install where runoff will concentrate downstream/downslope of graded areas and at proposed bioretention basin locations. Remove sediment and sediment laden runoff after each storm event.

SE-4, Check Dams

Use to divert water to swales and sediment traps and in conjunction with SE-8.

SE-5, Fiber Rolls

Use as an alternative to SE-1 and on slope faces. Install perpendicular to the direction of runoff.

SE-6, Gravel Bag Berm

Use around inlets for inlet protection and to divert runoff to swales, and to control flow velocities in swales and along gutters. Use on paved surfaces in lieu of SE-1 or SE-5.

SE-7, Street Sweeping

Implement on a daily basis to all paved areas and paved access roads and driveways.

SE-8, Sandbag Barrier

Use to divert water to swales and sediment traps and to contain sediment laden runoff .

SE-9, Straw Bale Barrier

Not used.

SE-10, Storm Drain Inlet Protection

Install at all existing storm drain inlets prior to land disturbance. Install at all newly installed storm drain inlets immediately upon their completion.

SE-11, ATS

Not used.

SE-12, Manufactured Linear Sediment Controls

Install at the downslope boundary of graded areas and at the interface between graded areas and paved areas. May use SE-1 or SE-5 as alternatives.

SE-13, Compost Sock and Berm

Not used.

SE-14, Biofilter Bags

Use as an alternative to SE-5 and for SE-10 at inlets in unpaved areas.

TC-1, Stabilized Construction Entrance and Exit

Install at the primary entrance/exit to the construction site and use in conjunction with SE-7.

TC-2, Stabilized Construction Roadway

Apply soil binders to temporary access roads having fine-grained soils or apply gravel surfacing.

TC-3, Entrance/Outlet Tire Wash

Not used.

3.3 NON-STORMWATER CONTROLS AND WASTE AND MATERIALS MANAGEMENT

3.3.1 Non-Stormwater Controls

Non-stormwater discharges into storm drainage systems or waterways, which are not authorized under the General Permit, are prohibited. Non-stormwater discharges for which a separate NPDES permit is required by the local Regional Water Board are prohibited unless coverage under the separate NPDES permit has been obtained for the discharge. The selection of non-stormwater BMPs is based on the list of construction activities with a potential for non-stormwater discharges identified in Section 2.7 of this SWPPP.

The following non-stormwater control BMP selection table indicates the BMPs that shall be implemented to control sediment on the construction site. Fact Sheets for temporary non-stormwater control BMPs are provided in Appendix M.

Table 3.4 Temporary Non-Stormwater BMPs

CASQA Fact Sheet	BMP Name	Meets a Minimum Requirement[1]	BMP used		If not used, state reason
			YES	NO	
NS-1	Water Conservation Practices	✓	☒	☐	
NS-2	Dewatering Operation		☒	☐	
NS-3	Paving and Grinding Operation		☒	☐	
NS-4	Temporary Stream Crossing		☐	☒	N/A
NS-5	Clear Water Diversion		☐	☒	N/A
NS-6	Illicit Connection/Discharge	✓	☒	☐	
NS-7	Potable Water/Irrigation		☒	☐	
NS-8	Vehicle and Equipment Cleaning	✓	☐	☒	Conduct cleaning operations off-site.
NS-9	Vehicle and Equipment Fueling	✓	☒	☐	
NS-10	Vehicle and Equipment Maintenance	✓	☒	☐	
NS-11	Pile Driving Operation		☐	☒	N/A
NS-12	Concrete Curing		☒	☐	
NS-13	Concrete Finishing		☒	☐	
NS-14	Material and Equipment Use Over Water		☐	☒	N/A
NS-15	Demolition Removal Adjacent to Water		☐	☒	N/A
NS-16	Temporary Batch Plants		☐	☒	N/A
Alternate BMPs Used:			**If used, state reason:**		

[1] Applicability to a specific project shall be determined by the QSD

Non-stormwater BMPs shall be implemented in conformance with the following guidelines and in accordance with the BMP Fact Sheets provided in Appendix M. If there is a conflict between documents, the Site Map will prevail over narrative in the body of the SWPPP or guidance in the BMP Fact Sheets. Site specific details in the Site Map prevail over standard details included in the Site Map. The narrative in the body of the SWPPP prevails over guidance in the BMP Fact Sheets.

NS-1, Water Conservation Practices

Apply throughout the construction site for the duration of the project.

NS-2, Dewatering Operation

Use in conjunction with sediment traps, gravity bag filters or cartridge filters. Do not dispose of sediment laden water to the storm drain system, but rather to graded areas and in a manner that will not produce runoff or to off-site areas in accordance with applicable regulations.

NS-3, Paving and Grinding Operation

Implement at all paving demolition areas and pavement construction areas for parking lots and roadways.

NS-4, Temporary Stream Crossing

Not used.

NS-5, Clear Water Diversion

Not used.

NS-6, Illicit Connection/Discharge

Implement at the onset of mobilization to evaluate the presence of contaminants and to establish a baseline for subsequent inspections and identification of illegal dumping activities. Conduct visual inspections for illegal dumping on a regular basis.

NS-7, Potable Water/Irrigation

Implement in accordance with the fact sheet wherever the discharge of potable water will occur.

NS-8, Vehicle and Equipment Cleaning

Not used.

NS-9, Vehicle and Equipment Fueling

Implement in accordance with the fact sheet wherever fueling operations are necessary and off-site fueling is not practical.

NS-10, Vehicle and Equipment Maintenance

Implement in accordance with the fact sheet wherever maintenance operations are necessary and off-site maintenance is not practical.

NS-11, Pile Driving Operation

Not used.

NS-12, Concrete Curing

Implement in accordance with the fact sheet on all newly placed concrete surfaces.

NS-13, Concrete Finishing

Implement in accordance with the fact sheet on all newly placed concrete surfaces or rehabilitated concrete surfaces.

NS-14, Material and Equipment Use Over Water

Not used.

NS-15, Demolition Removal Adjacent to Water

Not used.

NS-16, Temporary Batch Plants

Not used.

3.3.2 Materials Management and Waste Management

Materials management control practices consist of implementing procedural and structural BMPs for handling, storing and using construction materials to prevent the release of those materials into stormwater discharges. The amount and type of construction materials to be utilized at the Site will depend upon the type of construction and the length of the construction period. The materials may be used continuously, such as fuel for vehicles and equipment, or the materials may be used for a discrete period, such as soil binders for temporary stabilization.

Waste management consist of implementing procedural and structural BMPs for handling, storing and ensuring proper disposal of wastes to prevent the release of those wastes into stormwater discharges.

Materials and waste management pollution control BMPs shall be implemented to minimize stormwater contact with construction materials, wastes and service areas; and to prevent materials and wastes from being discharged off-site. The primary mechanisms for stormwater contact that shall be addressed include:

- Direct contact with precipitation
- Contact with stormwater run-on and runoff
- Wind dispersion of loose materials
- Direct discharge to the storm drain system through spills or dumping
- Extended contact with some materials and wastes, such as asphalt cold mix and treated wood products, which can leach pollutants into stormwater.

A list of construction activities is provided in Section 2.6. The following Materials and Waste Management BMP selection table indicates the BMPs that shall be implemented to handle materials and control construction site wastes associated with these construction activities. Fact Sheets for Materials and Waste Management BMPs are provided in Appendix M.

Table 3.5 Temporary Materials Management BMPs

CASQA Fact Sheet	BMP Name	Meets a Minimum Requirement[1]	BMP used		If not used, state reason
			YES	NO	
WM-01	Material Delivery and Storage	✓	☒	☐	
WM-02	Material Use	✓	☒	☐	
WM-03	Stockpile Management	✓	☒	☐	
WM-04	Spill Prevention and Control	✓	☒	☐	
WM-05	Solid Waste Management	✓	☒	☐	
WM-06	Hazardous Waste Management	✓	☒	☐	
WM-07	Contaminated Soil Management		☒	☐	
WM-08	Concrete Waste Management	✓	☒	☐	
WM-09	Sanitary-Septic Waste Management	✓	☒	☐	
WM-10	Liquid Waste Management		☒	☐	
Alternate BMPs Used:				**If used, state reason:**	

[1] Applicability to a specific project shall be determined by the QSD.

Material management BMPs shall be implemented in conformance with the following guidelines and in accordance with the BMP Fact Sheets provided in Appendix M. If there is a conflict between documents, the Site Map will prevail over narrative in the body of the SWPPP or guidance in the BMP Fact Sheets. Site specific details in the Site Map prevail over standard details included in the Site Map. The narrative in the body of the SWPPP prevails over guidance in the BMP Fact Sheets.

WM-01, Material Delivery and Storage

Implement in accordance with the fact sheet at material receiving and storage areas and on materials that pose a risk of contamination if released to the environment; applies to all staging areas.

WM-02, Material Use

Implement in accordance with the fact sheet on all materials that pose a risk of contamination if released to the environment. Use materials in strict accordance with the manufacturer's recommendations and in accordance with pollution prevention regulations.

WM-03, Stockpile Management

Implement in accordance with the fact sheet on all temporary stockpiles. Avoid the use of stockpiles to the extent practical. Do not place temporary stockpiles in the path of runoff.

WM-04, Spill Prevention and Control

Implement in accordance with the fact sheet wherever materials that pose a risk of contamination if released to the environment are stored or used. Provide training to workers on spill prevention and control methods prior to the use of materials, as applicable.

WM-05, Solid Waste Management

Implement in accordance with the fact sheet wherever demolition debris or surplus excavated materials are generated.

WM-06, Hazardous Waste Management

Conduct material use, waste disposal, and worker training in accordance with the fact sheet wherever hazardous materials are generated or used.

WM-07, Contaminated Soil Management

Implement in accordance with the fact sheet to evaluate the presence of contaminated soil in excavations or where hazardous materials have been spilled.

WM-08, Concrete Waste Management

Implement in accordance with the fact sheet for concrete debris, slurries or surplus materials that are generated or delivered to the site. Construct washout facilities outside of the path of runoff.

WM-09, Sanitary-Septic Waste Management

Implement in accordance with the fact sheet for all temporary or portable sanitary waste systems.

WM-10, Liquid Waste Management

Implement in accordance with the fact sheet wherever non-hazardous liquid wastes are generated, collected or disposed. Contain liquid waste in a controlled area such as holding pits, roll-off bins or holding tanks. Provide containment devices that are structurally sound, leak-free, and of sufficient quantity or volume to contain the liquid waste.

3.4 POST CONSTRUCTION STORMWATER MANAGEMENT MEASURES

Post construction BMPs are permanent measures installed during construction, designed to reduce or eliminate pollutant discharges from the site after construction is completed.

This site is located in an area subject to a Phase I or Phase II Municipal Separate Storm Sewer System (MS4) permit approved Stormwater Management Plan. ☒ Yes ☐ No

Post construction runoff reduction requirements have been satisfied through the MS4 program. This project is exempt from provision XIII.A of the General Permit.

The following source control post construction BMPs to comply with General Permit Section XIII.B and local requirements have been identified for the site:

- Refer to the project-specific Storm Water Quality Management Plan.

A plan for the post construction funding and maintenance of these BMPs has been developed to address at minimum five years following construction. If required, post construction funding and maintenance will be submitted with the NOT. The post construction BMPs that are described above shall be funded and maintained by:

- Olivenhain Municipal Water District.

Section 4 BMP Inspection, Maintenance, and Rain Event Action Plans

4.1 BMP INSPECTION AND MAINTENANCE

The General Permit requires routine weekly inspections of BMPs, along with inspections before, during, and after qualifying rain events. A BMP inspection checklist must be filled out for inspections and maintained on-site with the SWPPP. The inspection checklist includes the necessary information covered in Section 7.6. A blank inspection checklist can be found in Appendix I. Completed checklists shall be kept in CSMP Attachment 2 "Monitoring Records.

BMPs shall be maintained regularly to ensure proper and effective functionality. If necessary, corrective actions shall be implemented within 72 hours of identified deficiencies and associated amendments to the SWPPP shall be prepared by the QSD.

Specific details for maintenance, inspection, and repair of Construction Site BMPs can be found in the BMP Factsheets in Appendix M.

4.2 RAIN EVENT ACTION PLANS

Rain Event Action Plans (REAPs) are not required for Risk Level 1 projects.

Section 5 Training

Appendix L identifies the QSP for the project. To promote stormwater management awareness specific for this project, periodic training of job-site personnel shall be included as part of routine project meetings (e.g. daily/weekly tailgate safety meetings), or task specific trainings as needed.

The QSP shall be responsible for providing this information at the meetings, and subsequently completing the training logs shown in Appendix K, which identifies the site-specific stormwater topics covered as well as the names of site personnel who attended the meeting. Tasks may be delegated to trained employees by the QSP provided adequate supervision and oversight is provided. Training shall correspond to the specific task delegated including: SWPPP implementation; BMP inspection and maintenance; and record keeping.

Documentation of training activities (formal and informal) is retained in SWPPP Appendix K.

Section 6 Responsible Parties and Operators

6.1 RESPONSIBLE PARTIES

Approved Signatory(ies) who are responsible for SWPPP implementation and have authority to sign permit-related documents are provided in Appendix L along with written authorization(s) from the LRP for these individuals.

QSPs identified for the project are identified in Appendix L. The QSP shall have primary responsibility and significant authority for the implementation, maintenance and inspection/monitoring of SWPPP requirements. The QSP will be available at all times throughout the duration of the project. Duties of the QSP include but are not limited to:

- Implementing all elements of the General Permit and SWPPP, including but not limited to:
  - Ensuring all BMPs are implemented, inspected, and properly maintained;
  - Performing non-stormwater and stormwater visual observations and inspections;
  - Performing non-stormwater and storm sampling and analysis, as required;
  - Performing routine inspections and observations;
  - Implementing non-stormwater management, and materials and waste management activities such as: monitoring discharges; general Site clean-up; vehicle and equipment cleaning, fueling and maintenance; spill control; ensuring that no materials other than stormwater are discharged in quantities which will have an adverse effect on receiving waters or storm drain systems; etc.;
- The QSP may delegate these inspections and activities to an appropriately trained employee, but shall ensure adequacy and adequate deployment.
- Ensuring elimination of unauthorized discharges.
- The QSPs shall be assigned authority by the LRP to mobilize crews in order to make immediate repairs to the control measures.
- Coordinate with the Contractor(s) to assure that all the necessary corrections/repairs are made immediately and that the project complies with the SWPPP, the General Permit and approved plans at all times.
- Notifying the LRP or Authorized Signatory immediately of off-site discharges or other non-compliance events.

6.2 CONTRACTOR LIST

Refer to Appendix H for a list of Contractors and/or subcontractors.

Section 7 Construction Site Monitoring Program

7.1 Purpose

This Construction Site Monitoring Program was developed to address the following objectives:

1. To demonstrate that the site is in compliance with the Discharge Prohibitions of the Construction General Permit;
2. To determine whether non-visible pollutants are present at the construction site and are causing or contributing to exceedances of water quality objectives;
3. To determine whether immediate corrective actions, additional Best Management Practices (BMP) implementation, or SWPPP revisions are necessary to reduce pollutants in stormwater discharges and authorized non-stormwater discharges;
4. To determine whether BMPs included in the SWPPP are effective in preventing or reducing pollutants in stormwater discharges and authorized non-stormwater discharges.

7.2 Applicability of Permit Requirements

The General Permit identifies the following types of monitoring as being applicable:

Risk Level 1

- Visual inspections of Best Management Practices (BMPs);
- Visual monitoring of the site related to qualifying storm events;
- Visual monitoring of the site for non-stormwater discharges;
- Sampling and analysis of construction site runoff for non-visible pollutants when applicable; and
- Sampling and analysis of construction site runoff as required by the Regional Water Board when applicable.

Summary of monitoring and reporting requirements by Risk Level:

Risk Level	**Visual Inspections**					**Sample Collection**	
	Quarterly Non-Stormwater Discharge	Pre-Storm Event		Daily Storm	Post-Storm	Stormwater Discharge	Receiving Water
		Baseline	REAP				
1	**X**	**X**		**X**	**X**		
~~2~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	
~~3~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X*~~

Reference: CGP 2009-0009-DWQ Order Attachment C, Section I, Table 1.
* When receiving water monitoring trigger is exceeded.

7.3. Weather and Rain Event Tracking

Visual monitoring and inspection requirements of the General Permit are triggered by a qualifying rain event. The General Permit defines a qualifying rain event as any event that produces ½ inch of precipitation. A minimum of 48 hours of dry weather will be used to distinguish between separate qualifying storm events.

7.3.1 Weather Tracking

The QSP should daily consult the National Oceanographic and Atmospheric Administration (NOAA) for the weather forecasts. These forecasts can be obtained at http://www.srh.noaa.gov/. Weather reports should be printed and maintained with the SWPPP in CSMP Attachment 1 "Weather Reports".

7.3.2 Rain Gauges

The QSP shall install rain gauge(s) on the project site and shall note the location on the Site Map(s). Locate the gauge in an open area away from obstructions such as trees or overhangs. Mount the gauge on a post at a height of 3 to 5 feet with the gauge extending several inches beyond the post. Make sure that the top of the gauge is level. Make sure the post is not in an area where rainwater can indirectly splash from sheds, equipment, trailers, etc.

The rain gauge(s) shall be read daily during normal site scheduled hours. The rain gauge should be read at approximately the same time every day and the date and time of each reading recorded. Log the rain gauge readings in CSMP Attachment 1 "Weather Records". Follow the rain gauge instructions to obtain accurate measurements.

Once the rain gauge reading has been recorded, accumulated rain shall be emptied and the gauge reset.

For comparison with the site rain gauge, the nearest appropriate governmental rain gauge(s) is:

Encinitas, California

Rain gage locations can be viewed at:

http://www.cnrfc.noaa.gov/county_precipMaps.php?group=sandiego&hour=24

7.4 Monitoring Locations

Monitoring locations are shown on the Site Maps in Appendix B. Monitoring locations are described in the Sections 7.6 and 7.7.

Whenever changes in the construction site might affect the appropriateness of sampling locations, the sampling locations shall be revised accordingly. All such revisions shall be implemented as soon as feasible and the SWPPP amended. Temporary changes that result in a one-time additional sampling location do not require a SWPPP amendment.

7.5 Safety and Monitoring Exemptions

Safety practices for sample collection will be in accordance with the Contractor's Health and Safety Plan.

This project is not required to collect samples or conduct visual observations (inspections) under the following conditions:

- During dangerous weather conditions, such as flooding and electrical storms.
- Outside of scheduled site business hours.

Scheduled site business hours are:

- **Monday through Friday, 8:00 a.m. to 5:00 p.m.**

If monitoring (visual monitoring or sample collection) of the site is unsafe because of the dangerous conditions noted above, the QSP shall document the conditions for why an exception to performing the monitoring was necessary. The exemption documentation shall be filed in CSMP Attachment 2 "Monitoring Records".

7.6 Visual Monitoring

Visual monitoring includes observations and inspections. Inspections of BMPs are required to identify and record BMPs that need maintenance to operate effectively, that have failed, or that could fail to operate as intended. Visual observations of the site are required to observe storm water drainage areas to identify any spills, leaks, or uncontrolled pollutant sources.

Table 7.1 identifies the required frequency of visual observations and inspections.

Table 7.1 Summary of Visual Monitoring and Inspections

Type of Inspection	Frequency
Routine Inspections	
BMP Inspections	Weekly [1]
Tracking Control	Daily
Non-Stormwater Discharge Observations	Quarterly[4] during daylight hours
Rain Event Triggered Inspections	
Site Inspections Prior to a Qualifying Event	Within 48 hours of a qualifying event [2]
BMP Inspections During an Extended Storm Event	Every 24-hour period of a rain event [3]
Site Inspections Following a Qualifying Event	Within 48 hours of a qualifying event [2]

[1] Most BMPs must be inspected weekly; those identified below must be inspected more frequently.

[2] Inspections are required during scheduled site operating hours.

[3] Inspections are required during scheduled site operating hours regardless of the amount of precipitation on any given day.

[4] Quarterly periods: Jan – Mar, Apr – Jun, Jly – Sep, Oct – Dec.

7.6.1 Routine Observations and Inspections

Routine site inspections and visual monitoring are necessary to ensure that the project is in compliance with the requirements of the Construction General Permit.

7.6.1.1 Routine BMP Inspections

Inspections of BMPs are conducted to identify and record:

- BMPs that are properly installed;
- BMPs that need maintenance to operate effectively;
- BMPs that have failed; or
- BMPs that could fail to operate as intended.

7.6.1.2 Non-Stormwater Discharge Observations

Each drainage area will be inspected for the presence of or indications of prior unauthorized and authorized non-stormwater discharges. Inspections will record:

- Presence or evidence of any non-stormwater discharge (authorized or unauthorized);

- Pollutant characteristics (floating and suspended material, sheen, discoloration, turbidity, odor, etc.); and
- Source of discharge.

7.6.2 Rain-Event Triggered Observations and Inspections

Visual observations of the site and inspections of BMPs are required prior to a qualifying rain event; following a qualifying rain event, and every 24-hour period during a qualifying rain event. Pre-rain inspections will be conducted after consulting NOAA and determining that a precipitation event with a 50% or greater probability of precipitation has been predicted.

