

San Diego County, California

CONTRACT DOCUMENTS FOR THE CONSTRUCTION OF:

4S RANCH NEIGHBORHOOD 1 SEWER PUMP STATION REPLACEMENT PROJECT

NOVEMBER 2021

OMWD WO# D700004

Jason P. Hubbard, P.E.

Engineering Manager

OLIVENHAIN MUNICIPAL WATER DISTRICT

San Diego County, California

CONTRACT DOCUMENTS

FOR THE CONSTRUCTION OF

4S RANCH NEIGHBORHOOD 1 SEWER PUMP STATION REPLACEMENT PROJECT

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BID FORM CHECKLIST

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

Bid	Requirement	Initial
Form Page		
1 of 4	BID NOTICE-Fill in date of the non-mandatory Pre-Bid Conference	
	attended:	
1 of 13	BID FORM- Fill out the form and acknowledge all addenda in the	
	spaces provided at the end of the first paragraph	
2 of 13	BIDDING INSTRUCTIONS- Examination of the site and review of the	
	Contract Documents has been completed. Bid Schedule and all Bid	
	forms are to be submitted with this Bid Form Checklist	
3 & 4 of	BID SCHEDULE- Fill out all items in the Bid Schedule, including dollar	
13	amounts in words and in numbers for each item	
5 of 13	DESIGNATION OF SUBCONTRACTORS- Fill in all information	
	required on the form	
6 of 13	LISTING OF MANUFACTURERS- Fill in all information required on the	
	form	
7 of 13	Fill in the type of Bid Bond enclosed in the first paragraph, and list all	
	principals of the company in the third paragraph	
8 of 13	Fill in Bidder's license classification, license number, and all other	
	information required in the fourth paragraph, including signature and	
9 of 13	CERTIFICATE OF DRUG-FREE WORKPLACE- Fill in Bidder's name	
	at the top and Certification section at the bottom of the page, including	
10 (10		
10 of 13	CERTIFICATE OF NONDISCRIMINATION-Fill in all information	
11 - 6 10	required on the form, including signature and date	
11 01 13	form including signature and data and provide natorization	
12 of 12	PIDDEP'S EXDEPTENCE. Fill in all information required on the form	
12 01 13	DIDDER S EXPERIENCE- Fill in all information required on the form	
12 of 12	INSURANCE ACKNOW/EDGEMENT Fill in all information required	
13 01 13	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	1.04 MARKING AND ADDRESSING BID ENVELOPE- Contract	
2 of 23	Documents are sealed in an envelope marked and addressed as	
0	required in this section	

Dated_____ Signature of Bidder_____

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REFERENCE STANDARDS

Olivenhain Municipal Water District, Standard Specifications and Drawings for the Construction of Water, Recycled Water, and Sewer Facilities, February 2017.

Standard Specifications for Public Works Construction, "Greenbook", 2019.

San Diego Regional Standard Drawings, Latest Edition.

Other reference standards as may be identified elsewhere in the Contract Documents

PROJECT PLANS

Plans for the construction of 4S Ranch Neighborhood 1 Sewer Pump Station Replacement (90 sheets)

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PART I

BIDDING AND CONTRACT REQUIREMENTS

NOTICE INVITING SEALED PROPOSALS (BIDS)

FOR THE CONSTRUCTION OF

4S RANCH NEIGHBORHOOD 1 SEWER PUMP STATION REPLACEMENT PROJECT

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) up to the hour of **2:00 p.m. on the 13th day of January 2022** 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 **NON-MANDATORY** Pre-Bid Conference at the project site, located at 16106 4S Ranch Parkway, San Diego, California, 92127, at **10:00 a.m. on December 2, 2021.** A field walk of the site will follow the meeting.

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 January 7th, 2022,** after which they will not be answered.

Contract Documents consisting of plans, specifications and bidding documents can be downloaded from the "Upcoming Projects and Planning Resources" link under "Construction Projects" on the home page of the District's website at <u>www.olivenhain.com</u>. 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 number and email to <u>TGarnica@olivenhain.com</u>.

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.

Bidders shall have a minimum of five (5) years of successful prior experience performing the type of work required by this contract. Where the Bidder is a corporation or partnership, the entity must demonstrate at least five (5) years of successful experience with the work required by the contract. Bidders failing to demonstrate this experience may be rejected as nonresponsive at the option of the District.

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 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: _____

JASON P. HUBBARD, P.E. ENGINEERING MANAGER

PRE-BID QUESTION FORM

FOR THE CONSTRUCTION OF

4S RANCH NEIGHBORHOOD 1 SEWER PUMP STATION REPLACEMENT PROJECT

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, Attn: Jason Hubbard, Tel: (760) 753-6466, Fax: (760) 753-1578.** Bidders are encouraged to submit their pre-bid questions as early as possible, in writing to <u>TGarnica@olivenhain.com</u>, 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., January 7th, 2022, after which no questions will be taken or answered**.

BID FORM

PROPOSAL TO OLIVENHAIN MUNICIPAL WATER DISTRICT SAN DIEGO COUNTY, CALIFORNIA

FOR THE CONSTRUCTION OF

4S RANCH NEIGHBORHOOD 1 SEWER PUMP STATION REPLACEMENT PROJECT

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 Owner in the form set forth in the Contract Documents and that he will accept in full payment thereof the following prices, to wit:

BIDDING INSTRUCTIONS

FOR THE CONSTRUCTION OF

4S RANCH NEIGHBORHOOD 1 SEWER PUMP STATION REPLACEMENT PROJECT

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, in writing by fax or mail, 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., January 7th, 2022**, after which they will not be answered.

Bidders shall have a minimum of five (5) years of successful prior experience performing the type of work required by this Contract. Bidders failing to demonstrate this experience may be rejected as nonresponsive at the option of the Owner.

Bidders agree 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.

Bidders must satisfy themselves as to 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. Any bid protests must be submitted within three (3) calendar days of the bid.

The Contract Documents contain the provisions required for the construction of the Project. Information obtained from an officer, agent, or employee of the Owner 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 submitted 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 Owner reserves the right to find a bid non-responsive in its sole discretion if a Bidder lists any unlicensed subcontractors to perform any of the work. Submit with the bid the completed Certificate of Drug-Free Workplace, Certificate of Nondiscrimination, Noncollusion Affidavit, Designation of Subcontractors, Bidder's Experience, and Insurance Acknowledgment included in the Bid Form. Completely fill out the one page Bid Form Checklist included in front of the Table of Contents and include it with the bid. The Owner reserves the right to find a bid non-responsive in its sole discretion of a Bidder fails to complete or include any of the aforementioned certificates or acknowledgements.

The pay items listed in each Bid Schedule are described in Specification Section 01010 – Summary of Work.

BID SCHEDULE

4S RANCH NEIGHBORHOOD 1 SEWER PUMP STATION REPLACEMENT PROJECT

Item	Item Description	Quantity	Unit	Amount
1.	Mobilization, Demobilization, Bonds, Permits, Insurance, & Cleanup and Demobilization ¹	1	LS	\$
2.	Temporary Erosion Control/Storm Water Pollution Protection Program (SWPPP)	1	LS	\$
3.	Sheeting, Shoring & Bracing	1	LS	\$
4.	Demolition	1	LS	\$
5.	Earthwork	1	LS	\$
6.	Over-Excavation & Imported Bedding	100	CY	\$
7.	Civil Site Work	1	LS	\$
8.	Site Piping	1	LS	\$
9.	Dry-Pit Submersible Pumps	5	EA	\$
10.	Pump Station Mechanical	1	LS	\$
11.	Modifications to the Operating Wet Well	1	LS	\$
12.	Pump Station Building/Dry Pit	1	LS	\$
13.	Pump Station HVAC System	1	LS	\$
14.	Restroom in Existing Building	1	LS	\$
15.	Surge Tank Rehabilitation	1	LS	\$
16.	Surge Control Equipment	1	LS	\$

BID SCHEDULE

4S RANCH NEIGHBORHOOD 1 SEWER PUMP STATION REPLACEMENT PROJECT

ltem	Item Description	Quantity	Unit	Amount				
17.	Emergency Power Generation Equipment	1	LS	\$				
18.	Electrical & Telemetry	1	LS	\$				
19.	Systems Start-Up & Testing	1	LS	\$				
20.	Sewer Bypass Operations	1	LS	\$				
тот	TOTAL AMOUNT OF BID SCHEDULE \$							

TOTAL AMOUNT OF BID SCHEDULE (IN WORDS)

Amounts shall be shown in both words and figures, where indicated. In case of discrepancy, the amount shown in words will govern.

The above prices shall include all labor, materials, removal, overhead, profit, insurance, and incidentals required to complete the work.

¹Mobilization is limited to 8% of the total bid price for Bid Schedule.

Note: By submission of this Bid, the Contractor acknowledges the two year guarantee as outlined in Section 5-14 of the General Provisions and has included said expenses as a part of this Bid.

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, license number, 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 (1) percent (0.5%) 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 Owner.

If the Bidder fails to specify a subcontractor for any portion of the work in excess of one-half (1/2) of one (1) percent (0.5%) 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 is reduced to writing as a public record of the Owner.

Trade	% of Work To Be Done	Name of Subcontractor	License Number	Address

LISTING OF MANUFACTURERS

The Contractor shall submit this sheet with his bid, completed, to list the manufacturers of materials he intends to use. It shall be understood that where the Contractor elects to not use the material manufacturers called for in the Specifications, he will substitute only items of equal quality, durability, functional character, and efficiency as determined and approved by the Owner. The Contractor should ascertain the acceptability of substitutes prior to bidding. Only one manufacturer shall be listed for each item.

Item or Material	Manufacturer
Dry-Pit Submersible Pumps	
Check Valves	
Plug Valves	
Ductile Iron Pipe	
Generator	

Substitutions shall be allowed only if requested in accordance with Article 5-10 of the General Provisions within 35 calendar days of the date the Contract is awarded. Should a substitution be allowed, there will be no increase in the amount of the bid originally submitted.

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 Owner as liquidated damages in case this proposal is accepted by the Owner and the undersigned fails to execute a contract with the Owner as specified in the Contract Documents or fails to furnish the required payment and performance bonds, and insurance certificates and endorsements. Should the Owner be required to engage the services of an attorney in connection with the enforcement of this bid, Bidder promises to pay Owner'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 Owner 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 Owner, 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

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 Owner.

Bidders relying upon licenses of Responsible Managing Employees (RME) or Responsible Managing Officers (RMO) agree to provide the Owner 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:	_, 20		

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: _____

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 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:

NONCOLLUSION AFFIDAVIT

State of)	
) ss.	
County of)	
I,	, beir	ng duly sworn,
deposes and says that he or she is		of
	, the	party making the
partnership, company, association, organic collusive or sham; that the bidder has not agreed with any bidder or anyone else to bidding; that the bidder has not in any communication, or conference, with anyor or to fix any overhead, profit, or cost elem- secure any advantage against the public to proposed contract; that all statements cor has not, directly or indirectly, submitted h contents thereof, or divulged information o to any corporation, partnership, company member or agent thereof the effectuate a Signature of Bidder:	ization, or corporation; that the b t directly or indirectly colluded, co o put in a sham bid, or that any manner, directly or indirectly, s ne to fix the bid price of the bidde ent of the bid price, or of that of a body awarding the contract of an ntained in the bid are true; and, f his or her bid price or any break or data relative thereto, or paid, ar y association, organization, bid collusive or sham bid.	bid is genuine and not onspired, connived, or one shall refrain from ought by agreement, er or any other bidder, or to yone interested in the further, that the bidder kdown thereof, or the nd will not pay, any fee depository, or to any
Signature of Bidder:	_	

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

BIDDER'S EXPERIENCE

Name of Bidder:		
License		
Number:		

List a minimum of five (5) similar projects successfully completed by the Bidder during the last five (5) years. Projects not similar in scope, fee, and complexity will not be considered as representative of this project.

Project Name	Project Owner's Name,	Date
and Location	Address & Telephone No.	Completed

I declare, under penalty of perjury, that the foregoing is true and correct.

Dated:_____, 20____

(Signature of Bidder)

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 Owner prior to the time of Award, the Bidder agrees to promptly provide Owner 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 Owner with this proof of insurance prior to the time of Award shall entitle Owner to reject the Bidder's bid as nonresponsive and to Award the bid to the next lowest Bidder at the sole discretion of Owner.

The failure of Bidder to provide Owner 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 Owner 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:_____, 20____

(Name of Bidder)

(Signature)

(Typed Name and Title)

We,				a	is Principal	l, 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

4S RANCH NEIGHBORHOOD 1 SEWER PUMP STATION REPLACEMENT PROJECT

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
	Ву:	
(Seal if Corporation)	Title:	
(Attach Acknowledgment of Authorized Re	presentative of	of Principal)
Any claims under this bond may be addres	sed 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		
	Ву:	(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.
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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

4S RANCH NEIGHBORHOOD 1 SEWER PUMP STATION REPLACEMENT PROJECT

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)
		Ву:	(Authorized Representative of Contractor)
		Title:	
(Seal if Corporation)			
(Attach Acknowledgment for	Authorized F	Representa	ative of Contractor)
APPROVED:			

Date

(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:_____

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PERFORMANCE BOND

We,			as Princ	ipal,
and severally, bind ourselves, our heirs, representatives, successors and assig the	as Ins,	Surety, as set fo	jointly rth herei	and in, to

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

4S RANCH NEIGHBORHOOD 1 SEWER PUMP STATION REPLACEMENT PROJECT

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 for a three (3) year period, and shall indemnify and save harmless the Owner, District, 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:				
(Cool if Corneration)	Dy				
(Seal If Corporation)					
(Attach Acknowledgment of Authorized F	Representative	of Principal)			
Any claims under this bond may be addr	essed 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)					
	D. a	SURETY			
	Ву:	(Attorney-in-Fact)			
APPROVED:					
(Attorney for OWNER)		Date			
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.

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

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

4S RANCH NEIGHBORHOOD 1 SEWER PUMP STATION REPLACEMENT PROJECT

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 three-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
	Bv:	
(Seal if Corporation)	Title:	
(Attach Acknowledgment of Authorized Re	epresentative of	f Principal)
Any claims under this bond may be addre	essed 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)		
(maon / como agricon)		SURETY
	Ву:	(Attorney-in-Fact)
APPROVED:		
(Attorney for OWNER)		Date
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: 4S RANCH NEIGHBORHOOD 1 SEWER PUMP STATION REPLACEMENT PROJECT

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)
	Ву	/:
		(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:	4S RANCH NEIGHBORHOOD 1 SEWER PUMP STATION REPLACEMENT PROJECT
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 INS	URANCE		LIMITS OF LI	ABILITY		
	A. WOI		VORKERS' COMPENSATION			Statutory Limits Under the Laws of the State of California		
	В.	EMPLOYER'S L	IABILITY		Each Employee	Each Accident		
		Bodily Injury By	Accident		\$	\$		
		Bodily Injury By	Disease		\$	\$		
Named Insured	(Cor	ntractor)			Insurance Co	ompany		
Street Nu	ımbe	r			Street Nu	mber		
City and	State	9			City and S	State		
			Ву:	((SE	Company Repr E NOTICE ON	esentative) PAGE 2 OF 2)		

OLIVENHAIN MWD CI 4S RANCH NBHD1 SPS REPLACEMENT PROJECT

CERTIFICATE OF INSURANCE (WORKERS' COMP) 1 OF 2

) 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	o 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 written.	ed my official seal on the date in this certificate first above

Insurance Company Agent for Service of Process in California:

State of

Name

Street Number

City and State

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,

Agency

Street Number

City and State

Telephone Number

NOTARY PUBLIC

INSURANCE ENDORSEMENT

Name of Contract:	4S RANCH NEIGHBORHOOD 1 SEWER PUMP STATION REPLACEMENT PROJECT
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)

Street Number

City and State

Insurance Company

Street Number

City and State

Ву: _____

(Company Representative)

(SEE NOTICE ON PAGE 2 OF 2)

State o	of)							
County	of _))	SS.						
On this	;	_day of				,	20 <u> </u> b	efore	me perso	onally	came
						to	o me kno	wn, oi	r proved to	o me o	on the
basis	of	satisfactory	evidence,	who	being	duly	sworn,	did	depose	and	say:
that							is an	autho	rized repre	esentat	ive of
the							and	acki	nowledged	to	me
that							exec	uted th	ne within in	strume	ent on
behalf	of sa	id insurance c	ompany.								

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:	4S RANCH NEIGHBORHOOD 1 SEWER PUMP STATION REPLACEMENT PROJECT
Name of Owner:	OLIVENHAIN MUNICIPAL WATER DISTRICT
Type of Insurance:	LIABILITY INSURANCE

THIS IS TO CERTIFY that the following policies have been issued by the below-stated company in conformance with the requirements of Articles 8-1 and 8-3 of the General Provisions and are in force at this time. The policy shall be an occurrence policy with a deductible not to exceed \$5,000.

POLICY NUMBER		LIMITS OF LIA In Thousands (ABILITY (000)
EXPIRATION DATE	TYPE OF INSURANCE	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	3 \$	\$
	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
в.	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.	
)	
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

City and State

Street Number

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:	4S RANCH NEIGHBORHOOD 1 SEWER PUMP STATION REPLACEMENT PROJECT
Name of Owner:	OLIVENHAIN MUNICIPAL WATER DISTRICT
Type of Insurance:	LIABILITY INSURANCE
This endorsement forms a pa	art 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)

Street Number

Street Number

Insurance Company

City and State

City and State

Ву: ____

(Company Representative)

(SEE NOTICE	ON PAGE	2 OF 2)
-------------	----------------	---------

State o	of)							
County	of _))	SS.						
On this		_day of				,	20 <u> </u> b	efore	me perso	onally	came
						to	o me kno	wn, oi	r proved to	o me o	n the
basis	of	satisfactory	evidence,	who	being	duly	sworn,	did	depose	and	say:
that							is an	autho	rized repre	esentat	ive of
the							and	ack	nowledged	to	me
that							exec	uted th	ne within in	strume	ent on
behalf	of sa	id insurance c	ompany.								

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:	4S RANCH NEIGHBORHOOD 1 SEWER PUMP STATION REPLACEMENT PROJECT
Name of Owner:	OLIVENHAIN MUNICIPAL WATER DISTRICT
Type of Insurance:	BUILDERS' RISK "ALL RISK" 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 8-4 of the General Provisions and is in force at this time:

POLICY NUMBER	EXPIRATION DATE	LIMITS OF LIABILITY
		\$
		(Not Less Than Contract Amount)
		Deductible:
		\$
	(Not Sooner Than Contract Completion Date)	(Not More Than \$100,000)

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
	Bv:	
	,	(Company Representative)
		(SEE NOTICE ON PAGE 3 OF 3)
State of	<u>)</u>) SS.	
On this day of		, 20 before me personally came
basis of satisfactory evidence, who that	being	duly sworn, did depose and say: 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

City and State

Street Number

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.

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INSURANCE ENDORSEMENT

Name of Contract:	4S RANCH NEIGHBORHOOD 1 SEWER PUMP STATION REPLACEMENT PROJECT
Name of Owner:	OLIVENHAIN MUNICIPAL WATER DISTRICT
Type of Insurance:	BUILDERS' RISK "ALL RISK" INSURANCE
This endorsement forms a pa	art 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

City and State

Street Number

City and State

Ву: _____

(Company Representative)

(SEE NOTICE ON PAGE 2 OF 2)

State of	_)
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	o 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.

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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 Owner accepting the work as being complete.

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

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

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 Owner 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 Owner 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 – The term "Engineer/Architect" means the Engineer/Architect or his authorized representative.

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

OWNER'S REPRESENTATIVE - The person or firm authorized by the Owner to represent it during the performance of the work by the Contractor. The term "Owner's Representative" means the Owner'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 Owner's Representative is intended. Similarly, the terms "acceptable," "satisfactory," "or equal," or terms of like import shall mean acceptable to or satisfactory to the Owner'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 Owner. Bidders unable to demonstrate five (5) years of successful prior experience performing the type and magnitude 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 Owner and a part of the Contract Documents. The Bid Form Checklist, Bid Form and Bid Bond must be submitted with the bid. 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 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 Owner. Said 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 endorsements within 15 calendar days after notice of award by the Owner in writing, the cash or the check and the money represented by said check shall be forfeited to the Owner, or in the event that a bond is deposited, said security shall be forfeited. Forfeiture does not preclude the Owner 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 Owner 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 Owner 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 Owner 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 Owner a written request for an interpretation or correction thereof. The person submitting the request will be responsible for its prompt delivery prior to the last date/time noticed for prebid questions as stipulated in the Notice Inviting Sealed Proposals (Bids). An interpretation or correction of the Contract Documents will be made only by Addendum duly issued by the Owner. Notice of the availablity of such Addendum will be electronically delivered (email) to each person or entity that has received a set of such documents. The Owner 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 Owner, 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 Owner 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 Owner, 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 Owner'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 Owner, 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 Owner 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 Owner, 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 Owner, however, reserves the right to select the schedules under which the bids are to be compared; to delete certain bid items from the Bid Schedule, to reject any and all bids, and to waive any irregularity in bids received. If, in the judgment of the Owner, a bid is unbalanced or if the bidder is not responsible, it shall be considered sufficient grounds for rejection of the entire bid.

The Owner 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 Owner 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 Owner 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 Owner. 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 Owner, 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 Owner from the date of the mailing of notice from the Owner to the bidder or from the date of personal delivery of notice from the Owner 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-triplicate, one each of which shall be filed with the Owner and one each with the Attorney for the Owner and the Contractor.

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 Owner 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 Owner. Contractor agrees to provide Owner with a deposit in a sum determined adequate by the Owner to cover all attorney's fees and all other fees, costs, and expenses incurred by the Owner in reviewing Contractor's request to use alternative securities in lieu of the required bonds and to prepare all agreements determined necessary by Owner to adequately protect Owner'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 Owner, 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 Owner, 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 Owner 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 Owner, must remain in full effect throughout the period of the Work and for a period of two-year thereafter as required by Article 5-14 TWO-YEAR GUARANTEE.

3-4 INSURANCE REQUIREMENTS

The successful bidder will be required to furnish the Owner 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 within the period of time required by Section 3-2 Execution of Contract 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 Owner 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 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 to leave the grounds in a neat and presentable condition.

4-2 CHANGES IN THE WORK

The Owner 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 Owner'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 (7) calendar days of the receipt of such order notify the Owner'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 Owner 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 owner 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 owners 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, 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 Owner's Representative and the owner of the utility facility.

The Owner 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 Owner 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 Owner 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 owner 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 owner thereof; it being understood that the owner 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 owner 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 owner of the utility.

The right is reserved to governmental agencies and to owners 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 OWNER

The Owner will furnish to the Contractor free of charge up to five (5) full size copies 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 with red line changes available to the Owner'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 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 OWNER'S REPRESENTATIVE

The Owner'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 Owner'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 Owner'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 Owner's Representative shall constitute a material breach of this agreement. Neither the Owner's Representative nor the Owner 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 Owner'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 Owner'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 Owner 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 Owner'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 Owner'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 Owner'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 Owner'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 Owner'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 Owner'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 Owner, or in any subsequent mediation, arbitration, or settlement conference between the Owner and the Contractor. The Owner'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 which is directly affected by such alleged affect 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 Owner'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 Owner'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 Owner'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 Owner'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 Owner'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.

The Contractor shall review, mark with his approval, and submit for review by the Owner's Representative shop drawings as called for in the Special Provisions and Standard Specifications or requested by the Owner's Representative. Shop drawings shall be submitted by email as a PDF to the Owner'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. A log shall be maintained by the Contractor showing the following information: sequential shop drawings number, brief description, date submitted, date approved, any other data relevant to the shop drawings.

Within 30 calendar days after receipt of said shop drawings, the Owner's Representative will return via electronic mail (email) the shop drawings to the Contractor with any comments noted thereon.

If so noted by the Owner'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 Owner's Representative on previous submittals.

The review by the Owner'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 Owner'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 (7) calendar days of the receipt of the shop drawings notify the Owner'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 Owner 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 Owner'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

Owner'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 Owner, 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 prior to the 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 Owner's Representative.

5-12 OBSERVATION OF WORK BY OWNER'S REPRESENTATIVE

The Owner'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 Owner's Representative so that the Owner'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 Owner's Representative will be subject to rejection. Any time spent by the Owner's Representative in the observation of work in progress that exceeds eight (8) hours in any single day shall be compensated back to the Owner by the Contractor at the Owner's fully loaded rate.

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

The observation, if any, by the Owner'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 Owner'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 Owner or the Owner'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 Owner or the Owner'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 Owner or any changes in, additions to, or deductions from the work done without written authority from the Owner will be considered as unauthorized and will not be paid for. Work so done <u>will</u> be ordered remedied, removed, or replaced by the Owner or the Owner'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 Owner or Owner's Representative made under the provisions of this article the Owner or Owner'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 Owner including staff time from any monies due or to become due the Contractor under this contract.

5-14 TWO-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 two-years after the date of formal acceptance of the work by the Board of Directors of Owner except for any portion of the work that is utilized or placed into service by the Owner 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 two-years 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 Owner in workmanship and/or materials, equipment, parts or supplies within the twoyear 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 Owner within seven (7) consecutive days after written notice of the defects from Owner, the Owner 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 Owner 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 Owner, defective work creates a dangerous condition or requires immediate correction or attention to prevent further loss to the Owner or to prevent interruption of operations of the Owner, the Owner may require the Contractor to correct the defects in a shorter period of time determined solely by Owner. If the Contractor does not correct the defects within the time specified by Owner, Owner 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 Owner 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 Owner 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 Owner for all acts and omissions of the Contractor's directors, officers, agents, owners, and employees and for all acts and omissions of all subcontractors, materialmen and suppliers and their respective directors, officers, managers, members, agents, owners and employees performing any of the work or providing any materials or supplies included as part of the work. The Owner, the Engineer/Architect and the Owner'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 owners. Nothing contained in the Contract Documents shall create any contractual relationship between any subcontractor materialman, or supplier and the Owner. 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 Owner. 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 Owner consent to any assignment of a part of the work under the contract.

Upon obtaining a prior written consent of the Owner, 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 Owner 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 Owner 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 Owner may withhold funds due until all work required by the Contract Documents is completed to the Owner'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 Owner. The election to terminate in accordance with this provision shall be deemed effective as of the date the Owner 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 CONTRACTOR'S CONSTRUCTION SCHEDULE AND COST BREAKDOWN

Within fourteen (14) days after Notice to Proceed, the Contractor shall deliver to the Owner's Representative a construction progress schedule and cost breakdown in bar chart form showing the proposed dates of commencement and completion and cost of each of the various parts of the work and the anticipated amount of each monthly payment that will become due the Contractor in accordance therewith. The Owner shall be entitled to terminate this Contract if, in the Owner's opinion, the Contractor is failing to carry on the work diligently or in accordance with the approved construction schedule and breakdown. The Contractor has been advised and understands that time is of the essence with respect to completion of all phases of the work in accordance with the approved construction schedule.

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 Special 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 Owner 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 Owner 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 Owner'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 Owner to terminate.

In accordance with Government Code 53069.85, Contractor agrees to forfeit and pay Owner 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 Owner, or acts of another contractor in the performance of a contract with the Owner, 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 Owner or the owner 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 Owner's approval of any extension of time except to the extent that the Owner 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 Owner or other written form executed by the Owner.

Requests for an extension of time must be delivered to the Owner'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 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 Owner'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 Owner'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 Owner'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 Owner 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 Owner 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 Owner 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 Owner, 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 Owner 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 TWO-YEAR GUARANTEE.

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 Owner. 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 Owner's Representative in writing and cease operations on that part of the work until the Owner'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, owners, 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 Owner, the Water Authority, the Engineer/Architect, the Owner'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, owners, 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 Owner 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 Owner, the Water Authority, the Engineer/Architect, the Owner'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 owners 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 Owner and all owners 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 Owner 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 Owner, the San Elijo Joint Powers Authority, City of Encinitas, Engineer/Architect, the Owner'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, owners, 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 Owner, the Engineer/Architect, or the Owner's Representative excepting only those claims and causes of action caused by the sole active negligence or intentional misconduct of the Owner, the Engineer/Architect, or the Owner's Representative. From and after the date of submission of any claim or demand to Owner, 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 Owner, the Engineer/Architect, the Owner'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 Owner has Safety Data Sheets (hereinafter "SDS") available for review on any hazardous chemical they may be exposed to while working in or around Owner facilities. It shall be the sole responsibility of Contractor to request and inspect these SDS forms prior to commencement of any work and to alert all employees and agents of Contractor of potential hazardous waste exposure from Owner facilities. It shall be the sole responsibility of Contractor to provide the Owner's Representative with completed SDS 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 SDS 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 Owner, 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 Owner) 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 Owner and shall solely bear the expense thereof. Where the Owner or the Owner'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 Owner or the Owner'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 Owner or the Owner's Representative to protect the safety of life or property during any emergency as determined by Owner.

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 Owner, the Engineer/Architect and the Owners 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 Owner, the Engineer/Architect, the Owners 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, owners, 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 Owner or the Contractor at any adjacent or adjoining landowner 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 Owner 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 Owner 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 Owner 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 Owner for acceptance in advance of excavation will not be accepted by the Owner if the Plans are based on subsurface conditions which are more favorable than those revealed by the investigations made by the Owner 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.

The right of the Engineer/Architect or the Owner'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 Owner, the Engineer/Architect, the Owner'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 Owner, the Engineer/Architect, and the Owner'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 owners except only those claims and causes of action caused by the sole active negligence or intentional misconduct of the Owner, the Engineer/Architect or the Owner'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 Owner, the Engineer/Architect, and Owner'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 Owner 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 Owner 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 Owner \$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 Owner \$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 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 Owner, 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 Owner 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 Owner 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 Owner 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 Owner 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 Owner. 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 Owner 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 Owner 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 Owner'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 Owner's Representative shall be binding upon all contractors concerned and the Owner, the Engineer/Architect, the Owner'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 contracts on the project or caused by a decision or omission of the Owner'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 Owner, the Engineer/Architect, the Owner'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 Owner shall notify the Contractor who shall hold harmless, indemnify, and defend the Owner, the San Elijo Joint Powers Authority, City of Encinitas, the Engineer/Architect, the Owner'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 Owner or Owner's Representative, the Owner 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 Owner 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 Owner 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 Owner 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 Owner for any excess cost or other damage occasioned the Owner thereby, and in such event the Owner 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 Owner elects to complete by furnishing its own employees, materials, tools, and equipment, the Owner 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 Owner arising from professional services andattorneys' 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 Owner promptly upon demand; on failure of Contractor to pay, the surety shall pay on demand by Owner. 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 Owner 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 Owner.

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 Owner, 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 Owner 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 Owner. The Contractor shall make his own arrangements and pay all expenses for additional area required by him outside the limits of the Owner'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 Owner, Engineer/Architect, or Owner'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 Owner, Engineer/Architect, or Owner's Representative shall be effective for any purpose. To be effective, the waiver must be in writing and executed by an authorized representative of Owner, the Engineer/Architect, or the Owner's Representative. Contractor has been informed, and understands, that the Engineer/Architect and Owner's Representative have no authority whatsoever to waive any rights or remedies granted to the Owner 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 Owner, 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 Owner, 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 Owner, 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 Owner 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 Owner'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 Owner 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 Owner 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 Owner determines that hazardous waste exists and that conditions exist which Contractor could not discover through the investigations required by the preceding paragraph, the Owner 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 Owner 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 Owner 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 Owner exceed a total of \$375,000, this section shall not apply and neither the Owner 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 VI 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 Owner, the Engineer/Architect, the Owner'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 Owner, the Engineer/Architect, the Owner'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 Owner 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 Owner 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 Owner'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 Owner 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 Owner'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 Owner's Representative.

9-2 PROGRESS PAYMENTS

The Contractor shall, on or before the third day of each calendar month after actual construction work is started, prepare the Progress Estimate and Payment Form included at the end of the General Provisions. The Contractor and the Owner'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 Owner'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 Owner's Representative during the previous month shall be used. No progress payment will be processed by the Owner 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 Owner 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 Owner 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 Owner 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 Owner 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 Owner agree that the thirty-day period for payment shall not commence until the Contractor has executed and submitted the Release Form to the Owner for the corresponding pay period.

In preparing any progress payment with the Contractor, the Owner's Representative will may use the cost breakdown in 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 Owner's Representative may take into consideration any facts and conditions deemed proper by him or her in his or her sole discretion including, but not limited to, the ratio of the difficulty or cost of the work done to the probable difficulty or cost of the work remaining to be done under the contract, the value of the work actually completed, and the estimated cost to complete all of the work in accordance with the contract price. In the event of any dispute between the Owner and the Contractor on the amount that should be paid for any progress payment, the determination of the Owner or the Owner's Representative shall control and be binding on the Contractor No dispute between the Contractor and the Owner concerning

the amount to be paid for any progress payment shall relieve the Contractor of its continuing obligation to complete all contract work within the time required by the Contract Documents, and to complete the work for the contract price and shall not relieve the Contractor of any other obligations contained in the Contract Documents. Owner shall retain five percent (5%) of each progress payment approved by the Owner's Representative 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 total amount retained will equal 5% of the contract price. In the event of a dispute between the Owner and Contractor, the Owner shall have the right to withhold an amount up to 150% of the disputed amount in accordance with Public Contract Code Section 7107(c). As part of any progress payment the Owner shall have the express right to deduct and withhold from any payments due the Contractor any amounts the Owner or the Owner's Representative determines are necessary or appropriate to cover all fees, costs, expenses, and damages incurred or estimated by the Owner as a result of any breach of this contract by the Contractor and to cover any and all damages suffered or estimated by the Owner as a result of the breach of any term or provision of the contract by the Contractor. Amounts the Owner may withhold also expressly include any and all liquidated damages authorized by the terms of this 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 Owner's Representative. Upon receipt of a request from Contractor for final payment, the Owner'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 Owner and the Contractor, Owner 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 Owner 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 Owner, the Engineer/Architect, the Owner'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 OWNER'S RIGHT TO WITHHOLD CERTAIN AMOUNTS AND MAKE APPLICATION THEREOF

In addition to the amounts which the Owner may retain under Sections 9-2 and 9-3 of this contract, the Owner 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 Owner'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 Owner for correcting any work determined to be defective by the Owner.

Any amounts determined appropriate or necessary by the Owner to cover the Owner'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 Owner in responding to the claim or cause of action.

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

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

The Owner has the express authority to withhold any amount or amounts determined appropriate by Owner from time to time from any payments otherwise due Contractor to cover all or any of the preceding items in the Owner's sole and exclusive judgment. The Owner 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 Owner, in Owner's discretion. In withholding any sums permitted by this section or in paying any claims, the Owner shall be deemed the agent of the Contractor and any payments made by the Owner on any claim shall be considered as a payment made under the contract by the Owner to the Contractor. The Owner shall not be liable to the Contractor for Owner's withholding of any and all amounts permitted by this section or Owner's payment of any claims as permitted by this section. Such withholdings and payments may be made by Owner at any time without prior judicial determination of the merits of any claims or causes of action. The Owner 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 Owner reserves the right to solely determine the adequacy of the securities being proposed by the Contractor and the value of those securities. The Owner shall also be entitled to charge an administrative fee, as determined by Owner in its sole discretion, for substituting equivalent securities for retention amounts.

The Contractor agrees that the Owner'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 Owner. The Owner shall be entitled, at any time, to request the deposit of additional securities of a value designated by the Owner, in Owner's sole discretion, to satisfy this requirement. If the Owner does not receive satisfactory securities within 12 calendar days of the date of the written request, Owner shall be entitled to withhold amounts due Contractor until securities of satisfactory value to Owner 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(s) included at the end of the General Provisions releasing the Owner 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 Owner 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 Owner.

SECTION 10 AUTHORITY AND STATUS OF OWNERS REPRESENTATIVES

10-1 STATUS OF OWNERS REPRESENTATIVES

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

10-2 AUTHORITY OF OWNER'S REPRESENTATIVES

Contractor has been informed, and understands, that the Engineer/Architect and the Owner'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 Owner. 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 Owner through the Owner's Representative. Only the general manager of Owner 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 Owner. Any requested changes by the Contractor to the approved plans and specifications must be submitted to the Owner's Engineer for review and approval through the Owner's Representative. No changes to the approved plans or specifications shall be effective for any purpose unless the Owner'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 Owner. 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

11-1 APPROVED MATERIALS LIST SUBMITTAL

The Contractor shall complete the Approved Materials List (AML) which can be found on the Bids and Planning page of the District's website at www.olivenhain.com as called for in the Special Provisions and Standard Specifications and submit as directed by the Owner's Representative. No substitution or revision to this form will be accepted or approved by the Owner.

11-2 SHOP DRAWING SUBMITTAL FORM

The Contractor shall complete the Shop Drawing Submittal Form included at the end of the General Provisions when submitting Shop Drawings as called for in the Special Provisions and Standard Specifications or requested by the Owner's Representative. 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 and approved by the Owner.

11-3 PROGRESS ESTIMATE AND PAYMENT FORM

The Contractor will use the Progress Estimate and Payment Form included at the end of the General Provisions when preparing the monthly progress payment for review. No progress payment will be processed to pay the Contractor until the progress estimate and payment form and the release form included at the end of these general provisions have been fully completed and submitted by the Contractor to the Owner's Representative and approved by the Owner.

11-4 RELEASE FORM(S)

The Contractor shall complete the Conditional and/or Final Release Forms (as appropriate) included at the end of the General Provisions and submit to the Owner 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.

END OF SECTION

SHOP DRAWING SUBMITTAL FORM					
TO:	OWNER'S REPRESENTATIVE c/o Olivenhain Municipal Water District 1966 Olivenhain Road Encinitas, CA 92024	rom: (Contra (Addre ontractor Job Nur	actor) ss) nber		
Owner:	OLIVENHAIN MUNICIPAL WATER DISTRIC	OMWD PN:	D700004		
Project:	4S RANCH NEIGHBORHOOD 1 SEWER F STATION REPLACEMENT PROJECT	MP OWNER'S	REP ACCT NO.	. <u></u>	
SUBMI	ITTAL NO.:	_ RESUBM	IITTAL: 🗆 Y	es 🗆 No	
SPECIF DESCR	FICATION SECTION:				
This Sh and illus	nop Drawing Submittal has been prepared by the Contracto Istrates some portion of the work. The Contractor warrants c	or any subcontrac e of the following o	tor, manufacture conditions:	er, supplier, or distributor	
	□ The Contractor has approved this submittal an shown conforms to the Plans and Specifications.	represents that th	ne material, equ	upment, and other work	
	□ The Contractor has approved this submittal but the Plans and Specifications and has set forth th	presents that this easons for the de	is a deviation f viation below.	rom the requirements of	
DEVIAT	TION/REVISIONS:				
Ву:		tle:			

Owner:	OLIVENHAIN MUNICIPAL WATER DISTRICT				
Project: 4S RANCH NEIGHBORHOOD 1 SEWER PUMP ST REPLACEMENT PROJECT		• STATION Contract End Date	04		
		Revised Contract End Date			
Contractor					
		Contract Job No.			
		Date Created			
Work		Total Cost Percent	Value		
Item		of Work Item Complete c	ot vvork		
	-				
Total Proje	ct Cost of Work Items				
Estimated	Total Value of Work Performed				
Less Five I	Percent (5%) of Such Estimated Total Value				
Total Amou	unt Due for Work Performed				
Less All Pr	evious Payments				
AMOUNT	DUE AND PAYABLE TO THE CONTRACTOR				
Prepared b	y Owner's Representative				
Accepted b	y CONTRACTOR Ap	pproved by OWNER			
Ву:	Ву	ľ:			
Date:	Da	ate:			
Distributior	i: □ Owner □ Contracto	or 🛛 Engineer 🗆 Fin	ance		

CONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT

(CA CIVIL CODE §8132) (1)

NOTICE: THIS DOCUMENT WAIVES THE CLAIMANT'S LIEN, STOP PAYMENT NOTICE, AND PAYMENT BOND RIGHTS EFFECTIVE ON RECEIPT OF PAYMENT. A PERSON SHOULD NOT RELY ON THIS DOCUMENT UNLESS SATISFIED THAT THE CLAIMANT HAS RECEIVED PAYMENT.