7.6.2.1 Visual Observations Prior to a Forecasted Qualifying Rain Event

Within 48-hours prior to a qualifying event, a stormwater visual monitoring site inspection will include observations of the following locations:

- Stormwater drainage areas to identify any spills, leaks, or uncontrolled pollutant sources;
- BMPs to identify if they have been properly implemented;
- Any stormwater storage and containment areas to detect leaks and ensure maintenance of adequate freeboard.

Consistent with guidance from the State Water Resources Control Board, pre-rain BMP inspections and visual monitoring will be triggered by a NOAA forecast that indicates a probability of precipitation of 50% or more in the project area.

7.6.2.2 BMP Inspections during an Extended Storm Event

During an extended rain event, BMP inspections will be conducted to identify and record:

- BMPs that are properly installed;
- BMPs that need maintenance to operate effectively;
- BMPs that have failed; or
- BMPs that could fail to operate as intended.

If the construction site is not accessible during the rain event, the visual inspections shall be performed at all relevant outfalls, discharge points, downstream locations. The inspections should record any projected maintenance activities.

7.6.2.3 Visual Observations Following a Qualifying Rain Event

Within 48 hours following a qualifying rain event (0.5 inches of rain) a stormwater visual monitoring site inspection is required to observe:

- Stormwater drainage areas to identify any spills, leaks, or uncontrolled pollutant sources;
- BMPs to identify if they have been properly designed, implemented, and effective;
- Need for additional BMPs;
- Any stormwater storage and containment areas to detect leaks and ensure maintenance of adequate freeboard; and
- Discharge of stored or contained rain water.

7.6.3 Visual Monitoring Procedures

Visual monitoring shall be conducted by the QSP or staff trained by and under the supervision of the QSP.

The name(s) and contact number(s) of the site visual monitoring personnel are listed in Appendix L. Their training qualifications are provided in Appendix K.

Stormwater observations shall be documented on the *Visual Inspection Field Log Sheet* (see CSMP Attachment 3 "Example Forms"). BMP inspections shall be documented on the site-specific BMP inspection checklist. Any photographs used to document observations will be referenced on stormwater site inspection report and maintained with the Monitoring Records in Attachment 2.

The completed reports will be kept in CSMP Attachment 2 "Monitoring Records".

7.6.4 Visual Monitoring Follow-Up and Reporting

Correction of deficiencies identified by the observations or inspections, including required repairs or maintenance of BMPs, shall be initiated and completed as soon as possible.

If identified deficiencies require design changes, including additional BMPs, the implementation of changes will be initiated within 72 hours of identification and be completed as soon as possible. The SWPPP shall be amended to reflect the changes when design changes to BMPs are required.

Deficiencies identified in site inspection reports and correction of deficiencies will be tracked on the *Inspection Field Log Sheet* or *BMP Inspection Report* and shall be submitted to the QSP and shall be kept in CSMP Attachment 2 "Monitoring Records".

The QSP shall submit copies of the completed inspection report to the Site Supervisor within three days of completion of the inspection. However, if BMP failures or other shortcomings are identified, the completed inspection report with recommendations for corrective action shall be provided to the Site Supervisor as soon as practical after the inspection, but no more than 24 hours after the inspection.

Results of visual monitoring must be summarized and reported in the Annual Report.

7.6.5 Visual Monitoring Locations

The inspections and observations identified in Sections 7.6.1 and 7.6.2 will be conducted at the locations identified in this section. Refer to the Site Maps in Appendix B for the following:

- BMP locations.
- Graded areas, contractor's yard, staging areas, and storage area(s).
- Location of stormwater storage or containment area(s).
- Site stormwater discharge location(s).
- Materials and equipment storage areas.

7.7 Water Quality Sampling and Analysis

7.7.1 Sampling and Analysis Plan for Non-Visible Pollutants in Stormwater Runoff Discharges

This Sampling and Analysis Plan for Non-Visible Pollutants describes the sampling and analysis strategy and schedule for monitoring non-visible pollutants in stormwater runoff discharges from the project site.

Sampling for non-visible pollutants will be conducted when

(1) a breach, leakage, malfunction, or spill is observed; and

(2) the leak or spill has not been cleaned up prior to the rain event; and

(3) there is the potential for discharge of non-visible pollutants to surface waters or drainage system.

The construction materials, wastes, or activities identified in Appendix G are potential sources of non-visible pollutants to stormwater discharges from the project. Storage, use, and operational locations are shown on the Site Maps in Appendix B.

The following existing site features are potential sources of non-visible pollutants to stormwater discharges from the project. Locations of existing site features contaminated with non-visible pollutants are shown on the Site Maps in Appendix B.

- None

The following soil amendments have the potential to change the chemical properties, engineering properties, or erosion resistance of the soil and will be used on the project site. Locations of soil amendment application are shown on the Site Maps in Appendix B.

- All landscape areas

The project has the potential to receive stormwater run-on from the following locations with the potential to contribute non-visible pollutants to stormwater discharges from the project. Locations of such run-on to the project site are shown on the Site Maps in Appendix B.

- None

7.7.1.1 Sampling Schedule

Samples for the potential non-visible pollutant(s) and a sufficiently large unaffected background sample shall be collected during the first two hours of discharge from rain events that result in a sufficient discharge for sample collection. Samples shall be collected during the site's scheduled hours and shall be collected regardless of the time of year and phase of the construction.

Collection of discharge samples for non-visible pollutant monitoring will be triggered when any of the following conditions are observed during site inspections conducted prior to or during a rain event.

- Materials or wastes containing potential non-visible pollutants are not stored under watertight conditions. Watertight conditions are defined as (1) storage in a watertight container, (2) storage under a watertight roof or within a building, or (3) protected by temporary cover and containment that prevents stormwater contact and runoff from the storage area.
- Materials or wastes containing potential non-visible pollutants are stored under watertight conditions, but (1) a breach, malfunction, leakage, or spill is observed, (2) the leak or spill is not cleaned up prior to the rain event, and (3) there is the potential for discharge of non-visible pollutants to surface waters or a storm drain system.
- A construction activity, including but not limited to those in Appendix G, with the potential to contribute non-visible pollutants (1) was occurring during or within 24 hours prior to the rain event, (2) BMPs were observed to be breached, malfunctioning, or improperly implemented, and (3) there is the potential for discharge of non-visible pollutants to surface waters or a storm drain system.
- Soil amendments that have the potential to change the chemical properties, engineering properties, or erosion resistance of the soil have been applied, and there is the potential for discharge of non-visible pollutants to surface waters or a storm drain system.
- Stormwater runoff from an area contaminated by historical usage of the site has been observed to combine with stormwater runoff from the site, and there is the potential for discharge of non-visible pollutants to surface waters or a storm drain system.

7.7.1.2 Sampling Locations

Sampling locations are based on proximity to planned non-visible pollutant storage, occurrence or use; accessibility for sampling, and personnel safety. Planned non-visible pollutant sampling locations are shown on the Site Maps in Appendix B.

7.7.1.3 Monitoring Preparation

Non-visible pollutant samples will be collected by: (To Be Determined)

Contractor	☐ Yes	☐ No
Consultant	☐ Yes	☐ No
Laboratory	☐ Yes	☐ No

If sample collection is by contractor, sampling personnel will be as follows:

Name/Telephone No.: _____

Alternate(s)/Telephone No.: _____

An adequate stock of monitoring supplies and equipment for monitoring non-visible pollutants will be available on the project site prior to a sampling event. Monitoring supplies and equipment will be stored in a cool temperature environment that will not come into contact with

rain or direct sunlight. Sampling personnel will be available to collect samples in accordance with the sampling schedule. Supplies maintained at the project site will include, but are not limited to, clean powder-free nitrile gloves, sample collection equipment, coolers, appropriate number and volume of sample bottles, identification labels, re-sealable storage bags, paper towels, personal rain gear, ice, and *Effluent Sampling Field Log Sheets* and Chain of Custody (CoC) forms, which are provided in CSMP Attachment 3 "Example Forms".

If sample collection is by laboratory or environmental consultant:

Company Name: _____

Street Address: _____

City, State Zip: _____

Telephone No.: _____

Point of Contact: _____

Name of Sampler(s): _____

Name of Alternate(s): _____

The QSP or his/her designee will contact the company responsible for sample collection 24 hours prior to a predicted rain event or for an unpredicted event, as soon as a rain event begins if one of the triggering conditions is identified during an inspection to ensure that adequate sample collection personnel and supplies for monitoring non-visible pollutants are available and will be mobilized to collect samples on the project site in accordance with the sampling schedule.

7.7.1.4 Analytical Constituents

Table 7.10 lists the specific sources and types of potential non-visible pollutants for the project site and the water quality indicator constituent(s) for that pollutant.

Table 7.10 Potential Non-Visible Pollutants and Water Quality Indicator Constituents

General Activity/Potential Pollutants	Water Quality Indicator Constituent
Adhesives	COD, Phenols, SVOCs
Asphalt Work	VOCs
Cleaning	
Acids	pH
Bleaches	Residual chlorine
TSP	Phosphate
Solvents	VOCs, SVOCs
Detergents	MBAS

Table 7.10 Potential Non-Visible Pollutants and Water Quality Indicator Constituents	
General Activity/Potential Pollutants	**Water Quality Indicator Constituent**
Concrete / Masonry Work	
Sealant (Methyl methacrylate)	SVOC
Curing compounds	VOCs, SVOCs, pH
Ash, slag, sand	pH, Al, Ca, Va, Zn
Drywall	Cu, Al, General Minerals
Framing / Carpentry	
Treated Wood	Cu, Cr, As, Zn
Particle board	Formaldehyde
Untreated wood	BOD
Grading / Earthworks	
Gypsum / Lime amendments	pH
Contaminated Soil	Constituents specific to known contaminants, check with Laboratory
Heating, Ventilation, Air Conditioning	Freon
Insulation	Al, Zn
Landscaping	
Pesticides/Herbicides	Product dependent, see label and check with Laboratory
Fertilizers	TKN, NO_3, BOD, COD, DOC, Sulfate, NH_3, Phosphate, Potassium
Aluminum sulfate	Al, TDS, Sulfate
Liquid Waste	Constituents specific to materials, check with Laboratory
Painting	
Resins	COD, SVOCs
Thinners	COD, VOCs
Paint strippers	VOCs, SVOCs, metals
Lacquers, varnishes, enamels	COD, VOCs, SVOCs
Sealants	COD
Adhesives	Phenols, SVOCs

Table 7.10 Potential Non-Visible Pollutants and Water Quality Indicator Constituents	
General Activity/Potential Pollutants	**Water Quality Indicator Constituent**
Planting / Vegetation Management	
Vegetation stockpiles	BOD
Fertilizers	TKN, NO_3, BOD, COD, DOC, sulfate, NH_3, Phosphate, Potassium
Pesticides/Herbicides	Product dependent, see label and check with Laboratory
Plumbing	
Solder, flux, pipe fitting	Cu, Pb, Sn, Zn
Pools and Fountains	Residual chlorine, Cu, chloramines
Removal of existing structures	Zn, VOCs, PCBs (see also other applicable activity categories, e.g., grading, painting)
Roofing	Cu, Pb, VOCs
Sanitary Waste Sewer line breaks and Portable Toilets (using clear fluid – blue fluid is visible if discharged)	BOD, Total/Fecal coliform
Soil Preparation / Amendments/Dust Control	
Polymer/Co-polymers	TKN, NO_3, BOD, COD, DOC, Sulfate, Ni
Lignin sulfate	TDS, alkalinity
Psyllium	COD, TOC
Guar/Plant Gums	COD, TOC, Ni
Solid Waste (leakage)	BOD
Utility Line Testing and Flushing	Residual chlorine, chloramines
Vehicle and Equipment Use	
Batteries	Sulfuric acid; Pb, pH

Adapted from *Attachment S*, *Caltrans SWPPP/WPCP Preparation Manual*, *February 2003*, and *CASQA Construction BMP Handbook*, 2003

7.7.1.5 Sample Collection

Samples of discharge shall be collected at the designated non-visible pollutant sampling locations shown on the Site Maps in Appendix B or in the locations determined by observed breaches, malfunctions, leakages, spills, operational areas, soil amendment application areas, and historical site usage areas that triggered the sampling event.

Grab samples shall be collected and preserved in accordance with the methods identified in the Table, "Sample Collection, Preservation and Analysis for Monitoring Non-Visible Pollutants" provided in Section 7.7.1.6. Only the QSP, or personnel trained in water quality sampling under the direction of the QSP shall collect samples.

Sample collection and handling requirements are described in Section 7.7.7.

7.7.1.6 Sample Analysis

For samples to be analyzed by a laboratory: (To Be Determined)

Laboratory Name: _____

Street Address: _____

City, State Zip: _____

Telephone No.: _____

Point of Contact: _____

ELAP Certification No.: _____

Samples will be delivered to the laboratory by: (To Be Determined)

Driven by Contractor	☐ Yes	☐ No
Picked up by Laboratory Courier	☐ Yes	☐ No
Shipped	☐ Yes	☐ No

Refer to the laboratory for the analytical methods to be used for the specific constituent.

7.7.1.7 Data Evaluation and Reporting

The QSP shall complete an evaluation of the water quality sample analytical results.

Runoff/downgradient results shall be compared with the associated upgradient/unaffected results and any associated run-on results. Should the runoff/downgradient sample show an increased level of the tested analyte relative to the unaffected background sample, which cannot be explained by run-on results, the BMPs, site conditions, and surrounding influences shall be assessed to determine the probable cause for the increase.

As determined by the site and data evaluation, appropriate BMPs shall be repaired or modified to mitigate discharges of non-visible pollutant concentrations. Any revisions to the BMPs shall be recorded as an amendment to the SWPPP.

The General Permit prohibits the storm water discharges that contain hazardous substances equal to or in excess of reportable quantities established in 40 C.F.R. §§ 117.3 and 302.4. The results of any non-stormwater discharge results that indicate the presence of a hazardous substance in excess of established reportable quantities shall be immediately reported to the Regional Water Board and other agencies as required by 40 C.F.R. §§ 117.3 and 302.4.

Results of non-visible pollutant monitoring shall be reported in the Annual Report.

7.7.2 Sampling and Analysis Plan for pH and Turbidity in Stormwater Runoff Discharges

Sampling and analysis of runoff for pH and turbidity is not required for Risk Level 1 projects.

7.7.3 Sampling and Analysis Plan for pH, Turbidity, and SSC in Receiving Water

This project is not subject to Receiving Water Monitoring.

7.7.4 Sampling and Analysis Plan for Non-Stormwater Discharges

This project is not subject to the non-stormwater sampling and analysis requirements of the General Permit because it is a Risk Level 1 project.

7.7.5 Sampling and Analysis Plan for Other Pollutants Required by the Regional Water Board

The Regional Water Board has not specified monitoring for additional pollutants.

7.7.6 Training of Sampling Personnel

Sampling personnel shall be trained to collect, maintain, and ship samples in accordance with the Surface Water Ambient Monitoring program (SWAMP) 2008 Quality Assurance Program Plan (QAPrP). Training records of designated contractor sampling personnel are provided in Appendix K.

The stormwater sampler(s) and alternate(s) have received the following stormwater sampling training:

Name	**Training**

The stormwater sampler(s) and alternates have the following stormwater sampling experience:

Name	**Experience**

7.7.7 Sample Collection and Handling

7.7.7.1 Sample Collection

Samples shall be collected at the designated sampling locations shown on the Site Maps and listed in the preceding sections. Samples shall be collected, maintained and shipped in accordance with the SWAMP 2008 Quality Assurance Program Plan (QAPrP).

Grab samples shall be collected and preserved in accordance with the methods identified in preceding sections.

To maintain sample integrity and prevent cross-contamination, sample collection personnel shall follow the protocols below.

- Collect samples (for laboratory analysis) only in analytical laboratory-provided sample containers;
- Wear clean, powder-free nitrile gloves when collecting samples;
- Change gloves whenever something not known to be clean has been touched;
- Change gloves between sites;
- Decontaminate all equipment (e.g. bucket, tubing) prior to sample collection using a trisodium phosphate water wash, distilled water rinse, and final rinse with distilled water. (Dispose of wash and rinse water appropriately, i.e., do not discharge to storm drain or receiving water). Do not decontaminate laboratory provided sample containers;
- Do not smoke during sampling events;
- Never sample near a running vehicle;
- Do not park vehicles in the immediate sample collection area (even non-running vehicles);
- Do not eat or drink during sample collection; and
- Do not breathe, sneeze, or cough in the direction of an open sample container.

The most important aspect of grab sampling is to collect a sample that represents the entire runoff stream. Typically, samples are collected by dipping the collection container in the runoff flow paths and streams as noted below.

i. For small streams and flow paths, simply dip the bottle facing upstream until full.
ii. For larger stream that can be safely accessed, collect a sample in the middle of the flow stream by directly dipping the mouth of the bottle. Once again making sure that the opening of the bottle is facing upstream as to avoid any contamination by the sampler.
iii. For larger streams that cannot be safely waded, pole-samplers may be needed to safely access the representative flow.
iv. Avoid collecting samples from ponded, sluggish or stagnant water.
v. Avoid collecting samples directly downstream from a bridge as the samples can be affected by the bridge structure or runoff from the road surface.

Note, that depending upon the specific analytical test, some containers may contain preservatives. These containers should **never** be dipped into the stream, but filled indirectly from the collection container.

7.7.7.2 Sample Handling

Turbidity and pH measurements must be conducted immediately. Do not store turbidity or pH samples for later measurement.

Samples for laboratory analysis must be handled as follows. Immediately following sample collection:

- Cap sample containers;
- Complete sample container labels;
- Sealed containers in a re-sealable storage bag;

- Place sample containers into an ice-chilled cooler;
- Document sample information on the *Effluent Sampling Field Log Sheet*; and
- Complete the CoC.

All samples for laboratory analysis must be maintained between 0-6 degrees Celsius during delivery to the laboratory. Samples must be kept on ice, or refrigerated, from sample collection through delivery to the laboratory. Place samples to be shipped inside coolers with ice. Make sure the sample bottles are well packaged to prevent breakage and secure cooler lids with packaging tape.

Ship samples that will be laboratory analyzed to the analytical laboratory right away. Hold times are measured from the time the sample is collected to the time the sample is analyzed. The General Permit requires that samples be received by the analytical laboratory within 48 hours of the physical sampling (unless required sooner by the analytical laboratory).

Laboratory Name: _____

Address: _____

City, State Zip: _____

Telephone No.: _____

Point of Contact: _____

7.7.7.3 Sample Documentation Procedures

All original data documented on sample bottle identification labels, *Effluent Sampling Field Log Sheet*, and CoCs shall be recorded using waterproof ink. These shall be considered accountable documents. If an error is made on an accountable document, the individual shall make corrections by lining through the error and entering the correct information. The erroneous information shall not be obliterated. All corrections shall be initialed and dated.

Duplicate samples shall be identified consistent with the numbering system for other samples to prevent the laboratory from identifying duplicate samples. Duplicate samples shall be identified in the Effluent Sampling Field Log Sheet.

Sample documentation procedures include the following:

Sample Bottle Identification Labels: Sampling personnel shall attach an identification label to each sample bottle. Sample identification shall uniquely identify each sample location.

Field Log Sheets: Sampling personnel shall complete the *Effluent Sampling Field Log Sheet* and *Receiving Water Sampling Field Log Sheet* for each sampling event, as appropriate.

Chain of Custody: Sampling personnel shall complete the CoC for each sampling event for which samples are collected for laboratory analysis. The sampler will sign the CoC when the sample(s) is turned over to the testing laboratory or courier.

7.8 Active Treatment System Monitoring

An Active Treatment System (ATS) will be deployed on the site?

☐ Yes ☒ No

This project does not require a project specific Sampling and Analysis Plan for an ATS because deployment of an ATS is not planned.

7.9 Bioassessment Monitoring

This project is not subject to bioassessment monitoring because it is not a Risk Level 3 project.

7.10 Watershed Monitoring Option

This project is not participating in a watershed monitoring option.

7.11 Quality Assurance and Quality Control

An effective Quality Assurance and Quality Control (QA/QC) plan shall be implemented as part of the CSMP to ensure that analytical data can be used with confidence. QA/QC procedures to be initiated include the following:

- Field logs;
- Clean sampling techniques;
- CoCs;
- QA/QC Samples; and
- Data verification.

Each of these procedures is discussed in more detail in the following sections.

7.11.1 Field Logs

The purpose of field logs is to record sampling information and field observations during monitoring that may explain any uncharacteristic analytical results. Sampling information to be included in the field log include the date and time of water quality sample collection, sampling personnel, sample container identification numbers, and types of samples that were collected. Field observations should be noted in the field log for any abnormalities at the sampling location (color, odor, BMPs, etc.). Field measurements for pH and turbidity should also be recorded in the field log. A Visual Inspection Field Log, an Effluent Sampling Field Log Sheet are included in CSMP Attachment 3 “Example Forms”.

7.11.2 Clean Sampling Techniques

Clean sampling techniques involve the use of certified clean containers for sample collection and clean powder-free nitrile gloves during sample collection and handling. Adoption of a clean sampling approach will minimize the chance of field contamination and questionable data results.

7.11.3 Chain of Custody

The sample CoC is an important documentation step that tracks samples from collection through analysis to ensure the validity of the sample. Sample CoC procedures include the following:

- Proper labeling of samples;
- Use of CoC forms for all samples; and
- Prompt sample delivery to the analytical laboratory.