Identifying Information:

Name of Claimant:

Name of Customer: Olivenhain Municipal Water District

Job Location:

Owner: Olivenhain Municipal Water District

Through Date:

Conditional Waiver and Release

This document waives and releases lien, stop payment notice, and payment bond rights the claimant has for labor and service provided, and equipment and material delivered, to the customer on this job through the Through Date of this document. Rights based upon labor or service provided, or equipment or material delivered, pursuant to a written change order that has been fully executed by the parties prior to the date that this document is signed by the claimant, are waived and released by this document, unless listed as an Exception below. This document is effective only on the claimant's receipt of payment from the financial institution on which the following check is drawn:

Maker of Check: Olivenhain Municipal Water District

Amount of Check:		
Check Payable to:		
This document does	not affect any of the following:	
(1)	Retentions.	
(2)	Extras for which the claimant has not received payment.	
(3)	The following progress payments for which the claimant has previously given a conditional waiver and release but has received payment:	
	Date(s) of waiver and release:	
	Amount(s) of unpaid progress payment(s): \$	
(4)	Contract rights, including: (A) a right based on rescission, abandonment, or breach of contract, and (B) the right to recover compensation for work not compensated by the payment.	
	SIGNATURE	
	Claimant's Signature:	
	Claimant's Title:	

Date of Signature:

CONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT (CA CIVIL CODE §8136) (3)

NOTICE: THIS DOCUMENT WAIVES THE CLAIMANT'S LIEN, STOP PAYMENT NOTICE, AND PAYMENT BOND RIGHTS EFFECTIVE ON RECEIPT OF PAYMENT. A PERSON SHOULD NOT RELY ON THIS DOCUMENT UNLESS SATISFIED THAT THE CLAIMANT HAS RECEIVED PAYMENT.

Identifying Information:

Name of Claimant:

Name of Customer: Olivenhain Municipal Water District

Job Location:

Owner:

Conditional Waiver and Release

This document waives and releases lien, stop payment notice, and payment bond rights the claimant has for labor and service provided, and equipment and material delivered, to the customer on this job. Rights based upon labor or service provided, or equipment or material delivered, pursuant to a written change order that has been fully executed by the parties prior to the date that this document is signed by the claimant, are waived and released by this document, unless listed as an Exception below. This document is effective only on the claimant's receipt of payment from the financial institution on which the following check is drawn:

Maker of Check: Olivenhain Municipal Water District

Amount of Check:

Check Payable To:

Exceptions

This document does not affect any of the following:

Disputed claims for extras in the amount of: \$_____

SIGNATURE

Claimant's Signature:_____

Claimant's Title: _____

Date of Signature: _____

PRO	POSED CHANGE ORD	ER
Owner: OLIVENHAIN MUNICIPAL	WATER DISTRICT	OMWD PN D700004
Project: 4S Ranch Neighborhood1 Sewer Pump	2	
Station Replacement Project		
PROPOSED CHANGE ORDER NO.		Date:
*A change to the contract documents for the abov impact(s) for the following described work:	e referenced project is being co	nsidered. Please provide cost and schedule
DESCRIPTION OF CHANGE / PCO's	Cost Impact	Schedule Impact
	\$	Day(s)
TOTAL	\$	Calendar
Day(s)		
NOTE: Attention is called to the section Estimates and Payments.	ons in the General Provis	sions on Scope of Work and
THIS PROPOSED CHANGE ORDE	R IS NOT EFFECTIVE	UNTIL A CONTRACT
CHANGE ORDER HAS BEEN APPI	ROVED BY OWNER.	
This PCO was initiated by	On	
	011	
Colorita d	0	
Submitted Contractor	On	

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.

Section 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

of construction claims, was repealed by Stats. 1990, c. 1414 (A.B. 4165), § 2, operative Jan. 1, 1994. See, now, this section.

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

1990 Legislation

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.)

Instolical and Statutory Protes				
1990 Legislation	was repealed by Stats. 1990, c. 1414 (A.B. 4165), § 2, operative			
Former § 20104.2, added by Stats. 1990, c. 1414 (A.B. 4165),	Jan. 1, 1994. See, now, this section.			
§ 2, amended by Stats. 1991, c. 1029 (A.B. 1086), § 1, relating to requirements for claims filed under the article,	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,	Civil Procedure Before Trial, Well & Brown, Guide's Table of			
Knight, Fannin & Disco, see Guide's Table of Statutes for	Statutes for chapter paragraph number references to			

paragraphs discussing this section.

Historical and Statutowy Notas

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

chapter paragraph number references to paragraphs discussing

this section.

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.)

1990 Legislation

Historical and Statutory Notes

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,	for chapter paragraph number references to paragraphs
Knight, Fannin & Disco, see Guide's Table of Statutes	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 Derivation: Former § 20104.6, added by Stats. 1990,

1414, § 2.

c.

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.

§ 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. contracts and provided for repeal of the article on Jan 1, 1994. 4165), § 2, related to application of the article to specified

SECTION 00810 – SPECIAL PROVISIONS

1.01 DEFINITIONS

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

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

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

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, "PLANS FOR THE CONSTRUCTION OF 4S RANCH NEIGHBORHOOD 1 SEWER PUMP STATION REPLACEMENT" and referenced Standard Drawings or Regional Standard Drawings.

ENGINEER / DESIGN ENGINEER – Infrastructure Engineering Corporation, 14271 Danielson Street, Poway, CA 92064, Tel: (858) 413-2400.

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 2019 Errata.

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, October 2018.

SPECIAL PROVISIONS - Section 00810 of the specifications.

SPECIFICATIONS - Division 1 to 17 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 December 2017, with revisions.

STANDARD SPECIFICATIONS - Divisions 1 through 16 of the Olivenhain Municipal Water District, Standard Specifications and Drawings for the Construction of Water, Recycled Water, and Sewer Facilities, dated February 2017, with revisions.

STATE STANDARD SPECIFICATIONS - State of California, Department of Transportation, Standard Specifications, 2018, with revisions; Caltrans.

STATE STANDARD PLANS - State of California, Department of Transportation, Standard Plans, 2018, with revisions; 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: 4S RANCH NEIGHBORHOOD 1 SEWER PUMP STATION REPLACEMENT PROJECT

> OLIVENHAIN MUNICIPAL WATER DISTRICT Attention: Jason P. Hubbard, Engineering Manager 1966 Olivenhain Road Encinitas, California 92024

1.05 AWARD OF CONTRACT OR REJECTION OF BIDS

Within a period of 90 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 <u>Class A</u>.

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

The work shall be completed within <u>THREE HUNDRED (300)</u> CONSECTUTIVE CALENDAR <u>DAYS</u>, 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.

The Contractor shall complete all work in its entirety as specified in the Contract Documents within this time period. 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.

The Contractor shall provide proof of delays caused from equipment or material procurement outside of his/her control for approval by the Owner. Approved delays shall be remedied by additional time to the contract and shall not include additional compensation.

The Contractor shall provide submittals to the Owner for long-lead items seven (7) working days after issuance of the Notice to Proceed. Delays to the contract time for completion as a result of the Contractors failure to provide submittals for long-lead items within this time period will not be considered by the Owner for requests for additional time.

Pursuant to Government Code 53069.85, forfeiture for each day completion is delayed beyond the time allowed will be at the rate of \$2,500.00 per day, except as noted below.

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. The Contractor shall comply with the ordinances, directives, and regulations of the respective agencies with jurisdiction over the area of the work including but not limited to the County of San Diego, the City of San Diego, the Olivenhain Municipal Water District, and 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. The Contractor shall provide copies of all 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.

The Contractor shall be responsible for securing approved traffic control permits for all jurisdictional agencies where work is to occur or where traffic control measures will be placed at no cost to the District.

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 (AC) 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. AC 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

- A. Comply with all applicable Federal, State, County, and City laws and regulations concerning the prevention and control of air pollution.
- B. 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.
 - 1. The Contractor shall familiarize themselves with the City or County Zoning Performance Standards applicable to night work and day work.
- 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. 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. Each vehicle equipped with a back-up alarm shall use a white noise back-up alarm Brigade BBS-97 or equal at all times.
 - 2. The Contractor shall utilize hydraulically assisted tailgates on all dump style trucks to prevent slamming noises during all night work operations including off-site staging areas.

1.13 AMOUNT OF LIABILITY INSURANCE

- A. Employer's Liability Insurance:
 - 1. Bodily injury coverage by accident shall be for not less than \$1,000,000 for each employee and \$1,000,000 for each accident.
 - 2. Bodily injury coverage by disease shall be for not less than \$1,000,000 for each employee and \$1,000,000 for each disease.
- B. General Liability:

Bodily injury, personal injury, and property damage coverage shall be in a combined single limit of not less than \$1,000,000 for each occurrence and \$1,000,000 aggregate.

C. Automobile Liability:

Bodily injury and property damage coverage shall be in a combined single limit of not less than \$1,000,000 for each occurrence.

D. Builder's Risk Insurance:

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

E. Earthquake and Tidal Wave Insurance:

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

F. 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 latest edition of the Olivenhain Municipal Water District, Standard Specifications and Drawings for the Construction of Water, Recycled Water, and Sewer Facilities. These District Standard Drawings and Standard Specifications are available for purchase at the office of the District or available online.

1.15 CONSTRUCTION SCHEDULE AND BID BREAKDOWN

The Contractor shall conform to 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.

1.16 STORMWATER POLLUTION PREVENTION

A. The Contractor is responsible for Implementation, Maintenance, Inspection, Monitoring and Construction/Installation of all Best Management Practices (BMPs) required by the Storm Water Pollution Prevention Plan (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 and Special Provisions listed in the Bid Documents and References herein. A copy of the SWPPP must be submitted to the District seven (7) days in advance of any mobilization and/or construction at the project location. A copy of the SWPPP must also be kept on the project site at all times.

- a. The District has preliminarily calculated 0.7-acre of soil disturbance from activities related to the installation of improvements indicated on the Contract Plans. The Contractor shall perform their own analysis and include disturbances from their staging operations.
- b. If the Contractors total activities exceed 1-acre of soil disturbance, the Contractor shall notify the District. The Contractor shall provide the required documents for submission of a Notice of Intent with the State Water Resources Control Board at no-cost to the District. The District will file application and pay permit fees.
- B. The Contractor shall comply with all local ordinances, County of San Diego Ordinance No. 9424, National Pollutant Discharge Elimination Permit Number CAS 0108758 and State Water Resources Control Board NPDES Permit No. CAS000002. The Contractor shall install and maintain Best Management Practices (BMPs) to the Maximum Extent Practicable (MEP) to prevent or reduce pollutant discharges to local storm drain/storm water conveyance systems and/or receiving waters from construction activities. The Contractor shall manage the Work to prevent or reduce pollutant discharges to local storm drain/storm water conveyance systems and/or receiving waters. BMPs to be implemented are detailed in the County of San Diego "Stormwater Standards Manual" and shall be applied to the project.
- C. Contractor is advised that there is a high potential for "run-on" flows due to curb outlets from higher elevation developments to the West and shall provide all protections necessary.
- D. SCOPE OF WORK
 - The Contractor shall provide the services of a Qualified SWPPP Developer (QSD) to develop a SWPPP in compliance with the CGP. The name of the QSD, together with their qualifications and certifications, shall be submitted to the District as a formal submittal. In the event that the Project does not qualify for a SWPPP, the Contractor shall develop a Water Quality Control Plan (WQCP), Erosion Control Plan (ECP), or other storm water quality control document required by the jurisdictional agency.
 - 2. 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 and/or the storm water quality control document required by the jurisdictional agency. The name of the QSP, together with their qualifications and certifications, shall be submitted to the District as a formal submittal.
 - 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.
 - 5. The Contractor's QSP shall perform all of the required inspections, reporting and maintenance according to the appropriate sections and attachments per the CGP. Inspections and reporting shall continue for the duration of the project.

6. Inspection reports shall be kept on site in the SWPPP binder.

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

E. 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.

F. NON-COMPLIANCE

- 1. Should the Contractor not perform all required inspections per the CGP and SWPPP as determined by the District's SWPPP Manager, the site shall be deemed to be out of compliance. The Contractor will have 48 hours, upon notification by the District, to generate the proper reports and return the project back in compliance of 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 in 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. Should the Contractor not install all required BMPs per the CGP and SWPPP as determined by the District's SWPPP Manager, 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.
- 3. 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.
- 4. The District and the District's SWPPP Manager 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.
- 5. If at any time the site is deemed to be out of compliance as determined by the SWPPP Manager, 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.

6. 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.

G. 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 (2015) 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 cleanup 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 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

H. COMPLIANCE CERTIFICATION

1. An officer or other authorized representative of the Contractor shall certify that the site is and/or was in full compliance with the CGP during construction activities.

I. 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.

J. 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.

K. REFERENCES

- State Water Resources Control Board (SWRCB) Construction General Permit (CGP) Order No. 2012-0006-DWQ National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS0109266, 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*)

1.17 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".
- B. 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.
- C. 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.

1.18 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.

1.19 COORDINATION WITH DISTRICT OPERATIONS

- A. 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 system. <u>The Contractor shall submit a</u> <u>detailed sequence of work to the District for all work in accordance with Section 01115</u>. 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.
- B. The District will operate all existing valves. Therefore, the Contractor must coordinate connection work with District operations. Once the pipelines have been isolated, the Contractor shall dechlorinate and drain all lines. At its sole discretion, the District may use its own forces to dechlorinate and drain lines at above ground facilities only. The management of water drained into a trench, regardless of the origin or cause of the water, shall be the sole responsibility of the Contractor.
- C. The Contractor is responsible for all lock-out / tag-out operations and for ensuring all necessary connections required to be isolated for the work have been safely de-energized prior to disconnection.

1.20 PRE-CONSTRUCTION CONFERENCE AND PROGRESS MEETINGS

A Pre-Construction Conference shall be scheduled prior to start of project as described in Section 01039. 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.

During performance of the Work, the Contractor shall attend regular weekly meetings as described in Specification Section 01039.

1.21 HOURS OF WORK

Hours of work shall be 7:00 A.M. to 5:00 P.M. Saturday and nighttime work will only be allowed with prior written approval by the Owner. Overtime and shift work may be established as short-term procedure by Contractor with written notice to and advanced 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:

Thanksgiving Day	Thursday, November 25, 2021
Day after Thanksgiving	Friday, November 26, 2021
Christmas Day	Friday, December 24, 2021
New Year's Day	Friday, December 31, 2021
Martin Luther King Jr. Day	Monday, January 17, 2022
Presidents' Day	Monday, February 21, 2022
Memorial Day	Monday, May 30, 2022
Independence Day	Monday, July 4, 2022
Labor Day	Monday, September 5, 2022
Veterans Day	Friday, November 11, 2022
Thanksgiving Day	Thursday, November 24, 2022
Day after Thanksgiving	Friday, November 25, 2022
Christmas Day	Monday, December 26, 2022
New Year's Day	Monday, January 2, 2023
Martin Luther King Jr. Day	Monday, January 16, 2023
Presidents' Day	Monday, February 20, 2023
Memorial Day	Monday, May 29, 2023
Independence Day	Tuesday, July 4, 2023
Labor Day	Monday, September 4, 2023
Veterans Day	Friday, November 10, 2023
Thanksgiving Day	Thursday, November 23, 2023
Day after Thanksgiving	Friday, November 24, 2023
Christmas Day	Monday, December 25, 2023

1.22 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 Encinitas 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

- 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.
- 2. The Contractor's surveyor will establish the following minimum points along the pipeline alignment: one offset stake for line, station and grade at all angle points, beginning and ending of curves and points along the centerline of pipe with a maximum distance of 25.00 feet between stakes for pipeline to be constructed by open trench construction. Additional stakes may be requested for clarification of construction at the request of the District's Representative at no additional cost to the District.

1.23 GEOTECHNICAL WORK

A. SUBSURFACE INVESTIGATIONS

The following report which has been prepared and is available for review at the District's website:

"Geotechnical Evaluation, Neighborhood No. 1 Sewer Pump Station Replacement, 16106 4S Ranch Parkway, San Diego, California, February 21, 2018, Project No. 108505001" by Ninyo and Moore Geotechnical and Environmental Sciences Consultants.

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.

1.24 CONSTRUCTION WATER

- A. The Contractor shall obtain and pay for a construction water meter from the District and shall be responsible for all high lines and other temporary equipment and facilities necessary to provide adequate construction water to the project site. The Contractor shall coordinate the locations of water supply with the District. The following conditions must also be met:
 - 1. Excess water must be available in the pipeline at the connection point.
 - 2. The contractor shall submit a construction water service connection plan a minimum of two weeks prior to the need for water. This plan shall indicate all piping, valves, and other materials necessary to connect to District owned piping at designated blow-off, air vacuum, and air release structures located within the project site. Do not install piping, meter, or valves until the District's Representative has approved the water service plan.
 - 3. Accurately measure all water use and submit meter readings to the District's Representative when the meter is installed, at the end of each month and when the meter is removed.
 - 4. Securely lock the installed valve in the closed position at the end of each workday and during all times of inactivity. Avoid wasting water and prevent unauthorized use. Do not use water from the District on any other project.
 - 5. Coordinate all use of water, flushing of pipelines and filling of pipelines with the District's representative. All requests for use of water and for increases or decreases in quantity shall be made in writing to the District's Representative two working days in advance.

1.25 POWER AND LIGHTING

A. The Contractor shall provide all power required for construction operations, and shall provide and maintain all temporary power facilities required to perform the work in a safe and satisfactory manner. All electrical facilities shall conform to the requirements of the of the requirements of Title 8, Industrial Relations, Subchapter 5, Electrical Safety Orders, of the California Code of Regulation; and Subpart K of the OSHA Safety and Health Standards for Construction.

- B. The Contractor shall provide adequate light for work conducted at night or under low light conditions to provide adequate facilities for inspection and safe working conditions and to insure proper work.
- C. Temporary connections for electricity shall be subject to approval of the District's Representative and the power company representative. Remove temporary electrical connections in like manner prior to final acceptance of the work.

1.26 CONTRACTOR STAGING AND LAYDOWN AREA

For use of roadway right-of-way areas, Contractor shall apply for and obtain approval for use from the jurisdictional agency. For any private property to be used by the Contractor, 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. Staging areas shall be delineated with perimeter fencing, shall be secure, shall implement all required BMP's, and shall adhere to all noise and dust requirements. 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 Standard Specification Section 01300. 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.

1.27 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 project inspector, 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.
- B. The Contractor shall keep the premises free at all times from accumulations of waste materials and rubbish. Contractor shall provide adequate trash receptacles about the site, and shall promptly empty the containers when filled. Wastes shall not be buried or burned on the site or disposed of into storm drains, sanitary sewers, streams, or waterways. All wastes shall be removed from the site and disposed of in a manner complying with local ordinances and antipollution laws. Volatile wastes shall be properly stored in covered metal containers and removed daily. Construction materials shall be neatly stacked by the Contractor when not in use. The Contractor shall promptly remove splattered concrete, asphalt, oil, paint, corrosive liquids, and cleaning solutions from surfaces to prevent marring or other damage.

1.28 SANITATION AND DRINKING WATER

- A. The Contractor shall provide toilet and wash-up facilities for his work force at the site of work. They shall comply with applicable laws, ordinances, and regulations pertaining to the public health and sanitation of dwellings and camps. The facilities shall be stored within the staging areas overnight and on weekends. The Contractor shall maintain the sanitary facilities in an acceptable condition from the beginning of work to completion and shall remove the facilities and disinfect the premises.
- B. The Contractor shall provide safe drinking water at all times at the jobsite.

1.29 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.

1.30 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.

1.31 AUDIO-VIDEO DOCUMENTATION OF PROJECT SITE

- A. A minimum of one (1) week 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. The Contractor shall be responsible for repairing any damage or defect not documented as existing prior to construction.
- B. Digital color audio-video documentation shall consist of the recordation of surface features taken along the entire length 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.
- C. Coverage of the digital color audio-video documentation shall include, but not be limited to: all existing driveways, sidewalks, curbs, streets, access roads, signs, landscaping, trees, catch basins, fences, monuments, visible utilities and all buildings located within the zone of influence. Of particular concern are any existing faults, fractures, cracks, defects or other features. Audio description shall be made simultaneously with and support the video coverage.
- D. One (1) copy 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 or transferred electronically 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 preconstruction audio-video documentation. Any project areas not fully documented shall be reshot as directed by the Owner's Representative.
- E. Construction work shall not commence until audio-video documentation has been delivered to the Owner's Representative.

1.32 JURISDICTIONAL COORDINATION

A. The Contractor shall coordinate construction activities with the operations of the jurisdictional agency where work is to occur, including the City of San Diego and the County of San Diego. Coordination shall include communication with the agency representative and the agency's project contractor.

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.
- B. Lump Sum Work Items Listed in the Bid Schedules:
 - 1. 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.
 - 2. 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.
- C. Unit Price Work Items Listed in the Bid Schedules:
 - 1. 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.
 - 2. 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.
- D. Work Items Not Listed in the Bid Schedules:
 - 1. 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.
 - 2. 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 Base Bid – Bid Schedule. Upon substantial completion of the work encompassed in the executed Schedule,

the District, at the District's sole discretion, will issue a Notice of Substantial Completion for this work.

Upon completion of all work in the Base Bid – Bid Schedule, Contractor shall apply for acceptance of the work. Upon acceptance of the work encompassed in the executed Schedule, the District, at the District's sole discretion, will issue a Notice of Completion for this work.

1.35 GUARANTEE

For all work a two-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 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 projects shall be registered with the State Department of Industrial Relations. Registration is completed through an online 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/Public-Works/PublicWorks.html

Prior to award of the contract, 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

- A. Contractor shall furnish and coordinate public notices to be distributed by the District at least 1 week before starting construction in the form of door hangers using a format submitted to and approved by the District. This notice shall be distributed to all:
 - 1. Residents and occupants within 300 feet of where construction work is to be performed, and;
 - 2. Schools, fire stations and businesses within 500 feet of where construction work is to be performed.

Notice format shall include, but is not limited to, project name, District's project website address and hotline number. Contractor shall provide a draft notice to District's Representative for approval a minimum of 15 calendar days prior to printing.
- B. Contractor shall furnish and coordinate public notices to be distributed by the District 72 hours in advance of shutdowns and low pressure notifications in the form of door hangers using a format submitted to and approved by the District. This notice shall be distributed to all impacted customers
- C. All costs for printing, distributing and hanging of notices shall be the District's responsibility.
- D. For all construction activity taking place on private property outside of the public right-of-way or District easement areas, Contractor shall coordinate with the property owner and the District to obtain written permission from the property owner for use of the area including the terms and conditions of use. The Contractor shall coordinate with any resource or permitting agency having jurisdiction over the area, obtain and pay for any permits for use of the area, provide any environmental mitigation required, and pay any fees or rental charges required for use of the area. Prior to accessing the private property, Contractor shall contact each owner individually a minimum of 30 days prior to commencing the Work.
- E. If the Work is delayed longer than 14 days from initial notification, the Contractor shall compensate the District to re-notify residents and occupants of the new work schedule.

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.

1.38 ABANDONMENT OF EXISTING FACILITIES

- A. Existing facilities shall not be abandoned, broken into, or taken out of service until all new facilities have been completed and accepted by the Owner; all proposed connections are completed and accepted by the Owner; the proposed facilities are complete and in full operation.
- B. The Contractor shall submit to the Owner a detailed sequence and method of work for the abandonment of the existing facilities including, but not limited to, overview and general sequence of work, the method and procedure for each increment of abandonment, and dates and times for the proposed work.
- C. Contractor shall remove and legally dispose any existing pipeline or subsurface structure interfering with the construction of new improvements per the Contract Documents.
- D. Remove existing thrust or anchor blocks where interfering with the proposed facilities.
- E. Voids created by the removal of abandoned facilities shall be backfilled in accordance with the Standard Specifications.
- F. Pipeline Abandonment
 - 1. Pipelines shown as abandoned or abandoned per the Contractors construction methods shall be plugged per the San Diego Regional Standard Drawings WP-03, including at intervals of 200 feet for pipelines 14" and smaller. Pipelines 16" and larger shall be filled along its entire length by pressured grout only.

- 2. All valves and appurtenances associated with an abandoned pipeline or as indicated in the Contract Documents shall be abandoned by removing the valve can material, concrete ring, and frame and lid in its entirety. Piping and fittings associated with an appurtenance shall be cut and removed to a depth of three (3) feet below finished grade. All piping should be capped as described elsewhere in the Contract Documents. All removals shall be legally disposed of. Any voids created by the removal of abandoned facilities shall be backfilled in accordance with the Standard Specifications.
- G. Structure Abandonment
 - 1. Remove all mechanical and electrical systems and appurtenant equipment including ladders, gauges, fans, pipe supports, valves, and piping. Salvage to the Owner or legally dispose of per direction of the Owner's Representative.
 - 2. Cut, remove, and legally dispose of the upper three (3) feet of all structures including frames and covers, concrete collars, grade rings, hatches, vents, and vault roofs and walls.
 - 3. Break or core drill 4-inch holes into the floor of the structure. One hole per 16-square feet shall be made.
 - 4. Inlet and outlet piping shall be plugged with concrete. Plug shall consist of a cast of 12" thick concrete.
 - 5. Backfill structure with sand or 1-sack sand/cement slurry mix.
 - 6. Site to be restored to existing conditions including, but not limited to, minor grading, pavement and/or concrete replacement, and landscaping/irrigation.

1.39 SITE RESTORATION

Contractor shall return all disturbed areas to pre-construction conditions including, but not limited to topographic elevations, grade and material of existing surface, slopes, curb and gutter, sidewalks, driveways, striping, seal coatings, landscaping, sod grass, fences, irrigation lines and facilities, railroad ties, District facilities, and structures.

All valve cans, whether new or existing, located within the final paving limits, shall be raised to grade per the Standard Specifications at no additional cost to the District.

1.40 TREE PROTECTION

Contractor shall protect trees in place in accordance with the Contract Documents. No tree shall be cut or trimmed without approval of a certified arborist and a District Representative. The cutting of roots greater than 2-inches in diameter shall not be allowed and hand-digging will be required.

1.41 OWNER'S RIGHT TO STOP WORK

The Owner reserves the right to stop work for any reason, at any time. The Contractor's claim for compensation shall apply to an adjustment in the completion time of the project only. Any additional costs incurred due to any stop work order, shall be incurred by the Contractor.

1.42 HAZARDOUS WASTE

The Contractor shall perform work in such a manner that there will be no hazardous wastes (fuel, oil, chemical, etc.) generated or left on the site. Should the generation of hazardous waste be necessary in order to complete the Work, it shall be the Contractor's responsibility to take all necessary steps to legally dispose of the waste and any contaminated soil or material. All hazardous waste and/or contaminated soil found on the site which has been left by the Contractor shall be properly disposed of by the Contractor. All necessary documentation of the disposal shall be obtained by the Contractor and shall be submitted to the Owner.

1.43 WET WELL MONITORING

The Contractor shall provide surveying services to verify no vertical or horizontal movement of the existing wet well during the construction of the adjacent dry well. A minimum of four (4) survey points shall be used and readings shall be taken pre-excavation, post backfill, and bimonthly during the excavation and backfill operations. The Contractor shall also monitor the structural integrity of the existing wet well and provide weekly written communication to the Owner's Representative on the status. At the conclusion of the surveying and monitoring period, the Contractor shall provide a written report summarizing his findings. If at any time, movement or structural distress is detected for the existing wet well, the Contractor shall suspend the work causing the movement or structural distress and shall provide solutions to remedy the situation at no additional cost to the Owner.

PART II

TECHNICAL SPECIFICATIONS

PART 1 – GENERAL

1.1 WORK OF THIS SECTION

A. The work to be performed under this Contract shall consist of furnishing all plant, tools, equipment, materials, supplies, and manufactured articles and furnishing all labor, transportation and services, including fuel, power, water, and essential communications, and performing all work, or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents. The work shall be complete, and all work, materials, and services not expressly indicated or called for in the Contract Documents which may be necessary for the complete and proper construction of the work in good faith shall be provided by the Contractor as though originally so indicated, at no increase in cost to the Owner.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 – Record Drawings and Submittals

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. The work generally includes, but is not limited to, furnishing all products, labor, equipment, material, transportation, and incidental services to construct the following:
 - 1. Replacement of the 4S Ranch Neighborhood 1 Sewer Pump Station comprised of an electrical building and dry pit pump room adjacent to the existing operating wet well, modifications to the operating wet well, all site improvements, and all equipment including but not limited to pumps and motors, piping, valves, flowmeter, air conditioning and ventilation, odor control equipment, emergency standby generator, surge control facilities and all electrical equipment.

1.4 **PROJECT LOCATION**

A. The 4S Ranch Neighborhood 1 Sewer Pump Station site is a District owned parcel located in the southern portion of the 4S Ranch area in the City of San Diego, near the intersection of Dove Creek Road and 4S Ranch Parkway. The pump station is immediately south of Boys and Girls Club of Greater San Diego and the 4S Ranch Community Park. The address of the station is 16106 4S Ranch Parkway, San Diego, California, 92127.

1.5 WORK BY OTHERS

A. The 4S Ranch Neighborhood 1 Sewer Pump Station is an active and operating facility. The pump station is required to be operational during the construction of the new station. The Contractor's attention is directed to the fact that work may be conducted concurrently at or near the site by District staff or other Contractors during the performance of the work under this Contract. The Contractor shall conduct its operations so as to cause a minimum of interference with the work of such other Contractors, and shall cooperate fully with such Contractors to provide

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continued safe access to their respective portions of the site, as required to perform work under their respective contracts.

B. Interference with work on utilities: The Contractor shall cooperate fully with all utility forces of the District or forces of other public or private agencies engaged in the relocation, altering, or otherwise rearranging of utilities which interfere with the progress of work by others, and shall schedule the work so as to minimize interference with said relocation, altering, or other rearranging of facilities.

PART 2 – MEASUREMENT AND PAYMENT

GENERAL

The Contractor shall provide all labor, materials, equipment and incidentals for the work described within these Specifications and Construction Drawings. Payment for each bid item shall be included in the contract unit price or unit price shown on the Bidder's proposal.

Prior to the execution of a lump sum contract, the Contractor shall submit a detailed price breakdown showing the allocated portion of the total bid price to the various items of Work. Contractor must submit a preliminary price breakdown for the review and approval of the Engineer. The Owner reserves the right to reject any breakdown submitted by the Contractor which the Owner judges insufficient to allow for the preparation of accurate monthly progress payment estimates or extra work, whether addition or deletion, similar in nature to the Work included in the Contractor's bid. The detailed price breakdown shall be listed by specification section number and shall include a separate cost item for all items of equipment or work. The price breakdown shall typically be a unit price type breakdown and shall include quantities, unit prices and total bid cost for each cost item. Where a unit price breakdown is judged impractical, the Owner may allow a breakdown by lump sum for certain cost items. This information will be used by the Owner in preparing monthly progress payment estimates.

Payment for each bid item shall include full compensation for all labor, materials, tools, equipment, supplies, subcontracts, and incidentals necessary to complete the work in its entirety and no additional compensation will be allowed. Payment for each bid item shall include the costs of compliance with the regulations of public agencies having jurisdiction, including Safety and Health Requirements of the California Division of Industrial Safety and the Occupational Safety and Health Administration of the U.S. Department of Labor (OSHA). This includes the cost of work not specifically listed in the Bid Schedule or Schedule of Values, but is necessary to complete the project as described and shown in the Contract Documents. Work for which no separate payment has been provided will be considered a subsidiary obligation of the Contractor, and the cost therefore shall be included in the applicable contract price for the item to which the work applies. All measurements of work done will be made by the District or its representative.

2.1 BID ITEM NO. 1 – MOBILIZATION, BONDS, PERMITS, CLEANUP AND DEMOBILIZATION

Payment for Mobilization, Bonds, Permits, Cleanup and Demobilization shall be made at the contract lump sum price, complete and in accordance with the Contract Documents, and as directed by the Owner. The Contract Price shall include, but is not limited to the following principal items: obtaining all permits, insurance, and bonds; mobilizing labor force, equipment and construction facilities onto site; providing field offices and storage yard as needed for the contractors activities; securing offsite staging if necessary;

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securing construction water supply; providing all temporary construction fencing; installing and removing of temporary water meters and highlines; providing on-site sanitary facilities; posting OSHA requirements and establishing safety programs; daily cleanup; preparing the Schedule of Values prior to the pre-construction meeting; preconstruction/progress video and photographs; work not specified for payment in any other bid item; controlling site ingress/egress; performing all work and documentation necessary for the mobilization, bonding, and permitting for construction of the project as described within the Contract Documents. This work also includes the cost for maintaining and submitting the project record drawings at the end of the project. These record drawings must be reviewed monthly with the Owner to receive payment for any work. The amount for this bid item shall be limited to 8% of the total contract amount.

2.2 BID ITEM NO. 2 – TEMPORARY EROSION CONTROL/STORM WATER POLLUTION PROTECTION PROGRAM (SWPPP)

Payment shall include compensation for all labor, materials, tools, and equipment including but not limited to the following principal items: preparing a temporary Erosion Control Plan (ECP), SWPPP, Water Quality Control Plan (WQCP), or other storm water pollution prevention documentation in conformance with the Construction General Permit and/or jurisdictional authority as is applicable; implementing best management practices and erosion control measures in conformance with the Contractor's SWPPP documentation; placement of erosion control measures, monitoring, reporting, and any appurtenant work; and all other incidental work as described in the Contract Documents.

2.3 BID ITEM NO. 3 – SHEETING, SHORING & BRACING

Payment for Sheeting, Shoring, and Bracing will be paid for at the contract lump sum price, complete and in accordance with the Contract Documents, and as directed by the Owner. Payment shall include full compensation for furnishing all labor, materials, tools, and equipment, and doing all work involved in providing work and material protection. Payment shall include the cost of preparation and submittal of plans by a licensed Engineer and obtaining the required permit from the State Division of Industrial Safety and other agencies having jurisdiction for excavations 5 feet deep or greater; and all incidental work for sheeting, shields, shoring, sloping or benching of excavation side slopes, or other protective systems necessary for the support of trench excavations and for worker protection from materials or equipment that could pose a hazard by falling or rolling into excavations, including but not limited to railing and fence. This Bid Item includes all other work necessary to complete this item of work.

2.4 BID ITEM NO. 4 – DEMOLITION

Payment for Demolition will be made at the contract lump sum price, complete and in accordance with the Contract Documents, and as directed by the Owner. The Contract Price for work under this item shall include but is not limited to furnishing all labor, material, tools, transportation and equipment and performing all work required to complete the demolition as shown on the Contract Drawings in its entirety including all other work as described within the Contract Documents. This work shall include legal disposal of all items designated for demolition or removal, the abandonment of pipelines and structures and the filling of voids with 2-sack slurry as part of the demolition work, patching wall penetrations left behind from demolition work, the protection of existing improvements and active District operations, and salvaging items to the District as required.

2.5 BID ITEM NO. 5 – EARTHWORK

Payment for Earthwork will be made at the contract lump sum price, complete and in accordance with the Contract Documents, and as directed by the Owner. The Contract Price for work under this item shall include but is not limited to furnishing all labor, material, tools, transportation and equipment and performing all work required to complete the earthwork including but not limited to potholing, clearing and grubbing, mass grading, dewatering, constructing a stockpile, backfilling and/or slurry backfill after structures have been constructed, and the export of the spoil as shown on the Contract Drawings in its entirety including all other work as described within the Contract Documents.

2.6 BID ITEM NO. 6 – OVER-EXCAVATION AND IMPORTED BEDDING

Payment for over-excavation and imported bedding shall be made at the contract unit price in accordance with the Contract Documents, and as directed by the Owner. The contract price for work under this item shall include, but not be limited to, furnishing all labor, material, tools, and equipment, and performing all work necessary for the overexcavation of unsuitable subgrade soils as directed by the Engineer and to depths in accordance with the specifications, moisture conditioning, backfill, and compaction of suitable soils, and all other incidental work as described in the Contract Documents.

2.7 BID ITEM NO. 7 – CIVIL SITE WORK

Payment for Civil Site Work will be made at the contract lump sum price, complete and in accordance with the Contract Documents, and as directed by the Owner. The Contract Price for work under this item shall include but is not limited to furnishing all labor, material, tools, and equipment and performing all work required for site improvements including final grading, asphalt concrete pavement and base, redwood pavement headers, concrete pavement and steps, concrete curb and gutters, cross gutter, bollards, housekeeping pad for the overflow pond recycled water washdown and pressure relief piping, area lights, new brow ditch, retaining curb to existing brow ditch, BMP filter insert, surface improvements such as weed barriers, ³/₄" rock, and mulch, and all other work as described within the Contract Documents.

2.8 BID ITEM NO. 8 – SITE PIPING

Payment for Site Piping will be made at the contract lump sum price, complete and in accordance with the Contract Documents, and as directed by the Owner. The Contract Price for work under this item shall include but is not limited to furnishing all labor, material, tools, and equipment and performing all work required for construction of all buried or above grade site piping including the wet well influent sewer, wet well overflow, force main, bypass connection, relocated and new water and reclaimed water lines, storm water pump discharge line, pump station drain, suction, and sump piping to the wet well, concrete encasement, and all other piping as described by the Contract Documents. Work required includes, but is not limited to, potholing, excavation, rock removal, dewatering, water control, pipe bedding, pipe, backfill, detector tape, valves/stem extensions/valve cans, appurtenances, and all other work necessary for construction of the Site Piping.

2.9 BID ITEM NO. 9 – DRY-PIT SUBMERSIBLE PUMPS

Payment for the Dry-pit Submersible Pumps will be made at the contract unit price, complete and in accordance with the Contract Documents, and as directed by the Owner. The Contract Price for work under this item shall include but is not limited to furnishing all labor, material, tools, and equipment and performing all work required to install the dry-pit submersible pumps **suitable for in-series pumping conditions** in their entirety including but not limited to the pumps, pump bases and supports, and all other work as described within the Contract Documents.

2.10 BID ITEM NO. 10 – PUMP STATION MECHANICAL

Payment for Pump Station Mechanical will be made at the contract lump sum price, complete and in accordance with the Contract Documents, and as directed by the Owner. The Contract Price for work under this item shall include but is not limited to furnishing all labor, material, tools, and equipment and performing all work required to complete the Pump Station Mechanical construction in its entirety including but not limited to piping and supports, valves, flowmeter, gauges, flanges, sewage air-release valves, utility water piping, hose bibs, eyewash/shower and piping, floor drains, sump pumps and grating for sump, vents, motorized bridge crane, conditioning pump in the wet well, and all other work as described within the Contract Documents.

2.11 BID ITEM NO. 11 – MODIFICATIONS TO THE OPERATING WET WELL

Payment for Modifications to the Operating Wet Well will be made at the contract lump sum price, complete and in accordance with the Contract Documents, and as directed by the Owner. The Contract Price for work under this item shall include but is not limited to furnishing all labor, material, tools, and equipment and performing all work required to complete the modifications to the Operating Wet Well in their entirety as described within the Contract Documents including, but not limited to demolition and concrete repair/rehab, new concrete and reinforcement, new wet well cover and access hatches, shoring and protection, coatings and waterproofing for concrete, liner repairs straight and level around the perimeter of the wet well, inlet, overflow, suction, and force main drain connections, sluice gates, new odor control system and connections and all other work as described within the Contract Documents. The Contract Price for work under this item shall include pre-excavation and post-excavation survey and reporting from work performed under bid item no. 12.

2.12 BID ITEM NO. 12 – PUMP STATION BUILDING/DRY PIT

Payment for the Pump Station Building/Dry Pit will be made at the contract lump sum price, complete and in accordance with the Contract Documents, and as directed by the Owner. The Contract Price for work under this item shall include but is not limited to furnishing all labor, material, tools, and equipment and performing all work required to complete the Pump Station Building/Dry Pit construction in its entirety including but not limited to concrete masonry, reinforced concrete, equipment pads, stairways, railing, roof, doors, acoustical louvers, access hatch, hardware, finishes, industrial floor coatings, floor trench, safety equipment, architectural improvements, downspout, hose rack, wall penetrations, and all other work as described within the Contract Documents.

2.13 BID ITEM NO. 13 – PUMP STATION HVAC SYSTEM

Payment for the Pump Station HVAC System will be made at the contract lump sum price, complete and in accordance with the Contract Documents, and as directed by the Owner. The Contract Price for work under this item shall include but is not limited to furnishing all labor, material, tools, and equipment and performing all work required to complete and test the pump station HVAC system installation in its entirety including but not limited to exhaust and supply fans, fiberglass ducting with straightening vanes, fiberglass registers, fittings, transition pieces, supports, roof ventilator, equipment pad, and wiring and controls. This item also includes removal, temporary storage, replacement of pipelines, and reinstallation of the existing AC system (indoor and outdoor units) in the locations shown on the Contract Drawings, and all other work as described within the Contract Documents.

2.14 BID ITEM NO. 14 – RESTROOM IN EXISTING BUILDING

Payment for the Restroom in the Existing Building will be made at the contract lump sum price, complete and in accordance with the Contract Documents, and as directed by the Owner. The Contract Price for work under this item shall include but is not limited to furnishing all labor, material, tools, and equipment and performing all work required to complete the restroom in the existing building in its entirety including but not limited to building modifications, walls, door, ceiling, tiling, floor coating, lighting, ventilation, fixtures, electric water heater, plumbing, drainage, bathroom accessories, and all other work as described within the Contract Documents.

2.15 BID ITEM NO. 15 – SURGE TANK REHABILITATION

Payment for the Surge Tank Rehabilitation will be made at the contract lump sum price, complete and in accordance with the Contract Documents, and as directed by the Owner. The Contract Price for work under this item shall include but is not limited to furnishing all labor, material, tools, and equipment and performing all work required to rehabilitate the existing vertical surge tank including, but not limited to, removing the existing tank, removing all connections and appurtenances, recoating, and reinstallation of the tank as shown on the Contract Drawings.

2.16 BID ITEM NO. 16 – SURGE CONTROL SYSTEM

Payment for the Surge Control System will be made at the contract lump sum price, complete and in accordance with the Contract Documents, and as directed by the Owner. The Contract Price for work under this item shall include but is not limited to furnishing all labor, material, tools, and equipment and performing all work required to completely provide an operable surge control system including, but not limited to, providing a surge tank control panel, piping, appurtenances, concrete pad, and making all connections to the existing surge tank and air compressor. This item shall also include testing of the existing air compressor prior to startup of the surge system to verify proper operation. The system shall accomplish all functions applicable to the surge control system as described in the Contract Documents. This cost also includes all programming, testing, balancing, and all other work to make the surge control equipment operable.

2.17 BID ITEM NO. 17 – EMERGENCY POWER GENERATION EQUIPMENT

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Payment for the Emergency Power Generation Equipment will be made at the contract lump sum price, complete and in accordance with the Contract Documents, and as directed by the Owner. The Contract Price for work under this item shall include but is not limited to furnishing all labor, material, tools, and equipment and performing all work required to completely install the new standby generator, engine, automatic silencer, startup, testing, permitting, and all other work in its entirety to make the emergency power generation equipment operable as described within the Contract Documents. This cost includes all miscellaneous appurtenances, piping, pipe supports, concrete pad, and controls.

2.18 BID ITEM NO. 18 – ELECTRICAL AND TELEMETRY

Payment for Electrical and Telemetry will be made at the contract lump sum price, complete and in accordance with the Contract Documents, and as directed by the Owner. The Contract Price for work under this item shall include but is not limited to furnishing all labor, material, tools, and equipment and performing all work required for all electrical and telemetry work including power distribution, instrumentation and control, all work and coordination with SDG&E, utility extensions, transformers, wire, conduit, switches, controls, instrumentation, radios, PLC's, receptacles, area lights, antenna mast, reconnecting the solar power system, gas monitoring system, and all other work as described within the Contract Documents.

2.19 BID ITEM NO. 19 – SYSTEMS START-UP AND TESTING

Payment for Systems Start-Up and Testing shall be made at the contract lump sum price, complete and in accordance with the Contract Documents, and as directed by the Owner. Payment for this bid item shall include, but not be limited to, all labor, materials, tools, equipment, supplies, supervision, and incidentals required to complete all pump station systems start-up and testing as described in the Contract Documents. This bid item shall include coordination required for Owner programming as described in the Contract Documents.

2.20 BID ITEM NO. 20 – SEWER BYPASS PUMPING OPERATIONS

Payment for Sewer Bypass Pumping Operations shall be made at the contract unit price, complete, and in accordance with the Contract Documents, and as directed by the Owner. Payment for this bid item shall include, but not be limited to, the preparation of a bypass plan to be submitted by the Contractor for approval by the Owner, and furnishing all labor, materials, incidentals, and equipment to construct, establish, operate, and maintain all bypass pumping required to perform the Work as described in the Contract Documents. The work of this item shall include but is not limited to implementing a 24 hour per day/7 day per week operation and maintenance program throughout the required duration of the bypass pumping operation and shall include all excavation, pipe, fittings, pumps, redundant (backup) pumps, tanks, labor, power acquisition and utility coordination, generators, fuel, compliance with all noise ordinances and regulations, and removal of equipment and facilities at job completion. The Contractor shall obtain all necessary permits for the bypassing and ensure complete pumping redundancy. Work will also include the replacement of the non-operation valve in the bypass vault to perform the Contractor's bypass operations and removal of the valve at the conclusion of the work per the Contract Documents.

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section specifies the methods and requirements of coordination and meetings required for project coordination.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 00810 Special Provisions
- B. Section 01310 Construction Progress Schedules
- C. Section 01370 Schedule of Values

1.3 COORDINATION AND PROJECT CONDITIONS

A. Contractor shall coordinate scheduling, submittals, and Work of the various sections of the Project to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

1.4 **PRECONSTRUCTION MEETING**

- A. Owner will schedule a Preconstruction meeting after Notice to Proceed.
- B. 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.
- C. Attendance Required: The District, Resident Engineer, District Representative, and Contractor's Superintendent, Foreman, and Representatives from Subcontractors.
- D. The District Representative will distribute an agenda including, but not limited to the following items:
 - 1. Distribution of Contract Documents.
 - 2. Submission of list of Subcontractors and project schedule provided by Contractor prior to meeting.
 - 3. Designation of personnel representing the parties in Contract.
 - 4. Procedures and processing of field decisions, submittals, substitutions, applications for progress payments, proposal request, Change Orders, and Contract closeout procedures.
 - 5. Scheduling.

SECTION 01039 – COORDINATION AND MEETINGS

- 6. Scheduling activities of Subcontractors.
- 7. Procedures for testing.
- 8. Procedures for maintaining record documents.
- E. District Representative shall record minutes and distribute copies after meeting to participants and those affected by decisions made.

1.5 **PROGRESS MEETINGS**

- A. District Representative shall schedule and administer meetings throughout progress of the Work at a maximum interval of every two weeks.
- B. District Representative will arrange meetings, prepare agenda with copies for participants, and preside at meetings.
- C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Construction Manager, and District as appropriate to agenda topics for each meeting.
- D. The scheduled progress meetings will include, but is not limited to the following agenda items:
 - 1. Review minutes of previous meetings.
 - 2. Review of Work progress.
 - 3. Field observations, problems, and decisions.
 - 4. Identification of problems which impede planned progress.
 - 5. Review of submittals schedule and status of submittals.
 - 6. Review of off-site fabrication and delivery schedules.
 - 7. Maintenance of progress schedule.
 - 8. Corrective measures to regain projected schedules.
 - 9. Planned progress during succeeding work period.
 - 10. Coordination of projected progress.
 - 11. Maintenance of quality and work standards.
 - 12. Effect of proposed changes on progress schedule and coordination.
 - 13. Other business relating to Work.

SECTION 01039 – COORDINATION AND MEETINGS

E. District Representative will record minutes and distribute copies after meeting to participants and those affected by decisions made.

PART 1 - GENERAL

1.1 MAINTENANCE OF EXISTING FACILITIES/CONDITIONS

- A. The Contractor will be performing work contained in these drawings and specifications. Under these conditions, precautions will be necessary to assure that no damage or unscheduled shutdowns occur to any facilities, including tanks, piping, utilities, roads, and structures, that are to remain in operation and are not to be modified or replaced. Any temporary facilities, materials, equipment and labor required to achieve this objective shall be provided by the Contractor at his own expense. At the completion of work, all such temporary facilities, materials and equipment remaining shall be removed from the site.
- B. For any connections to existing buried piping and facilities at or adjacent to the site, it shall be the responsibility of the Contractor to uncover and verify their locations, elevations, materials, and dimensions prior to beginning construction or fabrication of any new materials or facilities which are dependent on the location of existing facilities.
- C. 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 system. The Contractor shall submit a detailed sequence of work to the District for all work, as stated in Section 01115. 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.
- D. The District will operate all existing valves.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01310 Construction Progress Schedules
- B. Section 01115 Construction and Sequence

1.3 ORDER OF THE WORK

A. The work shall be carried on at such places on the project and also in such order or precedence as may be found necessary by the Contractor to expedite the completion of the project with due consideration for District operations. After work has begun on any portion or designated part of the project, it shall be carried forward to its final completion. The Owner has the right to change the precedence of work as needed to maintain the District's operation.

1.4 SHUTDOWNS

A. Any proposed shutdowns must be indicated on the Contractor's preliminary schedule to be submitted for review by the Owner at the Preconstruction Meeting. The actual allowable durations of the shutdowns will be determined during the preparation of the detailed construction schedule.

SECTION 01043 – COORDINATION WITH DISTRICT'S OPERATIONS

- B. The Contractor shall compile a detailed list of all items of work which must be accomplished during any shutdown. The Contractor shall coordinate his work to minimize the required number of shutdowns by accomplishing as many tasks as possible during each shutdown period. The Contractor shall submit this list of items to the Owner for review as a part of the construction schedule defined within Section 01310. The schedule shall indicate all periods and duration of each proposed shutdown and the items of work which will be accomplished, unless otherwise specified herein or noted on the drawings. The Contractor shall make specific written requests for all shutdowns ten (10) working days in advance of the proposed shutdown for review and approval by the Owner. The written request shall include a complete detailed plan of the Contractor's proposed activities including schedule, manpower, equipment, materials and methods which will be utilized to perform the required work during the proposed shutdown. Should the Owner feel that the Contractor's proposed plan is insufficient to successfully complete the required work during the period of the shutdown, the Contractor shall make the appropriate revisions in his proposed plan to the satisfaction of the Owner.
- C. No shutdowns or tie-ins to existing pipes will be allowed on a Monday or a Friday.
- D. Lockout/Tagouts shall be performed in accordance with the District's procedures or the Contractor's procedures, whichever are more stringent.

PART 1 – GENERAL

1.1 WORK OF THIS SECTION

A. The Contractor shall provide labor and materials for cutting and patching required to perform the Work required under the Contract.

1.2 **DEFINITION**

A. "Cutting-and-Patching" is defined to include the cutting and patching of nominally completed and previously existing concrete, steel, wood and miscellaneous metal structures, piping and pavement, in order to accommodate the coordination of Work, or the installation of other facilities or structures or to uncover other facilities and structures for access or inspection, or to obtain samples for testing, or for similar purposes.

1.3 SUBMITTALS

- A. Prior to cutting which may affect integrity and design function of Project, Owner's operations, or work of another contractor, submit written notice to Owner's Representative, requesting consent to proceed with cutting, including:
 - 1. Identification of Project.
 - 2. Description of affected Work of Contractor and work of others.
 - 3. Necessity for cutting.
 - 4. Effect on other work and on structural integrity of Project.
 - 5. Description of Proposed Work. Designate:
 - a. Scope of cutting and patching.
 - b. Contractor, Subcontractor or trade to execute Work.
 - c. Products proposed to be used.
 - d. Extent of refinishing.
 - e. Schedule of operations.
 - 6. Alternatives to cutting and patching, if any.
 - 7. Designation of party responsible for cost of cutting and patching.
- B. Should conditions of Work, or schedule, indicate change of materials or methods, submit written recommendation to Engineer, including:
 - 1. Conditions indicating change.

SECTION 01045 – CUTTING AND PATCHING

- 2. Recommendations for alternative materials or methods.
- 3. Submittals as required for substitutions.
- C. Submit written notice to Engineer, designating time Work will be uncovered, to provide for observation. Do not begin cutting or patching operations until authorized by the Engineer.
- D. Provide shoring, bracing and support as required to maintain structural integrity of Project and protect adjacent Work from damage during cutting and patching.
- E. Conform to all applicable Specifications for application and installation of materials used for patching.

1.4 REQUIREMENTS OF STRUCTURAL WORK

- A. Structural Work shall not be cut and patched in a manner resulting in a reduction of load-carrying capacity or load/deflection ratio.
- B. Prior to cutting-and-patching the following categories of Work, the Contractor shall obtain the Engineer's approval to proceed:
 - 1. Structural steel
 - 2. Miscellaneous structural metals, including equipment supports, stair systems and similar categories of work
 - 3. Structural concrete
 - 4. Foundation construction
 - 5. Timber and primary wood framing
 - 6. Bearing and retaining walls
 - 7. Structural decking
 - 8. Exterior curtain wall construction
 - 9. Pressurized piping, vessels and equipment

1.5 OPERATIONAL AND SAFETY LIMITATIONS

A. The Contractor shall not cut-and-patch operational elements and safety-related components in a manner resulting in a reduction of capacities to perform in the manner intended or resulting in decreased operational life, increased maintenance, or decreased safety.

SECTION 01045 – CUTTING AND PATCHING

- B. Prior to cutting-and-patching the following categories of Work, the Contractor shall obtain the Engineer's approval to proceed:
 - 1. Sheeting, shoring and cross bracing
 - 2. Operating systems and equipment
 - 3. Water, moisture, vapor, air, smoke barriers, membranes and flashings
 - 4. Noise and vibration control elements and systems
 - 5. Control, communication, conveying and electrical wiring systems

1.6 VISUAL REQUIREMENTS

A. The Contractor shall not cut-and-patch Work which is exposed on the exterior or exposed in occupied spaces, in a manner resulting in a reduction of visual qualities or resulting in substantial evidence of the cut-and-patch work, both as judged solely by the Engineer. The Contractor shall remove and replace work judged by the Construction Manager to have been cut-and-patched in a visually unsatisfactory manner.

1.7 APPROVALS

- A. Where prior approval of cutting-and-patching is required, the Contractor shall submit the request 15 working days in advance of time the Work will be performed. The request should include a description of why cutting-and-patching cannot reasonably be avoided, how it will be performed, how structural elements (if any) will be reinforced, products to be used, firms and tradesmen to perform the Work, approximate dates of the Work, and anticipated results in terms of structural, operational, and visual variations from the original Work.
- B. The Contractor shall also request approval to proceed prior to starting Work of this Section.

PART 2 – MATERIALS

2.1 MATERIALS USED IN CUTTING-AND-PATCHING

- A. Except as otherwise indicated, the Contractor shall provide materials for cuttingand-patching which will result in equal-or-better Work than the Work being cutand-patched, in terms of performance characteristics and including visual effects where applicable. The Contractor shall use material identical with the original materials where feasible.
- B. Materials shall comply with the requirements of the technical specifications wherever applicable.

PART 3 - EXECUTION

3.1 **PREPARATION**

- A. The Contractor shall provide adequate temporary support for the Work to be cut to prevent failure.
- B. The Contractor shall provide adequate protection of other Work during cuttingand-patching.

3.2 INSTALLATION

- A. The Contractor shall employ skilled tradesmen to perform cutting-and-patching. Except as otherwise indicated, the Contractor shall proceed with cutting-andpatching at the earliest feasible time and perform the Work promptly.
- B. The Contractor shall use methods least likely to damage the Work to be retained and Work adjoining.
- C. In general, where physical cutting action is required, the Contractor shall cut the Work with sawing and grinding tools, not with hammering and chopping tools. Openings through concrete work shall be core drilled.
- D. Comply with the requirements of technical specifications wherever applicable.
- E. Comply with the requirements of applicable sections of Division 2 where cuttingand-patching requires excavating and backfilling.
- F. The Contractor shall patch with seams which are as invisible as possible and comply with specified tolerances for the Work.
- G. The Contractor shall restore exposed seams of patched area; and, where necessary, extend finish restoration onto retained Work adjoining, in a manner which will eliminate evidence of patching.

PART 1 - GENERAL

1.1 DESCRIPTION

A. <u>Applicable Publications</u>: Whenever in these specifications references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is specified, only the latest specifications, standards, or requirements of the respective issuing agencies which have been published as of the date that the Work is advertised for bids shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth herein or shown on the drawings shall be waived because of any provision of, or omission from, said standards or requirements.

When a reference standard is specified, comply with requirements and recommendations stated in that standard, except when they are modified by the Contract Documents, or when applicable laws, ordinances, rules, regulations or codes establish stricter standards. The latest provisions of applicable standards shall apply to the Work.

- B. Reference standards include, but are not necessarily limited to, the following:
 - 1. American Association of State Highway and Transportation Officials.
 - 2. American Concrete Institute.
 - 3. American Gear Manufacturer's Association.
 - 4. American Institute of Steel Construction.
 - 5. American Iron and Steel Institute.
 - 6. American National Standards Institute.
 - 7. American Society of Heating, Refrigerating and Air Conditions Engineers.
 - 8. American Society of Mechanical Engineers.
 - 9. American Society for Testing and Materials.
 - 10. American Water Works Association.
 - 11. American Welding Society.
 - 12. Concrete Reinforcing Steel Institute.
 - 13. Factory Mutual Association.
 - 14. Institute of Electrical and Electronics Engineers.
 - 15. National Electrical Manufacturer's Association

- 16. National Fire Protection Association.
- 17. Prestressed Concrete Institute.
- 18. Underwriter's Laboratories, Inc.
- 19. Standard Specifications for Public Works Construction (SSPWC of Greenbook), Current Edition.
- 20. State of California, Department of Transportation (CALTRANS) Standard Specifications, Current Edition.
- 21. Technical Guidelines for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays by International Concrete Repair Institute.
- 22. All other applicable standards listed in the Specifications, and the standards of utility service companies, where applicable.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 – Record Drawings and Submittals

1.3 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

- A. Without limiting the generality of other requirements of the specifications, all Work specified herein shall conform to or exceed the requirements of all applicable codes and the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of these Specifications nor the applicable codes.
- B. References herein to "Standard Specifications" shall mean the Olivenhain Municipal Water District Standard Specifications and Drawings for the Construction of Water, Recycled Water, and Sewer Facilities, latest edition, which are hereby incorporated in and made a part of these Contract Documents, to the extent of the applicable references thereto.
- C. References herein to "Building Code" or UBC shall mean the Uniform Building Code of the International Conference of Building Officials (ICBO). The latest edition of the code as approved and used by the local agency as of the date of award, as adopted by the agency having jurisdiction, shall apply to the Work herein, including all addenda, modifications, amendments, or other lawful changes thereto.
- D. No provisions of any referenced standard specification, manual or code, whether or not specifically incorporated by reference in the Contract Documents, shall be effective to change the duties and responsibilities of the District, Engineer, or Contractor from those set forth in the Contract Documents. Nor shall they be effective to assign to the Engineer any duty of authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of the Contract Documents.

SECTION 01090 – REFERENCE STANDARDS

- E. In case of conflict between codes, reference standards, drawings and the other Contract Documents, the most stringent requirements shall govern. All conflict shall be brought to the attention of the Engineer for clarification and directions prior to ordering or providing any materials or labor. The Contractor shall bid the most stringent requirements.
- F. <u>Applicable Standard Specifications</u>: The Contractor shall construct the Work specified herein in accordance with the requirements of the Contract Documents and the referenced portions of those referenced codes, standards, and specifications listed herein.
- G. References herein to "SSPWC" or "Green Book" shall mean "Standard Specifications for Public Works Construction," latest edition, including the County of San Diego Regional and City of San Diego Supplement Amendments.
- H. References to "Regional Standard Drawings" or "SDRSD" shall mean the "San Diego Area Regional Standard Drawings", latest edition, including all current supplements, addenda, and revisions thereof.
- I. References herein to "Cal-OSHA" shall mean <u>State of California, Department of</u> <u>Industrial Relations, Construction Safety Orders</u>, as amended to date, and all changes and amendments thereto which are effective as of the date of construction.
- J. References herein to "OSHA Regulations for Construction" shall mean <u>Title 29, Part</u> <u>1926, Construction Safety and Health Regulations</u>, Code of Federal Regulations (OSHA), including all changes and amendments thereto.
- K. References herein to "OSHA Standards" shall mean <u>Title 29, Part 1910,</u> <u>Occupational Safety and Health Standards</u>, Code of Federal Regulations (OSHA), including all changes and amendments thereto.

PART 1 – GENERAL

1.1 DESCRIPTION

- A. The Contractor shall execute the Work in the sequence as described herein and elsewhere in the Contract Documents in order to meet permitting timeframes and operational or other requirements of the Owner.
- B. Alternate sequences of work which meet the requirements of the project may be proposed by the Contractor and discussed with the District at the Pre-construction meeting. The Contractor shall not proceed with alternate sequences of work without written approval by the District.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01010 Summary of Work
- B. Section 01300 Record Drawings and Submittals
- C. Section 01310 Construction Progress Schedule

1.3 RECORD DRAWINGS AND SUBMITTALS

A. The Contractor shall furnish submittals in accordance with Section 01300.

1.4 SCHEDULING

A. Prior to mobilization and beginning any work, the Contractor shall submit a detailed, written work plan and schedule which describes the Contractor's proposed work schedule and sequence of major tasks and event milestones to complete the project in general accordance with the sequence of work as described in the Contract Documents. A critical path shall be identified on the schedule in accordance with Section 01310.

1.5 SEQUENCE OF WORK REQUIREMENTS

- A. See the Construction Drawings for Sequence of Work requirements.
- B. The Contractor shall maintain the operation of the existing sewer pump station at all times to the satisfaction of the Owner.

PART 1 – GENERAL

1.1 DESCRIPTION

A. Measurement and payment for bid items listed in the proposal shall be based upon use of a lump sum or unit price method. Extra work or changes in the work shall be accomplished as provided in the General Provisions.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 00810 Special Provisions
- B. Section 01010 Summary of Work

1.3 SUBMITTALS (NOT USED)

1.4 PAYMENT

A. Payment for Unit Price Items

Payment for a unit price bid item shall be based upon the amount shown in the bid schedule multiplied by the total quantity measurement of the item and shall be full compensation for furnishing all labor, transportation, materials, equipment, tools and appurtenances required for construction of the item complete in place in accordance with the Plans and Specifications.

B. Payment for Lump Sum Items

Payment for lump sum bid items shall be based upon the amount shown in the bid schedule and shall be full compensation for furnishing all labor, transportation, materials, equipment, tools and appurtenances required for construction of the unit complete in place in accordance with the Plans and Specifications. Progress payment will be based upon measurement of work completed as described in Section 2.6.

C. Work Not Listed in the Bid Schedule

Costs for related work and appurtenances which are required and/or implied by the General Provisions, Technical Specifications, Special Technical Provisions and Plans and are not listed as a separate bid item but are necessary to complete the project shall be included in the appropriate bid item or items within the proposal.

PART 2 – MATERIALS

2.1 GENERAL (MEASUREMENT)

Measurement for unit price quantities shall be based upon the appropriate bid item in the proposal. The actual quantity of measurement shall be as constructed by the Contractor in place in conformance with the Plans and Specifications.

2.2 LINEAR MEASUREMENTS

Pipelines' and related facilities' measurements shall be made horizontally and/or vertically along the centerline of the pipeline and related facilities through tees, bends, valves, fittings, and as shown on the Plans for its limits or as otherwise specified in the Special Technical Provisions.

2.3 AREA MEASUREMENTS

Measurement for bid items involving area units shall be based upon the surface area measured in acres, square yards, square feet or as indicated in the bid item.

2.4 VOLUME MEASUREMENTS

Measurement for bid items involving volume units shall be based upon the volume measured in cubic yards, tons or as indicated in the bid item.

2.5 UNIT MEASUREMENTS

Measurement for bid items involving units of the item shall be based upon the number of units counted as indicated in the bid item.

2.6 LUMP SUM MEASUREMENT

Measurement for a lump sum bid item shall be considered as a complete project or a completed portion of a project constituting a unit. The items to be included in the lump sum bid shall be as specified in the proposal bid item and/or Section 01170.

PART 3 – EXECUTION

3.1 GENERAL

This section covers methods of measurement and payment for items of Work under this Contract. The total Bid Price shall cover all Work required by the Contract Documents. All costs in connection with the proper and successful completion of the work, including furnishing all materials, equipment, supplies, and appurtenances; providing all construction plant, equipment, and tools; and performing all necessary labor and supervision to fully complete the Work, shall be included in the unit and lump sum prices bid. All Work not specifically set forth as a pay item in the Bid Form shall be considered a subsidiary obligation of Contractor and all costs in connection therewith shall be included in the prices bid.

3.2 ESTIMATED QUANTITIES

All estimated quantities stipulated in the Bid Form or other Contract Documents are approximate and are to be used only (a) as a basis for estimating the probable cost of the Work and (b) for the purpose of comparing the bids submitted for the Work. The actual amounts of work done and materials furnished under unit price items may differ from the estimated quantities. The basis of payment for work and materials will be the actual amount of work done and materials furnished. Contractor agrees that he will make no claim for damages, anticipated profits, or otherwise on account of any difference between the

SECTION 01150 - MEASUREMENT AND PAYMENT

amounts of work actually performed and materials actually furnished and the estimated amounts therefor.

PART 1 - GENERAL

1.1 DESCRIPTION

A. The term "submittal" as used herein shall be understood to include working drawings, detail design calculations, shop drawings, fabrication and installation drawings, erection drawings, lists, graphs, operating instructions, catalog sheets, data sheets, samples, and similar items. Unless otherwise required, such submittals shall be submitted to Engineer. Engineer will review and distribute all submittals in accordance with this section within thirty (30) calendar days following their receipt by Engineer.

1.2 SECTION INCLUDES

- A. Approved materials list.
- B. Shop drawings and product data.
- C. Manufacturer's instructions.
- D. Manufacturer's certificates.
- E. Record Drawing Description
- F. Detailed Requirements

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01090 Reference Standards
- B. Section 01370 Schedule of Values
- C. Section 01400 Quality Control
- D. Section 01700 Project Closeout

1.4 APPROVED MATERIALS LIST

- A. The Approved Materials List (AML) details the District's approved materials the Contractor may use for any construction within the District's boundaries. The AML can be found on the Upcoming Projects and Planning Resources page of the District's website at <u>www.olivenhain.com</u>.
- B. The Contractor shall fill out and submit one (1) legible electronic copy of the completed AML to the District's Engineering Department as directed by the Owner's Representative. Failure to complete all fields in the AML shall result in the District rejecting the AML until filled out correctly.
- C. Within 30 calendar days after receipt of the completed AML package, the District's Representative will return the AML through the District's file sharing site to the Contractor with comments noted thereon. If resubmittal is not required, the
SECTION 01300 - RECORD DRAWINGS AND SUBMITTALS

District's Representative will return the AML with Approval noted thereon. If resubmittal is required, the District's Representative will return the AML and the Contractor shall correct the AML. Resubmit the corrected AML in the same manner as specified for the original AML.

- D. The review by the District's Representative is only of general conformance with the design concept of the project and general compliance with the Drawings and Standard Specifications and shall not be construed as relieving the Contractor of the full responsibility for: providing materials, equipment, and work required by the project; 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.
- E. No portion of the work requiring an AML submittal shall be commenced until the AML submittal has been reviewed by the District's Representative and returned with a notation indicating that resubmittal is not required.
- F. If the Contractor would like to use products other than those listed in the A, he shall submit to the District's Representative a completed New Product Submittal Form. The purpose of the submittal form is to provide adequate information to determine if a product meets District criteria.

1.5 SHOP DRAWINGS AND PRODUCT DATA

- A. Submit as specified for Approved Materials List.
- B. Mark each copy to identify the specific quantity, product, model, options, and other data applicable to each unit being furnished for the Project. Supplement manufacturers' standard data to provide information unique to this Project.
- C. Shop drawings referred to herein shall include shop drawings and other submittals for both shop and field fabricated items. The Contractor shall submit, as applicable, the following for all prefabricated or manufactured structural, mechanical, electrical, plumbing, process systems, and equipment:
 - 1. Shop drawings or equipment drawings, including dimensions, size and location of connections to other work, and weight of equipment.
 - 2. Catalog information and cuts.
 - 3. Installation or placing drawings for equipment bases.
 - 4. Supporting calculations for equipment and associated supports specified to be designed by equipment manufacturers or suppliers.
 - 5. Wiring and control diagrams of systems and equipment.
 - 6. Complete manufacturer's specifications, including materials description and paint system.
 - 7. Suggested spare parts list with current price information.

- 8. List of special tools required for checking, testing, parts replacement, and maintenance. (Special tools are those which have been specially designed or adapted for use on parts of the equipment, and which are not customarily and routinely carried by maintenance mechanics.)
- 9. List of special tools furnished with the equipment.
- 10. List of materials and supplies required for the equipment prior to, and during startup.
- 11. List of materials and supplies furnished with equipment.
- 12. Samples of finish colors for selection.
- 13. Special handling instructions.
- 14. Material Safety Data Sheets (MSDS) and warning label for each chemical to be used in the work.
- 15. Requirements for storage and protection prior to installation.
- 16. Requirements for routine maintenance required prior to initial start-up.
- 17. List of all requested exceptions to the Contract Documents.
- D. Long-lead items shall be submitted within seven (7) working days after issuance of the Notice to Proceed.
- E. After review, distribute in accordance with Article on Procedures above and provide copies for Record Documents described in Section 01700.

1.6 MANUFACTURERS' INSTRUCTIONS

- A. When specified in individual Specification Sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.
- B. Identify conflicts between manufacturers' instructions and Contract Documents.

1.7 MANUFACTURERS' CERTIFICATES

- A. When specified in individual specification Sections, submit manufacturers' certificate to the Engineer for review, in quantities specified for Product Data.
- B. Indicate that the material or product conforms to or exceeds specified requirements. Submit supporting reference date, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or product, but must be acceptable to the Engineer.

SECTION 01300 - RECORD DRAWINGS AND SUBMITTALS

1.8 **RECORD DRAWING DESCRIPTION**

- A. Contractor shall provide and maintain on the jobsite one complete set of prints of all Plans which form a part of the contract. Immediately after each portion of the work is installed, indicate all deviations from the original design shown on the Plans either by additional sketches or marked in red ink thereon and reviewed by Construction Manager. Upon completion of the job, deliver this record set to the Construction Manager.
- B. Record drawings shall be submitted with final request of progress payment.
- C. Make the record drawings available for review by District in Contractor's field office.
- D. Protect the record set from damage or loss.
- E. After District's review, changes shall be made to the design mylars. Mylars and two print copies shall be delivered to the District.

1.9 DETAILED REQUIREMENTS

- A. The Contractor shall provide Record Drawings which shall clearly show all differences between the contract Work as drawn and as installed for all concealed construction, as well as construction added to the Contract, which is not indicated on the Contract Drawings.
- B. Concealed shall mean construction installed underground or in an area which cannot be readily inspected by use of access panels, inspection plates or other removable features.
- C. Show all changes in the Work, or Work added on the Record Drawings in a contrasting color.
- D. In showing changes in the Work, or added Work, use the same legends that are used on the Contract Drawings. Indicate exact locations by dimensions and exact elevations. Give dimensions from a permanent point.
- E. Record by marking on the Drawings all changes in the Work which occur during construction, including adding approved change orders.
- F. Show locations by key dimensions, depths, elevations of all underground lines, conduit runs, sensor lines, valves, capped ends, branch fittings, pull boxes, etc.
- G. Record information on how to maintain and/or service concealed Work.
- H. Make a record of finalized hydraulic and electrical equipment control settings in the tables and spaces provided on the Drawings.
- I. The Contractor shall perform all work required for as-built aerial topography, including 1 foot contours, spot elevations, and H & V shots. The as-built aerial topography shall be performed by the Contractor 10 working days following completion, except weather related delay as determined by District.

SECTION 01300 - RECORD DRAWINGS AND SUBMITTALS

J. District will not approve a Notice of Completion until the Record Drawings package has been approved by the District.

P.E. CERTIFICATION FORM

in accordance with Specification Section _____ for the (Name of Project) _____ The undersigned further certifies that he/she has performed the design of the

that said design is in conformance with all applicable local, state and federal codes, rules, and regulations, and that his/her signature and P.E. stamp have been affixed to all calculations and drawings used in, and resulting from, the design.

The undersigned hereby agrees to make all original design drawings and calculations available to the (Insert Name of Owner)

Owner's representative with seven (7) days following written request therefor by the Owner.

P.E. Name

Signature

Address

Contractor's Name

Signature

Title

Address

or

SECTION 01310 – CONSTRUCTION PROGRESS SCHEDULES

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Contractor shall provide a construction schedule, which conforms to the requirements below, unless otherwise approved by the Engineer.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01010 Summary of Work
- B. Section 01150 Measurement and Payment
- C. Section 01300 Submittals
- D. Section 01370 Schedule of Values

1.3 FORMAT

- A. Prepare network analysis system using the critical path method, as outlined in The Associated General Contractors of America (AGC) publication "The Use of CPM in Construction A Manual for General Contractors".
- B. Sheet Size: 11-inches by 17-inches.
- C. Time Scale: Indicate first date in each work week.
- D. Organization:
 - 1. Group Shop Drawing submittals and reviews into a separate sub-schedule.
 - 2. Group product deliveries into a separate sub-schedule.
 - 3. Group construction Work into a separate sub-schedule by activity.
 - 4. Group critical activities, which dictate the rate of progress into a separate subschedule.
 - 5. Organize each subschedule by Specification Section number.

1.4 CONTENT

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by Specification Section number.
- C. Arrange construction Work into logically grouped activities.
- D. Provide sub-schedules for each stage of Work identified in the Bid Schedule.

SECTION 01310 - CONSTRUCTION PROGRESS SCHEDULES

- E. Provide sub-schedules to define critical portions of the entire Schedule.
- F. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- G. Provide separate schedule of submittal dates for shop drawings, product data, factory and field testing dates, and dates reviewed submittals will be required from the Engineer.
- H. Indicate delivery dates for any Owner furnished items.
- I. Coordinate content with Schedule of Values specified in Section 01370.

1.5 REVISIONS TO SCHEDULES

- A. Indicate progress of each activity to date of submittal, and projected completion date of each activity.
- B. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.
- C. Provide narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect including the effect of changes on schedules of separate contractors, if any.

1.6 CONTRACTOR SUBMITTALS

- A. Submit initial Schedules within 14 days after date of Notice to Award or at the Preconstruction Meeting, whichever is sooner. After review, resubmit required revised data within ten days thereafter. Submit schedule in both printed and electronic forms.
- B. Submit revised Progress Schedules every month with progress payment, or as directed by the Engineer. Submit schedule in both printed and electronic forms.
- C. Attach a letter of transmittal to each submittal and include the following information in the letter:
 - 1. A listing of items which have changed since the last submittal.
 - 2. Discussion of problems causing delays, anticipated length of delays, and proposed solutions.
 - 3. Schedule narrative including the following:
 - a. Critical path.
 - b. Activities started, in progress and completed.
 - c. Description of logic changes from previous update.
 - d. Current problems.

SECTION 01310 - CONSTRUCTION PROGRESS SCHEDULES

- e. Milestone status.
- f. Potential problem areas.

1.7 DISTRIBUTION

- A. Distribute copies of reviewed Schedules to project site file, Subcontractors, suppliers, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in Schedules.

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PART 1 – GENERAL

1.1 DESCRIPTION

- A. The submittal of Samples shall conform to the procedures described in this Section.
- B. Samples and Shop Drawings which are related to the same unit of Work or Specification Section shall be submitted at the same time. If related Shop Drawings and Samples are submitted at different times, they cannot be reviewed until both are furnished to the Owner.

1.2 PROCEDURE

- A. Contractor shall review, approve, and submit Samples to the Owner. Samples shall be identified with correct reference to Specification Section, page, article and paragraph number, and Drawing No. when applicable. Samples shall clearly illustrate functional characteristics of the product and all related parts and attachments, and full range of color, texture, pattern and material. Samples shall be furnished at least ten (10) working days prior to fabrication so as not to delay fabrication, allowing the Owner reasonable time for the consideration of the Samples submitted.
- B. Contractor shall submit at least three (3) Samples of each item required for the Owner's approval. Submission of Samples shall conform to all applicable provisions under Shop Drawing Submittal and Correspondence Procedure. Two (2) of the Samples shall be delivered to the Owner's home office unless otherwise authorized by the Owner. One Sample shall be delivered to the Owner's field office if applicable. If the Contractor requires a Sample for the Contractor's use, an additional sample shall be ordered.
- C. The Contractor shall make all corrections required and shall resubmit the required number of new Samples until approved.

1.3 SAMPLES FOR TESTS

A. Contractor shall furnish such Samples of material as may be required for examination and test. All Samples of materials for tests shall be taken according to standard methods and as required by the Contract Documents.

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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 01039 – Coordination and Meetings

1.3 **PREPARATION**

- A. Schedule of Values shall be based on bid items and anticipated units completed each month.
- B. Schedule of Values shall be prepared on 8-1/2-inch by 11-inch white paper.
- C. The sum of the individual values shown on the Schedule of Values must equal the total Contract Price.
- D. Schedule shall show the purchase and delivery costs for materials and equipment that the Contractor anticipates he may request payment for prior to their installation.