Analytical laboratories usually provide CoC forms to be filled out for sample containers. An example CoC is included in CSMP Attachment 3 "Example Forms".

7.11.4 QA/QC Samples

QA/QC samples provide an indication of the accuracy and precision of the sample collection; sample handling; field measurements; and analytical laboratory methods. The following types of QA/QC will be conducted for this project:

☒ Field Duplicates at a frequency of (5% or 1 duplicate minimum per sampling event)
(Required for all sampling plans with field measurements or laboratory analysis)

☐ Equipment Blanks at a frequency of [as required by method]
(Only needed if equipment used to collect samples could add the pollutants to sample)

☐ Field Blanks at a frequency of [as required by method]
(Only required if sampling method calls for field blanks)

☐ Travel Blanks at a frequency of [as required by method]
(Required for sampling plans that include VOC laboratory analysis)

7.11.4.1 Field Duplicates

Field duplicates provide verification of laboratory or field analysis and sample collection. Duplicate samples shall be collected, handled, and analyzed using the same protocols as primary samples. The sample location where field duplicates are collected shall be randomly selected from the discharge locations. Duplicate samples shall be collected immediately after the primary sample has been collected. Duplicate samples must be collected in the same manner and as close in time as possible to the original sample. Duplicate samples shall not influence any evaluations or conclusion.

7.11.4.2 Equipment Blanks

Equipment blanks provide verification that equipment has not introduced a pollutant into the sample. Equipment blanks are typically collected when:

- New equipment is used;
- Equipment that has been cleaned after use at a contaminated site;
- Equipment that is not dedicated for surface water sampling is used; or
- Whenever a new lot of filters is used when sampling metals.

7.11.4.3 Field Blanks

Field blanks assess potential sample contamination levels that occur during field sampling activities. De-ioninzed water field blanks are taken to the field, transferred to the appropriate

container, and treated the same as the corresponding sample type during the course of a sampling event.

7.11.4.4 Travel Blanks

Travel blanks assess the potential for cross-contamination of volatile constituents between sample containers during shipment from the field to the laboratory. De-ioninzed water blanks are taken along for the trip and held unopened in the same cooler with the VOC samples.

7.11.5 Data Verification

After results are received from the analytical laboratory, the QSP shall verify the data to ensure that it is complete, accurate, and the appropriate QA/QC requirements were met. Data must be verified as soon as the data reports are received. Data verification shall include:

- Check the CoC and laboratory reports.
  Make sure all requested analyses were performed and all samples are accounted for in the reports.
- Check laboratory reports to make sure hold times were met and that the reporting levels meet or are lower than the reporting levels agreed to in the contract.
- Check data for outlier values and follow up with the laboratory.
  Occasionally typographical errors, unit reporting errors, or incomplete results are reported and should be easily detected. These errors need to be identified, clarified, and corrected quickly by the laboratory. The QSP should especially note data that is an order of magnitude or more different than similar locations, or is inconsistent with previous data from the same location.
- Check laboratory QA/QC results.
  EPA establishes QA/QC checks and acceptable criteria for laboratory analyses. These data are typically reported along with the sample results. The QSP shall evaluate the reported QA/QC data to check for contamination (method, field, and equipment blanks), precision (laboratory matrix spike duplicates), and accuracy (matrix spikes and laboratory control samples). When QA/QC checks are outside acceptable ranges, the laboratory must flag the data, and usually provides an explanation of the potential impact to the sample results.
- Check the data set for outlier values and, accordingly, confirm results and re-analyze samples where appropriate.
  Sample re-analysis should only be undertaken when it appears that some part of the QA/QC resulted in a value out of the accepted range. Sample results may not be discounted unless the analytical laboratory identifies the required QA/QC criteria were not met and confirms this in writing.

Field data including inspections and observations must be verified as soon as the field logs are received, typically at the end of the sampling event. Field data verification shall include:

- Check field logs to make sure all required measurements were completed and appropriately documented;
- Check reported values that appear out of the typical range or inconsistent;
  Follow-up immediately to identify potential reporting or equipment problems, if appropriate, recalibrate equipment after sampling;

- Verify equipment calibrations;
- Review observations noted on the field logs; and
- Review notations of any errors and actions taken to correct the equipment or recording errors.

7.12 Records Retention

All records of stormwater monitoring information and copies of reports (including Annual Reports) must be retained for a period of at least three years from date of submittal or longer if required by the Regional Water Board.

Results of visual monitoring, field measurements, and laboratory analyses must be kept in the SWPPP along with CoCs, and other documentation related to the monitoring.

Records are to be kept onsite while construction is ongoing. Records to be retained include:

- The date, place, and time of inspections, sampling, visual observations, and/or measurements, including precipitation;
- The individual(s) who performed the inspections, sampling, visual observation, and/or field measurements;
- The date and approximate time of field measurements and laboratory analyses;
- The individual(s) who performed the laboratory analyses;
- A summary of all analytical results, the method detection limits and reporting limits, and the analytical techniques or methods used;
- Rain gauge readings from site inspections;
- QA/QC records and results;
- Calibration records;
- Visual observation and sample collection exemption records;
- The records of any corrective actions and follow-up activities that resulted from analytical results, visual observations, or inspections.

CSMP Attachment 1: Weather Reports

CSMP Attachment 2: Monitoring Records

CSMP Attachment 3: Example Forms

Rain Gauge Log Sheet				
Construction Site Name:				
WDID #:				
Date (mm/dd/yy)	Time (24-hr)	Initials	Rainfall Depth (Inches)	Notes:

Risk Level 1, 2, 3 ***Visual Inspection Field Log Sheet***						
Date and Time of Inspection:				Report Date:		
Inspection Type:	☐ Weekly	☐ Before predicted rain	☐ During rain event	☐ Following qualifying rain event	☐ Contained stormwater release	☐ Quarterly non-stormwater
Site Information						
Construction Site Name:						
Construction stage and completed activities:				Approximate area of exposed site:		
Weather and Observations						
Date Rain Predicted to Occur:				Predicted % chance of rain:		
Estimate storm beginning: _____ (date and time)		Estimate storm duration:_____ (hours)		Estimate time since last storm: _____ (days or hours)	Rain gauge reading:_____ (inches)	
Observations: If yes identify location						
Odors	Yes ☐	No ☐				
Floating material	Yes ☐	No ☐				
Suspended Material	Yes ☐	No ☐				
Sheen	Yes ☐	No ☐				
Discolorations	Yes ☐	No ☐				
Turbidity	Yes ☐	No ☐				
Site Inspections						
Outfalls or BMPs Evaluated			**Deficiencies Noted**			
(add additional sheets or attached detailed BMP Inspection Checklists)						
Photos Taken:	Yes ☐	No ☐	Photo Reference IDs:			
Corrective Actions Identified (note if SWPPP/REAP change is needed)						
Inspector Information						
Inspector Name:				Inspector Title:		
Signature:					Date:	

Risk Level 2 ***Effluent Sampling Field Log Sheets***			
Construction Site Name:		Date:	Time Start:
Sampler:			
Sampling Event Type:	☐ Stormwater	☐ Non-stormwater	☐ Non-visible pollutant

Field Meter Calibration	
pH Meter ID No./Desc.: Calibration Date/Time:	Turbidity Meter ID No./Desc.: Calibration Date/Time:

Field pH and Turbidity Measurements			
Discharge Location Description	pH	Turbidity	Time

Grab Samples Collected		
Discharge Location Description	Sample Type	Time

Additional Sampling Notes:
Time End:

Risk Level 3 ***Effluent Sampling Field Log Sheets***			
Construction Site Name:		Date:	Time Start:
Sampler:			
Sampling Event Type:	☐ Stormwater	☐ Non-stormwater	☐ Non-visible pollutant
Field Meter Calibration			
pH Meter ID No./Desc.: Calibration Date/Time:		Turbidity Meter ID No./Desc.: Calibration Date/Time:	

Field pH and Turbidity Measurements			
Discharge Location Description	pH	Turbidity	Time

Grab Samples Collected		
Discharge Location Description	Other (specify)	Time

Additional Sampling Notes:
Time End:

Risk Level 3 ***Receiving Water Sampling Field Log Sheets***		
Construction Site Name:	Date:	Time Start:
Sampler:		
Receiving Water Description and Observations		
Receiving Water Name/ID:		
Observations:		
Odors	Yes ☐ No ☐	
Floating material	Yes ☐ No ☐	
Suspended Material	Yes ☐ No ☐	
Sheen	Yes ☐ No ☐	
Discolorations	Yes ☐ No ☐	
Turbidity	Yes ☐ No ☐	
Field Meter Calibration		
pH Meter ID No./Desc.: Calibration Date/Time:		Turbidity Meter ID No./Desc.: Calibration Date/Time:

Field pH and Turbidity Measurements and SSC Grab Sample			
Upstream Location			
Type	Result	Time	Notes
pH			
Turbidity			
SSC	Collected Yes ☐ No ☐		
Downstream Location			
Type	Result	Time	Notes
pH			
Turbidity			
SSC	Collected Yes ☐ No ☐		
Additional Sampling Notes:			
Time End:			

NAL Exceedance Evaluation Summary Report	Page __ of __
Project Name	
Project WDID	
Project Location	
Date of Exceedance	
Type of Exceedance	**NAL Daily Average** ☐ **pH** ☐ **Turbidity** ☐ **Other (specify) _____**
Measurement or Analytical Method	☐ **Field meter** **(Sensitivity: _____)** ☐ **Lab method (specify) _____** **(Reporting Limit: _____)** **(MDL: _____)**
Calculated Daily Average	☐ **pH _____ pH units** ☐ **Turbidity _____ NTU**
Rain Gauge Measurement	**_____ inches**
Compliance Storm Event	**_____ inches (5-year, 24-hour event)**
Visual Observations on Day of Exceedance	

NAL Exceedance Evaluation Summary Report	Page __ of __
Description of BMPs in Place at Time of Event	
Initial Assessment of Cause	
Corrective Actions Taken (deployed after exceedance)	
Additional Corrective Actions Proposed	
Report Completed By	_____ **(Print Name, Title)**
Signature	_____

CHAIN-OF-CUSTODY **DATE:** **Lab ID:**

DESTINATION LAB: ATTN: **ADDRESS:** **Office Phone:** **Cell Phone:**							REQUESTED ANALYSIS				Notes:
SAMPLED BY:											
Contact:											
Project Name											
Client Sample ID	**Sample Date**	**Sample Time**	**Sample Matrix**	**Container #**	**Container Type**	**Container Pres.**					

SENDER COMMENTS:	**RELINQUISHED BY**	
	Signature:	
	Print:	
	Company:	
	Date:	TIME:
LABORATORY COMMENTS:	**RECEIVED BY**	
	Signature:	
	Print:	
	Company:	
	Date:	TIME:

CSMP Attachment 4: Field Meter Instructions

CSMP Attachment 5: Supplemental Information

Section 8 References

Infrastructure Engineering Corporation, "*Drainage Study, Olivenhain Municipal Water District – New and Remodeled Operations and Administrations Facilities,"* dated January 3, 2018.

Infrastructure Engineering Corporation, Grading Plans, Olivenhain – New and Remodeled Operations and Administration Facilities, dated January 2017.

CASQA 2009, *Stormwater BMP Handbook Portal: Construction*, November 2009, www.casqa.org

State Water Resources Control Board (2009). Order 2009-0009-DWQ, NPDES General Permit No. CAS000002: National Pollutant Discharges Elimination System (NPDES) California General Permit for Storm Water Discharge Associated with Construction and Land Disturbing Activities. Available on-line at: http://www.waterboards.ca.gov/water_issues/programs/stormwater/construction.shtml.

State Water Resources Control Board (2010). Order 2010-0014-DWQ, NPDES General Permit No. CAS000002: National Pollutant Discharges Elimination System (NPDES) California General Permit for Storm Water Discharge Associated with Construction and Land Disturbing Activities. Available on-line at: http://www.waterboards.ca.gov/water_issues/programs/stormwater/construction.shtml.

State Water Resources Control Board (2012). Order 2012-0006-DWQ, NPDES General Permit No. CAS000002: National Pollutant Discharges Elimination System (NPDES) California General Permit for Storm Water Discharge Associated with Construction and Land Disturbing Activities. Available on-line at: http://www.waterboards.ca.gov/water_issues/programs/stormwater/construction.shtml.

Appendix A: Calculations

Appendix B: Site Maps

Appendix C: Permit Registration Documents

Permit Registration Documents included in this Appendix (to be inserted by the Legally Responsible Person):

Included	Document
☒	Notice of Intent
☒	Risk Assessment (see Appendix A)
☒	Certification
☐	Post Construction Water Balance
☐	Copy of Annual Fee Receipt
☐	ATS Design Documents
☒	Site Maps (see Appendix B)

Appendix D: SWPPP Amendment Certifications

SWPPP Amendment No. _____

Project Name: Olivenhain Municipal Water District – New and Remodeled Operations and Administration Facilities

Qualified SWPPP Developer's Certification of the Stormwater Pollution Prevention Plan Amendment

"This Stormwater Pollution Prevention Plan amendment was prepared under my direction to meet the requirements of the California Construction General Permit (SWRCB Order No. 2009-009-DWQ as amended by 2010-0014-DWQ and 2012-0006-DWQ). I certify that I am a Qualified SWPPP Developer in good standing as of the date signed below."

QSD Signature	Date
QSD Name	QSD Certificate Number
Title and Affiliation	Telephone No.
Address	Email

Appendix E: Submitted Changes to PRDs

Log of Updated PRDs

The General Permit allows for the reduction or increase of the total acreage covered under the General Permit when a portion of the project is complete and/or conditions for termination of coverage have been met; when ownership of a portion of the project is purchased by a different entity; or when new acreage is added to the project.

Modified PRDs shall be filed electronically within 30 days of a reduction or increase in total disturbed area if a change in permit covered acreage is to be sought. The SWPPP shall be modified appropriately, with revisions and amendments recorded in Appendix C. Updated PRDs submitted electronically via SMARTS can be found in this Appendix.

This appendix includes the following updated PRDs (check all that apply):

☐ Revised Notice of Intent (NOI);

☐ Revised Site Map;

☐ Revised Risk Assessment;

☐ New landowner's information (name, address, phone number, email address); and

☐ New signed certification statement.

Olivenhain Municipal Water District
Legally Responsible Person

Signature of Authorized Representative of Legally Responsible Person/Approved Signatory	Date
Name of Authorized Representative of Legally Responsible Person/Approved Signatory	(760) 753-6466 Telephone No.

Appendix F: Construction Schedule

Appendix G:Construction Activities, Materials Used, and Associated Pollutants

Table G.1 Construction Activities and Associated Pollutants

Activity	Associated Materials or Pollutants	Pollutant Category[1]
Demolition and Grading Phase		
Solid waste	• Litter, trash and debris • Vegetation	Gross Pollutants
Removal of existing structures	• Demolition of asphalt, concrete, masonry, framing, roofing, metal structures.	Metals, Oil and Grease, Synthetic Organics[2]
Vehicle and equipment use	• Equipment operation • Equipment maintenance • Equipment washing • Equipment fueling	Oil and Grease
Streets and Utilities Phase		
Adhesives	• Adhesives, glues, resins, epoxy synthetics, PVC cement • Caulks, sealers, putty, sealing agents and • Coal tars (naphtha, pitch)	Oil and Grease, Synthetic Organics[2]
Asphalt paving/curbs	Hot and cold mix asphalt	Oil and Grease
Concrete / Masonry	• Cement and brick dust • Colored chalks • Concrete curing compounds • Glazing compounds • Surfaces cleaners • Saw cut slurries • Tile cutting	Metals, Synthetic Organics[2]
Plumbing	• Solder (lead, tin), flux (zinc chloride), pipe fitting • Galvanized metal in nails, fences, and electric wiring	Metals, Synthetic Organics[2]
Sanitary waste	• Portable toilets • Disturbance of existing sewer lines.	Nutrients
Solid waste	• Litter, trash and debris • Vegetation	Gross Pollutants
Utility line testing and flushing	• Hydrostatic test water • Pipe flushing	Synthetic Organics[2]
Vehicle and equipment use	• Equipment operation • Equipment maintenance • Equipment washing • Equipment fueling	Oil and Grease

Table G.1 Construction Activities and Associated Pollutants

Activity	Associated Materials or Pollutants	Pollutant Category[1]
Vertical Construction Phase		
Adhesives	• Adhesives, glues, resins, epoxy synthetics, PVC cement • Caulks, sealers, putty, sealing agents and • Coal tars (naphtha, pitch)	Oil and Grease, Synthetic Organics[2]
Cleaners	• Polishes (metal, ceramic, tile) • Etching agents • Cleaners, ammonia, lye, caustic sodas, bleaching agents and chromate salts	Metals, Synthetic Organics[2]
Concrete / Masonry	• Cement and brick dust • Colored chalks • Concrete curing compounds • Glazing compounds • Surfaces cleaners • Saw cut slurries • Tile cutting	Metals, Synthetic Organics[2]
Drywall	• Saw-cutting drywall	Metals
Framing/Carpentry	• Sawdust, particle board dust, and treated woods • Saw cut slurries	Metals, Synthetic Organics[2]
Heating, Ventilation, Air Conditioning	• Demolition or construction of air condition and heating systems	Metals, Synthetic Organics[2]
Insulation	• Demolition or construction involving insulation, venting systems	Metals, Synthetic Organics[2]
Liquid waste	• Wash waters • Irrigation line testing/flushing	Metals, Synthetic Organics[2]
Landscaping / Site Stabilization Phase		
Liquid waste	• Wash waters • Irrigation line testing/flushing	Metals, Synthetic Organics[2]
Planting / Vegetation Management	• Vegetation control (pesticides/herbicides) • Planting • Plant maintenance • Vegetation removal	Nutrients, Metals, Synthetic Organics[2]
Pools/fountains	• Chlorinated water	Synthetic Organics[2]
Soil preparation/amendments	• Use of soil additives/amendments	Nutrients
Solid waste	• Litter, trash and debris • Vegetation	Gross Pollutants
Utility line testing and flushing	• Hydrostatic test water • Pipe flushing	Synthetic Organics[2]

Table G.1 Construction Activities and Associated Pollutants

Activity	Associated Materials or Pollutants	Pollutant Category[1]
Vehicle and equipment use	• Equipment operation • Equipment maintenance • Equipment washing • Equipment fueling	Oil and Grease

(1) Categories per CASQA BMP Handbook (i.e., Sediment, Nutrients, Bacteria and Viruses, Oil and Grease, Metals, Synthetic Organics, Pesticides, Gross Pollutants, and Vector Production)

(2) Synthetic Organics are defined in Table 1.2 of the CASQA *Stormwater BMP Handbook Portal: Construction* as adhesives, cleaners, sealants, solvents, etc. These are generally categorized as VOCs or SVOCs.

Appendix H: Contractors and Subcontractors

Contractors and Subcontractors

Project Name: Olivenhain Municipal Water District – New and Remodeled Operations and Administration Facilities

This is a list of contractors or subcontractors that will be responsible for the implementation of the SWPPP on the project site through the construction activity respective to their trade. This list is as complete as possible at the initial date of preparation of the SWPPP and will be amended periodically as additional contractors or subcontractors are involved. The contractors or subcontractors have also been provided with a copy of the SWPPP sections that describe the recommended good housekeeping practices and control measures.

Contractor and Subcontractor List				
Contractor/Subcontractor Name and Address	**Contact Person/ Phone No.**	**Activity**	**Start Date**	**End Date**

Appendix I: BMP Inspection Form

BMP INSPECTION REPORT

Date and Time of Inspection:			Date Report Written:	
Inspection Type:	☐ Weekly *Complete Parts I,II,III and VII*	☐ Pre-Storm *Complete Parts I,II,III,IV and VII*	☐ During Rain Event *Complete Parts I, II, III, V, and VII*	☐ Post-Storm *Complete Parts I,II,III,VI and VII*

Part I. General Information

Site Information

Construction site name:
Olivenhain Municipal Water District – New and Remodeled Operations and Administration Facilities

Construction stage and completed activities:	Approximate area of site that is exposed:
Photos taken: ☐ Yes ☐ No	Photo reference IDs:

Weather

Estimate storm beginning: (date and time)	Estimate storm duration: (hours)
Estimate time since last storm: (days or hours)	Rain gauge reading and location: (in)

Is a "Qualifying Event" predicted or did one occur (i.e., 0.5" rain with 48-hrs or greater between events)? ☐ Y ☐ N
If yes, summarize forecast:

Exemption Documentation (explanation required if inspection could not be conducted).

Visual inspections are not required outside of business hours or during dangerous weather conditions such as flooding or electrical storms.