1.4 CONTRACTOR SUBMITTAL

- A. A tentative schedule of values shall be submitted prior to or at the pre-construction meeting in accordance with Section 01039 of this specification. The submitted schedule of values shall include at a minimum the items contained in the attached spreadsheet table.
- B. The Contractor and Engineer shall meet and jointly review the preliminary schedule of values and make any adjustments in value allocation if, in the opinion of the Engineer, 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 copies of monthly updates of the schedule of values to the Engineer with request for project payments.

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PART 1 – GENERAL

1.1 DESCRIPTION

A. Specific quality control requirements for the Work are indicated throughout the Contract Documents. The requirements of this section are primarily related to performance of the Work beyond furnishing of manufactured products. The term "Quality Control" includes inspection, sampling and testing, and associated requirements.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 01453 Code-Required Special Inspections and Procedures

1.3 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

A. Work shall conform to Federal, State and local building codes, electrical codes, fire codes, mechanical codes and plumbing codes, and to Occupational Safety and Health Act (OSHA) Regulations. Nothing in Contract Documents shall be interpreted as permission or direction to violate any governing code or ordinance.

1.4 INSPECTION AT PLACE OF MANUFACTURE

- A. Unless otherwise indicated, all products, material and equipment shall be subject to inspection by the Engineer at the place of manufacture.
- B. The presence of the Engineer at the place of manufacture, however, shall not relieve the Contractor of the responsibility for furnishing products, material, and equipment which comply with all the requirements of the Contract Documents. Compliance is a duty of the Contractor, and said duty shall not be avoided by any act or omission on the part of the Engineer.

1.5 CONTRACTOR SUBMITTALS

- A. Certificates of compliance shall be submitted at Owner's request.
- B. Transcripts of results of acceptance to verify quality of manufactured products shall be submitted at Owner's request.

1.6 SAMPLING AND TESTING

A. Unless otherwise indicated, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered; however, the Owner reserves the right to use any generally-accepted system of sampling and testing, which in the opinion of the Engineer will insure the Owner that the quality of the workmanship is in full accordance with the Contract Documents.

SECTION 01400 – QUALITY CONTROL

- B. Any waiver by the Owner of any specific testing or other quality assurance measures, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief from the specified testing or other quality assurance requirements as originally specified, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial Work, shall not be construed as a waiver of any requirements of the Contract Documents.
- C. Notwithstanding the existence of such a waiver, the Owner reserves the right to make independent investigations and tests, and failure of any portion of the Work to meet any of the requirements of the Contract Documents, shall be reasonable cause for the Owner to require removal or correction and reconstruction of any such Work in accordance with the General Provisions. In addition, any costs for retests shall be borne by the Contractor.

1.7 INSPECTION, SPECIAL INSPECTION AND TESTING LABORATORY SERVICES

- A. Inspection and testing laboratory service shall comply with the following:
 - 1. Owner may appoint, employ, and pay for services of an independent firm to perform inspection and testing or will perform inspection and testing itself.
 - 2. The Contractor shall hire an independent firm who will perform inspections, testing, special inspections, and other services specified per the structural drawing sheet titled, "Special Inspection Tables and Notes," individual specifications and as required by the Owner unless otherwise noted. The Contractor shall pay for all testing and specialty inspections and for any retesting of tests that are paid for by the Owner described elsewhere.
 - 3. Reports will be submitted to the Owner by the independent firm in duplicate, indicating observations and results of tests indicating compliance or non-compliance with the Contract Documents.
 - 4. The Contractor shall cooperate with the Owner and/or independent firm and furnish samples of material, design mix, equipment, tools, storage, and assistance as requested.
 - 5. The Contractor shall notify the Owner's Representative 24 hours prior to the expected time for operations requiring inspection and laboratory testing services.
 - 6. Retesting required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the Owner. The Contractor shall bear all costs from such retesting at no additional cost to the Owner.
 - 7. For samples and tests required for Contractor's use, the Contractor shall make arrangements with an independent firm for payment and scheduling of testing. The cost of sampling and testing for the Contractor's use shall be included in the Contract Price.

1.8 CONTRACTOR'S QUALITY CONTROL

- A. Arrange work to be readily accessible and easy to operate and maintain where detail drawings are not included in Contract Documents, supplementary drawings or shop drawings and submittals.
- B. Combinations of manufactured equipment shall be fully compatible and work safely and successfully as a unit. Furnish necessary mountings, couplings and appurtenances with each unit.
- C. Relocations or adjustment of existing facilities noted in Contract Documents shall be done as needed. If existing items are lost or damaged during construction, replace with new items of equal or better quality.
- D. Make field measurements needed to fabricate and install Work before ordering or beginning work. Make minor changes in alignments and dimensions as needed to remedy or avoid utilities and structural conflicts.

1.9 **PROJECT CONDITIONS**

- A. Items furnished shall be capable of fulfilling their intended purpose in the environment in which they are installed. Allow for local temperature extremes, climactic conditions and corrosive environments where necessary to ensure proper functioning of furnished products.
- B. The Contractor shall verify all dimensions in the field and shall check field conditions continuously during construction. The Contractor shall be solely responsible for any inaccuracies built into the Work due to its failure to comply with this requirement.
- C. Points of connections to any existing pipelines must be accurately located by the Contractor. Information such as vertical elevations, pipe outside diameters, joints, materials of construction, shape, and pipe conditions must be obtained prior to beginning work in the affected area and this information shall be transmitted to the Owner. The Owner shall make any necessary adjustments to the drawings to reflect the actual field conditions. No additional payments will be made to the Contractor for any required adjustments in the drawings at the points of connection to existing pipelines. No payment will be allowed for special transition couplings or jointing materials required for connections to existing pipelines.

1.10 UNIT PRICES

A. Payment for Contractor-provided testing required in Contract Documents will be included in the price bid for items of work for which Contractor-provided testing is specified.

PART 2 – MATERIALS (NOT USED)

PART 3 – EXECUTION

3.1 INSPECTION

- A. Notify Owner of time and place of shop tests five working days before they begin. Complete manufacturing operations, checks, adjustments and tests before factory inspection.
- B. The Owner will inspect products after delivery and throughout construction process. Products will be subject to rejection at any time on account of failure to meet Contract Documents even though samples may have been accepted as satisfactory at place of manufacture.
- C. The Contractor shall inspect related and appurtenant Work and shall report in writing to the Owner any conditions, which will prevent proper completion of the Work. Failure to report any such conditions shall constitute acceptance of all conditions, and any required removal, repair, or replacement caused by unsuitable conditions shall be performed by the Contractor at its sole cost and expense.
- D. Before backfilling, request inspection by the Owner to verify proper installation of buried work.
- E. Before finishing, request inspection by the Owner to verify that no surfaces to receive product have defects or errors which could result in poor or potentially defective application or cause latent defects in workmanship.

3.2 INSTALLATION/APPLICATION/ERECTION

- A. Install products according to manufacturer's installation and warranty requirements. Install products to tolerances recommended by manufacturer. Unless otherwise shown, install equipment true and level using precision gauges and levels.
- B. Refer variances between manufacturer's installation instructions and Contract Documents to the Owner.
- C. Construct walls plumb, straight, level, square and true. Welds, unless otherwise shown, shall be continuous, watertight, and conforming to Structural Welding Code of American Welding Society. Welds shall be free of sharp points or edges.
- D. Pipe work, valves, fittings, tanks and appurtenances shall have no leaks at design pressures.
- E. Exposed surfaces shall be finished in appearance. Grind smooth exposed welds. Round or chamfer corners of exposed structural shapes for personal protection.
- F. Prime and paint exposed surfaces of ferrous products, piping, and conduit except for stainless steel or galvanized or sherardized surfaces or unless otherwise

SECTION 01400 - QUALITY CONTROL

shown. Clean painted surfaces and touch up bare or marred spots with finish to match factory finish.

3.3 FIELD QUALITY CONTROL

- A. Maintain complete set of Contract Documents at jobsite field office or superintendent's truck at all times.
- B. Frequency of sampling and testing shall be as shown, and shall be performed at such other times as necessary to document contract compliance.
- C. Notify the Owner and regulating authorities three (3) days before field tests.
- D. Perform field tests in presence of the Owner who will record results.
- E. Repair damage to work that is not cause for rejection.
- F. Repair, correct or replace work failing tests or inspection. Repeat tests until results satisfy Specifications. Repair damages resulting from tests.

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PART 1 – GENERAL

1.1 DESCRIPTION

- A. The Owner shall employ and pay for an independent testing laboratory to perform the specified services.
- B. Inspection, sampling and testing shall be as specified in the individual Sections.
- C. The testing laboratory is not authorized to approve or accept any portion of the Work; rescind, alter or augment the requirements of the Contract Documents; or perform any duties of the Contractor.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02200 – Earthwork

1.3 QUALIFICATIONS OF LABORATORY

- A. Where applicable, the testing laboratory will meet "Recommended Requirements for Independent Laboratory Qualification", latest edition, published by American Council of Independent Laboratories and the basic requirements of ASTM E 329 "Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction".
- B. Testing equipment used by the laboratory will be calibrated at maximum twelve (12) month intervals by devices of accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.

1.4 LABORATORY DUTIES

- A. The testing laboratory will:
 - 1. Cooperate with Owner and Contractor and provide qualified personnel promptly on notice.
 - 2. Perform specified inspections, sampling and testing of materials and methods of construction; comply with applicable standards; ascertain compliance with requirements of Contract Documents.
 - 3. Promptly notify Owner and Contractor of irregularities or deficiencies of Work which are observed during performance of services.
 - 4. Promptly submit five (5) copies of reports of inspections and tests to the Owner, including:
 - a. Date issued.
 - b. Project title and number.
 - c. Testing laboratory name and address.
 - d. Date of inspection or sampling.
 - e. Record of temperature and weather.

SECTION 01410 – TESTING LABORATORY SERVICES

- f. Date of test.
- g. Identification of product and Specification Section.
- h. Location in Project.
- i. Type of inspection or test.
- j. Results of tests and observations regarding compliance with Contract Documents.
- 5. Perform additional tests and services as required by Owner.

1.5 CONTRACTOR'S RESPONSIBILITIES

The Contractor shall:

- A. Cooperate with laboratory personnel, provide access to Work and to manufacturer's operations.
- B. Provide to laboratory, preliminary representative samples of materials to be tested, in required quantities.
- C. Furnish copies of product test reports.
- D. Provide to the laboratory the preliminary design mix proposed for concrete, and other material mixes that require testing by the testing laboratory.
- E. Furnish labor and facilities:
 - 1. To provide access to Work to be tested.
 - 2. To obtain and handle samples at the site.
 - 3. To facilitate inspections and tests.
 - 4. For laboratory's exclusive use for storage and curing of test samples.
 - 5. Forms for preparing concrete cylinders.
- F. Notify laboratory and Owner a minimum seventy-two (72) hours in advance of operations to allow for assignment of personnel and scheduling of tests.
- G. Arrange with laboratory and pay for, additional samples and tests required for Contractor's convenience.

PART 1 - GENERAL

1.1 INTENT AND CONDITIONS

- A. Intent
 - 1. Define and coordinate structural testing and special inspection services.
 - 2. Provide confidence that the specified Work is constructed in compliance with the contract documents and the intent of applicable codes including chapter 17 of the California Building Code (CBC).
 - 3. Structural testing and special inspection services are intended to assist in determining probable compliance of the Work with requirements specified. These services do not relieve the Contractor of responsibility for compliance with the requirements of the Contract Documents.
- B. Conditions
 - 1. If inspection of a fabricator's work is required, the District or Engineer may require testing and inspection of the Work at the plant, before shipment. District and Engineer reserve the right to reject material not complying with the Contract Documents.
 - 2. Refer to individual technical specification sections for specific qualifications, inspections, tests, frequency and standards required. Testing and inspection shall be performed in accordance with the referenced standard for the specific material or procedure unless other criteria are specified. In the absence of a referenced standard, tests shall be performed in accordance with generally accepted industry standards.
 - 3. Work shall be checked as it progresses. Failure to detect any defective Work or materials shall not prevent later rejection if defective Work or materials are discovered, nor shall it obligate District to accept such Work.
 - 4. Structural testing, special inspection, and periodic inspections by the District do not preclude the normal field involvement and site observations by the Engineer.
 - 5. Structural testing, special inspection, and periodic inspections by the District do not relieve the Contractor of any responsibility to complete the Work in accordance with the approved Drawings and Specifications.
 - 6. Testing agents and/or Special Inspectors may not waive or alter Contract Document requirements, or approve, accept, or reject any portion of the Work unless specifically authorized by the Engineer. They may not assume any duties of the Contractor, and they have no authority to stop or reject Work.

1.2 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including Division 1 Specifications apply to this Section.

1.3 **DEFINITIONS**

- A. Testing: Evaluation of systems, primarily requiring physical manipulation and analysis of materials, in accordance with approved standards.
- B. Inspection: Evaluation of systems, primarily requiring observation and judgment.
- C. Structural Special Inspections: Structural special inspections include inspections of structural items required by the CBC Section 1704 and other items, which are critical to the integrity of the building structure and are indicated to be performed under the requirements of the Contract Documents.
- D. Structural Testing: Structural testing includes those tests of structural items required by the CBC, or its referenced standards which are critical to the integrity of the building structure and are indicated to be performed under the requirements of the Contract Documents.
- E. Engineer of Record: The prime consultant in charge of overall design and coordination of the Project.
- F. Structural Engineer of Record (EOR): The licensed professional engineer in responsible charge of the structural design for the Project.
- G. Licensed Structural Engineer: A professional engineer with education and experience in the design of structures similar to this Project licensed to practice in the state in which the Project is located.
- H. Testing Agency (TA): The properly qualified firm performing testing services.
- I. Special Inspector (SI): A properly qualified individual or firm performing special inspections.
- J. District or Inspector: The officer or their duly authorized representative charged with the administration and enforcement of contract document compliance and building code requirements for the Project.

1.4 RELATED SECTIONS

A. Section 01400 – Quality Control

1.5 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC), as specified in Section 01090.

1.6 CODES

- A. The Work of this Section shall comply with the current editions of the following codes as adopted by the District:
 - 1. California Building Code

1.7 QUALIFICATIONS

- A. Testing Agency: An approved independent testing agency acceptable to the District and EOR and meeting the following:
 - 1. Authorized to operate in the State in which the Project is located and experienced with the requirements and testing methods specified in the Contract Documents.
 - 2. Meet applicable requirements of references stated in section 1.6.
 - 3. Have available testing equipment that is calibrated, at reasonable intervals, by devices of accuracy traceable to either the National Bureau of Standards, or to accepted values of natural physical constants.
 - 4. Provide individuals performing tests and taking samples with appropriate certifications for Work performed.
- B. Special Inspector: Either an appropriately certified inspector or a civil/structural engineer performing under the direct supervision of a licensed civil/structural engineer (as defined earlier in this Section) and acceptable to the EOR and District.

1.8 **RESPONSIBILITIES**

- A. Special Inspectors:
 - 1. Inspect the Work assigned for conformance with the building department approved Drawings, Specifications, and applicable material and workmanship provisions of the code. Perform inspection in a timely manner to avoid delay of Work.
 - 2. Bring nonconforming items to the immediate attention of the Contractor for correction. If not corrected within 24 hours or if Inspector will not be on site the following day, bring to the attention of the EOR by the end of the business day. If uncorrected after a reasonable period of time, bring to the attention of the Engineer and the District. Notify EOR immediately if non-conforming items are enclosed, embedded, or obscured prior to verification of correction.
 - 3. Submit inspection reports to the Contractor, the EOR, the District and other designated persons in accordance with the Structural Testing and Special Inspection Schedule.

- 4. Submit a final signed report stating whether the Work requiring special inspection was, to the best of his/her knowledge, in conformance with the approved drawings, Specifications and the applicable workmanship provisions of the code.
- 5. Sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties.
- 6. Attend Preconstruction meeting to review scope of special inspections.
- B. Testing Agency:
 - 1. Test the Work assigned for conformance with the building department approved Drawings, Specifications, and applicable material provisions of the documents. Perform tests in a timely manner to avoid delay of Work.
 - 2. Submit test reports to the Contractor, the EOR, the District, and other designated persons in accordance with the Structural Testing and Special Inspection Schedule.
 - 3. Sign the Structural Testing and Special Inspection schedule in conjunction with other responsible parties.
 - 4. Attend a Preconstruction meeting to review scope of structural testing if required.
- C. Contractor:
 - 1. Schedule a Preconstruction meeting to review scope of structural testing and special inspection.
 - 2. Schedule and coordinate Preconstruction, Construction testing, Special Inspections, and Inspections.
 - 3. Post or make available the Structural Testing and Special Inspection Schedule within its office at the job site. Also, provide adequate notification to those parties designated on the Schedule so they may properly prepare for and schedule their work.
 - 4. Provide Special Inspectors access to the approved Drawings and Specifications at the job site.
 - 5. Review all reports issued by Special Inspectors.
 - 6. Retain, at the job site, all reports submitted by the Special Inspectors for review on the District's request.
 - 7. Correct deficiencies identified in inspection or testing reports in a timely manner.
 - 8. Provide safe access to the Work requiring inspection or testing.

- 9. Provide labor and facilities to provide access to the Work, to obtain, handle and deliver samples, to facilitate testing and inspection and for storage and curing of test samples.
- 10. Verify conformance of the Work with specified construction tolerances.
- 11. Immediately remove all rejected materials from the site. Do not incorporate any rejected materials into the Work.
- 12. Inspections by District: Provide adequate notice for inspections performed by the District, as required by CBC Section 109, and local ordinances.
- 13. Sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties prior to commencing construction.
- D. Fabricator:

1. Sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties prior to commencing construction.

- E. District:
 - 1. Provide Special Inspector with approved Drawings, Specifications and approved shop drawings.
 - 3. Provide Special Inspectors and testing agencies with full access to the site during working hours.
 - 4. Sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties.

1.9 PAYMENT

- A. The Contractor will employ and pay for services of the Special Inspectors and testing agency to perform required structural testing and special inspections as mandated by code.
- B. The Contractor shall provide and pay for all materials, samples, mock-ups, and assemblies required for testing and inspection and shall pay for shipping costs related to delivery of such items to the testing agency testing facility.
- C. If items requiring testing or inspection are enclosed, embedded or obscured prior to testing or inspection or if such items are placed without tests or inspections, the Contractor shall pay for the costs of any exploratory work deemed necessary by the EOR to verify compliance with the Contract Documents.
- D. When any testing or observations indicate the Work is non-compliant with the Contract Documents, all retesting and re-observations shall be performed by the District's testing or observation agencies. All costs for retesting and re-observations, including additional services of the design professionals, the design professional's consultants and the District's consultants are the

Contractor's responsibility and shall be deducted from the Contract Sum by Change Order.

1.10 INSPECTION NOTICE

A. Contractor shall provide minimum of 5 working days prior to starting work and 3 working days prior to continuing work for all items requiring testing or inspection. Items requiring testing and inspection services prior to or during placement shall not be placed until testing and inspection services are available. Items requiring testing and inspection services are performed. If the Work is covered up prior to any required testing or observation, it shall be uncovered for review at the Contractor's expense.

1.11 REPORTS

- A. Testing agency and Special Inspectors shall submit reports for structural testing and special inspection in a timely manner to the District, Contractor, and Engineer of Record. Provide reports of daily activities to the EOR and Contractor. Submit reports to the Contractor on a daily basis and to the EOR on a daily or weekly basis. Provide summary reports to the District and Engineer on a monthly basis unless they request otherwise.
- B. Provide reports for ongoing work, containing the following information:
 - 1. Date issued.
 - 2. Project title and number.
 - 3. Firm name and address.
 - 4. Name and signature of tester or inspector.
 - 5. Date and time of sampling, test, or inspection.
 - 6. Identification of product and Specification Section.
 - 7. Location in Project, including elevations, grid locations and details.
 - 8. Type of test or inspection.
 - 9. Whether test specimens, test results or observations indicate compliance with Contract Documents. Specifically state any discrepancies
 - 10. Types and locations of discrepancies found in the Work.
 - 11. Work required to correct discrepancies and Work performed to correct previously noted discrepancies. Discrepancies corrected during an inspection need not be reported.

SECTION 01453 - CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

12. Submit certified final special inspection report stating that, to the best of the Special Inspector's knowledge, the Work requiring special inspection conformed to the Contract Documents.

1.12 FREQUENCY OF TESTING AND INSPECTION

A. For detailed requirements, see individual technical Specification Sections and the Structural Testing and Special Inspection Schedule, copy included after this Section.

1.13 PROTECTION AND REPAIR

A. Upon completion of testing, sample-taking, or inspection, the Contractor shall repair damaged Work and restore substrates and finishes to eliminate deficiencies, including deficiencies in the visual qualities of exposed surfaces, as judged solely by the Engineer/EOR. Protect Work exposed by or for testing and/or inspection and protect repaired work. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for testing and/or inspection.

1.14 TESTS TO DEMONSTRATE QUALIFICATION

- A. Any tests required to qualify the Contractor or the workers for any phase of the Work, shall be performed at no additional cost to the District.
- B. If the Contractor proposes a product material, method, or other system that has not been pre-qualified, the EOR may require applicable tests to establish a basis for acceptance or rejection. The Contractor shall pay for these tests.
- C. The Engineer of Record reserves the right to require certification or other proof that the system proposed is in compliance with specified tests, criteria or standards. A representative of an independent testing agency shall sign the certificate.

1.15 STRUCTURAL TESTING AND SPECIAL INSPECTION SCHEDULE

- A. The parties involved shall complete and sign the Structural Testing and Special Inspection Schedule. Schedule to be complete at time of permit issuance.
- B. The completed Schedule is an element of the Contract Documents and after permit issuance, becomes part of the building department approved Drawings and Specifications

1.16 OWNER'S MANUAL

- A. The following shall be included in the Owner's Manual in compliance with Section 01300:
 - 1. Certificates that steels comply with the indicated standards.

2. Certificates that welding operators and procedures comply with the indicated requirements.

1.17 SHOP DRAWINGS AND SAMPLES

- A. The following shall be submitted in compliance with Section 01300:
 - 1. Shop drawings, including details, dimensions, details of match markings and all information necessary for fabrication.
 - 2. Welding procedures and welder qualifications.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The parties involved shall complete and sign the Structural Testing and Special Inspection Schedule. The completed schedule is an element of the Contract Documents and after permit issuance, becomes part of the building department approved plans and specifications. The completed schedule shall include the following:
 - 1. Specific listing of items requiring inspection and testing.
 - 2. Associated specification section which defines applicable standards by which to judge conformance with approved plans and specifications in accordance with CBC Chapter 17. The specification section should also include the degree or basis of inspection and testing; i.e., intermittent/will-call or full-time/continuous.
 - 3. Frequency of reporting, i.e., intermittent, weekly, monthly, per floor, etc.
 - 4. Parties responsible for performing inspection and testing work.
 - 5. Required acknowledgments by each designated party.

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Temporary Utilities: Electricity, lighting, heating, cooling, ventilation, water, and sanitary facilities.
- B. Temporary Controls: Barriers, fencing, erosion control, exterior enclosures, protection of installed work, dust, noise, and security.
- C. Construction Facilities: Access roads, parking, progress cleaning and waste removal, project identification, field office and sheds, and removal of utilities, facilities and controls.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 01700 Project Closeout

1.3 TEMPORARY ELECTRICITY

- A. The Contractor shall make all arrangements for providing electric power needed to accomplish the project work.
- B. Temporary electric power installation and operation shall meet the construction safety requirements of CAL/OSHA, State of California, Construction Safety Orders and other governing agencies. In addition, the County of San Diego Noise Ordinance shall be complied with for all work.

1.4 TELEPHONE SERVICE

A. No field office, telephone or other utility facilities shall be provided for the Contractor by the Owner.

1.5 TEMPORARY WATER SERVICE

- A. The Contractor shall be fully responsible for obtaining construction water, making connection with the water source, transporting the water, and all other arrangements concerning water to be used by the Contractor. The Contractor shall be responsible for paying any construction meter deposits and fees. Any highlines used for temporary water shall remain outside the traveled roadway and shall be provided and maintained by the Contractor.
- B. If the meter is connected to a hydrant, use only special hydrant-operating wrenches to open hydrants. Make certain that the hydrant valve is open "full" since "cracking" the valve causes damage to the hydrant. If any hydrants are damaged, the Contractor will be held responsible and shall notify the appropriate agency so that all damage can be repaired as quickly as possible. Fire hydrants shall be completely

accessible to the Fire Department at all times. Upon completion of the Work, the Contractor shall remove all temporary piping and facilities.

C. If necessary, the Contractor must provide means, at Contractor's sole expense, for boosting the water pressure at the project site to meet all requirements for proper performance of the work.

1.6 TEMPORARY SANITARY FACILITIES

A. The Contractor shall provide and maintain sanitary facilities for his employees and his subcontractors' employees that will comply with the regulations of the local and State Departments of Health and as directed by the Engineer.

1.7 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades required by governing authorities for public rights-of-way.
- C. Provide protection for plants, trees, or landscaping designated to remain. Damaged plants will be replaced in-kind at the Contractor's expense.
- D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.8 SECURITY

- A. Security will not be provided by the Owner for the Contractor's materials, tools, and equipment lay down or storage area. The Contractor may use the project site for such purposes during the Contract period at the sole risk of the Contractor.
- B. The Contractor shall be responsible for security and facilities to protect Work, from unauthorized entry, vandalism, or theft.

1.9 MATERIAL STORAGE

A. Materials shall be so stored as to insure the preservation of quality and fitness for the Work. When considered necessary, they shall be placed on wooden platforms or other hard, clean surfaces, and not on the ground. Delicate instruments and materials subject to vandalism shall be placed under locked cover and, if necessary, provided with temperature control as recommended by the manufacturer. Stored materials shall be located so as to facilitate prompt inspection. Private property shall not be used for storage purposes without prior written permission of the Owner or lessee and submitting copies of the permission to the Engineer.

1.10 WATER CONTROL

A. Protect site from puddling or running water. Provide water barriers and erosion control facilities as required to protect site from soil erosion.

1.11 DUST CONTROL

A. The Contractor shall be responsible for dust control of abrasives in accordance with all applicable laws.

1.12 NOISE CONTROL

- 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. Said 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 laws for the protection of personnel.
- D. Diesel and gasoline engine driven generators used for powering any and all equipment shall be located, to the satisfaction of the Engineer, such that any exhaust or mechanical noise is directed away from populated areas. In the event that complaints of noise are received, the Contractor shall, as directed by the Engineer, relocate or modify his equipment in order to alleviate the noise problem.
- E. Full compensation for conforming to the requirements of this Article shall be considered as included in the Lump Sum or Unit Price Bid for the Work and no additional compensation will be allowed therefor.

1.13 SAFE ACCESS BY FEDERAL, STATE, AND LOCAL GOVERNMENT OFFICIALS

A. Authorized representatives of the State Board of Health, and other government officials shall at all times have safe access to the Work whether it is in preparation or progress, and the Contractor shall provide proper facilities for such access and inspection.

1.14 ACCESS ROADS

A. The Contractor shall assume that the condition of the access roads at the time of the job walk will be the condition during construction. Additional compensation will not be made for provision of access or for maintaining ingress/egress paths.

- B. Provide and maintain access to fire hydrants, free of obstructions.
- C. Provide means of removing mud from vehicle wheels before entering streets.
- D. Provide and maintain access to individual properties, free of obstructions.
- E. Designated existing on-site roads may only be used for construction traffic.
- F. Repair existing roads and facilities damaged by Contractor's use to original specified conditions or as directed by other Sections.

1.15 PROGRESS CLEANING AND WASTE REMOVAL

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe interiors, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space. The residential streets and surrounding area shall be clean swept thoroughly at the direction of the Owner's Representative.
- C. Collect and remove waste materials, debris, and rubbish from site weekly or as directed by the Owner's representative and legally dispose of off-site.

1.16 TRAFFIC MAINTENANCE AND SAFETY

- A. The Contractor shall be responsible for obtaining all traffic control required for the project. This includes but is not limited to traffic control shop drawings, plans, permits, or other requirements of the jurisdictional agency.
- B. Comply with all rules and regulations of the City, State, and County authorities regarding closing or restricting the use of public streets or highways. No public or private road shall be closed, except by express written permission of the local jurisdictional agency.
- C. Conduct the work so as to assure the least possible obstruction to traffic and normal commercial pursuits. Protect all obstructions within traveled roadways by installing approved signs, barricades and lights where necessary for the safety of the public. The convenience of the general public and residents, and the protection of persons and property are of prime importance and shall be provided for in an adequate and satisfactory manner.
- D. The Contractor shall leave his night emergency telephone number or numbers with the Police Department and Owner, so that contact may be made easily at all times in case of emergencies.

1.17 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities and materials, prior to Final inspection.

- B. Clean and repair damage caused by installation or use of temporary work.
- C. Restore existing used during construction to original condition. Restore permanent facilities used during construction to the condition specified by the Owner.

1.18 FIRE DANGER

A. Minimize fire danger in the vicinity of and adjacent to the construction site. Provide labor and equipment to protect the surrounding private property from fire damage resulting from construction operations.

1.19 PUBLIC SAFETY

A. Provide temporary fencing of all open or partially open trenches and excavations, all open or partially completed structures and all work and storage areas at all times while unattended by workmen. Temporary fencing shall be a minimum six feet high chain link with posts spaced no more than eight feet apart. Temporary fencing materials need not be new, but shall be in good condition. Gates shall be framed chain link with chains and padlocks. Provide the Engineer a minimum of two keys for each padlock. Erect temporary fencing immediately after starting an excavation and promptly remove the temporary fencing when the excavation has been backfilled or the structure secured.

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PART 1 – GENERAL

1.1 DESCRIPTION

- A. The Contractor shall be responsible for taking all precautions, providing all programs, and taking all actions necessary to protect the Work and all public and private property and facilities from damage as specified herein.
- B. In order to prevent damage, injury or loss, Contractor's actions shall include but not be limited to, the following:
 - 1. Store apparatus, materials, supplies, and equipment in an orderly safe manner that will not unduly interfere with the progress of the Work or the Work of any other contractor or utility service company.
 - 2. Provide suitable storage facilities for all materials, which are subject to injury by exposure to weather, theft, breakage, or otherwise.
 - 3. Place upon the Work or any part thereof only such loads as are consistent with the safety of that portion of the Work.
 - 4. Clean up frequently all refuse, rubbish, scrap materials, and debris caused by his operations, to the end that at all times the site of the Work shall present a safe, orderly and workmanlike appearance.
 - 5. Provide barricades and guard rails around openings, for scaffolding, for temporary stairs and ramps, around excavations, elevated walkways and other hazardous areas.
 - 6. Provide a Pre-Construction Video in accordance with Section 01170.
 - 7. Take work progress photos and submit monthly to the Engineer in digital format.
- C. The Contractor shall not, except after written consent from proper parties, enter or occupy privately-owned land with men, tools, materials or equipment, except on easements provided herein.
- D. The Contractor shall assume full responsibility for the preservation of all public and private property or facility on or adjacent to the site. If any direct or indirect damage is done by or on account of any act, omission, neglect or misconduct in the execution of the Work by the Contractor, it shall be restored by the Contractor, at his expense, to a condition equal to that existing before the damage was done.

1.2 **PROTECTION OF EXISTING STRUCTURES**

- A. Underground Structures:
 - 1. Underground structures are defined to include, but not be limited to, all sewer, water, gas, and other piping, and manholes, chambers, electrical conduits,
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tunnels and other existing subsurface work located within or adjacent to the limits of the Work.

- 2. All underground structures known to Engineer are shown. This information is shown for the assistance of Contractor in accordance with the best information available, but is not guaranteed to be correct or complete.
- 3. The Contractor shall explore ahead of his trenching and excavation Work and shall uncover all obstructing underground structures a minimum of two (2) weeks prior to the start of excavation to determine their location, type, material, and condition to prevent damage to them and to prevent interruption to the services which such structures provide. This exploration shall be completed sufficiently ahead of construction activities to allow for design revisions by the Engineer. If Contractor damages an underground structure, he shall restore it to original condition at his expense.
- 4. Necessary changes in the location of the Work may be made by Engineer, to avoid unanticipated underground structures.
- 5. If permanent relocation of an underground structure or other subsurface facility is required and is not otherwise provided for in the Contract Documents, Engineer will direct Contractor in writing to perform the Work, which shall be paid for under the provisions of the Contract.
- 6. The Contractor shall call USA Dig Alert at 1-800-227-2600 a minimum of forty-eight (48) hours prior to any excavation.
- B. Surface Structures:

Surface structures are defined as all existing buildings, structures and other facilities above the ground surface. Included with such structures are their foundations or any extension below the surface. Surface structures include, but are not limited to, buildings, walls, roads, channels, open drainage, piping, poles, wires, posts, signs, markers, curbs, walks and all other facilities that are visible above the ground surface.

- C. Protection of Underground and Surface Structures:
 - 1. The Contractor shall sustain in their places and protect from direct or indirect injury all underground and surface structures located within or adjacent to the limits of the Work. Such sustaining and supporting shall be done carefully and as required by the party owning or controlling such structure. Before proceeding with the Work of sustaining and supporting such structure, Contractor shall satisfy the Engineer that the methods and procedures to be used have been approved by the party owning same.
 - 2. The Contractor shall assume all risks attending the presence or proximity of all underground and surface structures within or adjacent to the limits of the Work. Contractor shall be responsible for all damage and expense for direct or indirect injury caused by his Work to any structure. Contractor shall repair

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immediately all damage caused by his Work, to the satisfaction of the owner of the damaged structure.

- D. All other existing surface facilities, including but not limited to, guard rails, posts, guard cables, signs, poles, markers, and curbs which are temporarily removed to facilitate installation of the Work shall be replaced and restored to their original condition at Contractor's expense.
- E. All pavement, pavement seal coatings, and striping damaged outside the work zone, including, but not limited to, staging area egress/ingress, parking, and haul routes, shall be repaired to the satisfaction of the jurisdictional agency at no additional cost to the District.

1.3 **PROTECTION OF INSTALLED PRODUCTS**

A. Provide protection of installed products to prevent damage from subsequent operations. Remove protection facilities when no longer needed, prior to completion of Work.

1.4 PROTECTION OF SURVEY OR ROADWAY MARKERS

A. The Contractor shall not destroy, remove, or otherwise disturb any existing survey markers or other existing street or roadway markers without proper authorization. No pavement breaking or excavation shall be started until all survey or other permanent marker points that will be disturbed by the construction operations have been properly referenced for easy and accurate restoration. It shall be the Contractor's responsibility to notify the proper representatives of the Owner of the time and location that Work will be done. Such notification shall be sufficiently in advance of construction so that there will be no delay due to waiting for survey points to be satisfactorily referenced for restoration. All survey markers or points disturbed will be accurately restored by the Contractor at the Contractor's expense after all work has been completed.

1.5 PROTECTION OF TREES AND LANDSCAPING

A. The Contractor shall exercise all necessary precautions so as not to damage or destroy any trees or shrubs of other existing landscaping, including those lying within or beyond street rights-of-way and project limits, and shall not trim or remove any trees unless such trees have been approved for trimming or removal by the Engineer and the jurisdictional agency or Owner. All existing trees and landscaping which are damaged during the construction shall be trimmed or replaced by the Contractor or a certified landscape maintenance company under permit from the jurisdictional Owner and to the satisfaction of said agency and/or the Owner. Additionally, Contractor shall pay for an ISA Certified Arborist of the Owner's choosing to recommend corrective actions. All costs shall be borne by the Contractor.

PART 2 – MATERIALS (NOT USED)

PART 3 – EXECUTION

3.1 PROCEDURES FOR PROTECTING EXISTING UTILITIES

- A. Protect in Place: Protect utilities in place, unless abandoned, and maintain the utility in service, unless otherwise specified.
- B. Cut and Plug Ends: Cut abandoned utility lines and plug ends with an 8-inch wall of brick and mortar or concrete plug. Dispose of the cut pipe as unsuitable material.
- C. Remove and Reconstruct: Where necessary or as required by the Engineer, remove the utility and, after passage, reconstruct it with new materials. Provide temporary service for the disconnected utility.

3.2 COMPACTION

- A. Utilities Protected in Place: Backfill and compact under and around the utility so that no voids are left. Where utilities are concrete encased, use the alternative construction method (sand slurry) for backfill around the utility.
- B. Alternative Construction Sand Slurry: Sand slurry consisting of one sack (94 pounds) of Portland cement per cubic yard of sand and sufficient moisture for workability may be required for backfill to aid in reducing compaction difficulties. Submit specific methods and procedures for review by the Engineer prior to construction.

3.3 ADJACENT UTILITIES

A. Protect existing utilities from any disturbances and repair the lines and associated appurtenances if they are damaged in any way. All costs incurred for protection of utilities or any costs incurred due to the presence of the lines, whether or not they lie within the new construction, shall be borne in full by the Contractor.

PART 1 – GENERAL

1.1 DESCRIPTION

A. The Contractor shall provide a complete sewer bypass pumping system capable of operating continuously, 24-hours per day, 7-days per week while the existing sewer pump station is taken out of service and until such time that the proposed pump station is placed into service. The bypass pumping system shall include but not be limited to pumps, controls, fuel, piping, valving, storage tanks, and all other equipment necessary for operation of the system.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 00810 Special Provisions
- B. Section 01300 Record Drawings and Submittals
- C. Section 01500 Construction Facilities and Temporary Controls

1.3 SUBMITTALS

- A. All submittals required by this Specification shall be provided to the District for approval within 20 days of receiving the Notice to Proceed. No construction activities related to bypass pumping shall begin prior to the approval by the District of the required submittals. Approval of the Contractor's Bypass Pumping Plan and Spill Prevention and Emergency Response Plan in no way relieves the Contractor of his responsibility to maintain sewage service or provide sewer bypass pumping as necessary during construction and to prevent any spills.
- B. Bypassing Plan
 - 1. The Contractor shall develop and submit to the District, for review and approval, a written Bypass Pumping Plan including sequence of work outlining how sewage flows will be maintained and the existing lift station bypassed during construction. The Bypass Pumping Plan shall include, but not be limited to:
 - a. A primary and 100% redundant backup pumping system, each capable of handling the peak flow of the system, which shall be on site and available 24 hours a day.
 - b. A flow monitoring plan describing the method of monitoring and showing the location of monitoring units as well as an emergency notification system.
 - c. Shop drawings for proposed bypass pumping equipment, system components, and controls.
 - d. A bypass pumping drawing showing the site/staging and configuration of all bypass pumping equipment and components. The Contractor's bypass pumping system shall not impede the District's operations or access to the site. Include pump sizes, capacity, and number of each size to be onsite. Include hydraulic calculations and a system head curve plotted on the pump curve.

- e. Sewer plugging method and the type of plug(s). How the plug(s) will be secured and emergency removal of the plug(s).
- f. Number, size, material, location, and method of installation of the suction and discharge piping.
- g. Number and size of portable power generators and the details of the noise suppression equipment. At least one standby generator for each size shall be provided in the event of an emergency.
- h. A description of bypass pumping operations, including installation, operation and maintenance procedures, and schedule.
- i. Certifications and operating experience of personnel operating and maintaining the bypass pumping system.
- C. Spill Prevention and Emergency Response Plan
 - 1. The Contractor shall develop and submit to the District, for review and approval, a written Spill Prevention and Emergency Response Plan. The Spill Prevention and Emergency Response Plan shall be developed to prevent and respond to any construction related sewage spills. The plan shall include, but not be limited to:
 - a. Identification of all nearby waterways, channels, catch basins and entrances to underground storm drains.
 - b. Furnishing of all the necessary materials, supplies, tools, equipment, labor and other services to prevent sewage from coming into contact with these areas.
 - c. Arrangements for an emergency response unit comprised of emergency response equipment and trained personnel to be immediately dispatched to the Site in the event of sewage spill(s).
 - d. An emergency notification procedure, which includes an emergency response roster with telephone numbers and arrangements for backup personnel and equipment and an emergency notification roster of designated District representatives.
 - e. Direct phone numbers (no voicemail) for 3 Contractor representatives who shall be accessible and available at all times to respond immediately to any construction related emergency.
- D. Confined Space Entry Plan (CSEP)
 - Develop a CSEP to comply with all laws and regulations. Submit for project records. This plan will not be reviewed and approved. It is the Contractor's plan. Be informed that sewers may have methane gas, H2S gas, and low oxygen gas levels. Include appropriate portable gas safety monitors for worker use in verifying the quality of air inside manholes and other confined spaces.

1.4 **RESPONSIBILITIES OF CONTRACTOR**

A. The Contractor shall observe and comply with all Federal, State, and local laws, ordinances, codes, orders, and regulations which in any manner affect the conduct of the work, specifically as it relates to sewage and prevention of sewage spills. The Contractor shall be fully responsible for preventing sewage spills, containing

any sewage spills, recovery and legal disposal of any spilled sewage, paying any and all fines, incurring and handling any penalties, claims, or liability arising from negligently causing or allowing a sewage spill, failure to prevent a sewage spill, or any violation of any law, ordinance, code, order, or regulation as a result of the spillage.

1.5 QUALITY ASSURANCE

A. The Contractor shall conduct a demonstration of its bypass pumping system continuously for 48 hours prior to taking the existing pump station out of service.

PART 2 – MATERIALS

2.1 GENERAL

- A. All equipment and tools used for sewer bypassing shall be designed to prevent any and all sewage leaks or spills.
- B. All equipment used as part of the bypassing system shall not cause a significant noise impact to the community in accordance with local noise ordinances. If noise complaints occur due to the Contractors activities, the Contractor shall immediately replace the noise generating equipment or reduce the noise generated with mitigating devices to the satisfaction of the District.
- C. The sewer bypassing system shall include means of sewage odor control. If odor complaints occur due to the Contractor's activities, the Contractor shall immediately improve or replace the odor control system to the satisfaction of the District.

2.2 PUMPING EQUIPMENT

- A. The Contractor shall use the following parameters as guidance in determining the preliminary size of the bypassing pumping system components. The Contractor is solely responsible for determining the size of all system components and providing equipment which will operate under the conditions required. The Contractor shall test the complete system prior to taking the existing pump station out of service. The Contractor shall replace equipment or components with units of adequate size, if testing identifies any deficiencies in the system.
 - 1. Average Dry Weather Flow into Station: 370 gallons per minute (gpm)
 - 2. Peak Dry Weather Flow: 750 gpm
 - 3. Peak Wet Weather Flow: 840 gpm
 - 4. Approximate Elevation Difference Between Existing Wet Well and Force Main Discharge at Treatment Plant: 227 feet
 - 5. Anticipated Total Dynamic Head Condition thru 10" Force Main at 840 pgm: 260 feet

C. The pumps shall be specifically intended for use with raw sewage and shall be capable of passing a 3-inch diameter solid.

PART 3 – EXECUTION

3.1 GENERAL

- A. The Contractor shall ensure personnel are on site continuously monitoring the system during bypass pumping operations.
- B. The Contractor shall take preventive measures to ensure no sewage spills occur.
- C. The Contractor shall be responsible for complete operation and maintenance of the bypass pumping system and shall be responsible for payment of all fines and clean-up costs as a result of sewage spills.
- C. Interception of sewage flows may be required at multiple locations upstream of the lift station inlet manhole.
- D. The Contractor shall continuously monitor the flow levels upstream of the lift station site to detect any possible failure that may cause a sewage backup and spill. The Contractor shall include the means and methods of monitoring the flow in their Sewer Bypassing Plan.
- E. The Contractor may connect to the existing force main at the Bypass Vault shown on the Drawings. The Contractor is responsible for providing the piping necessary to make the temporary connection.
- F. The Contractor shall ensure an adequate fuel supply is onsite at all time during bypassing.
- G. The Contractor shall implement best management practices (BMPs) in order to prevent leakage of fuel, oil, and lubricants, and shall immediately clean up such spills.
- H. The Contractor shall exercise care not to damage existing public and private improvements, interrupt existing services and/or facility operations which may cause a sewage spill. Any reasonably anticipated utility and/or improvement which is damaged by the Contractor shall be immediately repaired at the Contractor's expense. In the event that the Contractor damages an existing utility or interrupts an existing service which causes a sewage spill, the Contractor shall immediately notify the Owner. The Contractor shall request and obtain from the Owner an emergency roster of the designated Owner representatives with their respective telephone numbers, pager numbers, and cellular phone numbers. The Contractor shall take all measures necessary to prevent further damage or service interruption, and to control, contain and clean up the resultant impacts of the damage, service interruption and any resulting sewage spill(s).

3.2 SEWAGE SPILLS

- A. In case of sewage spill, the Contractor shall act immediately without instructions from the District to control the spill and take all appropriate steps to contain it in accordance with their Spill Response Plan.
- B. The Contractor shall immediately notify the District representatives of the sewage spill(s) and all remedial actions taken.
- C. The Contractor shall, within 24 hours from the occurrence of the spill, submit to the District a draft written report describing the following information related to the spill: the location on a current aerial map; the nature and volume; the date and time; the duration; the cause; the type of remedial and/or preventive actions taken; and the water body impacted and results of any necessary monitoring. The District will review the draft report, and if revisions are required, the Contractor shall make those revisions and submit the final report to the District within 24 hours of the receipt of comments. The Engineer may institute further corrective actions, as deemed necessary, to fully comply with existing law, ordinance, code, order or regulation. The Contractor shall be responsible for all costs incurred for the corrective actions.
- D. It shall be the Contractor's responsibility to assure that all field forces, including Subcontractors, know and obey all safety and emergency procedures, including the Spill Response Plan, to be maintained and followed at the Site.

3.3 SEWER BYPASSING

- A. The Contractor shall size the bypass system to handle the peak flow of the system. The Contractor shall provide a redundant, identically sized, one-hundred percent (100%) backup bypass pumping system. The Contractor shall utilize the backup system to mitigate any additional wet weather flows, perform the necessary maintenance and repairs on the primary bypass pumping system, and exercise and ensure the operability of the backup system. Each pump, including the backup pumps, shall be a complete unit with its own suction and discharge piping. The Contractor shall operate the backup bypass system for a minimum of twenty-five percent (25%) of the time on a weekly basis. The backup bypass system shall be fully installed and operationally ready at all times.
- C. Prior to the full operation of the bypass system, the Contractor shall demonstrate, to the satisfaction of the District, that both the primary and backup bypass systems are fully functional and adequate, and shall certify the same, in writing, in a manner acceptable to the District.
- D. The Contractor shall provide all equipment necessary to minimize the noise generated by the bypassing operations. Noise levels from the complete bypassing system shall not exceed the levels allowable under the local jurisdictional codes and requirements.
- E. The Contractor shall continuously monitor the operation of the bypass system and all impacted facilities. During bypass pumping operations, 24-hour, full-time monitoring by a person qualified and trained to operate and maintain the bypass

pumps and bypass system shall be provided by the contractor. This person (bypass monitor) may not be assigned any other duties and will be solely dedicated to the bypass system. The bypass monitor shall regularly inspect and maintain the pumped bypass system including the backup system. Monitoring intervals shall be no longer than twenty (20) minutes with more frequent monitoring intervals required for critical pumped bypass periods such as AM/PM diurnal periods. The Contractor shall submit, as part of their bypass plan, their system monitoring in a manner approved by the District as part of the Bypass Pumping Plan.

- F. The Contractor shall continuously monitor the flow levels upstream of the bypass location(s) to detect any possible failure that may cause a sewage backup and/or spill. The Contractor shall include the means and methods of monitoring the flow in District on a weekly basis in a format acceptable to the District.
- G. The Contractor shall routinely inspect and maintain the bypass system, including the backup system. The Contractor shall perform all necessary maintenance and repairs on the pumped bypass system. The Contractor shall submit as part of their Bypassing Plan their maintenance procedures and frequency. The Contractor shall maintain a log of all pertinent inspection, maintenance and repair records in a manner acceptable to the District.
- H. Sewer flows in new, rechanneled, or rehabilitated manholes or concrete structures shall be controlled across the surface in such a manner that sewage does not flow over concrete channels until they have cured for 24 hours or for the duration specified by the concrete material manufacturer. The controls shall prevent backup of sewage upstream from the manhole or structure.

3.4 PAYMENT

A. All costs associated with sewer bypass requirements listed above shall be included in the Bid Item "Sewer Bypass Operations".

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Contractor shall make all arrangements for transportation, delivery and handling of equipment and materials required for prosecution and completion of the Work.
- B. Shipments of materials to Contractor or Subcontractors shall be delivered to the site only during regular working hours. Shipments shall be addressed and consigned to the proper party giving name of Project, street number and city. Shipments shall not be delivered to Owner except where otherwise directed.
- C. If necessary to move stored materials and equipment during construction, Contractor shall move or cause to be moved materials and equipment without any additional compensation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01400 – Quality Control

1.3 **PRODUCTS**

A. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

1.4 DELIVERY

- A. Arrange deliveries of products in accord with construction schedules and in ample time to facilitate inspection prior to installation.
- B. Coordinate deliveries to avoid conflict with Work and conditions at site and to accommodate the following:
 - 1. Work of Owner.
 - 2. Limitations of storage space.
 - 3. Availability of equipment and personnel for handling products.
 - 4. Owner's use of premises.
- C. Do not have products delivered to project site until related Shop Drawings have been approved by the Engineer.
- D. Do not have products delivered to site until required storage facilities have been provided.
- E. Have products delivered to site in manufacturer's original, unopened, labeled containers. Keep Engineer informed of delivery of all equipment to be incorporated in the Work.

SECTION 01600 - MATERIALS AND EQUIPMENT

- F. Partial deliveries of component parts of equipment shall be clearly marked to identify the equipment, to permit easy accumulation of parts and to facilitate assembly.
- G. Immediately on delivery, inspect shipment to assure:
 - 1. Product complies with requirements of Contract Documents and reviewed submittals.
 - 2. Quantities are correct.
 - 3. Containers and packages are intact, labels are legible.
 - 4. Products are properly protected and undamaged.

1.5 PRODUCT STORAGE

- A. Store and protect materials in accordance with manufacturer's recommendations and requirements of the Contract Documents.
- B. Manufacturer's product containers shall not be opened until time of installation.
- C. Contractor shall make all arrangements and provisions necessary for the storage of materials and equipment. All excavated materials, construction equipment, and materials and equipment to be incorporated into the work shall be placed so as not to injure any part of the work or existing facilities, and so that free access can be maintained at all times to all parts of the work and to all public utility installations in the vicinity of the work. Materials and equipment shall be kept neatly and compactly stored in locations that will cause a minimum of inconvenience to the Owner, other contractors, public travel, adjoining owners, tenants and occupants. Arrange storage in a manner to provide easy access for inspection.
- D. Areas available on the construction site for storage of materials and equipment shall be within the project site or at other sites approved by the Owner.
- E. Materials and equipment shall be stored to facilitate inspection and to ensure preservation of the quality and fitness of the work, including proper protection against damage by freezing and moisture.
 - 1. Arrange storage to provide access for inspection and inventory control.
 - a. Periodically inspect to ensure products are undamaged, and are maintained under required conditions.
 - b. Maintain an inventory of materials stored to facilitate inspection and estimate progress payments for materials delivered but not yet installed.
 - 2. Store products in accordance with manufacturer's written instructions, with seals and labels intact and legible. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's written instructions.

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- F. Protect products against moisture, temperature extremes, dust, debris, tampering, vandalism, ultraviolet radiation, or damage from improper handling, storage or exposure. Protect exposed metals from rust and corrosion even though they will be sandblasted or otherwise cleaned before painting.
- G. Products subject to damage by moisture, freezing, UV exposure, or other effects of the elements shall be stored inside weatherproof storage areas equipped with suitable temperature and moisture controls.
- H. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.
- I. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.
- J. If necessary to relocate stored materials and equipment prior to or during construction, Contractor shall move materials and equipment without any additional compensation.

1.6 **PRODUCT HANDLING**

- A. Provide equipment and personnel necessary to handle products, including those provided by Owner, by methods to prevent soiling or damage to products or packaging.
- B. Provide additional protection during handling as necessary to prevent scraping, marring or otherwise damaging products or surrounding surfaces.
- C. Handle products by methods to prevent bending or overstressing.
- D. Lift heavy components only at designated lifting points.
- E. Materials and equipment shall at all times be handled in a safe manner and as recommended by manufacturer or supplier so that no damage will occur to them. Do not drop, roll or skid products off delivery vehicles. Hand carry or use suitable materials handling equipment.

1.7 **PRODUCT OPTIONS**

- A. Products Specified by Reference Standards or by Description Only: Any Product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Products of manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named in accordance with the following article.

1.8 SUBSTITUTIONS

- A. Unless otherwise authorized in writing by the Engineer, the substantiation of offers of equivalency must be submitted within sixty (60) days after execution of the Agreement. The Contractor's attention is further directed to the requirement that its failure to submit data substantiating a request for a substitution of an "equivalent" item within said 60-day period after the execution of the Agreement, shall be deemed to mean that the Contractor intends to furnish one of the specific brand-named products named in the specification, and the Contractor does hereby waive all rights to offer or use substitute products in each such case. Wherever a proposed substitute product has not been submitted within said 60-day period, or wherever the submission of a proposed substitute product fails to meet the requirements of the specifications and an acceptable resubmittal is not received by the Engineer within said 60-day period, the Contractor shall furnish only one of the products originally named in the Contract Documents.
- B. Items being submitted as an equivalent substitution shall be clearly identified as such in the proposed product list required to be submitted as specified in Section 01300.
- C. Substantiating data submittals for items being offered as an equivalent substitution shall conform in all respects to the requirements of Section 01300.
- D. Substitutions may be considered when a Product becomes unavailable through no fault of the Contractor.
- E. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- F. A request constitutes a representation that the Contractor:
 - 1. Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.
 - 2. Will provide the same warranty for the Substitution as for the specified Product.
 - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
 - 5. Will reimburse Owner for review or redesign services associated with reapproval by authorities.
- G. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
- H. Substitution Submittal Procedure:

- 1. Submit six copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
- 2. Submit shop drawings, product data, and certified test results attesting to the proposed Product equivalence. Burden of proof is on proposer.
- 3. The Engineer shall have sole discretion and will notify Contractor in writing of decision to accept or reject request.
- I. Substitutions will not be considered for equipment, material or methods not designated as allowing "Approved Equal" or "Or Equal" unless said equipment or material is no longer available.

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SECTION 01660 - SYSTEMS START-UP AND TESTING

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Starting Systems.
- B. Demonstration and instructions.
- C. Testing.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 01400 Quality Control
- C. Section 01700 Project Closeout
- D. Section 11000 Equipment General Provisions

1.3 STARTING SYSTEMS

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Engineer and Owner seven days prior too start-up of each item.
- C. Verify that each piece of equipment or system has been checked for conditions which may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable manufacturer's representative and Contractor's personnel in accordance with manufacturer's instructions.
- G. The equipment, where specified in individual specification Sections, require the manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report in accordance with Section 01300 that equipment or system has been properly installed and is functioning correctly.

1.4 DEMONSTRATION AND INSTRUCTION

A. Demonstrate operations and maintenance of Products to Owner's personnel two weeks prior to date of final inspection.

SECTION 01660 - SYSTEMS START-UP AND TESTING

- B. Demonstration of the Project equipment and instruction shall be by a qualified manufacturer's representative who is knowledgeable about the Project.
- C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
- D. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment.
- E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
- F. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

1.5 TESTING

- A. Contractor shall employ and pay for services of an independent firm to perform testing, demonstration, and instructions.
- B. When any Work, equipment or materials 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 testing shall be borne by the Contractor.
- C. Reports will be submitted by the independent firm to the Engineer indicating observations and results of tests and indicating compliance or noncompliance with the requirements of the Contract Documents.

SECTION 01700 - PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Contractor shall thoroughly clean the project site, as described in Section 01710, prior to final acceptance of the Work by the Owner.
- B. The Contractor shall conduct Performance Tests for each element of the Work as described in the individual sections. Where no performance test is specified, the Contractor shall demonstrate satisfactory performance for a period of one week prior to final acceptance.
- C. The Contractor shall establish dates for equipment testing and acceptance periods. The times shall be within the Contract time.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 01710 Clean Up

1.3 TECHNICAL MANUAL SUBMITTALS

The Contractor shall provide Technical Manuals in accordance with the Contract Documents at project close out.

1.4 FINAL SUBMITTALS

The Contractor shall complete all the requirements of Section 01300. The Contractor, prior to requesting final payment, shall obtain and submit the following items to the Engineer:

- A. Written guarantees, where required.
- B. Operating manuals and instructions (foursix (46) sets of all documents).
- C. Maintenance stock items; spare parts, special tools.
- D. Completed record drawings.
- E. Releases from all parties who are entitled to claims against the subject project, property, or improvement pursuant to the provisions of law.

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PART 1 – GENERAL

1.1 DESCRIPTION

- A. Contractor shall execute clean-up during progress of the Work, at completion of the Work, and as required by General Conditions.
- B. Requirements of Regulatory Agencies:
 - 1. In addition to the requirements herein, the Contractor shall maintain the cleanliness of the Work and surrounding premises within the Work limits so as to comply with federal, state, and local fire and safety laws, ordinances, codes and regulations.
 - 2. The Contractor shall comply with all federal, state and local anti-pollution laws, ordinances, codes and regulations when disposing of waste materials, debris and rubbish.
- C. Scheduling of Cleaning and Disposal Operations:
 - 1. The Contractor shall schedule all clean-up and disposal operations so that dust, wash water or other contaminants generated during such operations do not damage or mar painted or finished surfaces.
 - 2. The Contractor shall prevent accumulation of dust, dirt, debris, rubbish and waste materials on or within the Work or on the premises surrounding the Work.
- D. Waste Disposal:
 - 1. The Contractor shall dispose of all waste materials, surplus materials, debris and rubbish off the site.
 - 2. The Contractor shall not burn or bury rubbish and waste materials on the site.
 - 3. The Contractor shall not dispose of volatile or hazardous wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
 - 4. The Contractor shall not discharge wastes into streams or waterways.
- E. Materials:
 - 1. The Contractor shall use only cleaning materials recommended by manufacturer of surface to be cleaned.
 - 2. The Contractor shall use each type of cleaning material on only those surfaces recommended by the cleaning material manufacturer.
 - 3. The Contractor shall use only materials, which will not create hazards to health or property.

- F. During Construction:
 - 1. The Contractor shall keep the Work and surrounding premises within work limits free of accumulations of dirt, dust, waste materials, debris and rubbish.
 - 2. The Contractor shall keep dust generating areas wetted down.
 - 3. The Contractor shall provide suitable containers for storage of waste materials, debris and rubbish until time of disposal.
 - 4. The Contractor shall dispose of waste, debris and rubbish off site at legal disposal areas.
- G. When Project Is Completed:
 - 1. The Contractor shall remove and dispose of all excess or waste materials, debris, rubbish, and temporary facilities from the site, structures and all facilities.
 - 2. The Contractor shall repair pavement, roads, sod, and all other areas affected by construction operations and restore them to original condition or to minimum condition specified.
 - 3. The Contractor shall remove splatter, grease, stains, fingerprints, dirt, dust, labels, tags, packing materials and other foreign items or substances from interior and exterior surfaces, equipment, signs and lettering.
 - 4. The Contractor shall repair, patch and touch up chipped, scratched, dented or otherwise marred surfaces to match specified finish.
 - 5. The Contractor shall remove paint, clean and restore all equipment and material nameplates, labels and other identification markings.
 - 6. The Contractor shall wash and shine mirrors, glazing and polished surfaces.
 - 7. The Contractor shall clean all floors, slabs, pavements, and ground surfaces.
 - 8. The Contractor shall maintain cleaning until acceptance and occupation by Owner.

PART 1 – GENERAL

1.1 DESCRIPTION

- A. The Contractor shall provide operation and maintenance data in the form of instructional manuals for use by the Owner's personnel for:
 - 1. All equipment and systems.
 - 2. All valves, gates and related accessories.
 - 3. All instruments and control devices.
- B. Operation and Maintenance Data Manuals shall be submitted with last pay request.
- C. Definitions:
 - 1. Operation and Maintenance Data:
 - a. The term "operation and maintenance data" includes all product related information and documents which are required for preparation of the operation and maintenance manual. It also includes all data, which must accompany said manual as directed by current regulations of any participating government agency.
 - b. Required operation and maintenance data includes, but is not limited to, the following:
 - 1) Complete, detailed written operating instructions for each product or piece of equipment including: equipment function; operating characteristics; limiting conditions; operating instructions for startup, normal and emergency conditions; regulation and control; and shutdown.
 - 2) Complete, detailed written preventative maintenance instructions as defined below.
 - 3) Recommended spare parts lists and local sources of supply for parts.
 - 4) Written explanations of all safety considerations relating to operation and maintenance procedures.
 - 5) Name, address and phone number of manufacturer, manufacturer's local service representative, and Subcontractor or installer.
 - 6) Copy of all approved Shop Drawings, and copy of warranty bond and service contract as applicable.
 - 2. Preventive Maintenance Instructions:
 - a. The term "preventive maintenance instructions" includes all information and instructions required to keep a product or piece of equipment properly lubricated, adjusted and maintained so that the item functions economically throughout its full design life.

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- b. Preventive maintenance instructions include, but are not limited to, the following:
 - 1) A written explanation with illustrations for each preventive maintenance task.
 - 2) Recommended schedule for execution of preventive maintenance tasks.
 - 3) Lubrication charts.
 - 4) Table of alternative lubricants.
 - 5) Trouble shooting instructions.
 - 6) List of required maintenance tools and equipment.
- D. Submittals:
 - 1. General: The Contractor shall submit the operations and maintenance data to the Engineer within 30 days after approval of the final Shop Drawing.
 - 2. Number of Copies: Six of each item.
 - 3. Letter of Transmittal: Provide a letter of transmittal with each submittal and include the following in the letter:
 - a. Date of submittal.
 - b. Contract title and number.
 - c. Contractor's name and address.
 - d. A list of the attachments and the Specification Sections to which they relate.
 - e. Reference to or explanation of related submittals already made or to be made at a future date.
 - 4. Format Requirements:
 - a. The Contractor shall use 8-1/2 inch by 11-inch paper of high rag content and quality. Larger drawings or illustrations are acceptable if neatly folded to the specified size in a manner, which will permit easy unfolding without removal from the binder. Provide reinforced punched binder tab. Or provide fly-leaf for each product.
 - b. All text must be legible type-written or machine printed originals or high quality copies of same.
 - c. Each page shall have a binding margin of approximately 1-1/2 inches and be punched for placement in a three ring looseleaf or triple post binder. Provide binders not less than one inch or more than 2-1/2 inches thick. Identify each binder on the spine and outside front cover with the following:
 - 1) Title "OPERATING AND MAINTENANCE INSTRUCTIONS".
 - 2) Title of Project.
 - 3) Identity of building, structure or area as applicable.
 - 4) Identity of general subject matter covered.

- d. The Contractor shall use dividers and typewritten indexed tabs between major categories of information such as operating instructions, preventive maintenance instructions, or other. When necessary, place each major category in a separate binder.
- e. The Contractor shall provide a table of contents for each binder.
- f. The Contractor shall identify products by their functional names in the table of contents and at least once in each chapter or Section. Thereafter, abbreviations and acronyms may be used if their meaning is explained in a table in the back of each binder. Use of model or catalog numbers or letters for identification is not acceptable.

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PART 1 – GENERAL

1.1 DESCRIPTION

- A. The Contractor shall furnish all materials, equipment and labor necessary to demolish and remove from the site existing equipment, piping, valves, structures, walls, slabs, electrical conduit and wiring and appurtenances as shown and as specified.
- B. In areas indicated to be demolished, the Contractor shall cut back flush and seal any pipe stub-outs remaining, and remove exposed piping, conduits, fixtures, junction boxes, light fixtures, water fixtures, and supports. Switches, receptacles, wiring, and boxes shall also be removed. Concealed piping and conduits shall be removed as necessary to facilitate the Work. All other items shall be removed as shown.
- C. The Contractor shall dispose of all materials, including any wastewater, in accordance with California requirements.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 00810 – Special Provisions

1.3 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

- A. The Work of this Section shall comply with the current edition of the Uniform Building Code and California Building Code.
- B. Except as otherwise indicated in this Section, the Contractor shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC).

1.4 CONTRACTOR SUBMITTALS

- A. The Contractor shall submit a demolition schedule. The demolition schedule shall provide a complete coordination schedule for demolition work including shut-off and continuation of utility services before the start of the demolition. The schedule shall indicate proposed methods and operations of facility demolition, and provide a detailed sequence of demolition and removal work to in accordance with the Contract Documents.
- B. Before completion of the Work, the Contractor shall submit an Affidavit of Legal Disposal attesting to the lawful disposal of all demolished materials.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 GENERAL

A. Structures shall be demolished and removed in compliance with SSPWC subsection 306-5 and the requirements indicated herein.

3.2 CLEARING AND GRUBBING

- A. Unless otherwise specified, the Contractor shall remove obstructions such as roots, vegetation, rock, stones larger than six (6) inches by any dimension, broken or old concrete and pavement, debris, and structures when completion of the Work requires their removal.
- B. Material that is removed and is not to be incorporated in the Work shall be disposed of off the site.

3.3 STRUCTURAL REMOVAL

A. Unless otherwise shown or specified, demolition of structures shall be carried to the level shown on the plans. Where adjoining structures are to be kept in place, the demolition limit lines shall be neatly saw-cut. Sections to be removed shall be broken out, and the remaining face shall be chipped back to the saw-cut line. The Contractor shall do the necessary Work to provide the remaining face with a finish compatible with the surrounding surfaces.

3.4 EQUIPMENT, CONDUIT AND PIPING REMOVAL

A. All equipment and piping to be removed shall be properly disconnected from structures, piping, electrical and instrumentation systems. Below ground piping and conduits to be abandoned in place shall be properly capped and slurry filled. Disconnected wiring shall be removed from the conduits. The Contractor shall do all resurfacing and other Work as necessary to comply with the above requirements.

3.5 PAVEMENT REMOVAL

A. All pavements and concrete pads shall be saw-cut on a neat line at right angles to the curb face.

3.6 UTILITY INTERFERENCE

A. Where existing utilities interfere with the prosecution of the Work, the Contractor shall relocate them.

3.7 SALVAGE

A. The District has the right to salvage any items scheduled for removal. The Contractor shall notify the Engineer five (5) days prior to any salvage or demolition

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Work to determine the disposition of items to be removed. The Engineer will mark items to be salvaged. Such items shall be properly disconnected, removed from their foundations, cleaned and stored at a location on the plant site as directed.

3.8 DISPOSAL OF REMOVED MATERIAL AND DEBRIS

- A. All removed material not designated for salvage and all debris shall become the property of the Contractor and shall be removed from the site and properly disposed of.
- B. Materials and debris generated by demolition activities shall not be allowed to accumulate. Debris shall be removed daily and disposed of in a manner allowed by law. Burning of materials shall not be permitted.

3.9 BACKFILL

- A. Holes or depressions in the ground remaining after demolition of structures, tanks, pipelines, or equipment shall be filled with compacted backfilling materials as specified in Section 02223.
- B. Below-grade areas and voids resulting from demolition of structures shall be completely filled to a minimum of compaction of 90%.
- C. All fill shall be graded to meet adjacent contours and to provide flow to surface drainage structures, or as indicated.

3.10 POLLUTION CONTROL

- A. Water sprinkling, temporary enclosures, chutes, and other suitable methods shall be used for dust suppression in compliance with SSPWC Section 7.
- B. Water shall not be used when it creates hazardous or objectionable conditions such as flooding, erosion, sedimentation, or pollution.

3.11 PROTECTION

- A. Safe passage of persons around the area of demolition shall be provided. Operations shall be conducted to prevent injury to people and damage to adjacent buildings, structures, and other facilities in compliance with SSPWC Section 7.
- B. Interior and exterior shoring, bracing, or supports shall be provided to prevent movement, settlement or collapse of structures to be demolished.
- C. Existing landscaping materials, structures, and appurtenances which are not to be demolished shall be protected and maintained as necessary and in accordance with SSPWC Section 7.
- D. Unless otherwise indicated, the Contractor shall protect and maintain all utilities in the proximity of the facilities to be demolished.

E. The Contractor shall protect nearby existing equipment from dust caused by demolition activities by covering, drop-curtains and other similar methods.

3.12 DISPOSAL OF NON-FRIABLE ASBESTOS

- A. If non-friable asbestos cement pipe (ACP) is identified, the Contractor shall employ adequate care to maintain the pipe in a non-friable condition. Removal of the ACP shall be in whole sections where possible. Cutting or breaking of ACP to facilitate removal shall be in compliance with California Regulations, Title 8, and Section 5208. At a minimum, the Contractor shall follow the following requirements for ACP that is to be cut or broken:
 - 1. The Contractor shall evacuate the area of unauthorized and untrained personnel, post warning signs, and provide a demarcation zone and adequate barriers to keep unauthorized personnel out of the area.
 - 2. The Contractor shall provide personal protective equipment consisting at least of a respirator and disposable clothing to asbestos accredited workers performing the cutting or breaking of ACP. Respirator protection shall in accordance with the requirements of California Regulations, Title 8, and Section 5414.
 - 3. The area to be cut or broken shall be adequately wetted with amended water to reduce fiber emission. The method employed by the Contractor shall minimize fiber release. Power saw cutting will not be allowed. All related debris from the cutting or breaking of ACP shall be considered friable. The Contractor shall dispose of friable material in accordance with California Regulations Title 22.
 - 4. All waste generated and ACP shall be wrapped in six (6) mil polyethylene sheeting or bags and shall be properly transported and disposed.
- B. The Contractor is responsible for all ACP removal and associated contamination.
- C. Payment for disposal on non-friable asbestos-containing materials shall be in accordance with SSPWC Subsection 3-2.2.3.

3.13 PATCHING AND REPAIRING

- A. The Contractor shall provide patching, replacing, repairing, and refinishing of damaged areas involved in demolition as necessary to match the existing adjacent surfaces including, but not limited to materials, texture, and color.
- B. The Contractor shall repair all damages caused to adjacent facilities by demolition at no additional cost to the District.
- C. After patching and repairing has been completed, the Contractor shall carefully remove splatterings of mortar from adjoining Work (plumbing fixtures, trim, tile, and finished metal surfaces) and repair any damage caused by such cleaning operations.

3.14 CLEANING

- A. During and upon completion of Work, the Contractor shall promptly remove unused tools and equipment, surplus materials, rubbish, debris, and dust and shall leave areas affected by the Work in a clean condition.
- B. The Contractor shall clean adjacent structures and facilities of dust, dirt, and debris caused by demolition and return adjacent areas to condition existing prior to start of Work.
- C. The Contractor shall clean and sweep the affected portions of roads, streets, sidewalks and passageways daily.

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PART 1 – GENERAL

1.1 DESCRIPTION

- A. The Contractor shall perform site dewatering necessary to lower and control groundwater levels and hydrostatic pressures to allow excavation and construction to be performed properly under dry conditions. This Section includes materials, installation, maintenance, operation, and removal of temporary dewatering systems.
- B. The Contractor shall perform all treatment necessary for the legal disposal of all groundwater encountered. The cost of treatment shall be borne by the Contractor and no additional compensation will be made for inadequate treatment facilities.
- C. Dewatering operations shall be adequate to ensure the integrity of the finished project. The responsibility for conducting the dewatering operation in a manner which will protect adjacent structures and facilities rests solely with the Contractor. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the Contractor.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 02200 Earthwork
- C. Section 02270 Temporary Soil Erosion and Sediment Control

1.3 **REFERENCE SPECIFICATIONS, CODES AND STANDARDS**

- A. The Contractor shall develop and implement a site-specific Storm Water Pollution Prevention Plan (SWPPP) and comply with all aspects of the associated Storm Water General permit in accordance with Section 02270.
- B. The Contractor shall obtain and comply with all required permits and approvals including but not limited to the California Regional Water Quality Control Board General Waste Discharge Requirements for Groundwater Extraction Discharges to Surface Waters (Order R9-2018-0013), and all other applicable dewatering discharge permits.

1.4 CONTRACTOR SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300:
 - 1. Before starting excavation, the Contractor shall submit Shop Drawings including a detailed plan, schedule, and description of the dewatering of excavations. The Shop Drawings shall include: the proposed type of dewatering system; the arrangement, location, and depths of system components; a complete description of the equipment and instrumentation to be used, with installation, operation and maintenance procedure; a description of the Contractor's means and methods for measuring

SECTION 02140 – DEWATERING

groundwater levels and piezometric water levels; and the methods for disposal of dewatering effluent.

- 2. Before starting excavation, the Contractor shall submit copies of well installation permits.
- 3. Before starting excavation, the Contractor shall submit copies of its dewatering discharges permits from the local sewer agency or Regional Water Quality Control Board, whichever is applicable.
- 4. The Contractor shall submit copies of well destruction permits, as applicable.
- B. Contractor shall submit a daily report that includes the following information:
 - 1. Groundwater levels and piezometric water levels in observation wells (if any).
 - 2. Changes in elevation of reference points as stated in subparagraph 1.5C to detect settlement in adjacent structures.
 - 3. The average dewatering flow rate.
 - 4. Water quality testing results as required by the Regional Water Quality Control Board or local sewer agency, whichever is applicable.

1.5 QUALITY ASSURANCE

- A. The Contractor shall conduct a demonstration of its proposed system and shall provide verification that adequate personnel, materials and equipment are available.
- B. The Contractor shall maintain adequate control to ensure that the stability of excavated and constructed slopes is not adversely affected by water, that erosion is controlled, and that flooding of excavations or damage to structures does not occur.
- C. Where critical structures or facilities exist immediately adjacent to areas of proposed dewatering, the Contractor shall establish reference points and shall observe the reference points at frequent intervals to detect any settlement which may occur. Frequency of intervals shall be determined based on recommendations of the soils engineer and the nature of the critical structure or facility and distance from the excavation, except that the minimum frequency shall be twice per working day (once at the beginning of the work day and once at the conclusion of the work day).

PART 2 – MATERIALS

2.1 MATERIALS AND EQUIPMENT

- A. Dewatering, where indicated, includes well points, sump pumps, temporary pipelines for water disposal, rock or gravel placement, observation wells, and other means including standby pumping equipment maintained on the jobsite continuously.
- B. The Contractor shall provide piezometers for monitoring groundwater levels. The Contractor shall provide other instruments and measuring devices as required.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

- A. The Contractor is responsible for compliance with Regional Water Quality Control Board or local sewer agency requirements for any discharge of groundwater to the environment or sanitary sewer, whichever is applicable. The Contractor shall comply with Regional Water Quality Control Board Waste Discharge requirements. Before starting dewatering operations, the Contractor shall obtain authorization, as required, for the disposal of groundwater. The Contractor shall comply with all applicable sampling, testing, monitoring, and reporting requirements.
- B. The Contractor shall maintain an adequate system to lower and control the groundwater to permit excavation, construction of structures, and placement of fill materials to be performed under dry conditions.
- C. Sufficient dewatering equipment shall be installed to pre-drain the water-bearing strata below the bottom of foundations, drains, sewers, and other excavations.
- D. The hydrostatic head in water-bearing strata below foundations, drains, sewers, water pipelines and other excavations shall be reduced to ensure that the water level is below the excavation surface at all times.
- E. The system shall be placed into operation before excavation below groundwater level is started. The system shall be operated continuously 24 hours a day, 7 days a week until drains, sewers and structures have been constructed, fill materials have been placed, and dewatering is no longer required.
- F. The site shall be graded to facilitate drainage and runoff shall be diverted from the excavation. Surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped or drained by gravity away from the excavation.
- G. Dewatering shall at all times be conducted to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.
- H. If foundation soils are disturbed or loosened by the upward seepage of water or an uncontrolled flow of water, the affected areas shall be excavated and replaced with drain rock at no additional cost to the Owner.

- I. Flotation of structures and facilities shall be prevented by maintaining a positive and continuous removal of water.
- J. If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering and shall be sandpacked and/or other means shall be used to prevent pumping of fine sands or silts from the subsurface. A continuous check shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation.
- K. Water and debris shall be disposed of in a legal and suitable manner in compliance with permit requirements and SSPWC Subsection 306-3.3, without damage to adjacent property. No water shall be drained into work built or under construction. Before disposal, water shall be treated in accordance with permit requirements. Before disposal, water shall be filtered to remove sand and fine-sized soil particles.
- L. The release of groundwater to its original level shall be performed in a manner that avoids disturbance of natural foundation soils, prevents disturbance of compacted backfill, and prevents flotation or movement of structures.

3.2 DISPOSAL TO SANITARY SEWER

- A. The Owner may allow the Contractor to discharge clear groundwater to the sanitary sewer. Please note that at any time, the Owner may require a shutdown or limit the quantity and/or times of the discharge to the District's Water Reclamation Facility depending on various conditions including meeting treatment obligations in accordance with their permit, plant scheduled or emergency maintenance, or high rainfall events increasing plant sewer flow. The maximum continuous discharge rate shall be coordinated with the Owner's Representative. The Contractor shall provide a continuous record (recorder) of discharged flowrate and total flow at each site. The flowmeter shall be calibrated to provide an accuracy of +/-3%. Provide evidence that the meter is calibrated. Provide reports of the continuous flowrates and total flow weekly. If the Contractor finds it necessary to discharge a higher flow rate, he shall first consult with the Owner's Representative for approval.
- B. Owner's consideration for approval to discharge to the sanitary system is contingent on the following:
 - 1. Approved submittals as outlined in Section 1.4
 - 2. Laboratory analysis data along with chain of custody form for representative samples of groundwater taken from the project area. Multiple sample locations will be required review the project area with the Owner prior to sampling to determine the appropriate number of sample locations.
 - a. Laboratory analysis shall test local limit parameters as determined by Owner, including Total Dissolved Solids (TDS) and fuel contamination pollutants.

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- b. Laboratory shall be State-certified.
- c. EPA wastewater analytical methods must be utilized.
- d. pH field analysis required.
- C. The Contractor is responsible for all costs.