Inspector Information

Inspector Name:	Inspector Title:
Signature:	Date:

Part II. BMP Observations. Describe deficiencies in Part III.			
Minimum BMPs	**Failures or other short comings (yes, no, N/A)**	**Action Required (yes/no)**	**Action Implemented (Date)**
Good Housekeeping for Construction Materials			
Inventory of products (excluding materials designed to be outdoors)			
Stockpiled construction materials not actively in use are covered and bermed			
All chemicals are stored in watertight containers with appropriate secondary containment, or in a completely enclosed storage shed			
Construction materials are minimally exposed to precipitation			
BMPs preventing the off-site tracking of materials are implemented and properly effective			
Good Housekeeping for Waste Management			
Wash/rinse water and materials are prevented from being disposed into the storm drain system			
Portable toilets are contained to prevent discharges of waste			
Sanitation facilities are clean and with no apparent for leaks and spills			
Equipment is in place to cover waste disposal containers at the end of business day and during rain events			
Discharges from waste disposal containers are prevented from discharging to the storm drain system / receiving water			
Stockpiled waste material is securely protected from wind and rain if not actively in use			
Procedures are in place for addressing hazardous and non-hazardous spills			
Appropriate spill response personnel are assigned and trained			
Equipment and materials for cleanup of spills is available onsite			
Washout areas (e.g., concrete) are contained appropriately to prevent discharge or infiltration into the underlying soil			
Good Housekeeping for Vehicle Storage and Maintenance			
Measures are in place to prevent oil, grease, or fuel from leaking into the ground, storm drains, or surface waters			
All equipment or vehicles are fueled, maintained, and stored in a designated area with appropriate BMPs			
Vehicle and equipment leaks are cleaned immediately and disposed of properly			

Part II. BMP Observations Continued. Describe deficiencies in Part III.			
Minimum BMPs for Risk Level _____ Sites	Adequately designed, implemented and effective (yes, no, N/A)	Action Required (yes/no)	Action Implemented (Date)
Good Housekeeping for Landscape Materials			
Stockpiled landscape materials such as mulches and topsoil are contained and covered when not actively in use			
Erodible landscape material has not been applied 2 days before a forecasted rain event or during an event			
Erodible landscape materials are applied at quantities and rates in accordance with manufacturer recommendations			
Bagged erodible landscape materials are stored on pallets and covered			
Good Housekeeping for Air Deposition of Site Materials			
Good housekeeping measures are implemented onsite to control the air deposition of site materials and from site operations			
Non-Stormwater Management			
Non-Stormwater discharges are properly controlled			
Vehicles are washed in a manner to prevent non-stormwater discharges to surface waters or drainage systems			
Streets are cleaned in a manner to prevent unauthorized non-stormwater discharges to surface waters or drainage systems.			
Erosion Controls			
Wind erosion controls are effectively implemented			
Effective soil cover is provided for disturbed areas inactive (i.e., not scheduled to be disturbed for 14 days) as well as finished slopes, open space, utility backfill, and completed lots			
The use of plastic materials is limited in cases when a more sustainable, environmentally friendly alternative exists.			
Sediment Controls			
Perimeter controls are established and effective at controlling erosion and sediment discharges from the site			
Entrances and exits are stabilized to control erosion and sediment discharges from the site			
Sediment basins are properly maintained			
Linear sediment control along toe of slope, face of slope and at grade breaks **(Risk Level 2 & 3 only)**			
Limit construction activity to and from site to entrances and exits that employ effective controls to prevent offsite tracking **(Risk Level 2 & 3 only)**			

Ensure all storm, drain inlets and perimeter controls, runoff control BMPs and pollutants controls at entrances and exits are maintained and protected from activities the reduce their effectiveness **(Risk Level 2 & 3 only)**			
Inspect all immediate access roads daily **(Risk Level 2 & 3 only)**			
Run-On and Run-Off Controls			
Run-on to the site is effectively managed and directed away from all disturbed areas.			
Other			
Are the project SWPPP and BMP plan up to date, available on-site and being properly implemented?			

Part III. Descriptions of BMP Deficiencies

Deficiency	**Repairs Implemented:** Note - Repairs must begin within 72 hours of identification; complete repairs as soon as possible.	
	Start Date	**Action**

Part IV. Additional Pre-Storm Observations. Note the presence or absence of floating and suspended materials, sheen, discoloration, turbidity, odors, and source(s) of pollutants(s).	
	Yes, No, N/A
Do stormwater storage and containment areas have adequate freeboard? If no, complete Part III.	
Are drainage areas free of spills, leaks, or uncontrolled pollutant sources? If no, complete Part VII and describe below.	
Notes:	
Are stormwater storage and containment areas free of leaks? If no, complete Parts III and/or VII and describe below.	
Notes:	

Part V. Additional During-Storm Observations. If BMPs cannot be inspected during inclement weather, list the results of visual inspections at all relevant outfalls, discharge points, and downstream locations. Note odors or visible sheen on the surface of discharges. Complete Part VII (Corrective Actions) as needed.	
Outfall, Discharge Point, or Other Downstream Location	
Location	Description
Location	Description
Location	Description
Location	Description
Location	Description
Location	Description
Location	Description

Part VI. Additional Post-Storm Observations. Visually observe (inspect) stormwater discharges at all discharge locations within two business days (48 hours) after each qualifying rain event, and observe (inspect) the discharge of stored or contained stormwater that is derived from and discharged subsequent to a qualifying rain event producing precipitation of ½ inch or more at the time of discharge. Complete Part VII (Corrective Actions) as needed.	
Discharge Location, Storage or Containment Area	**Visual Observation**

Part VII. Additional Corrective Actions Required. Identify additional corrective actions not included with BMP Deficiencies (Part III) above. Note if SWPPP change is required.	
Required Actions	**Implementation Date**

Appendix J: Project Specific Rain Event Action Plan Template

(Not required for Risk Level 1 Sites)

Rain Event Action Plan (REAP)

Construction Site Name: Olivenhain Municipal Water District – New and Remodeled Operations and Administration Facilities

Date of REAP:		**WDID Number:**	
Date Rain Predicted to Occur:		**Predicted % Chance of Rain:**	

Predicted Rain Event Triggered Actions

Below is a list of suggested actions and items to review for this project. Each active Trade should check all material storage areas, stockpiles, waste management areas, vehicle and equipment storage and maintenance, areas of active soil disturbance, and areas of active work to ensure the proper implementation of BMPs. Project-wide BMPs should be checked and cross-referenced to the BMP progress map.

Trade or Activity	Suggested action(s) to perform / item(s) to review prior to rain event
❑ Information & Scheduling	❑ Inform trade supervisors of predicted rain ❑ Check scheduled activities and reschedule as needed ❑ Alert erosion/sediment control provider ❑ Alert sample collection contractor (if applicable) ❑ Schedule staff for extended rain inspections ❑ Check Erosion and Sediment Control (ESC) material stock ❑ Review BMP progress map ❑ Other: _____ ❑ Other: _____
❑ Material storage areas	❑ Material under cover or in sheds (ex: treated woods and metals) ❑ Perimeter control around stockpiles ❑ Other: _____ ❑ Other: _____
❑ Waste management areas	❑ Dumpsters closed ❑ Drain holes plugged ❑ Recycling bins covered ❑ Sanitary stations bermed and protected from tipping ❑ Other: _____ ❑ Other: _____
❑ Trade operations	❑ Exterior operations shut down for event (e.g., no concrete pours or paving) ❑ Soil treatments (e.g., fertilizer) ceased within 24 hours of event ❑ Materials and equipment (e.g., tools) properly stored and covered ❑ Waste and debris disposed in covered dumpsters or removed from site ❑ Trenches and excavations protected ❑ Perimeter controls around disturbed areas ❑ Fueling and repair areas covered and bermed ❑ Other: _____ ❑ Other: _____
❑ Site ESC BMPs	❑ Adequate capacity in sediment basins and traps ❑ Site perimeter controls in place ❑ Catch basin and drop inlet protection in place and cleaned ❑ Temporary erosion controls deployed ❑ Temporary perimeter controls deployed around disturbed areas and stockpiles ❑ Roads swept; site ingress and egress points stabilized ❑ Other: _____ ❑ Other: _____

❑ Concrete rinse out area	❑ Adequate capacity for rain ❑ Wash-out bins covered ❑ Other: _____ ❑ Other: _____
❑ Spill and drips	❑ All incident spills and drips, including paint, stucco, fuel, and oil cleaned ❑ Drip pans emptied ❑ Other: _____ ❑ Other: _____
❑ Other / Discussion / Diagrams	❑ Other: _____ ❑ Other: _____ ❑ Other: _____ ❑ Other: _____ ❑ Other: _____ ❑ Other: _____

Attach a printout of the weather forecast from the NOAA website to the REAP.

I certify under penalty of law that this Rain Event Action Plan (REAP) will be performed in accordance with the General Permit by me or under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

_____ Date: _____

Qualified SWPPP Practitioner (Use ink please)

Appendix K: Training Reporting Form

Trained Contractor Personnel Log

Stormwater Management Training Log and Documentation

Project Name: Olivenhain Municipal Water District – New and Remodeled Operations and Administration Facilities

WDID #: _____

Stormwater Management Topic: (check as appropriate)

☐ Erosion Control ☐ Sediment Control

☐ Wind Erosion Control ☐ Tracking Control

☐ Non-Stormwater Management ☐ Waste Management and Materials Pollution Control

☐ Stormwater Sampling

Specific Training Objective: _____

Location: _____ Date: _____

Instructor: _____ Telephone: _____

Course Length (hours): _____

Attendee Roster (Attach additional forms if necessary)

Name	Company	Phone

As needed, add proof of external training (e.g., course completion certificates, credentials for QSP).

Appendix L: Responsible Parties

Authorization of Approved Signatories

Project Name: Olivenhain Municipal Water District – New and Remodeled Operations and Administration Facilities

Legally Responsible Person: Olivenhain Municipal Water District

Telephone No.: (760) 753-6466

Name of Approved Signatory designated by the LRP | Title

Signature of Approved Signatory | Date

Name of Approved Signatory designated by the LRP | Title

Signature of Approved Signatory | Date

Name of Approved Signatory designated by the LRP | Title

Signature of Approved Signatory | Date

Identification of QSP

Project Name: Olivenhain Municipal Water District – New and Remodeled Operations and Administration Facilities

The following QSPs are associated with this project:

Name	Company	Date

Staff Trained By and Under the Supervision of the QSP

Project Name: Olivenhain Municipal Water District – New and Remodeled Operations and Administration Facilities

The name(s) and contact number(s) of personnel authorized to conduct site visual monitoring are listed below (refer to Appendix K for training qualifications).

Assigned Inspector	Phone No.
Alternate Inspector	**Phone No.**

Authorization of Data Submitters

Project Name: Olivenhain Municipal Water District – New and Remodeled Operations and Administration Facilities

Name of Personnel/Title	Company
Signature	Date
Name of Personnel/Title	Company
Signature	Date
Name of Personnel/Title	Company
Signature	Date
Approved Signatory's Signature	Date
Approved Signatory Name and Title	Telephone No.

Appendix N: Construction General Permit

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX B

GEOTECHNICAL DOCUMENTS

SDVOSB . DVBE

SCST, Inc.
Corporate Headquarters
6280 Riverdale Street
San Diego, CA 92120
P 619.280.4321
T 877.215.4321
F 619.280.4717
W www.scst.com

GEOTECHNICAL INVESTIGATION
OLIVENHAIN MUNICIPAL WATER DISTRICT (OMWD) BUILDING D
1966 OLIVENHAIN ROAD
ENCINITAS, CALIFORNIA

PREPARED FOR:

MR. DAVID PADILLA, P.E.
INFRASTRUCTURE ENGINEERING CORPORATION
14271 DANIELSON STREET
POWAY, CALIFORNIA 92064

PREPARED BY:

SCST, INC.
6280 RIVERDALE STREET
SAN DIEGO, CALIFORNIA 92120

Providing Professional Engineering Services Since 1959

SDVOSB . DVBE

SCST, Inc.
Corporate Headquarters
6280 Riverdale Street
San Diego, CA 92120
P 619.280.4321
T 877.215.4321
F 619.280.4717
W www.scst.com

March 3, 2016

SCST No. 160105P3
Report No. 1

David Padilla, P.E.
Project Manager
Infrastructure Engineering Corporation
14271 Danielson Street
Poway, California 92064

Subject: GEOTECHNICAL INVESTIGATION
OLIVENHAIN MUNICIPAL WATER DISTRICT (OMWD) BUILDING D
1966 OLIVENHAIN ROAD
ENCINITAS, CALIFORNIA

Dear Dave:

SCST, Inc. is pleased to present our report describing the geotechnical investigation performed for the subject project. We conducted the geotechnical investigation in general conformance with the scope of work presented in our proposal dated August 18, 2015. If you have any questions, please call us at (619) 280-4321.

Respectfully submitted,
SCST, INC.

REGISTERED PROFESSIONAL ENGINEER
THOMAS B. CANADY
No. 50057
Exp. 6/30/17
CIVIL
STATE OF CALIFORNIA

PROFESSIONAL GEOLOGIST
W. LEE VANDERHURST
No. 1125
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Thomas B. Canady, PE 50057
Principal Engineer

W. Lee Vanderhurst, CEG 1125
Principal Engineer

TBC:WLV:ER:aw

(1) Addressee via e-mail at dpadilla@iecorporation.com

TABLE OF CONTENTS

SECTION **PAGE**

EXECUTIVE SUMMARY i

1. INTRODUCTION 1

2. SCOPE OF WORK 1

2.1 FIELD INVESTIGATION 1
2.2 LABORATORY TESTING 1
2.3 PERCOLATION TESTING 1
2.4 ANALYSIS AND REPORT 1

3. SITE DESCRIPTION 2

4. PROPOSED DEVELOPMENT 2

5. GEOLOGY AND SUBSURFACE CONDITIONS 2

6. GEOLOGIC HAZARDS 3

6.1 FAULTING AND SURFACE RUPTURE 3
6.2 CBC SEISMIC DESIGN PARAMETERS 3
6.3 LIQUEFACTION, DYNAMIC SETTLEMENT AND LATERAL SPREADING 3
6.4 LANDSLIDES AND SLOPE STABILITY 4
6.5 TSUNAMIS, SEICHES AND FLOODING 4
6.6 SUBSIDENCE 4
6.7 HYDRO-CONSOLIDATION 4

7. CONCLUSIONS 4

8. RECOMMENDATIONS 5

8.1 SITE PREPARATION AND GRADING 5
8.1.1 Site Preparation 5
8.1.2 Remedial Grading - Building Areas 5
8.1.3 Remedial Grading - Pavement and Exterior Slab Areas 6
8.1.4 Compacted Fill 6
8.1.5 Imported Soil 6
8.1.6 Expansive Soil 6
8.1.7 Temporary Excavations 7
8.1.8 Temporary Shoring 7
8.1.9 Slopes 7
8.1.10 Site Excavation Characteristics 8
8.1.11 Surface Drainage 8
8.1.12 Grading Plan Review 8
8.2 FOUNDATIONS 8
8.2.1 Mat Foundations 8
8.2.2 Resistance to Lateral Loads 8
8.2.3 Settlement Characteristics 9
8.2.4 Moisture Protection 9
8.2.5 Foundation Plan Review 9
8.2.6 Foundation Excavation Observations 9
8.3 EXTERIOR SLABS-ON-GRADE 9
8.4 CONVENTIONAL RETAINING WALLS 10

TABLE OF CONTENTS (Continued)

SECTION **PAGE**

8.4.1 Foundations....10
8.4.2 Lateral Earth Pressures....10
8.4.3 Seismic Earth Pressure....11
8.4.4 Backfill....11
8.5 MECHANICALLY STABILIZED EARTH RETAINING WALLS....11
8.6 PIPELINES....12
8.6.1 Thrust Blocks....12
8.6.2 Modulus of Soil Reaction....12
8.6.3 Pipe Bedding....12
8.7 PAVEMENT SECTION RECOMMENDATIONS....12
8.8 PERVIOUS PAVEMENT SECTION RECOMMENDATIONS....13
8.9 SOIL CORROSIVITY....14
8.10 INFILTRATION....14

9. GEOTECHNICAL ENGINEERING DURING CONSTRUCTION....14

10. CLOSURE....15

11. REFERENCES....15

ATTACHMENTS

FIGURES

Figure 1....Site Vicinity Map
Figure 2....USGS Quadrangle Map
Figure 3....Subsurface Exploration Map
Figure 4....Regional Geology and Fault Map
Figure 5....Typical Retaining Wall Backdrain Detail
Figure 6....Typical MSE Retaining Wall Backdrain Detail

APPENDICES

Appendix I....Field Investigation
Appendix II....Laboratory Testing
Appendix III....Borehole Percolation Testing

EXECUTIVE SUMMARY

This report presents the results of the geotechnical investigation SCST performed for the subject project. We understand that the project will consist of the design and construction of a one-story building, pavements and storm water retention basins. The purpose of our work is to provide conclusions and recommendations regarding the geotechnical aspects of the project.

SCST explored the subsurface conditions by drilling four borings and four percolation test holes to depths between about 5 and 39½ feet below the existing ground surface. Kleinfelder (2001) previously drilled one boring to a depth of about 33½ feet below the existing ground surface in the area of the planned building. An SCST engineer logged the current borings and test holes and collected samples of the materials encountered for laboratory testing. SCST tested selected samples from the borings to evaluate pertinent soil classification and engineering properties to assist in developing geotechnical conclusions and recommendations.

The materials encountered in the borings and percolation test holes consist of young alluvial flood plain deposits underlain by Santiago Formation. The alluvial deposits consist of loose to dense silty to clayey sand and very stiff sandy fat clay. The Santiago Formation consists of dense to very dense, weakly cemented silty to clayey sandstone and hard claystone. Groundwater was encountered in borings B-1 through B-3 at depths between about 11½ and 15 feet below the existing ground surface.

SCST performed four borehole percolation tests. The test results indicate infiltration rates between <0.1 inch per hour and about 3.8 inches per hour. The infiltration rate of the actual soils that will be encountered at the bottom of storm water retention basins could vary significantly subsequent to grading.

The main geotechnical consideration affecting the planned development is the presence of potentially compressible and potentially liquefiable alluvium. Existing fill, if encountered, should be excavated in its entirety. In building areas, we recommend that alluvium within 5 feet of existing or planned grade, whichever is deeper, be excavated and replaced as compacted fill. In exterior slab areas, we recommend that alluvium within 2 feet of planned subgrade be excavated and replaced as compacted fill. We expect that most of the onsite soils can be reused as compacted fill. If the recommended remedial grading is performed, seismic settlements beneath planned Building D are estimated to be about 2 inches total and 1 inch differential across the structure. If the soils beneath the site liquefy, lateral spreading on the order of 3 feet could occur. Based on the type of construction, we recommend that the planned building be supported on a reinforced concrete mat foundation underlain by a geogrid-reinforced compacted fill mat. The mat foundation and exterior concrete slabs-on-grade should be underlain by at least 2 feet of material with an expansion index of 20 or less. We anticipate that most of the onsite soils will meet the expansion index criteria. If the estimated settlements are deemed not tolerable by the project structural engineer, then ground improvement, deep foundations, or other alternatives should be considered. The grading and foundation recommendations presented herein may need to be updated once final plans are developed.

1. INTRODUCTION

This report presents the results of the geotechnical investigation SCST performed for the subject project. We understand that the project will consist of the design and construction of a one-story building, pavements and storm water retention basins. The purpose of our work is to provide conclusions and recommendations regarding the geotechnical aspects of the project. Figure 1 presents a site vicinity map. Figure 2 presents the site location on a United States Geologic Survey 7.5 Minute Quadrangle Map.

2. SCOPE OF WORK

2.1 FIELD INVESTIGATION

SCST explored the subsurface conditions by drilling four borings and four percolation test holes to depths between about 5 and 39½ feet below the existing ground surface using a truck-mounted drill rig equipped with a hollow stem auger. Kleinfelder (2001) previously drilled one boring to a depth of about 33½ feet below the existing ground surface in the area of the planned building using a truck-mounted drill rig equipped with a hollow stem auger. Figure 3 shows the approximate locations of the borings and percolation test holes. An SCST engineer logged the current borings and percolation test holes and collected samples of the materials encountered for laboratory testing. Appendix I presents logs of the borings and the percolation test holes. Soils are classified according to the Unified Soil Classification System illustrated on Figure I-1.

2.2 LABORATORY TESTING

Selected samples were tested to evaluate pertinent soil classification and engineering properties and enable development of geotechnical conclusions and recommendations. The laboratory tests consisted of in situ moisture and density, grain size distribution, Atterberg Limits, R-value, expansion index, fines content and corrosivity. Appendix II presents the results of the laboratory tests and brief explanations of the test procedures.

2.3 PERCOLATION TESTING

We performed four borehole percolation tests. Appendix III presents the results of the tests.

2.4 ANALYSIS AND REPORT

The results of the field and laboratory tests were evaluated to develop conclusions and recommendations regarding:

- Subsurface conditions beneath the site
- Potential geologic hazards, including liquefaction
- Criteria for seismic design in accordance with the 2013 California Building Code (CBC)
- Site preparation and grading
- Appropriate alternatives for foundation support along with geotechnical engineering criteria for design of the foundations
- Estimated foundation settlements
- Support for concrete slabs-on-grade

- Lateral pressures for the design of retaining walls
- Pavement sections
- Corrosion potential
- Infiltration rate

3. SITE DESCRIPTION

The site is located within existing OMWD headquarters at 1966 Olivenhain Road in the City of Encinitas, California. The site is located on the northern flank of the Encinitas Creek drainage basin. Encinitas Creek flows in an east-west direction about 600 feet south of the site. The site is occupied by various buildings, hardscape and landscape areas, and pavements for site access and parking. Site elevations range from about 121 feet at the northwestern portion of the site to about 115 feet at the southeastern portion of the site.

4. PROPOSED DEVELOPMENT

We understand the proposed development will consist of a one-story building, pavements and storm water retention basins. As currently planned, the Building D will have a finished floor elevation of 122.12 feet. Minor grading with cuts and fills less than 5 feet deep will be required to achieve finished site elevations.

5. GEOLOGY AND SUBSURFACE CONDITIONS

The site is located within the Peninsular Ranges Geomorphic Province of California, which stretches from the Los Angeles basin to the tip of Baja California. This province is characterized as a series of northwest trending mountain ranges separated by subparallel fault zones, and a coastal plain of subdued landforms. The mountain ranges are underlain primarily by Mesozoic metamorphic rocks that were intruded by plutonic rocks of the southern California batholith, while the coastal plain is underlain by subsequently deposited marine and non-marine sedimentary formations. The site is located in the coastal plain portion of the province and is underlain by young alluvial flood plain deposits and Santiago Formation. Descriptions of the materials are presented below. Figure 4 presents the regional geology in the vicinity of the site.

Young Alluvial Flood Plain Deposits (Qya): The alluvial deposits consist of loose to dense silty to clayey sand and very stiff sandy fat clay. The alluvium encountered in the borings extends to depths between about 25 and 38 feet below the existing ground surface.

Santiago Formation (Tsa): The Santiago Formation underlies the alluvium. The Santiago Formation materials consists of dense to very dense, weakly cemented silty to clayey sandstone and hard claystone.

Groundwater - Groundwater was encountered in borings B-1 through B-3 at depths between about 11½ and 15 feet below the existing ground surface. Groundwater levels may fluctuate in the future due to rainfall, irrigation, broken pipes, or changes in site drainage.

6. GEOLOGIC HAZARDS

6.1 FAULTING AND SURFACE RUPTURE

The closest known active fault is the Rose Canyon fault zone (Del Mar section) located about 6 miles west of the site (Figure 4) capable of producing a 7.2 moment magnitude earthquake. The site is not located in an Alquist-Priolo Earthquake Fault Zone. No active faults are known to underlie or project toward the site. Therefore, the probability of fault rupture is low.

6.2 CBC SEISMIC DESIGN PARAMETERS

A geologic hazard likely to affect the project is groundshaking as a result of movement along an active fault zone in the vicinity of the subject site. The site coefficients and adjusted maximum considered earthquake spectral response accelerations in accordance with the 2013 CBC are presented below:

Site Coordinates: Latitude 33.06776°
Longitude -117.24652°
Site Class: D
Site Coefficients, F_a = 1.080
F_v = 1.594
Mapped Spectral Response Acceleration at Short Period, S_s = 1.051g
Mapped Spectral Response Acceleration at 1-Second Period, S_1 = 0.406g
Design Spectral Acceleration at Short Period, S_{DS} = 0.756g
Design Spectral Acceleration at 1-Second Period, S_{D1} = 0.431g
Site Peak Ground Acceleration, PGA_M = 0.448g

6.3 LIQUEFACTION, DYNAMIC SETTLEMENT AND LATERAL SPREADING

Liquefaction is a process in which soil grains in a saturated deposit lose contact after the occurrence of earthquakes or other sources of ground shaking. The soil deposit temporarily behaves as a viscous fluid; pore pressures rise, and the strength of the deposit is greatly diminished. Liquefiable soils typically consist of cohesionless sands and silts that are loose to medium dense, and saturated. Recent studies also show that some relatively soft cohesive soils can be subject to cyclic softening during significant earthquake shaking. To liquefy, saturated soils must be subjected to ground shaking of sufficient magnitude and duration. For our analysis we used a PGA of 0.448g, an earthquake magnitude of 7.2 and a groundwater depth of 10 feet. Based on our analysis, there is a potential for liquefaction to occur within the loose to medium dense alluvial sands underlying the site. Dynamic and post-liquefaction settlements beneath Building D are estimated to be about 3 inches total and 1½ inches differential across the structure. We also performed the analysis assuming that the top 5 feet of soil would be over-excavated and recompacted. Based on this analysis, the settlements are estimated to be about 2 inches total beneath Building D and 1 inches differential across the structure. Based on our analysis, the site is also susceptible to lateral spreading. If the soils beneath the site liquefy, lateral spreading on the order of 3 feet could occur.

6.4 LANDSLIDES AND SLOPE STABILITY

Evidence of landslides or slope instabilities was not observed. The potential for landslides or slope instabilities to occur at the site is considered negligible.

6.5 TSUNAMIS, SEICHES AND FLOODING

The site is not located within a mapped area on the State of California Tsunami Inundation Maps (Cal EMA, 2009); therefore, damage due to tsunamis is considered negligible. Seiches are periodic oscillations in large bodies of water such as lakes, harbors, bays, or reservoirs. The site is not located adjacent to any lakes or confined bodies of water; therefore, the potential for a seiche to affect the site is negligible. Portions of the site are located within a mapped 100-year floodplain (County of San Diego, 2012). We understand that fill will be placed to elevate Building D about 2 feet above the mapped 100-year floodplain.

6.6 SUBSIDENCE

The site is not located in an area of known subsidence associated with fluid withdrawal (groundwater or petroleum); therefore, the potential for subsidence due to the extraction of fluids is low.

6.7 HYDRO-CONSOLIDATION

Hydro-consolidation can occur in recently deposited (less than 10,000 years old) sediments that were deposited in a semi-arid environment. Examples of such sediments are aolian sands, alluvial fan deposits, and mudflow sediments deposited during flash floods. The pore space between particle grains can re-adjust when inundated by groundwater causing the material to consolidate. The upper alluvial deposits are susceptible to hydro-consolidation. The recommended remedial grading of the upper soils should effectively mitigate this hazard.

7. CONCLUSIONS

The main geotechnical consideration affecting the planned development is the presence of potentially compressible and potentially liquefiable alluvium. The loose alluvial soils that cover the site are potentially compressible and susceptible to settlement from static structural or fill loads. They are also susceptible to dynamic settlement under seismic loading. The saturated alluvium is potentially liquefiable and susceptible to post-liquefaction settlement. If the recommended remedial grading of the upper soils is performed, we estimate that dynamic and post-liquefaction settlements will be about 2 inches total and 1 inch differential beneath Building D. If the soils beneath the site liquefy, lateral spreading on the order of 3 feet could occur.

To reduce the liquefaction hazard, either the soils can be densified through ground improvement or the effects of liquefaction can be reduced through a combination of remedial grading and structural mitigation. If selected, various ground improvement methods, including compaction grouting, deep soil mixing, or jet grouting, could be used at the site to mitigate the liquefiable soils

and reduce settlements. If ground improvement is used, verification testing should be performed upon completion to confirm that the liquefiable soils have been sufficiently densified.

For relatively small, lightweight structures such as the planned building, the cost of ground improvement may not be practical if the effects of potential liquefaction can be reduced by constructing a geogrid-reinforced compacted fill mat and a rigid reinforced concrete mat foundation. The grading and foundation recommendations presented in this report assume that the effects of the estimated seismic settlements can be sufficiently reduced by remedial grading and by structural design. If the estimated settlements are deemed not tolerable by the structural engineer, then ground improvement, deep foundations or other alternatives should be considered.

8. RECOMMENDATIONS

8.1 SITE PREPARATION AND GRADING

8.1.1 Site Preparation

Site preparation should begin with the removal of existing improvements, vegetation and debris. Subsurface improvements that are to be abandoned should be removed, and the resulting excavations should be backfilled and compacted in accordance with the recommendations of this report. Pipeline abandonment can consist of capping or rerouting at the project perimeter and removal within the project perimeter. If appropriate, abandoned pipelines can be filled with grout or slurry as recommended by and observed by the geotechnical consultant.

8.1.2 Remedial Grading - Building Areas

We recommend that remedial grading be performed beneath the planned building to improve structural support and reduce the effects of static and seismic settlements. Existing fill, if encountered, should be excavated in its entirety. Alluvium within 5 feet of existing or planned grade, whichever is deeper, should be excavated. Horizontally, the bottom of excavation should extend at least 5 feet outside planned perimeter foundations or up to existing improvements, whichever is less. Prior to placing fill, we recommend placing a layer of Tensar TX5 or equivalent reinforcing geogrid at the base of the excavation. The geogrid layer should extend at least 3 feet beyond the edge of the foundation. An SCST representative should observe conditions exposed in the bottom of excavations to determine if additional excavation is required.

If the base of the excavation is wet and yielding, it can be stabilized by placing a layer of ¾-inch crushed rock over the geogrid. A minimum 1-foot thick layer rock is typically needed. Prior to placing compacted fill, a layer of nonwoven filter fabric (Mirafi 140N or equivalent) should be placed above the crushed rock to prevent fines from washing into the voids of the ¾-inch crushed gravel, which could result in post construction settlement.

8.1.3 Remedial Grading - Pavement and Exterior Slab Areas

Existing fill, if encountered, should be excavated in its entirety. Alluvium should be excavated to a depth of 2 feet below finished subgrade elevation. Horizontally, the excavations should extend at least 2 feet outside the perimeter of the planned improvement or up to existing improvements, whichever is less. An SCST representative should observe conditions exposed in the bottom of the excavation to determine if additional excavation is required.

8.1.4 Compacted Fill

Prior to placing geogrid or fill, the exposed surface at the bottom of excavation should be scarified to a depth of 12 inches, moisture conditioned to near optimum moisture content and compacted to at least 90% relative compaction. Material with an expansion index of 20 or less determined in accordance with ASTM D4829 should be used from 2 feet below the deepest planned foundation bottom level to finished pad grade elevation. Exterior concrete slabs-on-grade should be underlain by at least 2 feet of material with an expansion index of 20 or less. We expect that most of the excavated soils will meet the expansion index criteria and can be reused as compacted fill.

Excavated material, except for roots, debris and rocks greater than 6 inches, can be used as compacted fill. Fill should be moisture conditioned to near optimum moisture content and compacted to at least 90% relative compaction. Fill should be placed in horizontal lifts at a thickness appropriate for the equipment spreading, mixing, and compacting the material, but generally should not exceed 8 inches in loose thickness. The maximum dry density and optimum moisture content for the evaluation of relative compaction should be determined in accordance with ASTM D1557. Utility trench backfill beneath structures, pavements and slabs-on-grade should be compacted to at least 90% relative compaction. The top 12 inches of subgrade beneath pavements should be compacted to at least 95% relative compaction.

8.1.5 Imported Soil

Imported soil should consist of predominately granular soil free of organic matter and rocks greater than 6 inches. Imported soil should have an expansion index of 20 or less and should be inspected and, if appropriate, tested by SCST prior to transport to the site.

8.1.6 Expansive Soil

The onsite soils tested have a very low expansion potential. The recommendations presented in this report reflect a very low expansion potential.

8.1.7 Temporary Excavations

Temporary excavations 3 feet deep or less can be made vertically. Deeper temporary excavations should be laid back no steeper than 1:1 (horizontal:vertical). The faces of temporary slopes should be inspected daily by the contractor's Competent Person before personnel are allowed to enter the excavation. Any zones of potential instability, sloughing or raveling should be brought to the attention of the Engineer and corrective action implemented before personnel begin working in the excavation. Excavated soils should not be stockpiled behind temporary excavations within a distance equal to the depth of the excavation. SCST should be notified if other surcharge loads are anticipated so that lateral load criteria can be developed for the specific situation. If temporary slopes are to be maintained during the rainy season, berms are recommended along the tops of slopes to prevent runoff water from entering the excavation and eroding the slope faces. Slopes steeper than those described above will require shoring. Additionally, temporary excavations that extend below a plane inclined at 1½:1 (horizontal:vertical) downward from the outside bottom edge of existing structures or improvements will require shoring. A shoring system consisting of soldier piles and lagging can be used.

8.1.8 Temporary Shoring

For design of cantilevered shoring, an active soil pressure equal to a fluid weighing 35 pcf can be used for level retained ground or 55 pcf for 2:1 (horizontal:vertical) sloping ground. The surcharge loads on shoring from traffic and construction equipment adjacent to the excavation can be modeled by assuming an additional 2 feet of soil behind the shoring. For design of soldier piles, an allowable passive pressure of 350 psf per foot of embedment over three times the pile diameter up to a maximum of 5,000 psf can be used. Soldier piles should be spaced at least three pile diameters, center to center. Continuous lagging will be required throughout. The soldier piles should be designed for the full-anticipated lateral pressure; however, the pressure on the lagging will be less due to arching in the soils. For design of lagging, the earth pressure can be limited to a maximum value of 400 psf.

8.1.9 Slopes

All permanent slopes should be constructed no steeper than 2:1 (horizontal:vertical). Faces of fill slopes should be compacted either by rolling with a sheep-foot roller or other suitable equipment, or by overfilling and cutting back to design grade. All slopes are susceptible to surficial slope failure and erosion. Water should not be allowed to flow over the top of slopes. Additionally, slopes should be planted with vegetation that will reduce the potential for erosion.

8.1.10 Site Excavation Characteristics

It is anticipated that excavations can be achieved with conventional earthwork equipment in good working order.

8.1.11 Surface Drainage

Final surface grades around structures should be designed to collect and direct surface water away from the structure and toward appropriate drainage facilities. The ground around the structure should be graded so that surface water flows rapidly away from the structure without ponding. In general, we recommend that the ground adjacent to the structure slope away at a gradient of at least 2%. Densely vegetated areas where runoff can be impaired should have a minimum gradient of at least 5% within the first 5 feet from the structure. Roof gutters with downspouts that discharge directly into a closed drainage system are recommended on structures. Drainage patterns established at the time of fine grading should be maintained throughout the life of the proposed structures. Site irrigation should be limited to the minimum necessary to sustain landscape growth. Should excessive irrigation, impaired drainage, or unusually high rainfall occur, saturated zones of perched groundwater can develop.

8.1.12 Grading Plan Review

SCST should review the grading plans and earthwork specifications to ascertain whether the intent of the recommendations contained in this report have been implemented, and that no revised recommendations are needed due to changes in the development scheme.

8.2 FOUNDATIONS

8.2.1 Mat Foundations

Due to the potential for ground movement during a seismic event, we recommend that the building be constructed on a mat foundation unless ground improvement is performed. Mat foundations should be underlain by compacted fill. A modulus of subgrade reaction of 200 pounds per cubic inch (pci) can be used for structural design. An allowable bearing capacity of 1,500 pounds per square foot (psf) can be used. The bearing value can be increased by ⅓ when considering the total of all loads, including wind or seismic forces. Footings located adjacent to or within slopes should be extended to a depth such that a minimum horizontal distance of 7 feet exists between the lower outside footing edge and the face of the slope.

8.2.2 Resistance to Lateral Loads

Lateral loads will be resisted by friction between the bottoms of foundations and passive pressure on the faces of foundations and other structural elements below grade. An allowable coefficient of friction of 0.30 can be used. Passive pressure can be computed

using an allowable lateral pressure of 350 psf per foot of depth below the ground surface for level ground conditions. The passive pressure can be increased by ⅓ when considering the total of all loads, including wind or seismic forces. The upper 1 foot of soil should not be relied on for passive support unless the ground is covered with pavements or slabs.

8.2.3 Settlement Characteristics

The estimated mat foundation settlements are as follows:

Static: 1 inch total
¾ inch differential over a distance of 40 feet

Seismic: 2 inches total
1 inch differential across the structure

8.2.4 Moisture Protection

Moisture protection should be installed beneath the mat foundation where moisture sensitive floor coverings will be used. The project architect should review the tolerable moisture transmission rate of the proposed floor covering and specify an appropriate moisture protection system. Typically, a plastic vapor barrier is used. Minimum 10-mil plastic is recommended. The plastic should comply with ASTM E1745. The vapor barrier installation should comply with ASTM E1643.

Construction practice often includes placement of a 2-inch thick sand cushion between the bottom of the concrete slab and the vapor barrier. This cushion can provide some protection to the vapor barrier during construction, and may assist in reducing the potential for edge curling in the slab during curing. However, the sand layer also provides a source of moisture to the underside of the slab that can increase the time required to reduce vapor emissions to limits acceptable for the type of floor covering placed on top of the slab. The slab can be placed directly on the vapor barrier.

8.2.5 Foundation Plan Review

SCST should review the foundation plans to ascertain that the intent of the recommendations in this report has been implemented and that revised recommendations are not necessary as a result of changes after this report was completed.

8.2.6 Foundation Excavation Observations

A representative from SCST should observe the foundation excavations prior to forming or placing reinforcing steel.

8.3 EXTERIOR SLABS-ON-GRADE

The top 2 feet of material below exterior concrete slabs-on-grade should have an expansion index of 20 or less determined in accordance with ASTM D4829. Exterior slabs should be at

least 4 inches thick and reinforced with at least No. 3 bars at 18 inches on center each way. Slabs should be provided with weakened plane joints. Joints should be placed in accordance with the American Concrete Institute (ACI) guidelines. The project architect should select the final joint patterns. A 1-inch maximum size aggregate mix is recommended for concrete for exterior slabs. The corrosion potential of on-site soils with respect to reinforced concrete will need to be taken into account in concrete mix design. Coarse and fine aggregate in concrete should conform to the "Greenbook" Standard Specifications for Public Works Construction.

8.4 CONVENTIONAL RETAINING WALLS

8.4.1 Foundations

Retaining walls can be supported on shallow spread footings with bottoms levels on compacted fill. Footings should extend at least 18 inches below lowest adjacent finished grad and should be at least 24 inches wide. An allowable bearing capacity of 2,500 psf can be used. The bearing value can be increased by ⅓ when considering the total of all loads, including wind or seismic forces. Footings located adjacent to or within slopes should be extended to a depth such that a minimum horizontal distance of 7 feet exists between the lower outside footing edge and the face of the slope. The recommendations provided above for resistance to lateral loads are applicable for retaining wall foundations.

8.4.2 Lateral Earth Pressures

The active earth pressure for the design of unrestrained retaining walls with level backfill can be taken as equivalent to the pressure of a fluid weighing 35 pcf. The at-rest earth pressure for the design of restrained retaining walls with level backfills can be taken as equivalent to the pressure of a fluid weighing 55 pcf. These values assume a granular and drained backfill condition. An additional 20 pcf should be added to these values for walls with a 2:1 (horizontal:vertical) sloping backfill. An increase in earth pressure equivalent to an additional 2 feet of retained soil can be used to account for surcharge loads from light traffic. The above values do not include a factor of safety. Appropriate factors of safety should be incorporated into the design. If any other surcharge loads are anticipated, SCST should be contacted for the necessary increase in soil pressure.

Retaining walls should be designed to resist hydrostatic pressures or be provided with a backdrain to reduce the accumulation of hydrostatic pressures. Backdrains can consist of a 2-foot wide zone of ¾-inch crushed rock separated from the adjacent soils using a nonwoven filter fabric (Mirafi 140N or equivalent). Weep holes should be provided or a perforated pipe should be installed at the base of the backdrain and sloped to discharge to a suitable storm drain facility. As an alternative, a geocomposite drainage system such as Miradrain 6000 or equivalent placed behind the wall and connected to a suitable storm drain facility can be used. The project architect should provide waterproofing specifications and details. Figure 5 presents typical conventional retaining wall backdrain details.

8.4.3 Seismic Earth Pressure

If required, the seismic earth pressure can be taken as equivalent to the pressure of a fluid weighing 16 pcf. This value is for level backfill and does not include a factor of safety. Appropriate factors of safety should be incorporated into the design. This pressure is in addition to the un-factored, static active earth pressure. The passive pressure and bearing capacity can be increased by ⅓ in determining the seismic stability of the wall.

8.4.4 Backfill

Wall backfill should consist of granular, free-draining material. Expansive or clayey soil should not be used. Additionally, backfill within 3 feet from the back of the wall should not contain rocks greater than 3 inches in dimension. We anticipate that a portion of the onsite soils will be suitable for wall backfill. Backfill should be compacted to at least 90% relative compaction. Backfill should not be placed until walls have achieved adequate structural strength. Compaction of wall backfill will be necessary to minimize settlement of the backfill and overlying settlement sensitive improvements. However, some settlement should still be anticipated. Provisions should be made for some settlement of concrete slabs and pavements supported on backfill. Additionally, any utilities supported on backfill should be designed to tolerate differential settlement.

8.5 MECHANICALLY STABILIZED EARTH RETAINING WALLS

The following soil parameters can be used for design of mechanically stabilized earth (MSE) retaining walls.

MSE Wall Design Parameters

Soil Parameter	Reinforced Soil	Retained Soil	Foundation Soil
Internal Friction Angle	32°	32°	32°
Cohesion	0	0	0
Moist Unit Weight	125 pcf	125 pcf	125 pcf

The reinforced soil should consist of granular, free-draining material with an expansion index of 20 or less. The bottom of MSE walls should extend to such a depth that a total of 5 feet exists between the bottom of the wall and the face of the slope. Figure 6 presents a typical MSE retaining wall backdrain detail. MSE retaining walls may experience lateral movement over time. The wall engineer should review the configuration of proposed improvements adjacent to the wall and provide measures to help reduce the potential for distress to these improvements from lateral movement.

8.6 PIPELINES

8.6.1 Thrust Blocks

For level ground conditions, a passive earth pressure of 350 psf per foot of depth below the lowest adjacent final grade can be used to compute allowable thrust block resistance. A value of 150 psf per foot should be used below groundwater level, if encountered.