3.3 DISCHARGE WATER QUALITY

- A. The Contractor shall be responsible for providing adequate treatment to meet California Regional Water Quality Control Board, and Olivenhain Municipal Water District discharge requirements. Minimum treatment shall consist of the following:
 - 1. In all areas requiring dewatering, the Contractor shall discharge extracted groundwater to a baffle-wall holding tank of sufficient capacity to provide a minimum of 1 hour of holding time to allow sediment to settle out of the water. Water shall be pumped from holding tank through a minimum of two 25-micron filter bag filter units in series to remove suspended solids prior to discharge. The filters shall be equipped with pressure gauges to evaluate when filter bags require replacement. The Contractor shall be responsible for sizing the treatment system to accommodate dewatering flow rates.
 - 2. In areas identified to potentially be impacted by petroleum hydrocarbon contamination, the extracted groundwater, subsequent to the filtering described above, shall be treated with granular activated carbon (GAC) prior to discharge. Following the bag filter filtration stage, the groundwater shall be pumped through a minimum of two, 1,000-pound GAC vessels connected in series. The GAC vessel treatment system shall include sampling ports upstream and downstream of each vessel to allow for water sampling to determine when "break-through" has occurred in each vessel. The Contractor shall be responsible for sizing the treatment system to accommodate dewatering flow rates.
- B. Permit treatment obligations shall supersede the above listed minimum requirements.
- C. Monitoring reports shall be promptly submitted to the Owner.
- D. The Contractor shall bear all costs associated with discharge water sample collection and testing.
- E. The Contractor shall immediately notify the Owner upon noticing an exceedance of the effluent limits. The Contractor shall cooperate and assist the Owner in notifying the Regional Board within 24-hours of noticing the exceedance. The Contractor shall provide to the Owner, a detailed statement of the actions undertaken or proposed that will bring the discharge into full compliance with the requirements and submit a timetable for correction. Such information shall be provided to allow the Owner to submit it to the Regional Board within 14 days of
SECTION 02140 – DEWATERING

the exceedance observation. Contractor is responsible for reimbursing any direct costs the Owner accumulates as a result of effluent limit exceedance.

3.4 ABANDONMENT OF DEWATERING WELLS

A. The Contractor shall add 3/4-inch maximum size crushed rock to the annular space around the well casing while the casing is being pulled out. The crushed rock shall conform to the requirements of the Standard Specifications. The crushed rock shall be added up to a depth, which is approximately 15 feet below the ground surface at which point a 10-foot thick impervious layer is to be poured. The remaining 5 feet shall be select fill backfill compacted to 95 percent relative compaction. The impervious layer can be bentonite clay, cement slurry, or sandcement grout.

END OF SECTION

PART 1 – GENERAL

1.1 WORK OF THIS SECTION

- A. The work of this Section includes support of temporary open excavations by means of sheet pilings, soldier piles and lagging, structural steel walls and struts, liner plates, and timber. The Contractor shall be responsible for the design and selection of methods in conformance with the design criteria as specified herein.
- B. The work of this Section applies to temporary excavation support systems for demolition, and installation of buried pipelines, and boring and receiving shaft or pits.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 02140 Dewatering
- C. Section 02200 Earthwork
- D. Section 05120 Miscellaneous Metalwork

1.3 **REFERENCE SPECIFICATIONS, CODES AND STANDARDS**

- A. Except as otherwise indicated, the current editions of the following standards apply to the Work of this section:
 - 1. ASTM A36 Standard Specification for Carbon Structural Steel
 - 2. ASTM A328 Standard Specification for Steel Sheet Piling

1.4 CONTRACTOR SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300:
 - 1. The proposed excavation support system for each construction component where excavation support systems will be used.
 - 2. Arrangement and details for each excavation support system, supporting design calculations, and construction methods to be used for the installation of each system.
 - 3. Soldier pile installation methods, connection details, bracing preloading, and jacking procedures.
 - 4. Depths below the main excavation bottom elevation to which the support system will be installed.
 - 5. Elevations of ground surface, struts, and shores, as applicable.

- 6. Permissible depth to which excavation may be carried before supports must be installed and preloaded.
- 7. Full excavation depth load to be carried by various support system members.
- 8. Bracing loads for various stages of excavation, bracing removal, and concrete placement.
- 9. Preloads as required.
- 10. Proposed sequence of strut and shore removal as applicable and as related to concrete placement and backfilling operations.
- B. The above Shop Drawings shall be coordinated with other shop drawing submittals for work specified elsewhere in which support of excavation is required.
- C. The proposed method of installing sheet piling including sequence of installation, template, and equipment description.
- D. Contingency plan for alternative procedures to be implemented if the excavation support system is found to perform unfavorably.

1.5 QUALITY ASSURANCE

A. Support of excavation shall be designed, and Shop Drawings and calculations stamped and signed, by a Professional Engineer, licensed to practice in the State of California and experienced in the design of excavation support systems. All design drawings and calculations shall be checked and initialed by a checker.

1.6 DESIGN CRITERIA

- A. Shop Drawings with supporting calculations for the various excavation support systems shall be prepared in accordance with the following criteria:
 - 1. Design the excavation support system and all components to support the earth pressures, unrelieved hydrostatic pressures, utility loads, equipment, traffic, and construction loads including impact, and other surcharge loads in such manner as will allow the safe and expeditious construction of the permanent structures, to minimize ground movement or settlement, and to prevent damage to or movement of adjacent buildings, structures, roadways and utilities.
 - 2. Design support members to resist the maximum loads expected to occur during the excavation and support removal stages.
 - 3. Design for staged removal shall conform to construction concrete placement, and backfill sequence shown. Design shall consider provisions

SECTION 02160 – EXCAVATION SUPPORT SYSTEMS

for future construction, and limits on bracing level elevations as shown on the plans.

- 4. Maximum vertical center-to-center spacing of supports shall be 16 feet between top 2 support levels and 12 feet below second support level unless otherwise approved. If decking beams are not required, install the uppermost bracing tier at a vertical distance of not more than 6 feet below the top of excavation.
- 5. Where water flows from the face of excavation, the maximum height of unsupported excavation shall not exceed 15 inches.
- 6. In running sand and silt, provide positive means for securing timber lagging to the soldier piles to avoid shifting or falling off of the lagging, and positive means for containing such material behind lagging.
- 7. Review of the Contractor's Shop Drawings and methods of construction by the Construction Manager does not relieve the Contractor of responsibility for the adequacy of the excavation support systems.
- 8. No portion of the excavation support system's vertical face will be permitted to penetrate the design lines as indicated on the Drawings for the permanent concrete structure to be constructed within the excavation.
- 9. Vertical support capacity shall be provided for wall systems and internal bracing elements, for loads due to vertical force components of tieback anchors, the weight of the structural systems themselves, and live load on any portion of the system.
- B. Steel Components:
 - 1. Design and fabrication of steel components shall be as specified in Section 05120.
- C. Timber Support Systems and Members:
 - 1. Basis for determination of minimum allowable working stress: UBC Chapter 25.
 - 2. The minimum thickness of timber lagging between soldier piles spaced 5 to 7 feet center-to-center shall be 3 inches for excavations up to 25 feet in depth, and 4 inches for excavations deeper than 25 feet.
 - 3. For other conditions and types of lagging, design calculations shall be submitted.

1.7 SAFETY

A. Except as otherwise indicted, the following codes apply to the work of this Section:

SECTION 02160 – EXCAVATION SUPPORT SYSTEMS

1. Title 8, California Administrative Code, Chapter 4, Subchapter 4, Construction Safety Orders, Article 6, Excavations, Trenches, Earthwork, Section 1542, Shafts.

1.8 **PROJECT CONDITIONS**

- A. Utility agencies shall be notified and caution exercised while exposing utility facilities by hand or other methods approved by utility owner.
- B. If existing utility facilities interfere with the proposed method of support, the method shall be modified in a manner that will protect the facility and accommodate the proposed work. Shop Drawings shall be revised and resubmitted along with design calculations required to account for the modified support method and to show the actual location of the existing utilities.
- C. Provisions shall be made for contingencies as follows:
 - 1. Monitor performance of support system components, for both vertical and horizontal movement, at regular intervals not to exceed 3 days.
 - 2. Provide contingency plan for alternative procedures to be implemented if unfavorable performance is evidenced.
 - 3. Keep on hand materials and equipment necessary to implement contingency plan.
- D. Elements of the support system shall not be spliced unless submitted to and approved by the Owner.

PART 2 – MATERIALS

2.1 MATERIALS

- A. Steel sheet piling shall be continuous interlocking type ASTM A 328 of appropriate shape and provided with at least one 2-1/2-inch-diameter handling hole on the centerline of the web located at least 6 inches from each end of the sheet pile.
- B. Fabricated connections and accessories, steel H-piles, WF shapes, and other structural steel shall conform to the requirements of ASTM A 36, unless otherwise approved.
- C. Concrete shall be as specified below:
 - 1. For encasement of steel soldier piles below the final level of excavation, 2,500 psi shall be used.
 - 2. For encasement of soldier piles above the final level of excavation, lean concrete shall be used, the strength of which shall be adequate to protect the excavated faces of the augured hole.

SECTION 02160 – EXCAVATION SUPPORT SYSTEMS

- D. Wood lagging shall be dimension lumber with minimum allowable stress of 1100 psi.
 - 1. The stress grade of the lagging shall be in conformance with the allowable stresses of the UBC, Chapter 25.
 - 2. Lumber shall be grade marked by WWPA or WCLIB with species and grade conforming to those shown on approved Shop Drawings.

PART 3 – EXECUTION

3.1 GENERAL

- A. The support system shall extend the main excavation bottom elevation to a depth adequate to prevent lateral movement and to adequately support applied vertical loads. In areas where additional excavation is required below the main excavation subgrade provisions shall be made to prevent movement of main excavation supports. Damage to existing utilities during installation of excavation support system shall be avoided.
- B. Water control measures shall be provided in accordance with the requirements specified in Section 02140.

3.2 SOLDIER PILES

- A. Soldier piles shall be installed by preboring or other approved pre-excavation methods to tip elevation shown on approved Shop Drawings. Prevent prebored or other pre-excavated holes from collapsing.
- B. Prebored hole shall be filled with lean concrete from bottom of hole to subgrade dependent upon analysis of vertical support requirements.
- C. Remaining pile length shall be filled with lean concrete, completely encasing the pile.
- D. Concrete shall be placed from the bottom of the hole upwards by means of a flexible pipe connected to a hopper.

3.3 SHEETING AND LAGGING

- A. Sheeting and lagging shall be installed with no gap between the boards unless specifically approved. As installation progresses, the voids between the excavation face and the lagging or sheeting shall be backfilled with sand or soil and rammed into place. Materials such as hay or burlap shall be used where necessary to allow drainage of groundwater without loss of soil or packing material. If gaps in the lagging are allowed, the gap width between lagging boards shall be limited to 1/2 inch maximum.
- B. If unstable material is encountered, suitable measures shall be taken to retain it in place or to otherwise prevent soil displacement.

- C. Extend lagging down to final subgrade.
- D. A sufficient quantity of material shall be on hand for sheeting, shoring, bracing, and other operations for protection of work and for use in case of accident or emergency.

3.4 STEEL SHEET PILING

- A. Steel sheet piling may be used only where existing subsurface conditions are suitable for installation of sheet piling to the full depth of penetration required, and to proper alignment and plumbness, specified herein, without damage to the sheet piling or rupture of its interlocks. The use of steel sheet piling will not be permitted where sheeting would be required to penetrate boulders, rock or other materials which may prevent the proper installation of sheet piling.
- B. Steel sheet piling shall be installed in plumb position with each pile interlocked with adjoining piles for its entire length so as to form a continuous diaphragm throughout the length of each run of wall, bearing tightly against original ground. Install sheeting to depth required for design. Exercise care during installation so that interlocking members can be extracted, if required, without injury to adjacent ground. The installation equipment shall be suitable to the type and nature of the subsurface materials anticipated to be encountered. The equipment and methods of installation, cutting, and splicing shall conform to the approved Shop Drawings.
- C. Liner plate shall be installed to proper line and grade and dimensions which will enable final liner to be placed in accordance with tolerances specified by the Engineer. Annular void, if present by method of ground support shall be filled with tunnel grout as specified by the Engineer.

3.5 INTERNAL BRACING SUPPORT SYSTEM

- A. All bracing support members shall be installed and maintained in tight contact with each other and with the surface being supported.
- B. Bracing members shall be preloaded by jacking the struts and shores in accordance with loads, methods, procedures, and sequence as described on the approved Shop Drawings. Coordinate excavation work with bracing installation and preloading. Use steel shims and steel wedges welded or bolted in place to maintain the preloading force in the bracing after release of the jacking equipment pressure. Use procedures so as to produce uniform bracing member loading without appreciable eccentricities, overstressing, or support member distortion.
- C. Struts shall be provided with intermediate bracing as needed to enable them to carry their maximum design load without distortion or buckling. Provide diagonal bracing as necessary to maintain the stability of the system. Web stiffeners, plates, or angles shall be provided as needed to prevent rotation, crippling, or buckling of connectors at points of bearing between structural steel members. Allow for eccentricities resulting from field fabrication and assembly.

D. Excavations shall be to a depth no more than 2 feet below the elevation of the support member about to be placed. The support member shall be installed and preloaded immediately after installation and prior to continuing excavation.

3.6 REMOVAL OF SUPPORT SYSTEMS

- A. Where removal is required wholly or in part, such removal shall be performed in a manner that will not disturb or damage adjacent new or existing construction or utilities. Fill all voids immediately with lean concrete, or other means approved by the Engineer.
- B. All elements of support systems shall be removed to a minimum depth of 6 feet below final ground surface. However, when a structure poured against the sheeting system extends above the 6-foot limit, removal of the sheeting system shall be to the top of the structure.
- C. All damage to property resulting from removal shall be promptly repaired at no cost to the Owner. The Construction Manager shall be the sole judge as to the extent and determination of the materials and methods for repair.

END OF SECTION

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PART 1 – GENERAL

1.1 DESCRIPTION

- A. The Work of this section includes all earthwork required for construction of the Work. Such earthwork shall include, but not be limited to, the loosening, removing, loading, transporting, depositing, and compacting in its temporary or final location of all materials wet and dry, as required for the purposes of completing the Work specified in the Contract Documents, which shall include, but not be limited to, the furnishing, placing, and removing of sheeting and bracing necessary to safely support the sides of all excavation; all pumping, ditching, draining, and other required measures for the removal or exclusion of water from excavation; the supporting of structures above and below the ground; all backfilling around structures and all backfilling of trenches and pits; the disposal of excess excavated materials; borrow of materials to make up deficiencies for fills; and all other incidental earthwork, all in accordance with the requirements of the Contract Documents.
- B. Where there are any discrepancies between this section and the geotechnical investigation report, the requirements and recommendations set forth in the project geotechnical investigation report shall govern.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 01500 Construction Facilities and Temporary Controls
- C. Section 02140 Dewatering
- D. Section 02160 Excavation Support Systems
- E. Section 02200 Earthwork OMWD Standard Specification
- F. Section 02270 Temporary Soil Erosion and Sediment Control
- G. Section 02223 Trenching, Backfilling, and Compacting

1.3 SUBMITTALS

- A. Excavation Plans
 - 1. The Contractor's attention is directed to the provisions for "Shoring and Bracing Drawings" in Section 6705 of the California Labor Code. The Contractor, prior to beginning any trench or structure excavation 5 feet deep or over shall submit to the Owner and shall be in receipt of the Owner's written acceptance of the Contractor's detailed plan showing design of all shoring, bracing, sloping of the sides of excavation, or other provisions for worker protection against the hazard of caving ground during the excavation of such trenches or structure excavation. The plans shall be prepared by a civil or structural engineer licensed in the State of California.

- 2. As a part of the plan, a note shall be included stating that the registered civil or structural engineer certifies that the plan complies with the CALOSHA Construction Safety Orders. If, however, the plan does not comply with the Safety Orders, the plan shall include a note stating that the registered civil or structural engineer certifies that the plan is not less effective than the shoring, bracing, sloping, or other provisions of the Safety Orders. Each copy of the plan shall have an original seal and "wet" signature of a civil or structural engineer registered in the State of California across the seal.
- 3. Nothing contained in this section 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.
- 4. Nothing contained in this section 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; to familiarize himself with all the 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 site; to perform any 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.
- B. Samples of backfill materials shall be submitted for testing.
- C. A list and description of compaction equipment intended for use by the Contractor shall be submitted to the Engineer for approval in accordance with the requirements of this section.

1.4 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

- A. Without limiting the generality of other requirements of the Contract Documents, all Work specified herein shall conform to the local Grading Ordinances and Codes of the City and County of San Diego, Chapter 70 of the Uniform Building Code, or exceed the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of this section.
 - 1. Commercial Standards:

ASTM D 422	Standard Test Method for Particle-Size Analysis of Soils.
ASTM D 1140	Standard Test Methods for Amount of Material in Soils Finer than the No. 200 (75-um) Sieve.
ASTM D 1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

ASTM D 1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³)		
ASTM D 1633	Standard Test Method for Compressive Strength of Molded Soil-Cement Cylinders.		
ASTM D 2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.		
ASTM D 2487	Standard Classification of Soils for Engineering Purposes. (Unified Soil Classification System)		
ASTM D 2901	Standard Test Method for Cement Content of Freshly Mixed Soil-Cement.		
ASTM D 4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.		
ASTM D 3017	Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).		
ASTM D 2922	Standard Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods. (Shallow Depth).		
AASHTO T 224	Correction for Coarse Particles in the Soil Compaction Test.		

2. <u>Agency Standards</u>:

OMWD Standard Specification Section 02200

County of San Diego Grading Ordinance

1.5 QUALITY ASSURANCE

- A. General: All soils testing will be done by a testing laboratory under contract with the Owner.
- B. Field density in-place tests will be performed in accordance with ASTM D 1556, or by such other means acceptable to the Engineer.
- C. In case the tests of the fill or backfill show non-compliance with the required density, the Contractor shall accomplish such remedy as may be required to ensure compliance. Subsequent testing to show compliance shall be by a testing laboratory selected by the Owner and shall be at the Contractor's expense.
- D. Particle size analysis of soils and aggregates will be performed using ASTM D 422.

- E. Determination of sand equivalent value will be performed using ASTM D 2419.
- F. Unified Soil Classification System: References in these Contract Documents to soil classification type and standards are set forth in ASTM D 2487 shall have the meanings and definitions indicated in the unified soil classification system. The Contractor shall be bound by all applicable provisions of said ASTM D 2487 in the interpretation of soil classifications.

1.6 TESTING FOR COMPACTION

- A. The Owner will perform testing as described elsewhere in the specifications.
- B. "Relative compaction" is the ratio, expressed as a percentage, of the in place dry density to the laboratory maximum dry density.

1.7 WATER FOR CONSTRUCTION

A. Water shall be obtained in accordance with Section 01500.

PART 2 – MATERIALS

2.1 IMPORTED MATERIAL

- A. Imported material shall not contain rocks or lumps greater than 4 inches in maximum dimension or organic debris. Imported materials shall have an expansion index of 30 or less. A Registered and Licensed Geotechnical Engineer shall inspect and test proposed imported materials before they are brought to the site. Backfill shall be placed in lifts 8 inches or less in loose thickness, moisture conditioned to optimum moisture content, and compacted to a minimum of 90% relative compaction. The upper 12 inches of soil beneath subgrade for roadways shall be compacted to at least 95% relative compaction.
- B. Unclassified material shall conform to SSPWC Subsection 300-4.

2.2 WATER FOR COMPACTION

A. Water used in compaction shall have a maximum chloride concentration of 500 mg/l, a maximum sulfate concentration of 500 mg/l, and shall have a pH of 7.0 to 9.0. Water shall be free of acid, alkali, or organic materials. Salt water will not be allowed.

PART 3 – EXECUTION

3.1 GENERAL

A. The Contractor shall perform earthwork as necessary to complete the Work as shown on the Contract Drawings and specified herein. The Contractor shall take the necessary precautionary measures to prevent dust or other nuisances which might be created by reason of his activities. The necessary precautionary measures shall at a minimum conform to the requirements of SSPWC Subsection 7-8. The requirements specified in Subsection 7-8 shall be extended to include

paved surfaces. If in the opinion of the Engineer adequate site maintenance measures per SSPWC Subsection 7-8 are not being provided, the Contractor shall alter the work process or make necessary changes for compliance at no additional cost to the Owner.

B. Pursuant to California Code of Regulations, Title 8, Section 1541, at least two working days before the start of excavation, the Contractor shall notify the Regional Notification Center and known owners of underground facilities in the area who are not members of the Regional Notification Center of the proposed excavation.

3.2 SITE PREPARATION

A. Prior to excavation, clear the existing ground surface at the work site.

3.3 PREPARATION OF SUBGRADE SOILS

- A. Keyways shall be established beneath the toes of fill slopes and as indicated on the Drawings. The keyways shall extend to at least 3 feet into rock below the toes of the slopes, and shall be sloped back into the hillside at a minimum gradient of 2 percent. Keyways shall be at least 10 feet wide. Horizontal benches shall be cut into the natural materials as new fill is placed on slopes that are steeper than 5:1 (horizontal:vertical). The benches shall have a minimum width of 3 feet.
- B. Subdrains shall consist of 4-inch diameter perforated pipe surrounded by 1 cubic foot per lineal foot of free draining crushed rock enclosed in a suitable drainage fabric and shall be placed at the back of the lowest keyway.
- C. Final fill slopes shall not be steeper than 2:1. Final slopes shall be constructed of granular materials that are not susceptible to erosion. Fill shall be placed in lifts 8 inches or less in loose thickness, moisture conditioned to optimum moisture content and compacted to 90% relative compaction based on the ASTM D 1557 laboratory test procedure. The upper 12 inches of subgrade for roadways and roadway surface materials, shall be compacted to 95% percent relative compaction.
- D. All excavation and compaction shall be checked by a Registered Licensed Geotechnical Engineer prior to installing asphalt concrete.

3.4 TEMPORARY TRENCH EXCAVATIONS

A. Excavated materials should not be stockpiled immediately above temporary excavation slopes.

3.5 TRENCH BACKFILL

A. Imported material, if used, shall not contain rocks or lumps greater than 4 inches in maximum dimension or organic debris. Imported materials shall have an expansion index of 30 or less. A Registered Licensed Geotechnical Engineer shall inspect and if needed, test proposed imported materials before they are brought to the site. Backfill material shall be placed in lifts of 8 inches or less in loose thickness, moisture content and compacted to minimum of 90 percent relative compaction. The upper

12 inches of soil beneath subgrade for roadways shall be compacted to a minimum of 95 percent relative compaction.

3.6 SITE PROTECTION

- A. Protection of the site during the period of grading shall be responsibility of the Contractor. Protect the work site from flooding, ponding, or inundation during site clearing, excavation, and grading in accordance with Section 02270.
- B. Following periods of rainfall, the Construction Manager will visually assess rain related damage. At the request of the Construction Manager, the Contractor shall make excavations in order to evaluate the extent of rain related damage.
- C. Rain related damage will be considered to include, but may not be limited to, erosion, sitting, saturation, swelling, structural distress and other adverse conditions identified by the Construction Manager.
- D. Where soil has been adversely affected by rain related damage, it shall be overexcavated and replaced with compacted fill or other remedial grading as directed by the Construction Manager.

3.7 DEWATERING

A. Provide dewatering as necessary in accordance with Section 02140.

3.8 EXCAVATION

- A. General: Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. Unless otherwise directed, the removal of said materials shall conform to the lines and grades shown. The Contractor shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations, and all pumping, ditching, or other measures for the removal or exclusion of water as required by Section 02140 Dewatering. Excavations shall be sloped or otherwise supported in a safe manner in accordance with the rules, orders, and regulations of the Division of Industrial Safety of the State of California.
- B. Unclassified Excavation: Unclassified excavation shall consist of all excavation, including roadways, unless separately designated.
 - 1. Unsuitable material shall be excavated and disposed of in accordance with the requirements of SSPWC Subsection 300-2.2.
 - 2. Wet material, if unsatisfactory for the specified use on the project solely because of high moisture content, may be processed to reduce the moisture content, or may be required to be removed and replaced with suitable material in accordance with the requirements of SSPWC Subsection 300-2.2.2.

- 3. The removal and disposal of slide and slipout material shall be in accordance with SSPWC Subsection 300-2.4.
- 4. Excavation slopes shall be finished in conformance with the lines and grades shown, and in accordance with SSPWC Subsection 300-2.5.
- 5. Surplus material shall be legally disposed of off-site, and in accordance with SSPWC Subsection 300-2.6.
- C. Structure Excavation: Structure excavation shall consist of the removal of material for the construction of foundations for bridges, retaining walls, headwalls, culverts, buildings, or other structures, and shall be in accordance with SSPWC Subsection 300-3.
 - 1. Cofferdams for foundation construction shall be constructed in accordance with SSPWC Subsection 300-3.2.
 - 2. The treatment of foundation material shall be in accordance with SSPWC Subsection 300-3.3.
- D. Underground Conduit Excavation:
 - 1. General: Excavation for underground conduits shall be in accordance with SSPWC Subsection 306-1.1 and the requirements contained herein. Unless otherwise shown or ordered, excavation for pipelines and utilities shall be open-cut trenches. Trench widths shall be kept as narrow as is practical for the method of pipe zone densification selected by the Contractor.
 - 2. Sheeting, Shoring, and Bracing of Excavations shall be in accordance with Section 02160.
 - 3. Trench Bottom: Except when pipe base is required, the bottom of the trench shall be excavated uniformly to the grade of the bottom of the pipe. The trench bottom shall be given a final trim, using a string line for establishing grade, such that each pipe section when first laid will be continually in contact with the ground along the extreme bottom of the pipe. Rounding out the trench to form a cradle for the pipe will not be required.
 - 4. The maximum length of open trench shall be per Section 02223.
 - 5. Trench Over-Excavation: Where the Drawings indicate that trenches shall be over-excavated, they shall be excavated to the depth required, and then backfilled to the grade of the bottom of the pipe.
- E. Over-Excavation Ordered by Engineer. Trenches shall be over-excavated beyond the depth shown when required by the Engineer. Such over-excavation shall be to the depth ordered by the Engineer. The over-excavation shall then be backfilled using 3/4-inch crushed rock underlain by an approved woven geotextile. The Contractor shall then place pipe base material over the crushed aggregate. All work specified in this Section shall be performed by the Contractor at no additional

cost to the Owner when the over-excavation ordered by the Engineer is within 6 inches of the limit shown on the Drawings. When the over-excavation ordered by the Engineer is 6 inches more than the limit shown on the Drawings, additional payment will be made to the Contractor for the portion that exceeds the said 6-inch distance.

- F. Over-Excavation not Ordered or Indicated: Any over-excavation carried below the grade ordered or indicated shall be backfilled to the required grade with material specified by the Engineer and the material shall be compacted. Such work shall be performed by the Contractor at no additional cost to the Owner.
- G. <u>Rock excavation</u>: Classified rock excavation is defined as removal of solid rock, within the specified or indicated excavation or trench limits only, in ledges, bedded deposits, or unstratified masses which by actual demonstration cannot be reasonably excavated with a 235 Caterpillar track mounted hoe equipped with a standard 9-1/2 ft stick, general duty rippers and rock points, in good condition, or similar approved equipment. The term "rock excavation" shall be understood to indicate a method of removal and not a geological formation. Boulders larger than ½ cubic yard will be classified as rock, if systematic drilling and blasting are required, and are actually utilized, for their removal. The demonstration may be waived if, in the Engineer's opinion, the material is obviously unrippable.

END OF SECTION

SECTION 02223 - TRENCHING, BACKFILLING, AND COMPACTING

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section includes materials, installation, and testing of trench excavation, backfilling, and compacting.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. OMWD Standard Drawings
- B. Section 01300 Record Drawings and Submittals
- C. Section 01500 Construction Facilities and temporary Controls
- D. Section 01545 Protection of the Work and Property
- E. Section 02140 Dewatering
- F. Section 02160 Excavation Support Systems
- G. Section 02200 Earthwork
- H. Section 02223 Trenching, Backfilling, and Compacting OMWD Standard Specification

1.3 EARTHWORK AND REPAIRS IN CITY, COUNTY, AND STATE RIGHTS OF WAY

A. Conform to the requirements and provisions of the permits issued by those agencies in addition to the requirements of these Specifications. If a permit is not required, earthwork and repairs shall conform to the standards of the agency in whose right of way the work is done in addition to the requirements of these Specifications.

1.4 SAFETY PRECAUTIONS

A. Observe safety precautions in all phases of the work. Included shall be trench shoring, bracing, lighting, and barricades as dictated by the Safety Orders of the Division of Industrial Safety, State of California (CAL/OSHA) and as directed by the Construction Manager. Acquire an exemption letter or trenching permit from the California Division of Industrial Safety (CAL/OSHA) and comply with Labor Code Section 6705, Excavation Plans For Worker Protection. Submit a copy of the exemption letter or trenching permit with excavation drawings to the District prior to excavation work.

1.5 OBSTRUCTIONS

A. The Contractor's attention is directed to the possible existence of pipe and other underground improvements which may or may not be shown on the Drawings. Preserve and protect any such improvements whether shown on the Drawings or not. Expose such improvements in advance of the pipeline construction to allow

SECTION 02223 – TRENCHING, BACKFILLING, AND COMPACTING

for changes in the alignment as necessary. Where it is necessary to remove and replace or to relocate such improvements in order to prosecute the work, they shall be removed, maintained, and permanently replaced by the Contractor at his expense. Protect existing underground utilities in accordance with Section 01545.

1.6 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01300.
- B. Submit a report from a testing laboratory verifying that imported material is asbestos-free and conforms to the specified gradations or characteristics.

1.7 TESTING FOR COMPACTION

- A. The District or the agency having jurisdiction over the area of the work will require the Contractor to test for compaction as described below.
- B. Determine the density of soil in place by the sand cone method, ASTM D 1556, or by nuclear methods, ASTM D 2922 and D 3017.
- C. Determine laboratory moisture-density relations of soils by ASTM D 1557.
- D. Determine the relative density of cohesionless soils by ASTM D 4253 and D 4254.
- E. Sample backfill materials by ASTM D 75.
- F. "Relative compaction" is the ratio, expressed as a percentage, of the inplace dry density to the laboratory maximum dry density.
- G. Make excavation for compaction tests at the locations and to the depths designated by the Construction Manager. Backfill and recompact the excavations at completion of testing. When tests indicate that the compaction is less than the specified relative compaction, rework and retest those areas until the specified relative compaction has been obtained.

1.8 PIPE BASE

A. The pipe base shall be defined as a layer of material immediately below the bottom of the pipe and extending over the full trench width in which the pipe is bedded. Thickness of pipe base shall be a minimum of 6 inches.

1.9 PIPE ZONE

A. The pipe zone shall include the full width of trench from the bottom of the pipe to a horizontal level 12 inches above the top of the pipe. Where multiple pipes are placed in the same trench, the pipe zone shall extend from the bottom of the lowest pipe to a horizontal level 12 inches above the top of the highest or topmost pipe.

1.10 TRENCH ZONE

SECTION 02223 – TRENCHING, BACKFILLING, AND COMPACTING

A. The trench zone includes the portion of the trench from the top of the pipe zone to the bottom of the pavement zone or to the existing surface in unpaved areas.

1.11 PAVEMENT ZONE

A. The pavement zone includes the asphalt concrete and aggregate base pavement section placed over the trench backfill.

1.12 WATER FOR CONSTRUCTION

A. See Section 01500 for requirements of water for construction.

1.13 REGIONAL NOTIFICATION CENTER CONTACT

- A. The Contractor, 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 surfacesor with marking such as flags or stakes in unpaved areas. The Contractor shall provide the regional notification center with all job site location information. The reginal 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.
- B. 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).

PART 2 – MATERIALS

2.1 NATIVE EARTH BACKFILL - TRENCH ZONE

A. Native earth backfill used above the pipe zone shall be excavated fine grained materials or loose soil free of asbestos, organic matter, roots, debris, rocks larger than 6 inches in diameter, clods, clay balls, broken pavement, and other deleterious materials. Backfill material shall be so graded that at least 40% of the material passes a No. 4 sieve. The coarser materials shall be well distributed throughout the finer material. Backfill materials that are obtained from trench excavated materials to the extent such material is available is generally acceptable provided that the above requirements are met. Under no circumstances will native earth backfill be allowed or used in the pipe base or pipe zone areas.

2.2 IMPORTED MATERIAL FOR BACKFILL - TRENCH ZONE

A. Imported material shall conform to that specified for native earth backfill or imported sand.

SECTION 02223 - TRENCHING, BACKFILLING, AND COMPACTING

2.3 IMPORTED SAND - PIPE BASE AND PIPE ZONE

A. Imported sand used in the pipe base and pipe zone shall consist of natural or manufactured granular material, or a combination thereof, free of deleterious amounts of organic material, mica, loam, clay, and other substances. Under no circumstances will decomposed granite or native earth backfill be allowed or used in the pipe base or pipe zone areas. Imported sand shall have the following gradation or similar:

Sieve Size	Percent Passing By Weight	
3/8-inch	100	
No. 4	75 - 100	
No. 30	12 - 50	
No. 100	5 - 20	
No. 200	0 - 15	

B. Imported sand shall have a coefficient of permeability greater than 0.014 measured in accordance with ASTM D2434 or a minimum sand equivalent of 30 per ASTM D2419. Imported sand shall have a saturated resistivity greater than 1,000 ohm-cm, a neutral pH, and chlorides less than 100 ppm.

2.4 ROCK REFILL FOR FOUNDATION STABILIZATION

A. Rock refill shall be crushed or natural rock having the following gradation:

Sieve Size	Percent Passing By Weight	
3 inches	100	
1-1/2 inches 3/4-inch	70 - 100 60 - 100	
No. 4	25 - 55	
No. 30	10 - 30	
No. 200	0 - 15	

2.5 GRANULAR MATERIAL FOR STRUCTURAL BACKFILL

A. Granular material for structural backfill shall be free of asbestos, organic materials, clay balls, and shall have the following gradation:

Sieve Size	Percent Passing By Weight	
3/4-inch 1/2-inch	100 95 - 100	
3/8-inch	50 - 100	
No. 4	20 - 65	

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No. 8	10 - 40
No. 40	0 - 20
No. 200	0 - 5

- B. Whenever the phrase "structural backfill material" is used in these Specifications, it shall mean granular material for structural backfill as described above.
- C. Excavated material may be used for structural backfill provided it conforms to the requirements for structural backfill material as stated herein.

2.6 CONCRETE FOR BELOW GROUND INSTALLATIONS

- A. Concrete for anchors, collars, cradles, encasements, supports, and thrust blocks shall be Class A for reinforced items and Class C for unreinforced items per Section 03000, except use rapid set concrete mix where indicated.
- B. Provide anchor blocks at valves in pipe having rubber gasket bell and spigot or unrestrained mechanical joints.
- C. Provide support blocks at valves in ductile iron pipe or steel pipe.

2.7 WATER FOR COMPACTION

A. Water used in compaction shall have a maximum chloride concentration of 500 mg/l, a maximum sulfate concentration of 500 mg/l, and shall have a pH of 7.0 to 9.0. Water shall be free of acid, alkali, or organic materials injurious to the pipe or coatings. Salt water will not be allowed.

PART 3 – EXECUTION

3.1 COMPACTION REQUIREMENTS

- A. Unless otherwise shown on the Drawings, otherwise described in the Specifications or required by the agency having jurisdiction over the area of the work, relative compaction in pipe trenches shall be a minimum as follows:
 - 1. Pipe base--90% relative compaction.
 - 2. Pipe zone--90% relative compaction.
 - 3. Backfill above pipe zone not beneath paving--90% relative compaction.
 - 4. Backfill above pipe zone in paved areas--95% relative compaction.
 - 5. Rock refill for foundation stabilization--80% relative density.
 - 6. Imported sand refill for overexcavation--90% relative compaction.

3.2 SHEETING, SHORING, AND BRACING OF TRENCHES

SECTION 02223 – TRENCHING, BACKFILLING, AND COMPACTING

A. Sheeting, shoring and bracing of trenches shall be in accordance with Section 02160.

3.3 SIDEWALK, PAVEMENT, AND CURB REMOVAL

A. Cut and remove bituminous and concrete pavements regardless of the thickness, and curbs and sidewalks prior to excavation of the trenches with a pavement saw, hydrohammer, or pneumatic pavement cutter. Width of the pavement cut shall be at least equal to the required width of the trench at ground surface. Haul pavement and concrete materials from the site. Do not use for trench backfill.

3.4 DEWATERING

Dewatering shall be in accordance with Section 02140.

3.5 MATERIAL REPLACEMENT

A. Remove and replace any trenching and backfilling material which does not meet the Specifications, at the Contractor's expense.

3.6 TRENCH WIDTHS

A. Pipe trench widths in the pipe zone for water pipelines will be limited as follows:

Pipe Diameter	Minimum Trench Width	Maximum Trench Width
1" through 8"	O.D. + 12"	O.D. + 18"
10" through 16"	O.D. + 16"	O.D. + 24"
18" through 24"	O.D. + 20"	O.D. + 36"
27" through 36"	O.D. + 24"	O.D. + 48"

- B. Trench width at the top of the trench will not be limited except where width of excavation would undercut adjacent structures and footings. In such case, width of trench shall be such that there is at least 2 feet between the top edge of the trench and the structure or footing. Where shoring or encasement is required, trench widths shall be increased accordingly.
- C. Pipe trench widths for sewer pipelines shall be the sewer pipe outside diameter plus 12 inches minimum and 16 inches maximum.

3.7 TRENCH EXCAVATION

- A. Perform all excavation regardless of the type, nature, or condition of the material encountered to accomplish the construction. Do not operate excavation equipment within 5 feet of existing structures or newly completed construction. Excavate with hand tools in these areas.
- B. Excavate the trench to the lines and grades shown on the Drawings with allowance for pipe thickness, sheeting and shoring if used, and for pipe base. If the trench is excavated below the required subgrade, refill any part of the trench excavated

SECTION 02223 – TRENCHING, BACKFILLING, AND COMPACTING

below the subgrade at no additional cost to the District with imported sand. Place the refilling material over the full width of trench in compacted layers not exceeding 6 inches deep to the established grade with allowance for the pipe base.

- C. Trench depth shall accommodate the pipe and the pipe base at the elevations shown in the profile on the Drawings. In the absence of such profile, the top of pipe shall be located 4 feet below the surface elevation of the centerline of the street or 3 feet below existing ground at the pipe location, whichever is lower.
- D. Construct trenches in rock by removing rock to a minimum of 6 inches below bottom of pipe and backfilling with imported sand.
- E. Where unsuitable materials, as determined during construction by the Engineer, are encountered near trench bottom levels, they shall be excavated to competent material, or to a depth of 24 inches below the bottom of the pipe, whichever is less, and replaced with compacted pipe bedding material as described elsewhere. The bottoms of the excavations shall be approved by the Engineer prior to placement of pipe bedding.

3.8 TRENCH EXCAVATION IN BACKFILL OR EMBANKMENT AREAS

Construct trench excavation for pipe or pipes in backfill or embankment areas in accordance with one of the following procedures:

- A. Construct and compact the embankment to an elevation of 1-foot minimum over the top of the largest pipe to be installed. Excavate trench in the compacted embankment. Place pipe base material, install pipe, and backfill with pipe zone material. Construct embankment as specified in Section 02200.
- B. Excavate trench in the completed backfill or embankment. Place pipe base material, install pipe, and backfill with pipe zone material. Place and compact backfill above the pipe zone to the same relative compaction as the adjacent embankment as specified in the Section 02200.