8.6.2 Modulus of Soil Reaction

A modulus of soil reaction (E') of 2,000 psi can be used to evaluate the deflection of buried flexible pipelines. This value assumes that granular bedding material is placed adjacent to the pipe and is compacted to at least 90% relative compaction.

8.6.3 Pipe Bedding

Pipe bedding as specified in the "Greenbook" Standard Specifications for Public Works Construction can be used. Bedding material should consist of clean sand having a sand equivalent not less than 30 and should extend to at least 12 inches above the top of pipe. Alternative materials meeting the intent of the bedding specifications are also acceptable. Samples of materials proposed for use as bedding should be provided to the engineer for inspection and testing before the material is imported for use on the project. The onsite materials are not expected to meet "Greenbook" bedding specifications. The pipe bedding material should be placed over the full width of the trench. After placement of the pipe, the bedding should be brought up uniformly on both sides of the pipe to reduce the potential for unbalanced loads. No voids or uncompacted areas should be left beneath the pipe haunches. Ponding or jetting the pipe bedding should not be allowed.

8.7 PAVEMENT SECTION RECOMMENDATIONS

The pavement support characteristics of the soils encountered during our investigation are considered moderate. An R-value of 26 was assumed for design of preliminary pavement sections. The actual R-value of the subgrade soils should be determined after grading and final pavement sections be provided. Based on an R-value of 26, the following pavement structural sections are recommended for the assumed Traffic Indices.

Flexible Pavement Sections

Traffic Type	Traffic Index	Asphalt Concrete (inches)	Aggregate Base* (inches)
Parking Stalls	4.5	3	5
Drive Lanes	6.0	4	8
Heavy Traffic Areas	7.0	4	11

***Aggregate Base should conform to Class 2 Aggregate Base in accordance with the Caltrans Standard Specifications or Crushed Miscellaneous Base in accordance with the "Greenbook."**

Portland Cement Concrete Pavement Sections

Traffic Type	Traffic Index	Full-Depth JPCP* (inches)
Parking Stalls	4.5	6
Drive Lanes	6.0	6½
Heavy Traffic Areas	7.0	7

***Jointed Plain Concrete Pavement**

The top 12 inches of subgrade should be scarified, moisture conditioned to near optimum moisture content and compacted to at least 95% relative compaction. Aggregate base and asphalt concrete should be compacted to at least 95% relative compaction. All soft or yielding areas should be removed and replaced with compacted fill or aggregate base. All materials and methods of construction should conform to good engineering practices and the minimum local standards.

8.8 PERVIOUS PAVEMENT SECTION RECOMMENDATIONS

Pervious pavement section recommendations are based on Caltrans (2014) pavement structural design guidelines. The pavement sections below are based on the strength of the materials. However, the actual thickness of the sections may be controlled by the reservoir layer design, which the project civil engineer should determine.

Pervious Asphalt Pavement

Traffic Type	Category	*Asphalt Treated Permeable Base (ATPB) (inches)	Permeable Base (inches)
Parking Stalls	B	5	9

***1 inch of an open graded friction course (OGFC) should be placed on top of the ATPB.**

Pervious Concrete Pavement

Traffic Type	Category	Pervious Concrete (inches)	Permeable Base (inches)
Parking Stalls	B	5½	6

Permeable Interlocking Concrete Pavers (PICP)

Traffic Type	Category	PICP (inches)	Permeable Base (inches)
Parking Stalls	B	Minimum 3⅛	10

The top 12 inches of subgrade should be scarified, moisture conditioned to near optimum moisture content and compacted to at least 95% relative compaction if infiltration is not used.

The permeable base should consist of a Caltrans Class 4 Aggregate Base. All soft or yielding subgrade areas should be removed and replaced with compacted fill or permeable base if infiltration is used. All materials and methods of construction should conform to good engineering practices and the minimum local standards.

We recommend installing deepened curbs or vertical cutoff membranes consisting of 30 mil HDPE or PVC at the edges of pervious pavements to reduce the potential for water-related distress to adjacent structures or improvements. The membrane should extend below the reservoir section. If infiltration is not used, the membrane should also be placed between the subgrade and pervious base, and a suitable subdrain system should be installed.

8.9 SOIL CORROSIVITY

A representative sample of the onsite soils was tested to evaluate corrosion potential. The test results are presented in Appendix II. The project design engineer can use the sulfate results in conjunction with ACI 318 to specify the water/cement ratio, compressive strength and cementitious material types for concrete exposed to soil. A corrosion engineer should be contacted to provide specific corrosion control recommendations.

8.10 INFILTRATION

We performed four borehole percolation tests at the approximate locations shown on Figure 3. Appendix III presents the results of the tests. The test results indicate infiltration rates between <0.1 inch per hour and about 3.8 inches per hour. The infiltration rate of the actual soils that will be encountered at the bottom of storm water retention basins could vary significantly subsequent to grading. An adequate safety factor should be applied to the infiltration rate during design of the proposed infiltration facilities. Site characteristics such as excessive slope of the drainage area, fine-grained soil types, and proximate location of the water table may preclude the use of an infiltration basin. Generally, infiltration basins are not suitable for areas with relatively impermeable soils containing clay and silt or in areas with fill. Further testing of the actual basin subgrade soils is recommend following grading. Additionally, infiltration basins will require periodic maintenance to function as intended.

9. GEOTECHNICAL ENGINEERING DURING CONSTRUCTION

The geotechnical engineer should review project plans and specifications prior to bidding and construction to check that the intent of the recommendations in this report has been incorporated. Observations and tests should be performed during construction. If the conditions encountered during construction differ from those anticipated based on the subsurface exploration program, the presence of the geotechnical engineer during construction will enable an evaluation of the exposed conditions and modifications of the recommendations in this report or development of additional recommendations in a timely manner.

10. CLOSURE

SCST should be advised of any changes in the project scope so that the recommendations contained in this report can be evaluated with respect to the revised plans. Changes in recommendations will be verified in writing. The findings in this report are valid as of the date of this report. Changes in the condition of the site can, however, occur with the passage of time, whether they are due to natural processes or work on this or adjacent areas. In addition, changes in the standards of practice and government regulations can occur. Thus, the findings in this report may be invalidated wholly or in part by changes beyond our control. This report should not be relied upon after a period of two years without a review by us verifying the suitability of the conclusions and recommendations to site conditions at that time.

In the performance of our professional services, we comply with that level of care and skill ordinarily exercised by members of our profession currently practicing under similar conditions and in the same locality. The client recognizes that subsurface conditions may vary from those encountered at the boring locations, and that our data, interpretations, and recommendations are based solely on the information obtained by us. We will be responsible for those data, interpretations, and recommendations, but shall not be responsible for interpretations by others of the information developed. Our services consist of professional consultation and observation only, and no warranty of any kind whatsoever, express or implied, is made or intended in connection with the work performed or to be performed by us, or by our proposal for consulting or other services, or by our furnishing of oral or written reports or findings.

11. REFERENCES

American Concrete Institute (ACI) (2012), Building Code Requirements for Structural Concrete (ACI 318-11) and Commentary, August.

California Emergency Management Agency, California Geological Survey, University of Southern California (Cal EMA) (2009), Tsunami Inundation Map for Emergency Planning, National City Quadrangle, June 1.

Caltrans (2010), Standard Specifications.

Caltrans (2014), Pervious Pavement Design Guidance, August.

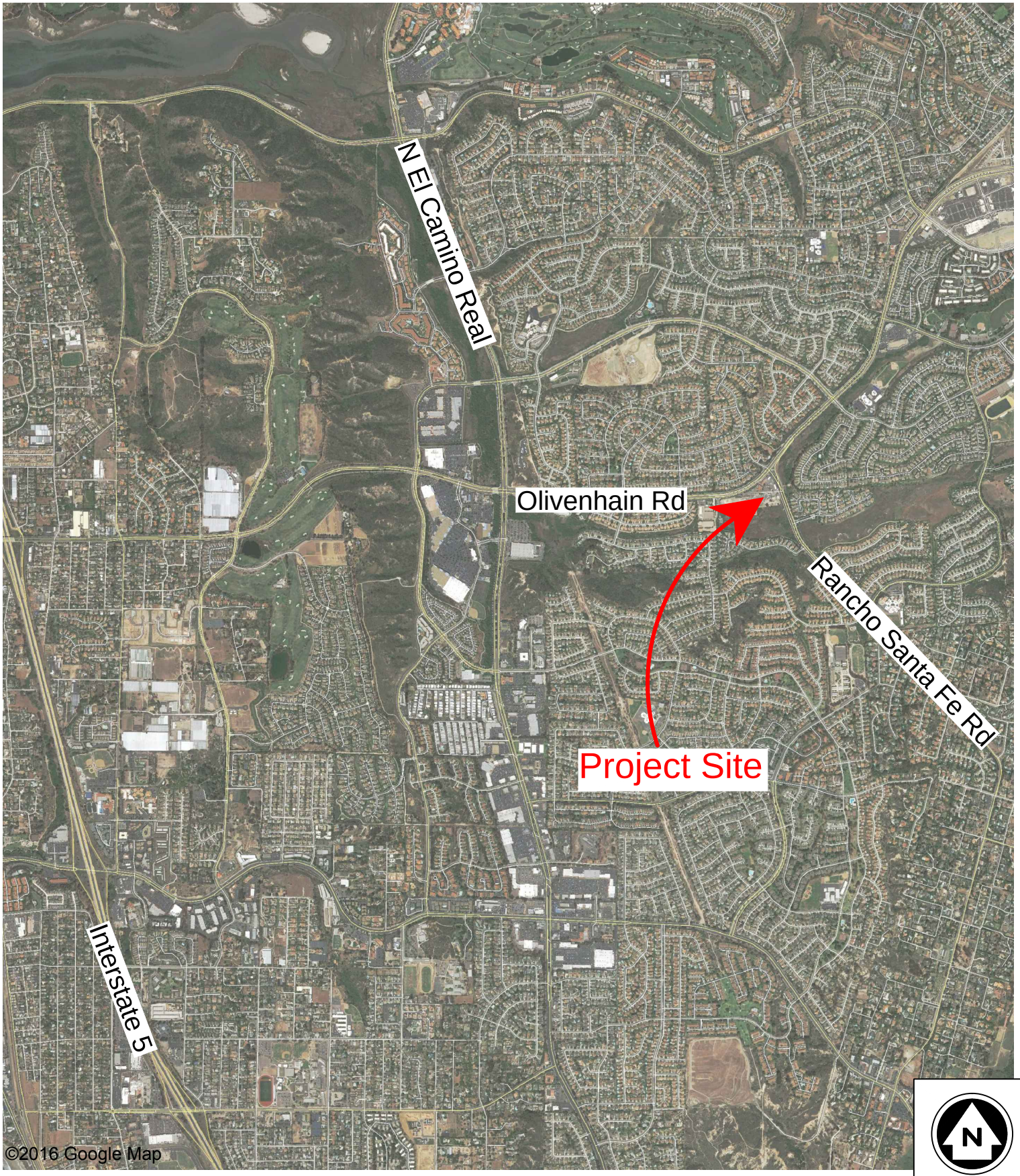
County of San Diego (2012), SanGIS Interactive Map.

International Code Council (2012), 2013 California Building Code, California Code of Regulations, Title 24, Part 2, Volume 2 of 2, Based on the 2012 International Existing Building Code, Effective Date: January 1, 2014.

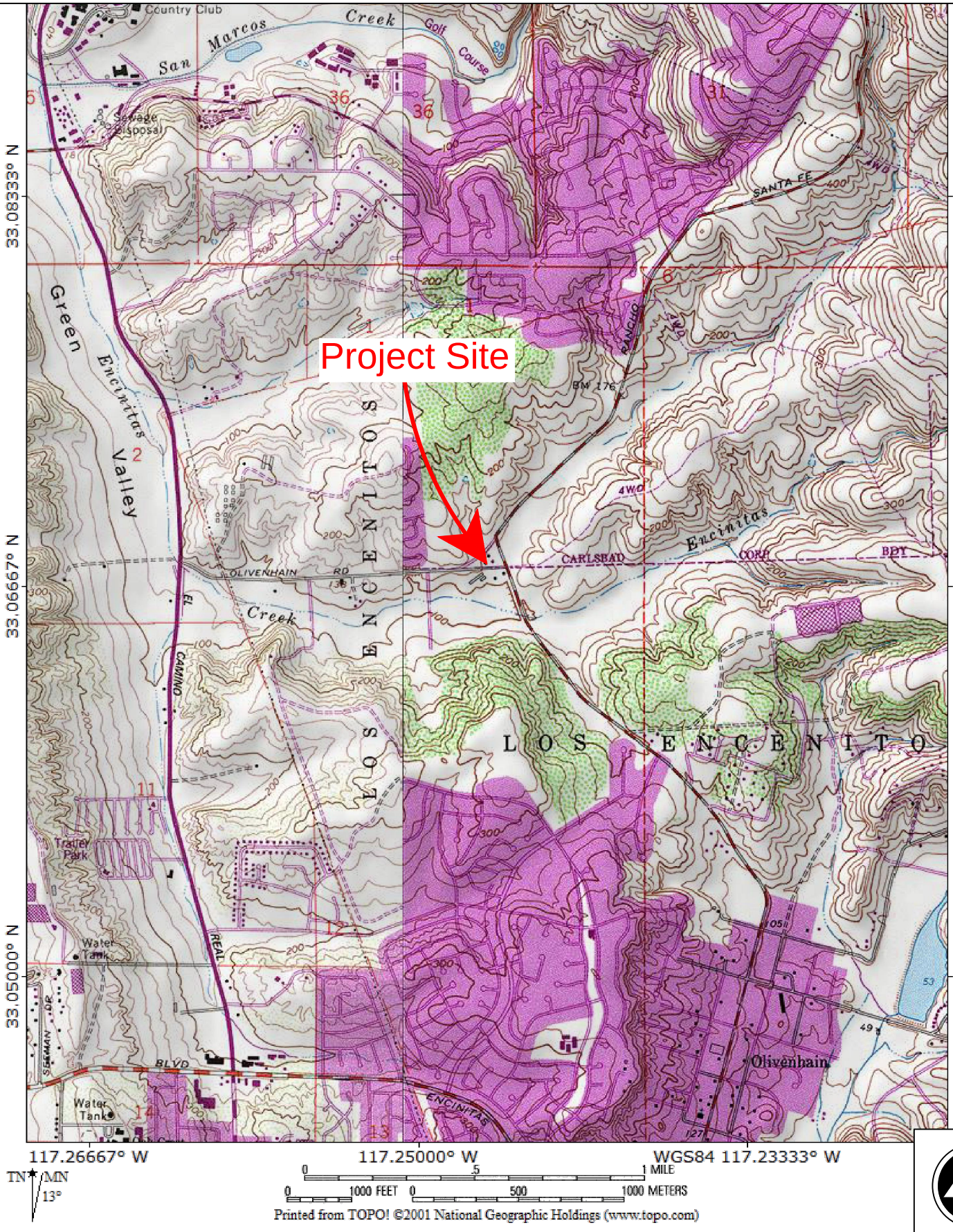
Kennedy, M.P. and Tan, S.S. (2007), Geologic Map of the Oceanside 30' x 60' Quadrangle, California, California Geological Survey.

Kleinfelder (2001), Preliminary Geotechnical Evaluation, Olivenhain Municipal Water District, Headquarters and Road Project, Encinitas, CA, Project No. 51-598601, December 12.

Public Works Standards, Inc. (2011), "Greenbook," Standard Specifications for Public Works Construction, 2012 Edition.



SCST, Inc.	SITE VICINITY MAP OMWD Building D Encinitas, California	Date: March, 2016 By: CJC/JCU Job No.: 160105P3-1	Figure: 1

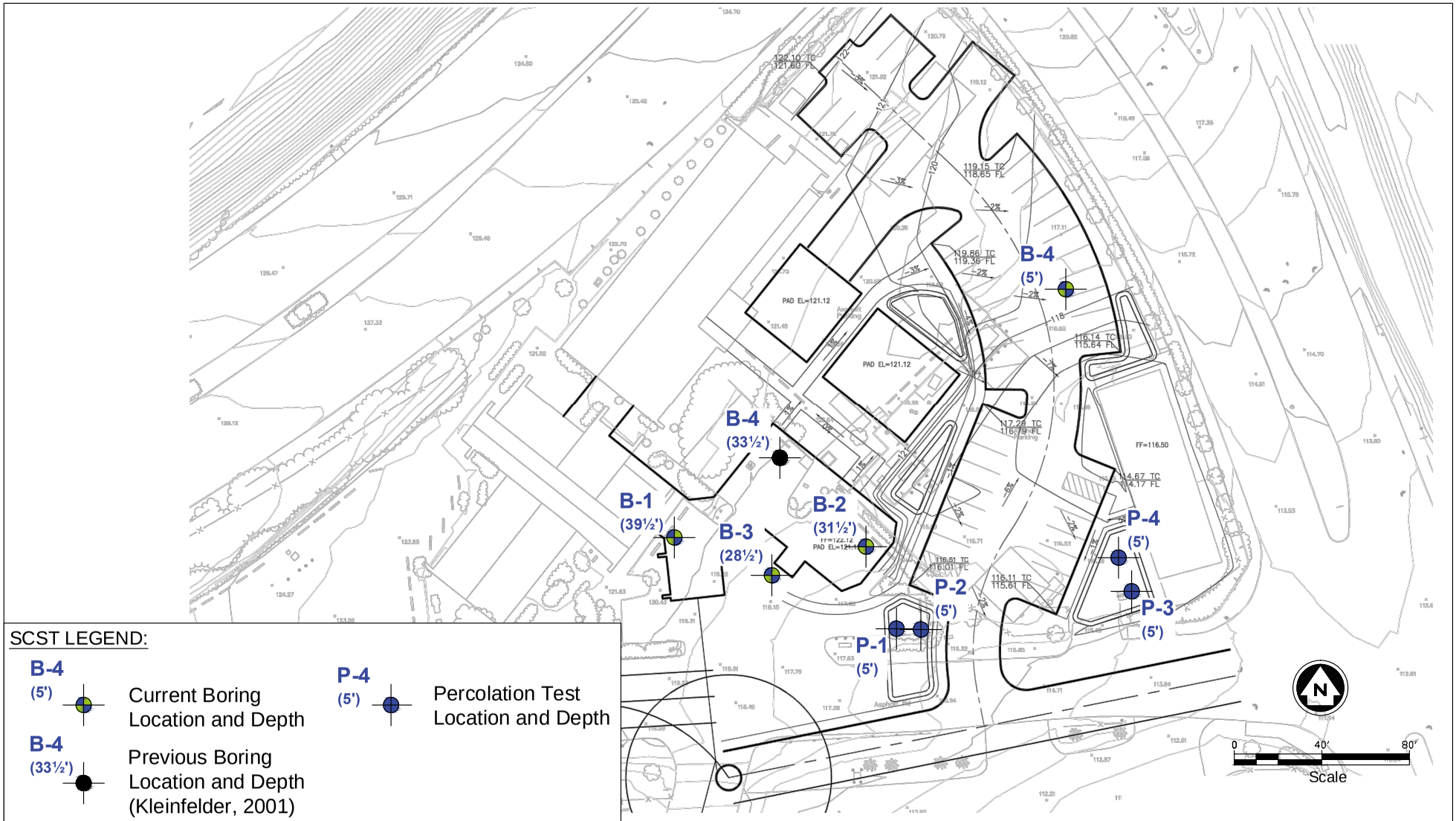


SCST, Inc.