3.9 LOCATION OF EXCAVATED MATERIAL

- A. During trench excavation, place the excavated material only within the working area or within the areas shown on the Drawings. Do not obstruct any roadways or streets. Conform to federal, state, and local codes governing the safe loading of trenches with excavated material.
- B. Excavated materials shall not be placed immediately adjacent to open trenches.

3.10 LENGTH OF OPEN TRENCH

- A. Limit the length of open trench to the amount of pipe installed in one working day.
- B. Complete backfilling and temporary or first layer paving not more than 120 feet in the rear of pipelaying.

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- C. Where pipelines are located beneath or adjacent to existing paved roads, backfill all trenches at the end of each workday and place temporary or first layer of paving. Clean all new and adjacent existing paved surfaces of residual excavated and backfill materials. Perform dust control operations in these areas with a brush or vacuum type mobile street sweeper. Where it is necessary to leave a trench open (i.e. in order for a thrust block to cure) trenches shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic. The top of the steel plates shall be set flush with the top of the adjacent pavement, and the plates shall be surfaced for improved vehicular traction. The above requirements for backfilling or use of steel plate will be waived in cases where the trench is located further than 100-feet from any traveled roadway or occupied structure. In such cases, however, the Contractor shall provide and maintain barricades and warning lights conforming to requirements set forth in the California Department of Transportation Traffic Manual.
- D. Where open trenches are not required to be backfilled at the end of the day per the Specifications or Drawings, but in the opinion of the Construction Manager pose a hazard to the public, the trench shall be surrounded with temporary chain link fence panels or be backfilled.
- E. Provide ingress and egress to buildings and property at all times. Provide steel covering for vehicular access.

3.11 FOUNDATION STABILIZATION

Α. After the required excavation has been completed, the Construction Manager will inspect the exposed subgrade to determine the need for any additional excavation. It is the intent that additional excavation be conducted in all areas within the influence of the pipeline where unacceptable materials such as soft, spongy or deleterious materials exist at the exposed grade. Overexcavation shall include the removal of all such unacceptable material that exists directly beneath the pipeline to a minimum width equal to the maximum trench width and to a depth determined by the Construction Manager. Backfill the trench to the established subgrade of the pipe base with rock refill material for foundation stabilization. Place the foundation stabilization material over the full width of the trench and compact in layers not exceeding 6 inches deep to the required grade. Place imported sand on the compacted foundation stabilization and apply water to wash the sand into the voids of the rock refill material. Continue this procedure until the voids of the rock refill have been filled with imported sand. Do not apply water in such quantities that it will damage the integrity of the foundation stabilization. Rock refill material and imported sand may be placed and compacted at the same time.

3.12 CONCRETE FOR BELOW GROUND INSTALLATIONS

A. Encase pipe with concrete to the line and dimensions indicated or place concrete between the undisturbed ground and the pipe or fittings to be restrained or supported. Quantity or bearing area of the concrete against undisturbed ground shall be as shown on the Standard Drawings, Drawings, or as directed by the Engineer. Provide temporary support on the pipe, fittings, or valves until the concrete has obtained a 3-day cure. Place concrete such that the pipe joints, fittings, or valves are accessible for repairs. Spade or rod the concrete during

SECTION 02223 – TRENCHING, BACKFILLING, AND COMPACTING

placement to eliminate honeycombing. Backfilling of the trench adjacent to the concrete will not be allowed until the concrete has cured for at least 3 days. Allow concrete to cure for at least 7 days prior to subjecting the concrete to pipeline pressure. Where rapid set concrete mix has been used, the 3-day and 7-day cure time is not required. Backfill the rapid set concrete mix as soon as the concrete is hard (approximately one to two hours) and place pipeline into service.

3.13 TRENCH BACKFILLING

- A. Place the specified thickness of pipe base material (imported sand) over the full width of trench and compact to the specified relative compaction. Grade the top of the pipe base ahead of the pipelaying to provide firm, continuous, uniform support along the full length of the trench for the pipe, fittings, and valves.
- B. Excavate bell holes at each joint to permit proper assembly and inspection of the entire joint. Fill and compact the area excavated for the joints with the pipe base material.
- C. After the pipeline has been bedded and the cement mortar used in the exterior joints has set hard, place pipe zone material (imported sand) simultaneously on both sides of the pipe, fittings, and valves, keeping the level of backfill the same on each side. Carefully place the material around the pipe so that the pipe barrel is completely supported and that no voids or uncompacted areas are left beneath the pipe. Use particular care in placing material on the underside of the pipe to prevent lateral movement during subsequent backfilling. Do not drop sharp, heavy pieces of material directly onto the pipe or the tamped material around the pipe.
- D. Compact imported sand in the pipe zone by hand tamping only. Care shall be exercised in backfilling to avoid damage to pipe coatings and polyethylene encasement.
- E. Push the native earth backfill or imported material for backfill carefully onto the imported sand previously placed in the pipe zone. Do not permit free fall of the material until at least 2 feet of cover is provided over the top of the pipe. Compact backfill material in the trench zone to the specified relative compaction by mechanical compaction or hand tamping.
- F. Place and compact imported sand in the pipe zone in layers not exceeding 12 inches of compacted thickness. Place and compact native earth or imported material for backfill in the trench zone in layers not exceeding 6 inches of compacted thickness.

3.14 MECHANICAL COMPACTION OR HAND TAMPING

A. Place imported sand and backfill materials in uniform layers of the indicated thickness. Compact each layer to the required minimum relative compaction at the optimum moisture content. Do not use heavy duty compaction equipment with an overall weight in excess of 125 pounds until backfill has been completed to a depth of 2 feet over the top of pipe. Do not use high impact hammer type equipment except where the pipe manufacturer warrants in writing that such use will not damage the pipe.

3.15 DISPOSAL OF EXCESS EXCAVATED MATERIAL

A. Legally dispose of excess excavated material offsite. Contractor shall make his own arrangements for the disposal of the excess material and bear all costs incidental to such disposal.

3.16 FINAL CLEAN-UP

- A. After backfilling, grade the right-of-way to the contours of the original ground and match the adjacent undisturbed ground. Make surfaces free of all cleared vegetation, rubbish and other construction wastes. Dispose of all excavated or surface rocks and lumps which cannot be readily covered by spreading.
- B. Replace in kind street improvements, such as curbs and gutters, barricades, fences, signs, etcetera that are cut, removed, damaged, or otherwise disturbed by the construction.

END OF SECTION

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PART 1 – GENERAL

1.1 **DESCRIPTION**

- A. The Contractor shall be fully responsible for implementing a complete temporary erosion and sedimentation control program for all earthwork, trenching, clearing and grubbing operations. This includes but is not limited to SWPPP preparation.
- B. Erosion and sediment control plans have not been prepared for this project. The Contractor shall prepare its own project-specific Storm Water Pollution Prevention Plan (SWPPP); however, in no case shall these plans be considered as the complete erosion and sediment control program and SWPPP. The Contractor shall prepare its SWPPP consistent with how it intends to manage the site and comply with all applicable requirements of the local jurisdictional agency requirements, and applicable of the National Pollutant Discharge Elimination System (NPDES) permit(s) that are issued by the Regional Water Quality Control Board.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 00810 Special Provisions
- B. Section 02050 Demolition
- C. Section 02200 Earthwork
- D. Section 02223 Trenching, Backfilling, and Compacting

1.3 SUBMITTALS

A. Manufacturers' catalog data and samples on materials used for erosion and sedimentation control characteristics, application, and installation instructions.

PART 2 – MATERIALS

2.1 MATERIALS

A. Provide gravel bags, fiber rolls, erosion control blankets, silt fences, desilting basins, risers, and all other materials to control erosion and sedimentation in accordance with the SWPPP and as required for compliance with the NPDES permit.

PART 3 – EXECUTION

3.1 CONSTRUCTION

A. Construct and implement erosion control measures in accordance with the SWPPP and as described herein.

- B. Grade disturbed surfaces to provide positive drainage and prevent ponding of water. Surface water shall be controlled to prevent water damage or deposition of sediment to all adjoining and downstream properties.
- C. Install silt fences, desilting basins, risers, erosion control blankets, gravel bag dikes, stabilized construction entrances and any other erosion control measure to minimize sediment escape from the construction site and to maintain runoff quality in compliance with the NPDES Permit. Prevent construction sediment from entering any streams, ponds or drainage facilities.
- D. At a minimum, provide erosion and sedimentation control measures immediately following clearing and grubbing operations in the following locations:
 - 1. At the lowest end of areas disturbed by construction before runoff from storms can reach natural streams.
 - 2. At additional locations to control sedimentation as required by the Plans, SWPPP, and NPDES Permit.
- E. Erosion and sedimentation control measures shall remain in place until such time that the site of work is prepared for permanent drainage and erosion control measures.

3.2 MAINTENANCE

- A. Conduct site inspections of the erosion and sedimentation control measures prior to forecasted storm events and after the actual storm to evaluate the adequacy and effectiveness of such measures. Make and implement modifications as necessary to comply with the NPDES Permit. Submit inspection reports to the Engineer after each storm event. Include in the inspection reports at a minimum, the date of the inspection, the individual(s) who performed the inspection, the observations, and any modifications implemented. Post inspection schedules and reports within Contractor field office.
- B. Maintain sedimentation and erosion control measures, ensuring proper operation before, during, and after storm events. Remove sediment from desilting basins as required to ensure their proper operation.
- C. Repair all damaged erosion and sedimentation controls. Reinstate to finished condition any erosion damage within the construction area for the duration of the Contract.
- D. In accordance with the NPDES Permit, annually certify that the construction activity is in compliance with the requirements of the NPDES Permit. The certification shall be based upon the site inspections required above. The written certification shall be submitted to the Engineer. Immediately notify the Engineer in writing if it is determined, during the annual certification that the construction activity is not or has not been in compliance with any of the NPDES Permit requirements. The notification shall identify the type of noncompliance and include a time schedule when compliance will be achieved.

- E. Additional site inspections and/or sampling and analysis may be required at the request of the California Regional Water Quality Control Board, San Diego Region, or the Engineer.
- F. Materials used for sedimentation and erosion control measures shall be left in place and in working order at the time of acceptance by the District.

END OF SECTION

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PART 1 – GENERAL

1.1 DESCRIPTION

A. This section includes materials and installation of polyvinyl chloride (PVC) gravity sewer pipe for gravity sewer applications using the open cut construction method. Size range is 4-inch to 24-inch nominal size.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 02223 Trenching, Backfilling and Compacting

1.3 SUBMITTALS

- A. Submit shop drawings in accordance with Standard Specification Section 01300.
- B. Submit manufacturer's catalog data and descriptive literature for PVC conduit, pipe, fittings, solvent, and miscellaneous materials. Show dimensions and materials of construction by specification reference and grade.

1.4 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

- A. Except as otherwise indicated, the current editions of the following standards apply to the work of this section:
 - 1. ASTM D3034 Standard Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings
 - 2. ASTM F679 Standard Specification for Polyvinyl Chloride (PVC) large Diameter Plastic Gravity Sewer Pipe and Fittings
 - 3. ASTM F477 Standard Specification for Elastomeric Seals (Gaskets) for joining plastic pipe
 - 4. ASTM D3212 Standard Specification for joints for drain and sewer plastic pipes using flexible Elastomeric Seals

PART 2 – MATERIALS

2.1 PVC PIPE

A. PVC gravity sewer pipe shall conform to ASTM D 3034 for 4-inch to 15-inch nominal diameter sizes and ASTM F 679 for 18-inch to 24-inch nominal diameter sizes. Provide PVC pipe of the size and standard dimension ratio (SDR) as follows:

0-6 FT COVER: SDR 26 6-12 FT COVER: SDR 35 12+FT COVER: SDR 26

2.2 GASKETS

A. Gaskets shall be factory installed and conform to ASTM F 477.

2.3 JOINTS

A. Pipe and fitting joints shall conform to ASTM D 3212 and be gasket bell and spigot except where alternative methods are required.

PART 3 – EXECUTION

3.1 GENERAL

- A. Do not install PVC pipe when the temperature is below 40 degrees F or above 90 degrees F.
- B. Before installation, check pipe for cuts, scratches, gouges, buckling, kinking, or splitting on pipe ends. Remove any pipe section containing defects by cutting out the damaged section as a complete cylinder.

3.2 INSTALLATION

A. Do not drag PVC pipe over the ground, drop it into the ground, or drop objects on it. Cut pipe ends square and remove all burrs, chips, and filings before joining pipe or fittings. Bevel spigot pipe ends as recommended by the pipe manufacturer.

3.3 INSTALLING BURIED PIPE

- A. See Specification Section 02223 for earthwork requirements. Use imported sand in the pipe base and pipe zone.
- B. Remove foreign matter and dirt from inside of pipe and gasket area, and keep clean during and after laying.
- C. Check the gasket, making sure it is seated uniformly in the groove.
- D. Apply lubricant only to the bevel of the spigot end and approximately mid-way back to the stop line. Use only those lubricants supplied or approved by the pipe manufacturer.
- E. Grade the bottom of the trench to the line and grade to which the pipe is to be laid. Remove hard spots that would prevent a uniform thickness of pipe base material. Before laying the pipe, check the grade with a straightedge and correct any irregularities found.

3.4 INSPECTIONS AND TESTING

- A. Perform video inspection of all PVC gravity sewer pipe and provide for review to the Owner. If defects are found, contractor shall excavate, replace and backfill the pipe with no additional cost to the owner.
- B. Perform air pressure testing per Section 306-1.4.4 of the SSPWC.
- C. Perform all other tests as called for on drawings.

END OF SECTION

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PART 1 – GENERAL

1.1 DESCRIPTION

A. This section includes materials, testing, and installation of aggregate base course, prime coat, tack coat, asphalt concrete pavement, crack sealer, seal coat, striping and markers.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 – Record Drawings and Submittals

1.3 SUBMITTALS

A. Submit shop drawings in accordance with Section 01300. Included with the shop drawing submittal a report from a testing laboratory verifying that aggregate material is asbestos-free and conforms to the specified gradations or characteristics.

1.4 TESTING FOR COMPACTION

- A. The Owner will require the Contractor to test for compaction as described below.
- B. Determine the density of soil in place by the sand cone method, ASTM D 1556, or by nuclear methods, ASTM D 2922 and D 3017.
- C. Determine laboratory moisture-density relations of soils by ASTM D 1557.
- D. Determine the relative density of cohesionless soils by ASTM D 4253 and D 4254.
- E. Sample backfill materials by ASTM D 75.
- F. "Relative compaction" is the ratio, expressed as a percentage, of the inplace dry density to the laboratory maximum dry density.
- G. Compaction shall be deemed to comply with the Specifications when no more than one test of any three consecutive tests falls below the specified relative compaction. The one test shall be no more than three percentage points below the specified compaction. The Contractor shall pay the costs of any retesting of work not conforming to the Specifications.

PART 2 – MATERIALS

2.1 ASPHALT CONCRETE PAVING

A. Asphalt concrete paving shall conform to Type III-C2-PG 64-10 in accordance with SSPWC Section 203-1 and 400-4. Asphalt content in the pavement shall be 5.5% to 6.0%. Aggregate shall be asbestos-free.

SECTION 02743 – ASPHALT CONCRETE PAVING

2.2 AGGREGATE BASE COURSE

A. Base course materials shall conform to crushed aggregate base in accordance with SSPWC Section 200-2.2. Aggregate shall be asbestos-free.

2.3 PRIME COAT

A. All areas to be paved shall receive a prime coat. Prime coat shall conform to SC-70 slow curing liquid asphalt in accordance with SSPWC Section 203-2.

2.4 TACK COAT

A. When paving over existing pavement, a tack coat shall be applied. Tack coat shall conform to SS-1h slow setting emulsified asphalt in accordance with SSPWC Section 203-3.

2.5 FOG SEAL COAT

A. Seal coat shall conform to SS-1h slow setting emulsified asphalt in accordance with SSPWC Section 203-3.

2.6 PAINT FOR TRAFFIC STRIPING AND MARKINGS (NOT USED)

2.7 REFLECTIVE PAVEMENT MARKERS (NOT USED)

2.8 SEALING OF CRACKS

A. Cracks in existing AC pavement shall be sealed using a single component, selfleveling, hot applied sealant suitable for use in warm climates and meeting the requirements of ASTM D6690, Type 1, "Joint and Crack Sealants, Hot Applied for Concrete and Asphalt Pavements."

PART 3 – EXECUTION

3.1 PERMIT REQUIREMENTS

A. Comply with the ordinances, directives, and regulations of the respective agencies having jurisdiction over the area of the work. Pavement removal and replacement shall be in accordance with these Specifications and the issued permit.

3.2 PAVEMENT REMOVAL

- A. Initially cut asphalt concrete pavement with a pavement saw, hydrohammer, or pneumatic pavement cutter at the limits of the excavation and remove the pavement regardless of the thickness. After backfilling the excavation, saw cut asphalt concrete pavement to a minimum depth of 2 inches at a point not less than 9 inches outside the limits of the excavation or the previous pavement cut, whichever is greater, and remove the additional pavement.
- B. Saw cut concrete pavement, including cross gutters, curbs and gutters, sidewalks, and driveways, to a minimum depth of 1-1/2 inches at a point 1-foot beyond the edge of the excavation and remove the pavement. The concrete pavement may

SECTION 02743 – ASPHALT CONCRETE PAVING

initially be cut at the limits of the excavation by other methods prior to removal and then saw cut after backfilling the excavation. If the saw cut falls within 3 feet of a concrete joint or pavement edge, remove the concrete to the joint or edge.

- C. Make arrangements for and legally dispose of the removed pavement.
- D. Final pavement saw cuts shall be straight along both sides of trenches, parallel to the pipeline alignment, and provide clean, solid, vertical faces free from loose material. Saw cut and remove damaged or disturbed adjoining pavement. Saw cuts shall be parallel to the pipeline alignment or the roadway centerline or perpendicular to same.

3.3 PAVEMENT RESTORATION

A. All paved areas, including asphaltic concrete berms, cut or damaged during construction shall be replaced with similar materials and of equal thickness to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the Contract Documents or in the requirements of the agency issuing the permit. All temporary and permanent pavements shall conform to the requirements of the affected pavement owner. All pavements which are subject to partial removal shall be neatly saw cut in straight lines.

3.4 **PREPARATION OF SUBGRADE**

A. Over-excavate, dry, or moisten the soil as necessary to slightly above optimum moisture content, and compact to at least 90% relative compaction in the upper 12 inches. The underlying soils should be scarified, moisture conditioned, and compacted to at least 90 % in the upper 6 to 8 inches. The berm soils should be scarified, moisture conditioned, and compacted to at least 90% in the upper 6 to 8 inches. Remove all soft material disclosed by the compacting and replace with suitable material and recompact. The finished subgrade shall be within a tolerance of +/-0.08 of a foot and shall be smooth and free from irregularities and at the specified relative compaction. The subgrade shall be considered to extend over the full width of the base course.

3.5 PLACING AGGREGATE BASE COURSE

A. Aggregate base course shall be furnished, placed, and compacted in accordance with SSPWC Section 301-2. Aggregate base course thickness shall be as shown on the Drawings, or a minimum of 6 inches, whichever is greater. Compact aggregate base course to 95% relative compaction.

3.6 COMPACTION OF AGGREGATE BASE AND LEVELING COURSES

A. Compaction and rolling shall begin at the outer edges of the surfacing and continue toward the center. Apply water uniformly throughout the material to provide moisture for obtaining the specified compaction. Compact each layer to the specified relative compaction before placing the next layer.

SECTION 02743 – ASPHALT CONCRETE PAVING

3.7 PLACING PRIME COAT

A. Apply prime coat to the surface of the leveling course of aggregate base at the rate of 0.25 gallon per square yard in accordance with SSPWC Section 302-5.3.

3.8 PLACING TACK COAT

A. Apply tack coat on both horizontal and vertical surfaces to receive finish pavement in accordance with SSPWC Section 302-5.4.

3.9 PLACING ASPHALT PAVING

A. Asphalt paving shall be furnished, placed, compacted, and finished in accordance with SSPWC Section 302-5. Thickness of asphalt concrete paving shall be as shown on the plans, one-inch thicker than adjacent pavement sections, in accordance with the standards of the agency having jurisdiction over the area of the work, or to a minimum of 4 inches, whichever is greater. Apply seal coat to all paving.

3.10 COMPACTION OF ASPHALT CONCRETE PAVING

A. Compact asphalt concrete paving until roller marks are eliminated and a minimum density of 95% has been attained per ASTM D 2041.

3.11 SURFACE TOLERANCE

A. Finished grade shall not deviate more than 0.02 of a foot in elevation from the existing surface.

3.12 APPLYING SEAL COAT

A. Apply seal coat at the rate of 0.10 to 0.15 gallon per square yard and in accordance with SSPWC Section 302-8. After application, spread a cover coat of sand at the rate of 6 to 12 pounds per square yard. Remove excess sand after 5 days.

END OF SECTION

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The Work of this Section includes providing concrete formwork, bracing, shoring, and supports.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 03200 Reinforcement Steel
- B. Section 03290 Joints in Concrete Structures
- C. Section 03300 Cast-in-Place Structural Concrete
- D. Section 03315 Grout

1.3 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

- A. Except as otherwise indicated in this Section of the Specifications, the Contractor shall comply with the Standard Specifications for Public Works Construction (SSPWC), as specified in Section 01090.
- B. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:
 - PS 1 U.S. Product Standard for Concrete Forms, Class I.
 - ACI 117 Standard Tolerances for Concrete Construction and Materials
 - ACI 347 Recommended Practice for Concrete Formwork

1.4 SHOP DRAWINGS AND SAMPLES

- A. The following shall be submitted in compliance with Section 01300:
- B. Falsework Calculations and Drawings: The Contractor's attention is directed to the provisions of Section 1717 of the Division of Industrial Safety, Construction Safety Orders, as revised November 1973, which requires that all falsework or vertical shoring installations where the height of the falsework or vertical shoring, as measured from the top of the sills to the soffit of the superstructure, exceeds 14 feet, or where individual horizontal span lengths exceed 16 feet, or provision for vehicular or railroad traffic through falsework or vertical shoring is made, shall be approved and signed by a civil engineer, registered in the State of California; provided further, that a copy of the falsework plan or shoring layout shall be available on the job site at all times.
- C. Detailed plans of the falsework proposed to be used. Such plans shall be in sufficient detail to indicate the general layout, sizes of members, anticipated stresses, grade of materials to be used in the falsework, means of protecting existing construction which supports falsework, and typical soil conditions.

- D. Catalog information on:
 - 1. Form ties and all related accessories, including taper tie plugs, if taper ties are used.
 - 2. Form gaskets.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Materials for concrete forms and falsework shall conform to SSPWC Subsection 303-1.3 and the requirements herein.
- B. Except as otherwise expressly accepted, all lumber brought on the job site for use as forms, shoring, or bracing shall be new material. All forms shall be smooth surface forms and shall be of the following materials:

Walls	Steel or plywood panel
Columns	Steel, plywood, or fiber glass
Roof and floor	Plywood
All other work	Steel panels, plywood or tongue and groove lumber

C. Form materials which may remain or leave residues on or in the concrete shall be classified as acceptable for potable water use by the Environmental Protection Agency within 30 days of application or use.

2.2 FORM AND FALSEWORK MATERIALS

- A. Materials for concrete forms, formwork, and falsework shall conform to the following requirements:
 - 1. Lumber shall be Douglas Fir or Southern Pine, construction grade or better, in conformance with U.S. Product Standard PS20.
 - 2. Plywood for concrete formwork shall be new, waterproof, synthetic resin bonded, exterior type Douglas Fir or Southern Pine plywood manufactured especially for concrete formwork and shall conform to the requirements of PS 1 for Concrete Forms, Class I, and shall be edge sealed.
 - 3. Form materials shall be metal, wood, plywood, or other approved material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line, and grade shown. Metal forms shall be an approved type that will accomplish such results. Wood forms for surfaces to be painted shall be Medium Density Overlaid plywood, MDO Ext. Grade.
- B. Unless otherwise indicated, exterior corners in concrete members shall be provided with 3/4-inch chamfers. Re-entrant corners in concrete members shall not have fillets unless otherwise indicated.

C. Forms and falsework to support the roof and floor slabs shall be designed for the total dead load, plus a live load of 30 psf (minimum).

2.3 FORM TIES

- A. Form ties with integral waterstops shall be provided with a plastic cone or other suitable means for forming a conical hole to insure that the form tie may be broken off back of the face of the concrete. The maximum diameter of removable cones for rod ties, or of other removable form-tie fasteners having a circular cross-section, shall not exceed 1-1/2 inches; and all such fasteners shall be such as to leave holes of regular shape for reaming.
- B. Form ties for water-retaining structures shall have integral waterstops. Removable taper ties may be used when approved. A preformed neoprene or polyurethane tapered plug sized to seat at the center of the wall shall be inserted in the hole left by the removal of the taper tie.

2.4 MANUFACTURERS

- A. Products of the type indicated shall be manufactured by one of the following (or equal):
 - 1. Form Ties

Burke Penta - Tie System by the Burke Company Richmond Snap Tys by the Richmond Screw Anchor Company

2. Form ties with Integral Waterstops

Burke Taper - Tie System by the Burke Company Taper Ty by the Richmond Screw Anchor Company

PART 3 - EXECUTION

3.1 GENERAL

- A. Forms and falsework shall be designed and constructed in accordance with ACI 347 and SSPWC Subsections 303-1.3, 303-1.6, and 303-5.2, and the requirements herein, except that the submittal of detailed falsework will not be required.
- B. Tolerances: The variation from established grade or lines shall not exceed 1/4inch in 10 feet and there shall be no offsets or visible waviness in the finished surface. All other tolerances shall be within the tolerances of ACI 117.
- C. Forms to confine the concrete and shape it to the required lines shall be used wherever necessary. The Contractor shall assume full responsibility for the adequate design of all forms, and any forms which are unsafe or inadequate in any respect shall promptly be removed from the Work and replaced at the Contractor's expense. A sufficient number of forms of each kind shall be provided to permit the

SECTION 03100 - CONCRETE FORMWORK

required rate of progress to be maintained. The design and inspection of concrete forms, falsework, and shoring shall comply with applicable local, state and Federal regulations. Plumb and string lines shall be installed before concrete placement and shall be maintained during placement. Such lines shall be used by Contractor's personnel and by the Engineer and shall be in sufficient number and properly installed. During concrete placement, the Contractor shall continually monitor plumb and string line form positions and immediately correct deficiencies.

D. Concrete forms shall conform to the shape, lines, and dimensions of members as called for on the Drawings, and shall be substantial, free from surface defects, and sufficiently tight to prevent leakage. Forms shall be properly braced or tied together to maintain their position and shape under a load of freshly-placed concrete. If adequate foundation for shores cannot be secured, trussed supports shall be provided.

3.2 FORM DESIGN

All forms shall be true in every respect to the required shape and size, shall Α. conform to the established alignment and grade, and shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete. Suitable and effective means shall be provided on all forms for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete. Plywood, 5/8-inch and greater in thickness, may be fastened directly to studding if the studs are spaced close enough to prevent visible deflection marks in the concrete. The forms shall be tight so as to prevent the loss of water, cement and fines during placing and vibrating of the concrete. Specifically, the bottom of wall forms that rest on concrete footings or slabs shall be provided with a gasket to prevent loss of fines and paste during placement and vibration of concrete. Such gasket may be a 1- to 1-1/2-inch diameter polyethylene rod held in position to the underside of the wall form. Adequate clean-out holes shall be provided at the bottom of each lift of forms. The size, number, and location of such clean-outs shall be as acceptable to the Construction Manager. Whenever concrete cannot be placed from the top of a wall form in a manner that meets the requirements of the Contract Documents, form windows shall be provided in the size and spacing needed to allow placement of concrete to the requirements of Section 03300. The size, number, and location of such form windows shall be acceptable to the Construction Manager.

3.3 CONSTRUCTION

A. Vertical Surfaces: All vertical surfaces of concrete members shall be formed, except where placement of the concrete against the ground is shown. Not less than 1-inch of concrete shall be added to the thickness of the concrete member as shown where concrete is permitted to be placed against trimmed ground in lieu of forms. Such permission will be granted only for members of comparatively limited height and where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed.

SECTION 03100 - CONCRETE FORMWORK

- B. Construction Joints: Concrete construction joints will not be permitted at locations other than those shown or specified, except as may be acceptable to the Construction Manager. When a second lift is placed on hardened concrete, special precautions shall be taken in the way of the number, location, and tightening of ties at the top of the old lift and bottom of the new to prevent any unsatisfactory affect whatsoever on the concrete. Pipe stubs and anchor bolts shall be set in the forms where required.
- C. Form Ties:
 - 1. Embedded Ties: Holes left by the removal of form tie cones shall be reamed with suitable toothed reamers so as to leave the surface of the holes clean and rough before being filled with mortar as indicated in Section 03300. Wire ties for holding forms will not be permitted. No form-tying device or part thereof, other than metal, shall be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete members. The use of snapties which cause spalling of the concrete upon form stripping or tie removal will not be permitted. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste. Where metal rods extending through the concrete are used to support or to strengthen forms, the rods shall remain embedded and shall terminate not less than 1-inch back from the formed face or faces of the concrete.
 - 2. Removable Ties: Where taper ties are approved for use, the larger end of the taper tie shall be on the wet side of walls in water retaining structures. After the taper tie is removed, the hole shall be thoroughly cleaned and roughened for bond. A precast neoprene or polyurethane tapered plug shall be located at the wall centerline. The hole shall be completely filled with non-shrink grout for water bearing and below-grade walls. The hole shall be completely filled with non-shrink or regular cement grout for above-grade walls which are dry on both sides. Exposed faces of walls shall have the outer 2 inches of the exposed face filled with a cement grout which shall match the color and texture of the surrounding wall surface.

3.4 REUSE OF FORMS

A. Forms may be reused only if in good condition and only if acceptable to the Construction Manager. Light sanding between uses will be required wherever necessary to obtain uniform surface texture on all exposed concrete surfaces. Exposed concrete surfaces are defined as surfaces which are permanently exposed to view. In the case of forms for the inside wall surfaces of hydraulic/water retaining structures, unused tie rod holes in forms shall be covered with metal caps or shall be filled by other methods acceptable to the Construction Manager.

3.5 REMOVAL OF FORMS

Careful procedures for the removal of forms shall be strictly followed, and this work Α. shall be done with care so as to avoid injury to the concrete. No heavy loading on green concrete will be permitted. In the case of roof slabs and above-ground floor slabs, forms shall remain in place until test cylinders for the roof concrete attain a minimum compressive strength of 75 percent of the 28-day strength specified in Section 03300; provided, that no forms shall be disturbed or removed under an individual panel or unit before the concrete in the adjacent panel or unit has attained 75 percent of the specified 28-day strength and has been in place for a minimum of 7 days. The time required to establish said strength shall be as determined by the Construction Manager who will make several test cylinders for this purpose from concrete used in the first group of roof panels placed. If the time so determined is more than the 7-day minimum, then that time shall be used as the minimum length of time. Forms for all vertical walls and columns shall remain in place at least 2 days after the concrete has been placed. Forms for all parts of the Work not specifically mentioned herein shall remain in place for periods of time as determined by the Construction Manager.

3.6 MAINTENANCE OF FORMS

A. Forms shall be cleaned, treated with a releasing agent, and maintained in accordance with SSPWC Subsection 303-1.3 and the following. The form surfaces shall be treated with a nonstaining mineral oil or other lubricant compatible with the waterproofing membrane material and] acceptable to the Construction Manager. Any excess lubricant shall be satisfactorily removed before placing the concrete. Where field oiling of forms is required, the Contractor shall perform the oiling at least two weeks in advance of their use. Care shall be exercised to keep oil off the surfaces of steel reinforcement and other metal items to be embedded in concrete.

3.7 FALSEWORK

A. Falsework, including staging, walkways, forms, ladders, and similar appurtenances, shall be designed, engineered, constructed, and maintained according to the applicable requirements of the provisions of the OSHA Safety and Health Standards for Construction, and the requirements of the Construction Safety Orders of the California Division of Industrial Safety.

END OF SECTION

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The Work of this Section includes providing all concrete reinforcement steel, welded wire fabric, couplers, and concrete inserts for use in reinforced concrete and masonry construction, including all the wires, clips, supports, chairs, spacers, and other accessories.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 03100 Concrete Formwork
- B. Section 03300 Cast-in-Place Structural Concrete
- C. Section 04232 Reinforced Concrete Block Masonry

1.3 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

- A. The Work of this Section shall comply with the current editions of the following codes as adopted by the City Municipal Code:
 - 1. California Building Code
- B. Except as otherwise indicated, the current editions of the following apply to the Work of this Section.
 - ACI 315 Details and Detailing of Concrete Reinforcement.
 - ACI 318 Building Code Requirements for Structural Concrete.
 - CRSI MSP-1 Concrete Reinforcing Steel Institute Manual of Standard Practice
 - WRI Manual of Standard Practice for Welded Wire Fabric.
 - AWS D1.4 Structural Welding Code Reinforcing Steel.
 - ASTM A 82 Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - ASTM A 185 Specification for Welded Steel Wire Fabric For Concrete Reinforcement.
 - ASTM A 615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - ASTM A 775 Specification for Epoxy-Coated Reinforcing Steel Bars.

SECTION 03200 – REINFORCEMENT STEEL

1.4 SHOP DRAWINGS AND SAMPLES

- A. The following shall be submitted in accordance with Section 01300:
 - 1. Shop bending diagrams, placing lists, and drawings of all reinforcement steel prior to fabrication.
- B. Details of the concrete reinforcement steel and concrete inserts shall be submitted by the Contractor at the earliest possible date after receipt by the Contractor of the Notice to Proceed. Details of reinforcement steel for fabrication and erection shall conform to ACI 315 and the requirements indicated. The shop bending diagrams shall show the actual lengths of bars, to the nearest inch measured to the intersection of the extensions (tangents for bars of circular cross section) of the outside surface. The shop drawings shall include bar placement diagrams which clearly indicate the dimensions of each bar splice.
- C. Where mechanical couplers are required or permitted to be used to splice reinforcement steel, manufacturer's literature shall be submitted which contains instructions and recommendations for installation for each type of coupler used; certified test reports which verify the load capacity of each type and size of coupler used; and shop drawings which show the location of each coupler with details of how they are to be installed in the formwork.
- D. If reinforcement steel is spliced by welding at any location, the Contractor shall submit mill test reports which shall contain the information necessary for the determination of the carbon equivalent as specified in AWS D1.4. The Contractor shall submit a written welding procedure for each type of weld for each size of bar which is to be spliced by welding; merely a statement that AWS procedures will be followed is not acceptable.
- E. Mill certificates shall be delivered with each shipment of reinforcing bars.

1.5 FACTORY TESTING

- A. If requested by the Engineer, the Contractor shall provide samples from each heat of reinforcement steel delivered in a quantity adequate for testing. Costs of initial tests and sample materials will be paid by the District. Costs of additional tests due to material failing initial tests shall be paid by the Contractor.
- B. If reinforcement steel is spliced by welding at any location, the Contractor shall submit certifications of procedure qualifications for each welding procedure used and certification of welder qualifications, for each welding procedure, and for each welder performing the work. Such qualifications shall be as specified in AWS D1.4.

1.6 FIELD TESTING

A. Products shall be field tested for compliance with the indicated requirements. If requested by the Engineer, the Contractor shall provide samples of each type of welded splice used in the work in a quantity and of dimensions adequate for testing. At the discretion of the Engineer, radiographic testing of direct butt welded splices will be performed. The Contractor shall provide assistance necessary to

SECTION 03200 - REINFORCEMENT STEEL

facilitate testing. The Contractor shall repair any weld which fails to meet the requirements of AWS D1.4. The costs of testing will be paid by the District; except, the costs of all tests which fail to meet specified requirements shall be paid by the Contractor at no additional cost to the District.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials specified in this Section which may remain or leave residues on or within the concrete shall be classified as acceptable for potable water use by the Environmental Protection Agency within 30 days of application or use.

2.2 REINFORCEMENT STEEL

- A. Reinforcement Steel for all cast-in-place reinforced concrete construction shall conform to the following requirements:
 - 1. Bar reinforcement shall conform to the requirements of ASTM A 615 for Grade 60 Steel Reinforcement, or as otherwise indicated.
 - 2. Welded wire fabric reinforcement shall conform to the requirements of ASTM A 185 and as indicated; provided, that welded wire fabric with longitudinal wire of W4 size wire and smaller shall be either furnished in flat sheets or in rolls with a core diameter of not less than 10 inches; and provided further, that welded wire fabric with longitudinal wires larger than W4 size shall be furnished in flat sheets only.
 - 3. Spiral reinforcement shall be cold-drawn steel wire conforming to the requirements of ASTM A 82.
- B. Accessories:
 - 1. Accessories shall include all necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers, and other devices to position reinforcement during concrete placement. All bar supports shall meet the requirements of the CRSI Manual of Standard Practice including special requirements for supporting epoxy coated reinforcing bars. Wire bar supports shall be CRSI Class 1 for maximum protection with a 1/8-inch minimum thickness of plastic coating which extends at least 1/2-inch from the concrete surface. Plastic shall be gray in color.
 - 2. Concrete blocks (dobies), used to support and position reinforcement steel, shall have the same or higher compressive strength as specified for the concrete in which it is located. Wire ties shall be embedded in concrete block bar supports.
 - 3. Tie wire shall be a minimum 14 gauge annealed steel wire.
- C. Epoxy coating for reinforcing and accessories, where specified or shown, shall conform to ASTM A 775, but its usage shall be subject to approval by the District.

2.3 MECHANICAL COUPLERS

- A. Mechanical couplers shall be provided where shown and where approved by the Engineer. The couplers shall develop a tensile strength which exceeds 125 percent of the yield strength of the reinforcement bars being spliced at each splice.
- B. Where the type of coupler used is composed of more than one component, all components required for a complete splice shall be supplied. This shall apply to all mechanical splices, including those splices intended for future connections.
- C. The reinforcement steel and coupler used shall be compatible for obtaining the required strength of the connection. Straight threaded type couplers shall require the use of the next larger size reinforcing bar or shall be used with reinforcing bars with specially forged ends which provide upset threads which do not decrease the basic cross section of the bar.

2.4 WELDED SPLICES

- A. Welded splices shall be provided where shown and where approved by the Engineer. All welded splices of reinforcement steel shall develop a tensile strength which exceeds 125 percent of the yield strength of the reinforcement bars which are connected.
- B. All materials required to conform the welded splices to the requirements of AWS D1.4 shall be provided.

2.5 EPOXY GROUT

A. Epoxy for grouting reinforcing bars shall be specifically formulated for such application, for the moisture condition, application temperature, and orientation of the hole to be filled. Epoxy grout shall meet the requirements found in Section 03315.

PART 3 - EXECUTION

3.1 GENERAL

A. All reinforcement steel, welded wire fabric, couplers, and other appurtenances shall be fabricated, and placed in accordance with the requirements of the Building Code and the supplementary requirements specified herein.