USGS QUADRANGLE MAP
OMWD Building D
Encinitas, California

Date: March, 2016
By: CJC/JCU
Job No.: 160105P3-1

Figure:
2



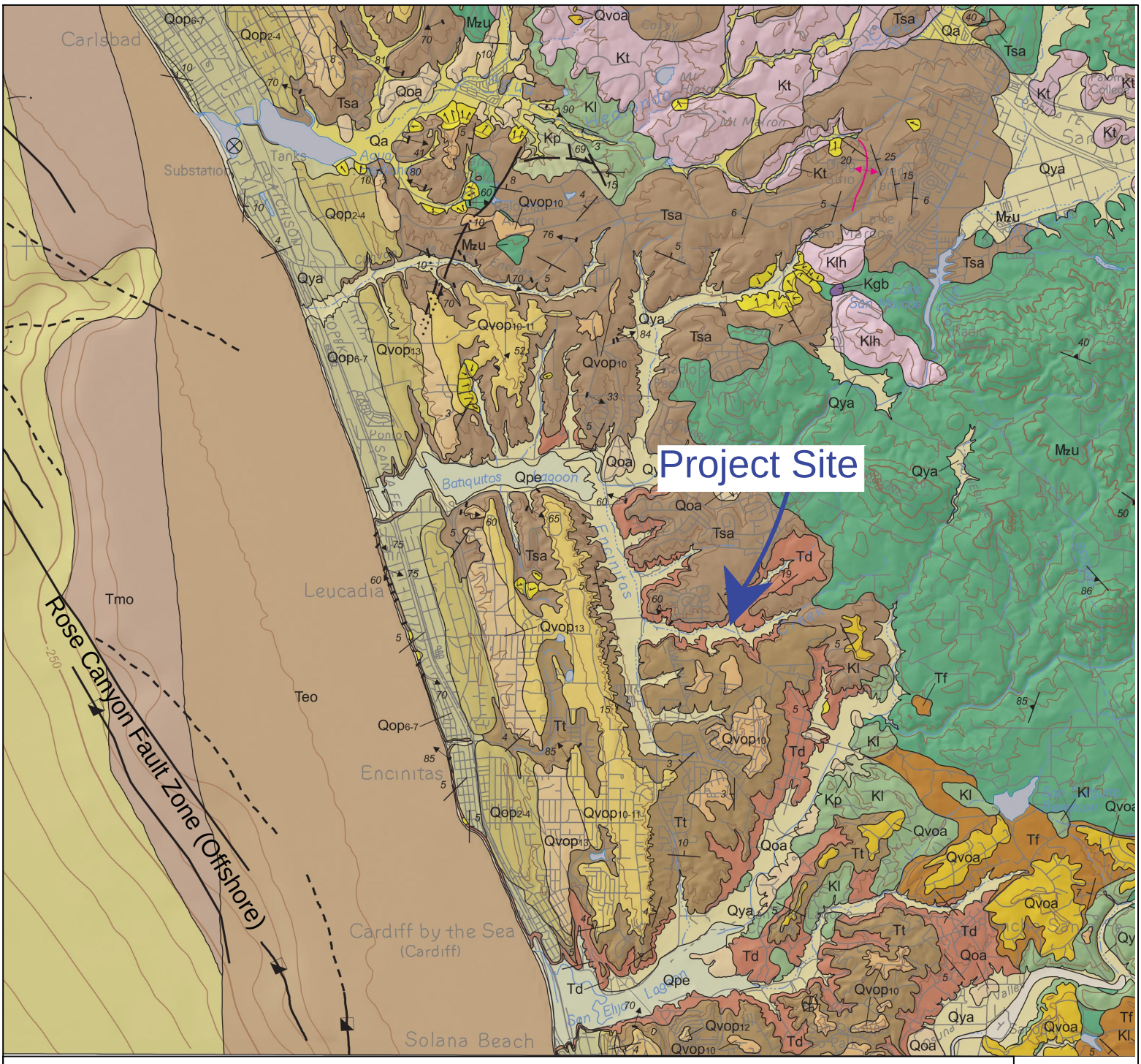
SCST LEGEND:

B-4 (5') — Current Boring Location and Depth

B-4 (33½') — Previous Boring Location and Depth (Kleinfelder, 2001)

P-4 (5') — Percolation Test Location and Depth

SCST, Inc.	SUBSURFACE EXPLORATION MAP OMWD Building D Encinitas, California	Date: March, 2016 By: JCU Job No.: 160105P3-1	Figure: 3



Explanation:

Qya	Young alluvial flood-plain deposits (Holocene and late Pleistocene)
Td	Delmar Formation (middle Eocene)
Tsa	Santiago Formation (middle Eocene)

0 1 2 Miles

Scale

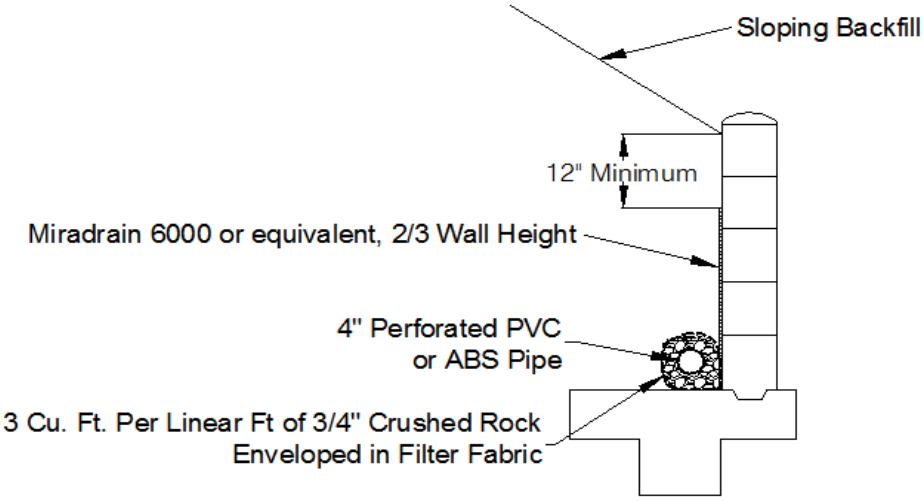
N

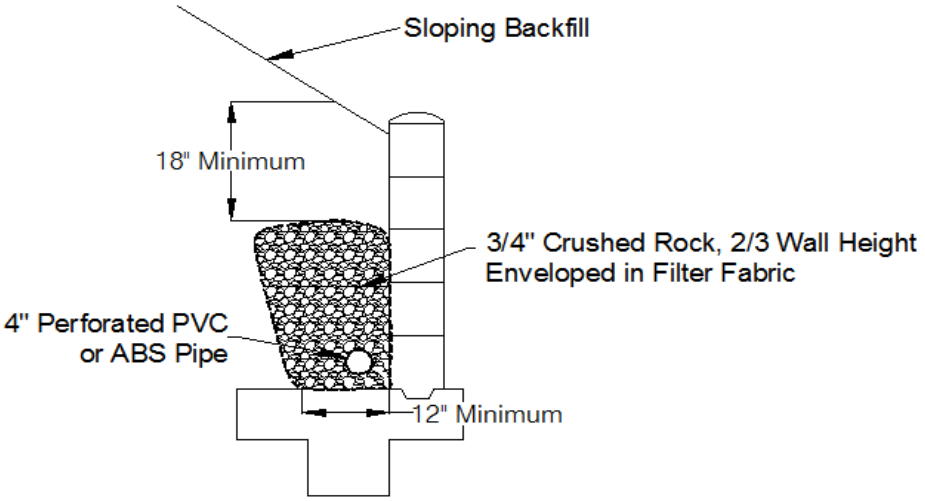
SCST, Inc.

REGIONAL GEOLOGY AND FAULT MAP
OMWD Building D
Encinitas, California

Date: March, 2016
By: CJC/JCU
Job No.: 160105P3-1
Scale: Not to Scale

Figure: 4





Not to Scale

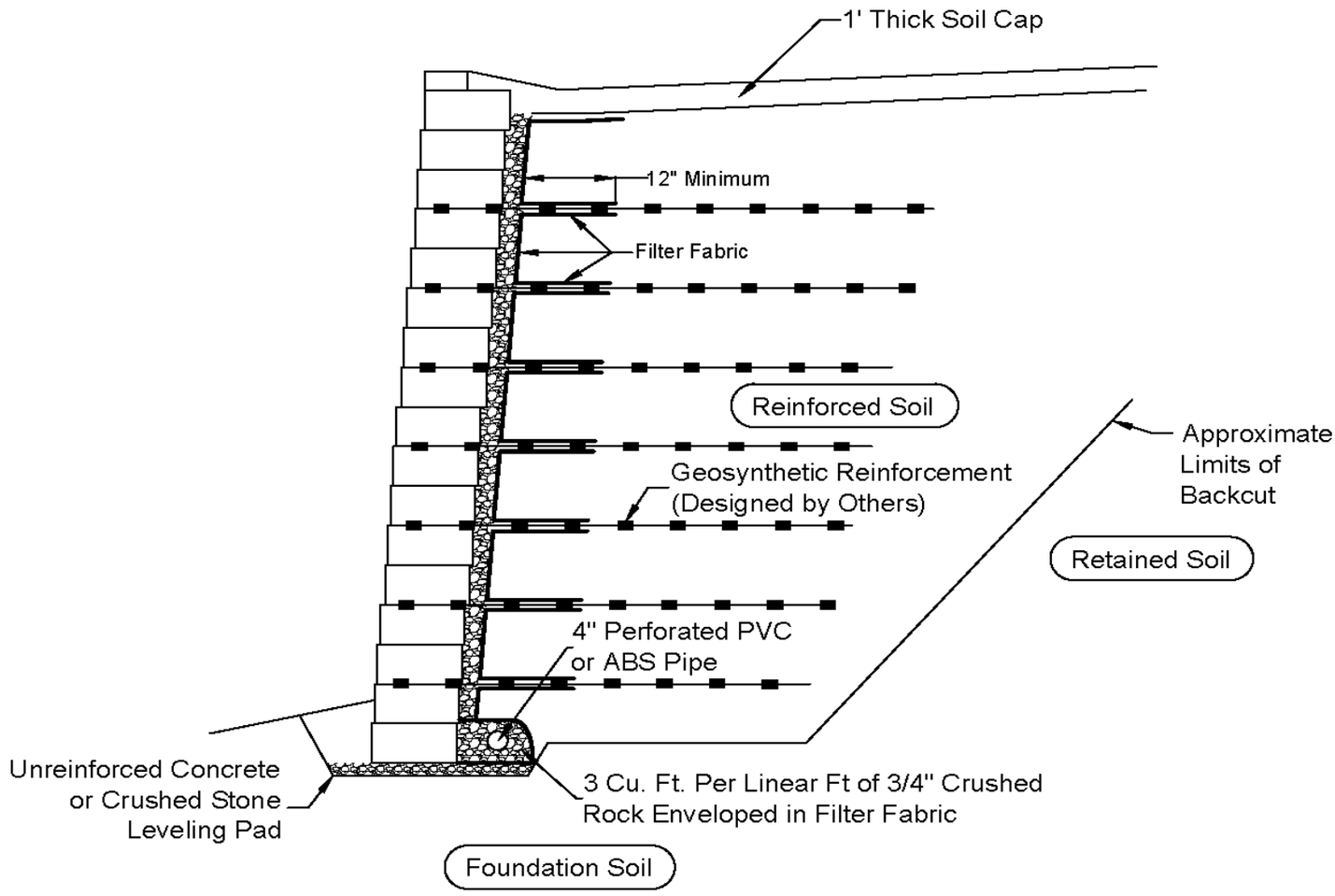
NOTES

1) Waterproof back of wall following architect's specifications.

2) 4" minimum perforated pipe, SDR35 or equivalent, holes down, 1% fall to outlet. Provide solid outlet pipe at suitable locations.

3) Drain instalation and outlet connection should be observed by the geotechnical consultant.

SCST, Inc.	TYPICAL RETAINING WALL BACKDRAIN DETAILS OMWD Building D Encinitas, California		
	By: JCU	Date:	March, 2016
	Job Number: 160105P3-1	Figure:	5



Not to Scale

NOTES

1) Backcut as recommended by the geotechnical report or field evaluation.
2) Additional drain at excavation backcut may be recommended based on conditions observed during construction.
3) Filter fabric should be installed between crushed rock and soil. Filter fabric should consist of Mirafi 140N or equivalent. Filter fabric should be overlapped approximately 6 inches.
4) Perforated pipe should outlet through a solid pipe to an appropriate gravity outfall. Perforated pipe and outlet pipe should have a fall of at least 1%.
5) Drain installation and outlet connection should be observed by the geotechnical consultant.

SCST, INC.	TYPICAL MSE RETAINING WALL DETAIL OWMD Building D Encinitas, California		
	By: JCU	Date:	March, 2016
	Job No: 160105P3-1	Figure:	6

APPENDIX I
FIELD INVESTIGATION

Our field investigation consisted of a visual reconnaissance of the site drilling four borings and four percolation test holes on February 8, 2016 to depths between about 5 and 39½ feet below the existing ground surface using a truck-mounted drill rig equipped with a hollow stem auger. Kleinfelder (2001) previously drilled one boring to a depth of about 33½ feet below the existing ground surface in the area of the planned building using a truck-mounted drill rig equipped with a hollow stem auger. Figure 3 shows the approximate locations of the borings and percolation test holes. The field investigation was performed under the observation of an SCST engineer who also logged the borings and test holes and obtained samples of the materials encountered.

Relatively undisturbed samples were obtained using a modified California (CAL) sampler, which is ring-lined split tube sampler with a 3-inch outer diameter and 2½-inch inner diameter. Standard Penetration Tests (SPT) were performed using a 2-inch outer diameter and 1⅜-inch inner diameter split tube sampler. The CAL and SPT samplers were driven with a 140-pound weight dropping 30 inches. The number of blows needed to drive the samplers the final 12 inches of an 18-inch drive is noted on the borings logs as "Driving Resistance (blows/foot of drive)." SPT and CAL sampler refusal was encountered when 50 blows were applied during any one of the three 6-inch intervals, a total of 100 blows was applied, or there was no discernible sampler advancement during the application of 10 successive blows. The SPT penetration resistance was normalized to a safety hammer (cathead and rope) with a 60% energy transfer ratio in accordance with ASTM D6066. The normalized SPT penetration resistance is noted on the boring logs as "N_{60}." Disturbed bulk samples were obtained from the SPT sampler and drill cuttings.

The soils are classified in accordance with the Unified Soil Classification System as illustrated on Figure I-1. Logs of the current borings and percolation test holes are presented on Figures I-2 through I-12. The log of the previous Kleinfelder boring is also included.

SUBSURFACE EXPLORATION LEGEND

UNIFIED SOIL CLASSIFICATION CHART

SOIL DESCRIPTION		GROUP SYMBOL	TYPICAL NAMES
I. COARSE GRAINED, more than 50% of material is larger than No. 2	00 sieve size.		
GRAVELS More than half of coarse fraction is larger than No. 4 sieve size but smaller than 3".	CLEAN GRAVELS	GW	Well graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly graded gravels, gravel sand mixtures, little or no fines.
	GRAVELS WITH FINES (Appreciable amount of fines)	GM	Silty gravels, poorly graded gravel-sand-silt mixtures.
		GC	Clayey gravels, poorly graded gravel-sand, clay mixtures.
SANDS More than half of coarse fraction is smaller than No. 4 sieve size.	CLEAN SANDS	SW	Well graded sand, gravelly sands, little or no fines.
		SP	Poorly graded sands, gravelly sands, little or no fines.
		SM	Silty sands, poorly graded sand and silty mixtures.
		SC	Clayey sands, poorly graded sand and clay mixtures.
II. FINE GRAINED, more than 50% of material is smaller than No. 200 sieve size.			
	SILTS AND CLAYS (Liquid Limit less than 50)	ML	Inorganic silts and very fine sands, rock flour, sandy silt or clayey-silt-sand mixtures with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		OL	Organic silts and organic silty clays or low plasticity.
	SILTS AND CLAYS (Liquid Limit greater than 50)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity.
III. HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils.

SAMPLE SYMBOLS

- ☒ - Bulk Sample
- CAL - Modified California sampler
- CK - Undisturbed Chunk sample
- MS - Maximum Size of Particle
- ST - Shelby Tube
- SPT - Standard Penetration Test sampler

GROUNDWATER SYMBOLS

- ▽ - Water level at time of excavation or as indicated
- - Water seepage at time of excavation or as indicated

LABORATORY TEST SYMBOLS

- AL - Atterberg Limits
- CON - Consolidation
- COR - Corrosivity Tests (Resistivity, pH, Chloride, Sulfate)
- DS - Direct Shear
- EI - Expansion Index
- MAX - Maximum Density
- RV - R-Value
- SA - Sieve Analysis
- WA - No. 200 Sieve Wash
- (71%) (Percent Passing No. 200 Sieve)
- RW - Response to Wetting

SCST INC.

OMWD Building D
Encinitas, California

By:	CJM	Date:	March, 2016
Job Number:	160105P3-1	Figure:	I-1

LOG OF BORING B-1

Date Drilled:	2/8/2016	Logged by:	CTL
Equipment:	CME 95 with 8-inch Hollow Stem Auger	Project Manager:	TBC
Elevation (ft):	120½	Depth to Groundwater (ft):	15

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVEN	SAMPLES: BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
		4 inches of asphalt concrete.							
1	SM	**YOUNG ALLUVIAL FLOOD PLAIN DEPOSITS (Qya):** SILTY SAND, moderate brown, fine to medium grained, moist, loose.		X					
2				X					
3			SPT	X	5	6			
4				X					
5				X					
6			CAL		15		11.5	100.7	
7									
8									
9									
10									
11			SPT		7	9			
12									
13									
14									
15		▽ Groundwater level on 2/8/16.							
16		Wet.	CAL		12		22.6	101.8	
17									
18	CH	SANDY FAT CLAY, moderate brown, wet, very stiff.							
19			SPT		14	18			
20									

BORING CONTINUED ON I-3.

SCST, Inc.

OMWD Building D
Encinitas, California

By:	CJM	Date:	March, 2016
Job Number:	160105P3-1	Figure:	I-2

LOG OF BORING B-1 (Continued)

Date Drilled:	2/8/2016	Logged by:	CTL
Equipment:	CME 95 with 8-inch Hollow Stem Auger	Project Manager:	TBC
Elevation (ft):	120½	Depth to Groundwater (ft):	15

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVEN	SAMPLES: BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
21	CH	**YOUNG ALLUVIAL FLOOD PLAIN DEPOSITS (Qya):** SANDY FAT CLAY, moderate brown, wet, very stiff.							
	SC	CLAYEY SAND, moderate brown, fine grained, wet, medium dense.							
22			SPT		9	12			
23									
24			SPT		12	15			WA (21%)
25									
26									
27			SPT		10	13			
28									
29									
30	CH	SANDY FAT CLAY, moderate brown, wet, very stiff.	SPT		11	14			
31									
32									
33			SPT		14	18			
34									
35									
36	SC	CLAYEY SAND, moderate brown and gray, fine grained, wet, dense.	SPT		26	33			
37									
38		**SANTIAGO FORMATION (Tsa):** CLAYSTONE, gray, fine grained, moist, hard.							
39		SILTY SANDSTONE, reddish-brown, fine to medium grained, moist, very dense, weakly cemented.	SPT		68	85			
40		**BORING TERMINATED AT 39½ FEET.**							

SCST, Inc.

OMWD Building D Encinitas, California			
By:	CJM	Date:	March, 2016
Job Number:	160105P3-1	Figure:	I-3

LOG OF BORING B-2

Date Drilled:	2/8/2016	Logged by:	CTL
Equipment:	CME 95 with 8-inch Hollow Stem Auger	Project Manager:	TBC
Elevation (ft):	118½	Depth to Groundwater (ft):	11½

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVEN	SAMPLES: BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
		4 inches of asphalt concrete.							
1	SM	**YOUNG ALLUVIAL FLOOD PLAIN DEPOSITS (Qya):** SILTY SAND, moderate brown, fine to medium grained, moist, loose.		X					
2				X					SA AL EI COR
3			CAL	X	12		13.4	99.2	
4				X					
5				X					
6		Light brown.	SPT		6	8			
7									
8									
9									
10									
11		▽ Groundwater level on 2/8/16	CAL		11		20.8	102.5	
12		Wet.							
13									
14									
15	SC	CLAYEY SAND, light brown, fine to medium grained, wet, medium dense.							
16			SPT		12	16			
17									
18									
19			SPT		12	16			WA (42%)
20									

BORING CONTINUED ON I-5.

SCST, Inc.

OMWD Building D
Encinitas, California

By:	CJM	Date:	March, 2016
Job Number:	160105P3-1	Figure:	I-4

LOG OF BORING B-2 (Continued)

Date Drilled:	2/8/2016	Logged by:	CTL
Equipment:	CME 95 with 8-inch Hollow Stem Auger	Project Manager:	TBC
Elevation (ft):	118½	Depth to Groundwater (ft):	11½

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVEN	SAMPLES: BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
21	SC	**YOUNG ALLUVIAL FLOOD PLAIN DEPOSITS (Qya):** CLAYEY SAND, light brown, fine to medium grained, wet, loose.							
22			SPT		7	9			
23									
24									
25		Medium dense.	SPT		15	19			
26		**SANTIAGO FORMATION (Tsa):** CLAYEY SANDSTONE, brownish-yellow, fine to medium grained, moist, dense.							
27									
28		Very dense, weakly cemented.	SPT		42	53			
29									
30									
31			SPT		50	63			
32		**BORING TERMINATED AT 31½ FEET.**							
33									
34									
35									
36									
37									
38									
39									
40									

SCST, Inc.

OMWD Building D
Encinitas, California

By:	CJM	Date:	March, 2016
Job Number:	160105P3-1	Figure:	I-5

LOG OF BORING B-3

Date Drilled:	2/8/2016	Logged by:	CTL
Equipment:	CME 95 with 8-inch Hollow Stem Auger	Project Manager:	TBC
Elevation (ft):	118½	Depth to Groundwater (ft):	12

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVEN	SAMPLES: BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
		4 inches of asphalt concrete.							
1	SM	**YOUNG ALLUVIAL FLOOD PLAIN DEPOSITS (Qya):** SILTY SAND, moderate brown, fine to medium grained, moist, loose to medium dense.							
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12		▽ Groundwater level on 2/8/16							
13	SC	CLAYEY SAND, moderate brown, fine to medium grained, wet, medium dense.	SPT		13	17			
14									
15	CH	SANDY FAT CLAY, moderate brown, fine grained, wet, very stiff.							
16			SPT		14	18			WA (71%)
17									
18									
19			SPT		16	21			
20									

BORING CONTINUED ON I-5.

SCST, Inc.

OMWD Building D
Encinitas, California

By:	CJM	Date:	March, 2016
Job Number:	160105P3-1	Figure:	I-6

LOG OF BORING B-3 (Continued)

Date Drilled:	2/8/2016	Logged by:	CTL
Equipment:	CME 95 with 8-inch Hollow Stem Auger	Project Manager:	TBC
Elevation (ft):	118½	Depth to Groundwater (ft):	12

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVEN	SAMPLES: BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
21	CH	**YOUNG ALLUVIAL FLOOD PLAIN DEPOSITS (Qya):** SANDY FAT CLAY, moderate brown, fine to medium grained, wet, very stiff.							
22			SPT		10	13			
23									
24	SC	CLAYEY SAND, moderate brown, fine to medium grained, wet, medium dense.							
25			SPT		10	13			
26									
27		**SANTIAGO FORMATION (Tsa):** CLAYEY SANDSTONE, grayish-yellow and grayish-red, fine grained, moist, very dense.							
28			SPT		49	63			
29		**BORING TERMINATED AT 28½ FEET.**							
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									

LOG OF BORING B-4

Date Drilled:	2/8/2016	Logged by:	CTL
Equipment:	CME 95 with 8-inch Hollow Stem Auger	Project Manager:	TBC
Elevation (ft):	117	Depth to Groundwater (ft):	Not encountered

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVEN	SAMPLES: BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
		4 inches of asphalt concrete							
1	SM	**YOUNG ALLUVIAL FLOOD PLAIN DEPOSITS (Qya):** SILTY SAND, light brown, fine to medium grained, moist, loose to medium dense.		X					RV
2									
3									
4									
5		**BORING TERMINATED AT 5 FEET.**							
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

SCST, Inc.

OMWD Building D
Encinitas, California

By:	CJM	Date:	March, 2016
Job Number:	160105P3-1	Figure:	I-8

LOG OF BORING P-1

Date Drilled:	2/8/2016	Logged by:	CTL
Equipment:	CME 95 with 8-inch Hollow Stem Auger	Project Manager:	TBC
Elevation (ft):	117	Depth to Groundwater (ft):	Not encountered

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVEN	SAMPLES: BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
		4 inches of asphalt concrete.							
1	SM	**YOUNG ALLUVIAL FLOOD PLAIN DEPOSITS (Qya):** SILTY SAND, moderate brown, fine to medium grained, moist, loose to medium dense.		X					
2									
3									
4									
5		Percolation test performed at 5 feet.							
		BORING TERMINATED AT 5 FEET.							
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

SCST, Inc.

OMWD Building D
Encinitas, California

By:	CJM	Date:	March, 2016
Job Number:	160105P3-1	Figure:	I-9

LOG OF BORING P-2

Date Drilled:	2/8/2016	Logged by:	CTL
Equipment:	CME 95 with 8-inch Hollow Stem Auger	Project Manager:	TBC
Elevation (ft):	117	Depth to Groundwater (ft):	Not encountered

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVEN	SAMPLES: BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
		4 inches of asphalt concrete.							
1	SM	**YOUNG ALLUVIAL FLOOD PLAIN DEPOSITS (Qya):** SILTY SAND, moderate brown, fine to medium grained, moist, loose to medium dense.		X					
2									
3									
4									
5		Percolation test performed at 5 feet.							
		BORING TERMINATED AT 5 FEET.							
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

SCST, Inc.

OMWD Building D
Encinitas, California

By:	CJM	Date:	March, 2016
Job Number:	160105P3-1	Figure:	I-10

LOG OF BORING P-3

Date Drilled:	2/8/2016	Logged by:	CTL
Equipment:	CME 95 with 8-inch Hollow Stem Auger	Project Manager:	TBC
Elevation (ft):	116	Depth to Groundwater (ft):	Not encountered

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVEN	SAMPLES: BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
		3 inches of asphalt concrete.							
1	SM	**YOUNG ALLUVIAL FLOOD PLAIN DEPOSITS (Qya):** SILTY SAND, moderate brown, fine to medium grained, moist, loose to medium dense.		X					
2									
3									
4									
5		Percolation test performed at 5 feet.							
		BORING TERMINATED AT 5 FEET.							
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

SCST, Inc.

OMWD Building D
Encinitas, California

By:	CJM	Date:	March, 2016
Job Number:	160105P3-1	Figure:	I-11

LOG OF BORING P-4

Date Drilled:	2/8/2016	Logged by:	CTL
Equipment:	CME 95 with 8-inch Hollow Stem Auger	Project Manager:	TBC
Elevation (ft):	116	Depth to Groundwater (ft):	Not encountered

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVEN	SAMPLES: BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
		3 inches of asphalt concrete.							
1	SM	**YOUNG ALLUVIAL FLOOD PLAIN DEPOSITS (Qya):** SILTY SAND, moderate brown, fine to medium grained, moist, loose to medium dense.		X					
2									
3									
4									
5		Percolation test performed at 5 feet.							
		BORING TERMINATED AT 5 FEET.							
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

SCST, Inc.

OMWD Building D
Encinitas, California

By:	CJM	Date:	March, 2016
Job Number:	160105P3-1	Figure:	I-12

DATE DRILLED:	11/20/01	WATER DEPTH:	15 feet
DRILLED BY:	Tri-County Drilling	DATE MEASURED:	11/20/2001
DRILLING METHOD:	CME-75 HT, 140 lbs., 30" drop Autohammer	ELEVATION:	117'± MSL
		LOGGED BY:	BTB
HOLE DIAMETER:	8" diameter Hollow Stem Auger	REVIEWED BY:	REL

ELEVATION (ft.)	DEPTH (feet)	SAMPLES: BULK	SAMPLES: DRIVEN	BLOW COUNTS (blows/foot)	SAMPLE NUMBER	GRAPHIC LOG	SOIL DESCRIPTION AND CLASSIFICATION	DRY UNIT WEIGHT (pcf)	MOISTURE CONTENT (%)	COMMENTS/ ADDITIONAL TESTS
							ASPHALT CONCRETE: Approximately 4" thick			
							ALLUVIUM:			
							SILTY SAND (SM), tan, dry, medium dense, fine grained			
115				25	2			84.2	4.2	CORR
	5				1					
				29	3			91.2	3.7	
110										
	10									
				13	4		Moist, loose		14.1	WA (23.1%)
105										
	15 ▽									
				5	5		Wet, loose, increased clay content		23.5	Note: SPT sampler has room for liners WA (29.3), PI
100							CLAYEY SAND (SC), tan, wet, medium dense, fine-grained			
				14	6					

KLEINFELDER
5015 SHOREHAM PLACE
SAN DIEGO, CALIFORNIA 92122

PROJECT NO. 51-5985-01

OLIVENHAIN MUNICIPAL WATER DISTRICT
HEADQUARTERS AND ROAD PROJECT
CARLSBAD, CALIFORNIA

LOG OF BORING 4

FIGURE
A9

ELEVATION (ft.)	DEPTH (feet)	SAMPLES: BULK	SAMPLES: DRIVEN	BLOW COUNTS (blows/foot)	SAMPLE NUMBER	GRAPHIC LOG	SOIL DESCRIPTION AND CLASSIFICATION	DRY UNIT WEIGHT (pcf)	MOISTURE CONTENT (%)	COMMENTS/ ADDITIONAL TESTS
							(Continued From Previous Page)			
			■	14	7		Orange-brown, coarser grained sand			
95			■							
			■	8	8		CLAYEY SAND (SC), tan with orange mottling, wet, medium dense, fine-grained		23.8	SA (32%), PI
	25		■							
			■	17	9					
90										
			■							
			■	11	10					
	30									
85			■				SAND (SP), tan-brown, wet, very dense			
			■	50/4"	11		Total depth 33.5 feet Groundwater encountered at 15 feet Boring backfilled 11/20/2001			
	35									
80										
	40									
75										

KLEINFELDER
5015 SHOREHAM PLACE
SAN DIEGO, CALIFORNIA 92122

PROJECT NO. 51-5985-01

OLIVENHAIN MUNICIPAL WATER DISTRICT
HEADQUARTERS AND ROAD PROJECT
CARLSBAD, CALIFORNIA

LOG OF BORING 4

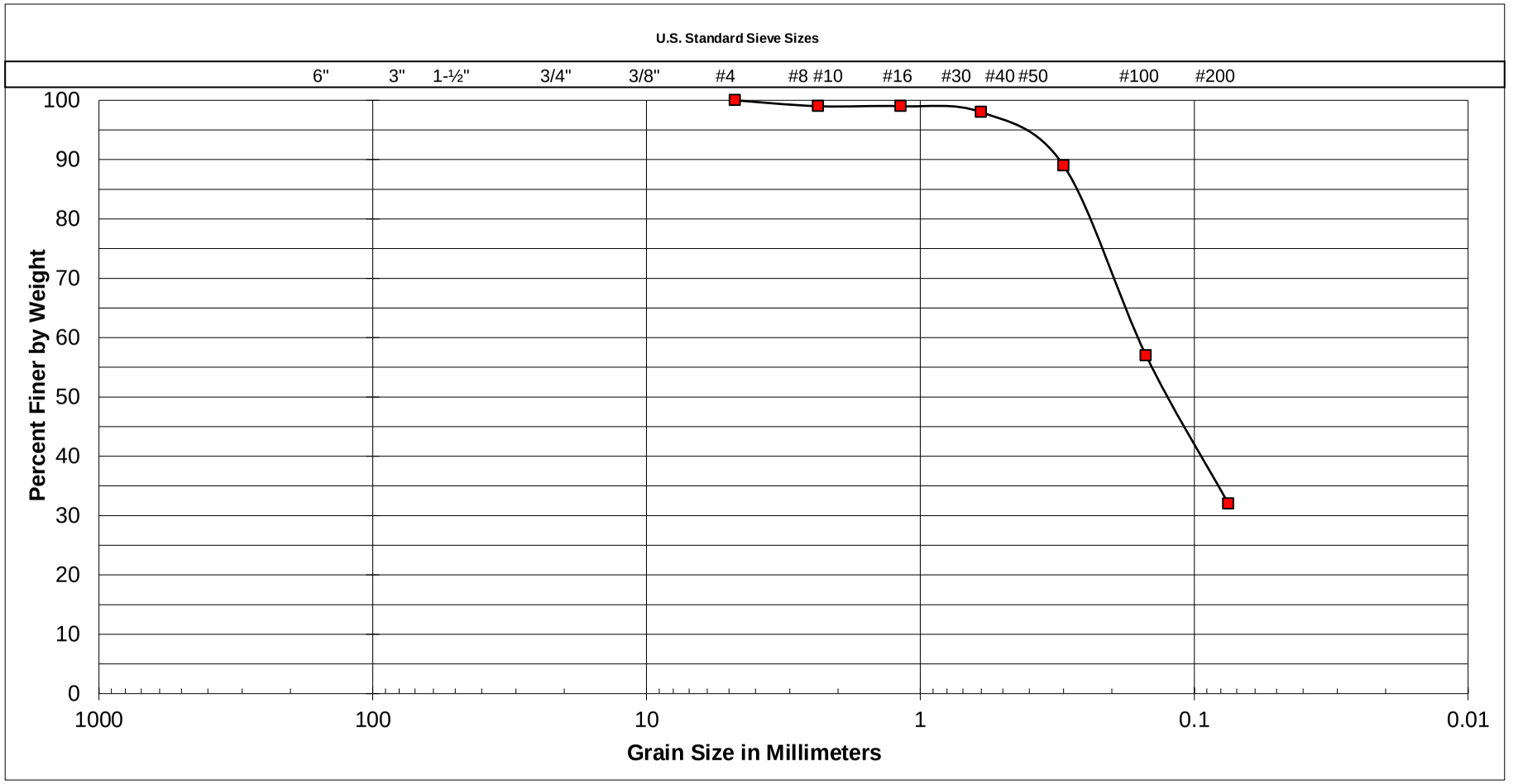
FIGURE
A10

APPENDIX II
LABORATORY TESTING

Laboratory tests were performed to provide geotechnical parameters for engineering analyses. The following tests were performed:

- **CLASSIFICATION:** Field classifications were verified in the laboratory by visual examination. The final soil classifications are in accordance with the Unified Soil Classification System.
- **IN SITU MOISTURE AND DENSITY:** The in situ moisture content and dry unit weight were determined on samples collected from the borings. The test results are presented on the boring logs in Appendix I.
- **GRAIN SIZE DISTRIBUTION:** The grain size distribution was determined on one soil sample in accordance with ASTM D422. Figure II-1 presents the test results.
- **ATTERBERG LIMITS:** The Atterberg limits were determined on one soil sample in accordance with ASTM D4318. Figure II-1 presents the test results.
- **FINES CONTENT:** The amount of material finer than the No. 200 sieve was determined on three samples in accordance with ASTM D1140. Figure II-2 presents the test results.
- **R-VALUE:** An R-value test was performed on one sample in accordance with California Test Method 301. Figure II-2 presents the test result.
- **EXPANSION INDEX:** The expansion index was determined on one sample in accordance with ASTM D4829. Figure II-2 presents the test results.
- **CORROSIVITY**: Corrosivity tests were performed on one soil sample. The pH and minimum resistivity were determined in accordance with California Test 643. The soluble sulfate content was determined in accordance with California Test 417. The total chloride ion content was determined in accordance with California Test 422. Figure II-2 presents the test results.

Soil samples not tested are now stored in our laboratory for future reference and analysis, if needed. Unless notified to the contrary, all samples will be disposed of 30 days from the date of this report.



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

SAMPLE LOCATION
B-2 at ½ to 5 feet

UNIFIED SOIL CLASSIFICATION:	SM
DESCRIPTION	SILTY SAND

ATTERBERG LIMITS	
LIQUID LIMIT	NP
PLASTIC LIMIT	NP
PLASTICITY INDEX	NP

SCST, Inc.

OMWD Building D
Encinitas, California

By:	CTL	Date:	March, 2016
Job Number:	160105P3-1	Figure:	II-1

APPENDIX III
BOREHOLE PERCOLATION TESTING

We performed falling head borehole percolation testing at four locations (P-1 through P-4) in general conformance with Appendix C of the Model BMP Design Manual for San Diego Region. The borings were prepared for percolation testing by placing about 6 inches of pea gravel in the bottom of the test hole and then installing a 4-inch diameter solid PVC pipe from the top of the pea gravel (about 4½ feet below the existing ground surface) to about 2 feet above the ground surface. Pea gravel was placed in the annular space between the PVC pipe and the boring sidewall between the depths of about 4½ feet and about 2½ feet below the ground surface; hydrated bentonite chips were placed above about 2½ feet. Prior to starting the percolation testing, the test holes were presoaked overnight (approximately 16 hours) by filling the holes with water. The percolation testing was performed immediately after presoaking by filling the test holes with clean potable water to the top of the PVC pipe and measuring the drop in the water level every 30 minutes until a constant rate was established. Figures III-1 through III-4 present the results of the testing.

Report of Falling Head Borehole Percolation Testing

Storm Water Infiltration

Project Name:	Olivenhain MWD, Building D	Test Location Number:	P-1
Job Number:	160105P3		
Date Drilled:	2/9/2016	Tested By:	EM
Drilling Method:	Truck Mounted Drill Rig	Date Tested:	2/10/2016
Drilled Depth:	5 Feet	Presoak Time:	21 Hours
Solid Pipe Interval:	0 to 4½ Feet		

Reading	Time	Interval (min)	Initial Level (in)	Final Level (in)	Change in Level (in)	Percolation Rate (in/min)	Percolation Rate (min/in)
1	9:40 10:10	0:30	6.0	0.75	5.3	0.175	6
2	10:13 10:43	0:30	6.0	0.80	5.2	0.173	6
3	10:44 11:14	0:30	6.0	0.80	5.2	0.173	6
4	11:16 11:46	0:30	6.0	0.80	5.2	0.173	6
5	11:47 12:17	0:30	6.0	0.80	5.2	0.173	6
6	12:18 12:48	0:30	6.0	0.88	5.1	0.171	6
7	12:50 13:20	0:30	6.0	0.88	5.1	0.171	6
8	13:21 13:51	0:30	6.0	0.88	5.1	0.171	6
9	13:51 14:21	0:30	6.0	0.88	5.1	0.171	6
Uncorrected Percolation Rate:						6 min/in 10.31 in/hr	

Gravel Correction Factor:	1.95

Corrected Percolation Rate:	3.0 min/in 5.3 in/hr

Estimated Infiltration Rate*:	**3.8 in/hr**

* Infiltration rates estimated using the Prochet Method on borehole percolation data.

Report of Falling Head Borehole Percolation Testing

Storm Water Infiltration

Project Name:	Olivenhain MWD, Building D	Test Location Number:	P-2
Job Number:	160105P3		
Date Drilled:	2/9/2016	Tested By:	EM
Drilling Method:	Truck Mounted Drill Rig	Date Tested:	2/10/2016
Drilled Depth:	5 Feet	Presoak Time:	21 Hours
Solid Pipe Interval:	0 to 4½ Feet		

Reading	Time	Interval (min)	Initial Level (in)	Final Level (in)	Change in Level (in)	Percolation Rate (in/min)	Percolation Rate (min/in)
1	9:41 10:11	0:30	6.0	2.00	4.0	0.133	7
2	10:12 10:42	0:30	6.0	2.13	3.9	0.129	8
3	10:44 11:14	0:30	6.0	2.25	3.8	0.125	8
4	11:15 11:45	0:30	6.0	2.25	3.8	0.125	8
5	11:46 12:16	0:30	6.0	2.50	3.5	0.117	9
6	12:17 12:47	0:30	6.0	2.50	3.5	0.117	9
7	12:47 13:17	0:30	6.0	3.00	3.0	0.100	10
8	13:18 13:48	0:30	6.0	3.00	3.0	0.100	10
9	13:51 14:21	0:30	6.0	3.00	3.0	0.100	10
Uncorrected Percolation Rate:						9 min/in 6.70 in/hr	

Gravel Correction Factor:	1.95

Corrected Percolation Rate:	4.6 min/in 3.4 in/hr

Estimated Infiltration Rate*:	**1.8 in/hr**

* Infiltration rates estimated using the Prochet Method on borehole percolation data.

Report of Falling Head Borehole Percolation Testing

Storm Water Infiltration

Project Name:	Olivenhain MWD, Building D	Test Location Number:	P-3
Job Number:	160105P3		
Date Drilled:	2/9/2016	Tested By:	EM
Drilling Method:	Truck Mounted Drill Rig	Date Tested:	2/10/2016
Drilled Depth:	5 Feet	Presoak Time:	21 Hours
Solid Pipe Interval:	0 to 4½ Feet		

Reading	Time	Interval (min)	Initial Level (in)	Final Level (in)	Change in Level (in)	Percolation Rate (in/min)	Percolation Rate (min/in)
1	10:21 10:51	0:30	7.0	5.5	1.5	0.050	20
2	10:52 11:22	0:30	6.0	5.0	1.0	0.033	30
3	11:23 11:53	0:30	6.0	4.8	1.3	0.042	24
4	11:53 12:23	0:30	6.0	4.8	1.3	0.042	24
5	12:24 12:54	0:30	6.0	4.5	1.5	0.050	20
6	12:55 13:25	0:30	6.0	4.5	1.5	0.050	20
7	13:26 13:56	0:30	6.0	4.5	1.5	0.050	20
8	13:57 14:27	0:30	6.0	4.5	1.5	0.050	20
Uncorrected Percolation Rate:						21 min/in 2.90 in/hr	

Gravel Correction Factor:	1.95

Corrected Percolation Rate:	10.7 min/in 1.5 in/hr

Estimated Infiltration Rate*:	**0.8 in/hr**

* Infiltration rates estimated using the Prochet Method on borehole percolation data.

SCST, Inc.

OMWD Building D
Encinitas, California

By:	EM	Date:	March, 2016
Job No:	160105P3-1	Figure:	III-3

Report of Falling Head Borehole Percolation Testing

Storm Water Infiltration

Project Name:	Olivenhain MWD, Building D	Test Location Number:	P-4
Job Number:	160105P3		
Date Drilled:	2/9/2016	Tested By:	EM
Drilling Method:	Truck Mounted Drill Rig	Date Tested:	2/10/2016
Drilled Depth:	5 Feet	Presoak Time:	21 Hours
Solid Pipe Interval:	0 to 4½ Feet		

Reading	Time	Interval (min)	Initial Level (in)	Final Level (in)	Change in Level (in)	Percolation Rate (in/min)	Percolation Rate (min/in)
1	10:22 10:52	0:30	21.5	21.1	0.4	0.013	80
2	10:53 11:23	0:30	21.1	20.8	0.4	0.013	79
3	11:24 11:54	0:30	20.8	20.5	0.3	0.008	120
4	11:55 12:25	0:30	20.5	20.3	0.3	0.008	120
5	12:26 12:56	0:30	20.3	20.0	0.3	0.008	120
6	12:58 13:28	0:30	20.0	19.8	0.3	0.008	120
7	13:29 13:59	0:30	19.8	19.5	0.3	0.008	120
8	14:00 14:30	0:30	19.5	19.3	0.3	0.008	120
Uncorrected Percolation Rate:						120 min/in 0.50 in/hr	

Gravel Correction Factor:	1.95

Corrected Percolation Rate:	61.5 min/in 0.3 in/hr

Estimated Infiltration Rate*:	**< 0.1 in/hr**

* Infiltration rates estimated using the Prochet Method on borehole percolation data.