3.2 FABRICATION

- A. General:
 - 1. Reinforcement steel shall be accurately formed to the dimensions and shapes shown, and the fabricating details shall be prepared in accordance with ACI 315 and ACI 318, except as indicated. Stirrups and tie bars shall be bent around a pin having a diameter not less than 1-1/2-inch for No. 3 bars, 2-inch for No. 4 bars, and 2-1/2-inch for No. 5 bars. Bends for other

SECTION 03200 - REINFORCEMENT STEEL

bars shall be made around a pin having a diameter not less than 6 times the bar diameter, except for bars larger than 1 inch, in which case the bends shall be made around a pin of 8 bar diameters. Bars shall be bent cold.

- 2. The Contractor shall fabricate reinforcement bars for structures in accordance with bending diagrams, placing lists, and placing drawings.
- B. Fabricating Tolerances: Bars used for concrete reinforcement shall meet the following requirements for fabricating tolerances:
 - 1. Sheared length: <u>+</u>1 inch
 - 2. Depth of truss bars: + 0, 1/2 inch
 - 3. Stirrups, ties, and spirals: <u>+</u> 1/2 inch
 - 4. All other bends: ± 1 inch

3.3 PLACING

- A. Reinforcement steel shall be accurately positioned and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. All reinforcement steel shall be supported by concrete, plastic or metal supports, spacers or metal hangers which are strong and rigid enough to prevent any displacement of the reinforcement steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used, in sufficient numbers to support the bars without settlement, but in no case shall such support be continuous. All concrete blocks used to support reinforcement steel shall be tied to the steel with wire ties which are embedded in the blocks. For concrete over formwork, the Contractor shall furnish concrete, metal, plastic, or other acceptable bar chairs and spacers.
- B. Limitations on the use of bar support materials shall be as follows.
 - 1. Concrete Dobies: permitted at all locations except where architectural finish is required.
 - 2. Wire Bar Supports: permitted only at slabs over dry areas, interior dry wall surfaces, and exterior wall surfaces.
 - 3. Plastic Bar Supports: permitted at all locations except on grade.
- C. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.
- D. Bars additional to those shown which may be found necessary or desirable by the Contractor for the purpose of securing reinforcement in position shall be provided by the Contractor at no additional cost to the District.

SECTION 03200 - REINFORCEMENT STEEL

- E. Unless otherwise specified, reinforcement placing tolerances shall be within the limits specified in Chapter 25 of ACI 318 except where in conflict with the requirements of the CBC.
- F. Bars may be moved as necessary to avoid interference with other reinforcement steel, conduits, or embedded items. If bars are moved more than one bar diameter, or enough to exceed the above tolerances, the resulting arrangement of bars shall be subject to the approval of the Engineer.
- G. Welded wire fabric reinforcement placed over horizontal forms shall be supported on slab bolsters. Slab bolsters shall be spaced not more than 30 inches on centers, shall extend continuously across the entire width of the reinforcement mat, and shall support the reinforcement mat in the plane indicated.
- H. Welded wire fabric placed over the ground shall be supported on wired concrete blocks (dobies) spaced not more than 3 feet on centers in any direction. The construction practice of placing welded wire fabric on the ground and hooking into place in the freshly placed concrete shall not be used.
- I. Epoxy coated reinforcing bars shall be stored, transported, and placed in such a manner as to avoid chipping of the epoxy coating. Non-abrasive slings made of nylon and similar materials shall be used. Specially coated bar supports shall be used. All chips or cracks in the epoxy coating shall be repaired with a compatible epoxy repair material prior to placing concrete.
- J. Accessories supporting reinforcing bars shall be spaced such that there is no deflection of the accessory from the weight of the supported bars. When used to space the reinforcing bars from wall forms, the forms and bars shall be located so that there is no deflection of the accessory when the forms are tightened into position.

3.4 SPACING OF BARS

- A. The clear distance between parallel bars (except in columns and between multiple layers of bars in beams) shall be not less than the nominal diameter of the bars nor less than 1-1/3 times the maximum size of the coarse aggregate, nor less than one inch.
- B. Where reinforcement in beams or girders is placed in 2 or more layers, the clear distance between layers shall be not less than one inch.
- C. In columns, the clear distance between longitudinal bars shall be not less than 1-1/2 times the bar diameter, nor less than 1-1/2 times the maximum size of the coarse aggregate, nor less than 1-1/2 inches.
- D. The clear distance between bars shall also apply to the distance between a contact splice and adjacent splices or bars.

3.5 SPLICING

A. General:

- 1. Reinforcement bar splices shall only be used at locations indicated. When it is necessary to splice reinforcement at points other than where shown, the character of the splice shall be as acceptable to the Engineer.
- B. Splices of Reinforcement:
 - 1. The length of lap for reinforcement bars, unless otherwise indicated, shall be in accordance with ACI 318.
 - 2. Laps of welded wire fabric shall be in accordance with the ACI 318. Adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each 2 running feet. Wires shall be staggered and tied in such a manner that they cannot slip.
 - 3. Splices in column spiral reinforcement, when necessary, shall be made by welding or by a lap of 1-1/2 turns.
- C. Bending or Straightening: Reinforcement shall not be straightened or rebent in a manner which will injure the material. Bars with kinks or bends not shown shall not be used. All bars shall be bent cold, unless otherwise permitted by the Engineer. No bars partially embedded in concrete shall be field-bent except as shown or specifically permitted by the Engineer.
- D. Couplers which are located at a joint face shall be a type which can be set either flush or recessed from the face as shown. The couplers shall be sealed during concrete placement to completely eliminate concrete or cement paste from entering. Couplers intended for future connections shall be recessed a minimum of 1/2 inch from the concrete surface. After the concrete is placed, the coupler shall be plugged with plastic plugs which have an O-ring seal and the recess filled with sealant to prevent any contact with water or other corrosive materials. Threaded couplers shall be plugged.
- E. Unless indicated otherwise, mechanical coupler spacing and capacity shall match the spacing and capacity of the reinforcing shown for the adjacent section.
- F. Tack welding of reinforcing bars is prohibited.

3.6 CLEANING AND PROTECTION

- A. Reinforcement steel shall at all times be protected from conditions conducive to corrosion until concrete is placed around it.
- B. The surfaces of all reinforcement steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcement shall be reinspected and, if necessary recleaned.

3.7 EMBEDMENT OF DRILLED REINFORCING STEEL DOWELS

- A. Hole Preparation:
 - 1. The hole diameter shall be as recommended by the epoxy manufacturer but shall be no larger than 0.25 inch greater than the diameter of the outer surface of the reinforcing bar deformations.
 - 2. The depth of the hole shall be as recommended by the epoxy manufacturer to fully develop the bar but shall not be less than 12 bar diameters, unless noted otherwise.
 - 3. The hole shall be drilled by methods which do not interfere with the proper bonding of epoxy.
 - 4. Existing reinforcing steel in the vicinity of proposed holes shall be located prior to drilling. The location of holes to be drilled shall be adjusted to avoid drilling through or nicking any existing reinforcing bars.
 - 5. The hole shall be blown clean with clean, dry compressed air to remove all dust and loose particles.
 - 6. Epoxy shall be injected into the hole through a tube placed to the bottom of the hole. The tube shall be withdrawn as epoxy is placed but kept immersed to prevent formation of air pockets. The hole shall be filled to a depth that insures that excess material will be expelled from the hole during dowel placement.
 - 7. Dowels shall be twisted during insertion into the partially filled hole so as to guarantee full wetting of the bar surface with epoxy. The bar shall be inserted slowly enough to avoid developing air pockets.

END OF SECTION

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The Work of this Section includes providing the construction joints, contraction joints, expansion joints, and control joints in structural concrete, including waterstops, joint fillers, and joint sealants.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 03100 Concrete Formwork
- B. Section 03200 Reinforcement Steel
- C. Section 03300 Cast-in-Place Structural Concrete
- D. Section 07920 Sealants and Caulking

1.3 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section.

ASTM C 920	Specification for Elastomeric Joint Sealants.
ASTM D 412	Test Methods for Rubber Properties in Tension.
ASTM D 624	Test Method for Rubber Property Tear Resistance.
ASTM D 638	Test Method for Tensile Properties of Plastics.
ASTM D 746	Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
ASTM D 747	Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam.
ASTM D 1056	Specification for Flexible Cellular Materials Sponge or Expanded Rubber.
ASTM D 1752	Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
ASTM D 2240	Test Method for Rubber Property Durometer Hardness.
CRD-C572	PVC Waterstop.
TT-S-0227E(3)	Sealing Compound, elastomeric type, Multi-component for Caulking, Sealing, and Glazing Buildings and Other

Structures).

1.4 TYPES OF JOINTS

- A. Construction Joints: When fresh concrete is placed against a hardened concrete surface, the joint between the two pours is called a construction joint. Unless otherwise specified, all joints in water bearing members shall be provided with a waterstop and/or sealant groove of the shape specified and shown. The surface of the first pour may also be required to receive a coating of bond breaker as shown.
- B. Contraction Joints: Contraction joints are similar to construction joints except that the fresh concrete shall not bond to the hardened surface of the first pour, which shall be coated with a bond breaker. The slab reinforcement shall be stopped 4-1/2 inches from the joint; which is provided with a sleeve-type dowel, to allow shrinkage of the concrete of the second pour. Waterstop and/or sealant groove shall also be provided when specified or shown.
- C. Expansion Joints: To allow the concrete to expand freely, a space is provided between the two pours, the joint shall be formed as shown. This space is obtained by placing a filler joint material against the first pour, which acts as a form for the second pour. Unless otherwise specified, all expansion joints in water bearing members shall be provided with a center-bulb type waterstop as shown.
- D. Premolded expansion joint material shall be installed with the edge at the indicated distance below or back from finished concrete surface, and shall have a slightly tapered, dressed, and oiled wood strip secured to or placed at the edge thereof during concrete placement, which shall later be removed to form space for sealing material.
- E. The space so formed shall be filled with a joint sealant material as indicated below. In order to keep the two wall or slab elements in line the joint shall also be provided with a sleeve-type dowel as shown.
- F. Control Joints: The function of the control joint is to provide a weaker plane in the concrete, where shrinkage cracks will probably occur. A groove, of the shape and dimensions shown, is formed or saw-cut in the concrete. This groove is afterward filled with a joint sealant material.

1.5 SHOP DRAWINGS AND SAMPLES

- A. The following shall be submitted in compliance with Section 01300:
- B. Waterstops: Prior to production of the material required under this contract, qualification samples shall be submitted. Such samples shall consist of extruded or molded sections of each size or shape to be used, and shall be accomplished so that the material and workmanship represents in all respects the material to be furnished under this contract. The balance of the material to be used under this contract shall not be produced until after the Engineer has reviewed the qualification samples.

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- C. Waterstop Samples: Prior to use of the waterstop material in the field, a sample of a fabricated mitered cross and a tee constructed of each size or shape of material to be used shall be submitted. These samples shall be fabricated so that the material and workmanship represent in all respects the fittings to be furnished under this contract.
- D. Field samples of fabricated fittings (crosses, tees, etc.) will be selected at random by the Engineer for testing by a laboratory at the District's expense. When tested, they shall have a tensile strength across the joints equal to at least 600 psi.
- E. Joint Sealant: Prior to ordering the sealant material, the Contractor shall submit sufficient data to show general compliance with the requirements of the Contract Documents.
- F. Joint Location: The Contractor shall submit placement shop drawings showing the location and type of all joints for each structure.
- G. Certified test reports from the sealant manufacturer on the actual batch of material being supplied indicating compliance with the above requirements shall be furnished before the sealant is used on the job.

1.6 OWNER'S MANUAL

A. Shipping Certification: The Contractor shall provide written certification from the manufacturer as an integral part of the shipping form, to show that all of the material shipped to this project meets or exceeds the physical property requirements of the Contract Documents. Supplier certificates are not acceptable.

1.7 SERVICES OF MANUFACTURER

A. Before work is commenced, the Contractor shall arrange for a representative of the sealant manufacturer to instruct the crew doing the Work on the proper methods of mixing and applying the sealant.

1.8 INSPECTION AND TESTING

- A. Waterstop Inspection: It is required that all waterstop field joints shall be subject to rigid inspection, and no such work shall be scheduled or started without having made prior arrangements with the Engineer to provide for the required inspections. Not less than 24 hours' notice shall be provided to the Engineer for scheduling such inspections.
- B. All field joints in waterstops shall be subject to rigid inspection for misalignment, bubbles, inadequate bond, porosity, cracks, offsets, and other defects which would reduce the potential resistance of the material to water pressure at any point. All defective joints shall be replaced with material which shall pass said inspection, and all faulty material shall be removed from the site and disposed of by the Contractor at its own expense.
- C. The following waterstop defects represent a partial list of defects which shall be grounds for rejection:

- 1. Offsets at joints greater than 1/16-inch or 15 percent of material thickness, at any point, whichever is less.
- 2. Exterior crack at joint, due to incomplete bond, which is deeper than 1/16inch or 15 percent of material thickness, at any point, whichever is less.
- 3. Any combination of offset or exterior crack which will result in a net reduction in the cross section of the waterstop in excess of 1/16-inch or 15 percent of material thickness at any point, whichever is less.
- 4. Misalignment of joint which result in misalignment of the waterstop in excess of 1/2-inch in 10 feet.
- 5. Porosity in the welded joint as evidenced by visual inspection.
- 6. Bubbles or inadequate bonding which can be detected with a penknife test. (If, while prodding the entire joint with the point of a pen knife, the knife breaks through the outer portion of the weld into a bubble, the joint shall be considered defective.)
- D. Construction Joint Sealant: The Contractor shall prepare adhesion and cohesion test specimens as specified herein, at intervals of 5 working days while sealants are being installed.
- E. The sealant material shall show no signs of adhesive or cohesive failure when tested in accordance with the following procedure in laboratory and field tests:
 - 1. Sealant specimen shall be prepared between 2 concrete blocks (1-inch by 2-inch by 3-inch). Spacing between the blocks shall be 1-inch. Coated spacers (2-inch by 1-1/2-inch by 1/2-inch) shall be used to insure sealant cross-sections of 1/2-inch by 2 inches with a width of 1-inch.
 - 2. Sealant shall be cast and cured according to manufacturer's recommendations except that curing period shall not exceed 24 hours.
 - 3. Following curing period, the gap between blocks shall be widened to 1-1/2inch. Spacers shall be used to maintain this gap for 24 hours prior to inspection for failure.

1.9 GUARANTEE

A. The Contractor shall provide a 5-year written guarantee of the entire sealant installation against faulty and/or incompatible materials and workmanship, together with a statement that it agrees to repair or replace, to the satisfaction of the District, at no additional cost to the District, any such defective areas which become evident within said 5-year guarantee period.

PART 2 - PRODUCTS

2.1 GENERAL

A. All joint materials specified herein shall be classified as acceptable for potable water use, by the Environmental Protection Agency, within 30 days of application.

2.2 PVC WATERSTOPS

- A. General: Waterstops shall be extruded from an elastomeric polyvinyl chloride compound containing the plasticizers, resins, stabilizers, and other materials necessary to meet the requirements of these Specifications. No reclaimed or scrap material shall be used. The Contractor shall obtain from the waterstop manufacturer and shall furnish to the Engineer for review, current test reports and a written certification of the manufacturer that the material to be shipped to the job meets the physical requirements as outlined in the U.S. Army Corps of Engineers Specification CRD-C572 and those listed herein.
- B. Flatstrip and Center-Bulb Waterstops: Flatstrip and center-bulb waterstops shall be as indicated; provided, that at no place shall the thickness of flat strip waterstops, including the center bulb type, be less than 3/8-inch.
- C. Multi-Rib Waterstops: Multi-rib waterstops, where required, shall be as indicated. Prefabricated joint fittings shall be used at all intersections of the ribbed-type waterstops.
- D. Other Types of Waterstops: When other types of waterstops, not listed above, are required, they shall be subjected to the same requirements as those listed herein.
- E. Waterstop Testing Requirements: When tested in accordance with the specified test standards, the waterstop material shall meet or exceed the following requirements:

Physical Property, Sheet Material	Value ASTM Std.
Tensile Strength-min (psi) Ultimate Elongation-min (percent) Low Temp Brittleness-max (degrees F) Stiffness in Flexure-min (psi)	1750D 638, Type IV350D 638, Type IV-35D 746400D 747
Accelerated Extraction (CRD-C572)	
Tensile Strength-min (psi) Ultimate Elongation-min (percent)	1500 D 638, Type IV 300 D 638, Type IV
Effect of Alkalies (CRD-C572)	
Change in Weight (percent) Change in Durometer, Shore A	+0.25/-0.10 +5 D 2240

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Finish Waterstop

Tensile Strength-min (psi)	1400	D 638, Type IV
Ultimate Elongation-min (percent)	280	D 638, Type IV

2.3 JOINT SEALANT

- A. Joint sealant shall be polyurethane polymer designed for bonding to concrete which is continuously submerged in water. No material will be acceptable which has an unsatisfactory history as to bond or durability when used in the joints of water retaining structures.
- B. Joint sealant material shall meet the following requirements (73 degrees F and 50 percent R.H.):

Work Life	45 - 180 minutes
Time to Reach 20 Shore "A" Hardness (at 77 degrees F, 200 gr quantity)	24 hours, maximum
Ultimate Hardness (ASTM D 2240)	20 - 45 Shore "A"
Tensile Strength (ASTM D 412)	200 psi, minimum
Ultimate Elongation (ASTM D 412)	400 percent, minimum
Tear Resistance (Die C ASTM D 624) minimum	75 pounds per inch of thickness,
Color	Light Gray

- C. All polyurethane sealants for waterstop joints in concrete shall conform to the following requirements:
 - 1. Sealant shall be 2-part polyurethane with the physical properties of the cured sealant conforming to or exceeding the requirements of ANSI/ASTM C 920 Type M or Federal Specification TT-S-00227 E(3) for 2-part material, as applicable.
 - 2. For vertical joints and overhead horizontal joints, only "non-sag" compounds shall be used; all such compounds shall conform to the requirements of ANSI/ASTM C 920 Class 25, Grade NS, or Federal Specification TT-S-0027 E(3), Type II, Class A.
 - 3. For plane horizontal joints, the self-leveling compounds which meet the requirements of ANSI/ASTM C 920 Class 25, Grade P, or Federal Specification TT-S-0027 E(3), Type I shall be used. For joints subject to either pedestrian or vehicular traffic, a compound providing non-tracking characteristics, and having a Shore "A" hardness range of 35 to 45, shall be used.

- 4. Primer materials, if recommended by the sealant manufacturer, shall conform to the printed recommendations of the sealant manufacturer.
- D. Sealants for non-waterstop joints in concrete shall conform to the requirements of Section 07920.

2.4 JOINT MATERIALS

- A. Bearing Pad: Bearing pad to be neoprene conforming to ASTM D 1752 Type I, 40 durometer hardness unless otherwise noted.
- B. Neoprene Sponge: Sponge to be neoprene, closed-cell, expanded, conforming to ASTM D 1056, type RE-45-E1, with a compression deflection, 25 percent deflection (limits), 119 to 168 kPa (17 to 24 psi) minimum.
- C. Preformed Joint Filler: Preformed joint filler material for water retaining applications shall be of the preformed non-extruding type joint filler constructed of cellular neoprene sponge rubber or polyurethane of firm texture. Bituminous fiber type will not be permitted. All non-extruding and resilient-type preformed expansion joint fillers shall conform to the requirements and tests set forth in ASTM D 1752 for Type I, except as otherwise specified herein.

2.5 BACKING ROD

A. Backing rod shall be an extruded closed-cell, polyethylene foam rod. The material shall be compatible with the joint sealant material used and shall have a tensile strength of not less than 40 psi and a compression deflection of approximately 25 percent at 8 psi. The rod shall be 1/8-inch larger in diameter than the joint width except that a one-inch diameter rod shall be used for a 3/4-inch wide joint.

2.6 BOND BREAKER

A. Bond breaker shall contain a fugitive dye so that areas of application will be readily distinguishable.

2.7 SLIP DOWELS

A. Slip dowels in joints shall be A36 smooth epoxy-coated bars, conforming to ASTM A 775.

2.8 PVC TUBING

A. PVC tubing in joints shall be Sch. SDR 13.5, conforming to ASTM D 2241.

2.9 MANUFACTURERS

- A. Products shall be manufactured by one of the following (or equal):
 - 1. Flatstrip and Center-Bulb Waterstops:

Kirkhill Rubber Company

OLIVENHAIN MWD

Water Seals, Incorporated Progress Unlimited, Incorporated Greenstreak Plastic Products Company

2. Multi-Rib Waterstops

Water Seals, Incorporated Progress Unlimited, Incorporated Greenstreak Plastic Products Company

3. Sealants

Permapol RC-270 by Products Research Elastothane 227R by Pacific Polymers Sikaflex 2C by Sika Corporation

4. Bond Breaker

Super Bond Breaker by Burke Company Select Cure CRB by Select Products Company

PART 3 - EXECUTION

3.1 WATERSTOPS - GENERAL

- A. Waterstops of the type specified herein shall be embedded in the concrete across joints as shown. All waterstops shall be fully continuous for the extent of the joint. Splices necessary to provide such continuity shall be accomplished in conformance to printed instructions of manufacturer of the waterstops. The Contractor shall take suitable precautions and means to support and protect the waterstops during the progress of the work and shall repair or replace at its own expense any waterstops damaged during the progress of the work. All waterstops shall be stored so as to permit free circulation of air around the waterstop material.
- B. When any waterstop is installed in the concrete on one side of a joint, while the other half or portion of the waterstop remains exposed to the atmosphere for more than 2 days, suitable precautions shall be taken to shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.

3.2 SPLICES IN WATERSTOPS

- A. Splices in waterstops shall be performed by heat sealing the adjacent waterstop sections in accordance with the manufacturer's printed recommendations. It is essential that:
 - 1. The material not be damaged by heat sealing.
 - 2. The splices have a tensile strength of not less than 60 percent of the unspliced materials tensile strength.

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- 3. The continuity of the waterstop ribs and of its tubular center axis be maintained.
- B. Butt joints of the ends of 2 identical waterstop sections may be made while the material is in the forms.
- C. All joints with waterstops involving more than 2 ends to be jointed together, and all joints which involve an angle cut, alignment change, or the joining of 2 dissimilar waterstop sections shall be prefabricated by the Contractor prior to placement in the forms, allowing not less than 24-inch long strips of waterstop material beyond the joint. Upon being inspected and approved, such prefabricated waterstop joint assemblies shall be installed in the forms and the ends of the 24-inch strips shall be butt welded to the straight run portions of waterstop in place in the forms.
- D. Where a centerbulb waterstop intersects and is jointed with a non-centerbulb waterstop, care shall be taken to seal the end of the centerbulb, using additional PVC material if needed.

3.3 JOINT CONSTRUCTION

- A. Setting Waterstops: In order to eliminate faulty installation that may result in joint leakage, particular care shall be taken of the correct positioning of the waterstops during installation. Adequate provisions must be made to support and anchor the waterstops during the progress of the WORK and to insure the proper embedment in the concrete. The symmetrical halves of the waterstops shall be equally divided between the concrete pours at the joints. The center axis of the waterstops shall be coincident with the joint openings. Maximum density and imperviousness of the concrete shall be insured by thoroughly working it in the vicinity of all joints.
- B. In placing flat-strip waterstops in the forms, means shall be provided to prevent them from being folded over by the concrete as it is placed. Unless otherwise shown, all waterstops shall be held in place with light wire ties on 12-inch centers which shall be passed through the edge of the waterstop and tied to the curtain of reinforcing steel. Horizontal waterstops, with their flat face in a vertical plane, shall be held in place with continuous supports to which the top edge of the waterstop shall be tacked. In placing concrete around horizontal waterstops, with their flat face in a horizontal plane, concrete shall be worked under the waterstops by hand so as to avoid the formation of air and rock pockets.
- C. In placing centerbulb waterstops in expansion joints, the centerbulb shall be centered on the joint filler material.
- D. Waterstop in vertical wall joints shall stop 6 inches from the top of the wall where such waterstop does not connect with any other waterstop and is not to be connected to for a future concrete placement.
- E. Joint Location: Construction joints, and other types of joints, shall be provided where shown. When not shown, construction joints shall be provided at 25-foot maximum spacing for all concrete construction, unless noted otherwise. The location of all joints, of any type, shall be submitted to the Engineer for acceptance.

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- F. Joint Preparation: Special care shall be used in preparing concrete surfaces at joints where bonding between 2 sections of concrete is required. Unless otherwise shown, such bonding will be required at all horizontal joints in walls. Surfaces shall be prepared in accordance with the requirements of Section 03300. Except on horizontal wall construction joints, wall to slab joints or where otherwise shown or specified, at all joints where waterstops are required, the joint face of the first pour shall be coated with a bond breaker as specified herein.
- G. Construction Joint Sealant: Construction joints in water-bearing floor slabs, and elsewhere as shown, shall be provided with tapered grooves which shall be filled with a construction joint sealant. The material used for forming the tapered grooves shall be left in the grooves until just before the grooves are cleaned and filled with joint sealant. After removing the forms from the grooves, all laitance and fins shall be removed, and the grooves shall be sand-blasted. The grooves shall be allowed to become thoroughly dry, after which they shall be blown out; immediately thereafter, they shall be primed, bond breaker tape placed in the bottom of the groove, and filled with the construction joint sealant. No sealant will be permitted to be used without a primer. Care shall be used to completely fill the sealant grooves. Areas designated to receive a sealant fillet shall be thoroughly cleaned, as outlined for the tapered grooves, prior to application of the sealant.
- H. The primer and sealant shall be placed strictly in accordance with the printed recommendations of the manufacturer, taking special care to properly mix the sealant prior to application. The sides of the sealant groove shall not be coated with bond breaker, curing compound, or any other substance which would interfere with proper bonding of the sealant. All sealant shall achieve final cure at least 7 days before the structure is filled with water.
- I. All sealant shall be installed by a competent waterproofing specialty contractor who has a successful record of performance in similar installations.
- J. Thorough, uniform mixing of 2-part, catalyst-cured materials is essential; special care shall be taken to properly mix the sealer before its application.
- K. Any joint sealant which, after the manufacturer's recommended curing time for the job conditions of the Work hereunder, fails to fully and properly cure shall be completely removed; the groove shall be thoroughly sandblasted to remove all traces of the uncured or partially cured sealant and primer, and shall be re-sealed with the specified joint sealant. All costs of such removal, joint treatment, re-sealing, and appurtenant work shall be at the expense of the Contractor.

END OF SECTION

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

- A. The Work of this Section includes providing finished cast-in-place structural concrete including forming, mixing, placing, curing, repairing, and finishing.
- B. The following types of concrete shall be covered in this Section:
 - 1. Structural Concrete: Concrete to be used in all cases except where indicated otherwise.
 - 2. Lean Concrete: Concrete to be used for thrust blocks, pipe trench cut-off blocks and cradles, where the preceding items are indicated as unreinforced. Lean concrete shall be used as protective cover for dowels intended for future connection.
- C. The term "hydraulic structure" used in these specifications shall refer to environmental engineering concrete structures for the containment, treatment, or transmission of water, wastewater, or other fluids.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 03100 Concrete Formwork
- B. Section 03200 Reinforcement Steel
- C. Section 03290 Joints in Concrete Structures
- D. Section 03315 Grout
- E. Section 07920 Sealants and Caulking

1.3 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section.
- B. Federal Specifications:

UU-B-790A (Int.Amd. 1)	Building	Paper,	Vegetable	Fiber	(Kraft,
	Waterproo	fed, Water	Repellant and	I Fire Res	istant).

C. Commercial Standards:

ACI 117	Standard	Tolerances	for	Concrete	Construction	and
	Materials					

ACI 214 Recommended Practice for Evaluation of Strength Test Results of Concrete

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- ACI 301 Specifications for Structural Concrete for Buildings
- ACI 309 Consolidation of Concrete
- ACI 315 Details and Detailing of Concrete Reinforcement
- ACI 318 Building Code Requirements for Structural Concrete
- ASTM C 31 Practices for Making and Curing Concrete Test Specimens in the Field
- ASTM C 33 Specification for Concrete Aggregates
- ASTM C 39 Test Method for Compressive Strength of Cylindrical Concrete Specimens
- ASTM C40 Test Method for Organic Impurities in Fine Aggregates for Concrete
- ASTM C 88 Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
- ASTM C 94 Specification for Ready-Mixed Concrete
- ASTM C 131 Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- ASTM C 143 Test Method for Slump of Portland Cement Concrete
- ASTM C 150 Specification for Portland Cement
- ASTM C 157 Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete
- ASTM C 172 Standard Method of Sampling Freshly Mixed Concrete
- ASTM C 192 Method of Making and Curing Concrete Test Specimens in the Laboratory
- ASTM C 260 Specification for Air-Entraining Admixtures for Concrete
- ASTM C 289 Test Method for Potential Reactivity of Aggregates (Chemical Method)
- ASTM C 309 Specifications for Liquid Membrane-Forming Compounds for Curing Concrete
- ASTM C 494 Specification for Chemical Admixtures for Concrete

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- ASTM C 535 Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- ASTM C 1077 Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for use in Construction & Criteria for Laboratory Evaluation
- ASTM D 175 Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
- ASTM D 2419 Test Method for Sand Equivalent Value of Soils and Fine Aggregate
- ASTM E 119 Method for Fire Tests of Building Construction and Materials

1.4 SHOP DRAWINGS AND SAMPLES

- A. The following shall be submitted in compliance with Section 01300:
 - 1. Mix Designs: Prior to beginning the Work and within 14 days of the notice to proceed, preliminary concrete mix designs which shall show the proportions and gradations of all materials proposed for each class and type of concrete. The mix designs shall be checked by an independent testing laboratory acceptable to the Engineer. All costs related to such checking shall be borne by the Contractor.
 - 2. Provide the following submittals in accordance with ACI-301:
 - a. Mill tests for cement.
 - b. Admixture certification. Chloride ion content must be included.
 - c. Aggregate gradation and certification.
 - d. Materials and methods for curing.
 - 3. Certified Delivery Tickets: Where ready-mix concrete is used, the Contractor shall provide certified weighmaster delivery tickets at the time of delivery of each load of concrete. Contractor's certificate with each delivery ticket shall show the public weighmaster's signature, and the total quantities, by weight of cement, sand, each class of aggregate, admixtures, and the amounts of water in the aggregate and added at the batching plant as well as the amount of water allowed to be added at the site for the specific design mix. Each certificate shall, in addition, state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to when the batch was dispatched, when it left the plant, when it arrived at the job, the time that unloading began, and the time that unloading was finished.

1.5 CONCRETE CONFERENCE

- A. A meeting to review the detailed requirements of the Contractor's proposed concrete design mixes and to determine the procedures for producing proper concrete construction shall be held no later than 14 days after the notice to proceed.
- B. All parties involved in the concrete work shall attend the conference, including the following:
 - Contractor's representative Testing laboratory representative Concrete subcontractor Reinforcing steel subcontractor and detailer Concrete supplier Admixture manufacturer's representative
- C. The conference shall be held at a mutually agreed upon time and place. The Engineer shall be notified no less than 5 days prior to the date of the conference.

1.6 TESTING

- A. General
 - 1. Tests on component materials and for compressive strength and shrinkage of concrete will be performed as specified herein. Test for determining slump will be in accordance with the requirements of ASTM C 143.
 - 2. The cost of all laboratory tests on cement, aggregates, and concrete, will be borne by the District. However, the Contractor shall be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. The laboratory must meet or exceed the requirements of ASTM C 1077.
 - 3. Concrete for testing shall be supplied by the CONTRACTOR at no cost to the District, and the Contractor shall provide assistance to the Engineer in obtaining samples, and disposal and cleanup of excess material.
- B. Field Compression Tests:
 - 1. Compression test specimens will be taken during construction from the first placement of each class of concrete specified herein and at intervals thereafter as selected by the Engineer to insure continued compliance with these specifications. Each set of test specimens will be a minimum of 4 cylinders.
 - 2. Compression test specimens for concrete will be made and cured in accordance with ASTM C 31. Specimens will be 6-inch diameter by 12-inch high cylinders.

- 3. Compression tests will be performed in accordance with ASTM C 39. One test cylinder will be tested at 7 days and 2 at 28 days. The remaining cylinder will be held to verify test results, if needed.
- C. Evaluation and Acceptance of Concrete:
 - 1. Evaluation and acceptance of the compressive strength of concrete shall be according to the requirements of ACI 318, Chapter 5 "Concrete Quality," and as specified herein.
 - 2. A statistical analysis of compression test results will be performed according to the requirements of ACI 214. The standard deviation of the test results shall not exceed 640 psi.
 - 3. If any concrete fails to meet these requirements, immediate corrective action shall be taken to increase the compressive strength for all subsequent batches of the type of concrete affected.
 - 4. When the standard deviation of the test results exceeds 640 psi, the average strength for which the mix is designed shall be increased by an amount necessary to satisfy the statistical requirement that the probability of any test being more than 500 psi below or the average of any 3 consecutive tests being below the specified compressive strength is 1 in 100. The required average strength shall be calculated by Criterion No. 3 of ACI 214 using the actual standard of deviation.
 - 5. All concrete which fails to meet the ACI requirements and these specifications, is subject to removal and replacement at no additional cost to the District.
- D. Shrinkage Tests:
 - 1. Drying shrinkage tests will be made for the trial batch indicated below, the first placement of each class of concrete, and during construction to insure continued compliance with these Specifications.
 - 2. Drying shrinkage specimens shall be 4-inch by 4-inch by 11-inch prisms with an effective gauge length of 10 inches, fabricated, cured, dried and measured in accordance with ASTM C 157 modified as follows: specimens shall be removed from molds at an age of 23 ±1 hours after trial batching, shall be placed immediately in water at 70 degrees F ±3 degrees F for at least 30 minutes, and shall be measured within 30 minutes thereafter to determine original length and then submerged in saturated lime water at 73 degrees F ±3 degrees F. Measurement to determine expansion expressed as a percentage of original length shall be made at age 7 days. This length at age 7 days shall be the base length for drying shrinkage calculations ("0" days drying age). Specimens then shall be stored immediately in a humidity control room maintained at 73 degrees F ±3 degrees F ±3 degrees F and 50 percent ±4 percent relative humidity for the remainder of the test. Measurements to determine shrinkage expressed as percentage

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of base length shall be made and reported separately for 7, 14, 21, and 28 days of drying after 7 days of moist curing.

- 3. The drying shrinkage deformation of each specimen shall be computed as the difference between the base length (at "0" days drying age) and the length after drying at each test age. The average drying shrinkage deformation of the specimens shall be computed to the nearest 0.0001 inch at each test age. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004-inch, the results obtained from that specimen shall be disregarded. Results of the shrinkage test shall be reported to the nearest 0.001 percent of shrinkage. Compression test specimens shall be taken in each case from the same concrete used for preparing drying shrinkage specimens. These tests shall be considered a part of the normal compression tests for the project. Allowable shrinkage limitations shall be as indicated below.
- E. Construction Tolerances: The Contractor shall set and maintain concrete forms and perform finishing operations so as to ensure that the completed work is within the tolerances specified herein. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the specified permissible variation from lines, grades, or dimensions shown. Where tolerances are not stated in the specifications, permissible deviations will be in accordance with ACI 117.
 - 1. The following construction tolerances are hereby established and apply to finished walls and slab unless otherwise shown:

Item	Tolerance
Variation of the constructed linear outline from the established position in plan.	In 10 feet: 1/4-inch; In 20 feet or more: 1/2-inch
Variation from the level or from the grades shown.	In 10 feet: 1/4-inch; In 20 feet or more: 1/2-inch
Variation from the plumb	In 10 feet: 1/4-inch; In 20 feet or more: 1/2-inch
Variation in the thickness of slabs and walls.	Minus 1/4-inch; Plus 1/2-inch
Variation in the locations and sizes of slabs and wall openings	Plus or minus 1/4-inch

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. General:
 - 1. All materials specified herein shall be classified as acceptable for potable water use by the Environmental Protection Agency within 30 days of application.
 - 2. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage. Only one brand of cement shall be used. Cement reclaimed from cleaning bags or leaking containers shall not be used. All cement shall be used in the sequence of receipt of shipments.
- B. All materials furnished for the work shall comply with the requirements of Sections 201, 203, and 204 of ACI 301, as applicable.
- C. Storage of materials shall conform to the requirements of Section 205 of ACI 301.
- D. Materials for concrete shall conform to the following requirements:
 - 1. Cement shall be standard brand Portland cement conforming to ASTM C 150 for Type V, including Table 1A optional requirements. A minimum of 85 percent of cement by weight shall pass a 325 screen. A single brand of cement shall be used throughout the work, and prior to its use, the brand shall be acceptable to the Engineer. The cement shall be suitably protected from exposure to moisture until used. Cement that has become lumpy shall not be used. Sacked cement shall be stored in such a manner so as to permit access for inspection and sampling. Certified mill test reports, including fineness, for each shipment of cement to be used shall be submitted to the Engineer if requested regarding compliance with these Specifications.
 - 2. Water for mixing and curing shall be potable, clean, and free from objectionable quantities of silty organic matter, alkali, salts and other impurities. The water shall be considered potable, for the purposes of this Section only, if it meets the requirements of the local governmental agencies. Agricultural water with high total dissolved solids (over 1000 mg/l TDS) shall not be used.
 - 3. Aggregates shall be obtained from pits acceptable to the Engineer, shall be non-reactive, and shall conform to ASTM C 33. Maximum size of coarse aggregate shall be as specified herein. Lightweight sand for fine aggregate will not be permitted.
 - a. Coarse aggregates shall consist of clean, hard, durable gravel, crushed gravel, crushed rock or a combination thereof. The coarse aggregates shall be prepared and handled in two or more size groups for combined aggregates with a maximum size greater than 3/4-inch. When the aggregates are proportioned for each batch of

concrete the two size groups shall be combined. See the requirements below for the use of the size groups.

- b. Fine aggregates shall be natural sand or a combination of natural and manufactured sand that are hard and durable. When tested in accordance with ASTM D2419, the sand equivalency shall not be less than 75 percent for an average of three samples, nor less than 70 percent for an individual test. Gradation of fine aggregate shall conform to ASTM C 33, with 15 to 30 percent passing the number 50 screen and 5 to 10 percent passing the number 100 screen. The fineness modulus of sand used shall not be over 3.00.
- c. Combined aggregates shall be well graded from coarse to fine sizes and shall be uniformly graded between screen sizes to produce a concrete that has optimum workability and consolidation characteristics. Where a trial batch is required for a mix design, the final combined aggregate gradations will be established during the trial batch process.
- d. When tested in accordance with ASTM C 289, the ratio of silica released to reduction in alkalinity shall not exceed 1.0.
- e. When tested in accordance with ASTM C 40, the fine aggregate shall produce a color in the supernatant liquid no darker than the reference standard color solution.
- f. When tested in accordance with ASTM C 131 or ASTM C 535, the coarse aggregate shall show a loss not exceeding 42 percent after 500 revolutions, or 10.5 percent after 100 revolutions.
- g. When tested in accordance with ASTM C 88, the loss resulting after five cycles shall not exceed 10 percent for fine or coarse aggregate when using sodium sulfate.
- 4. Ready-mix concrete shall conform to the requirements of ASTM C 94.
- 5. Admixtures: All admixtures shall be compatible and by a single manufacturer capable of providing qualified field service representation. Admixtures shall be used in accordance with manufacturer's recommendations. If the use of an admixture is producing an inferior end result, the Contractor shall discontinue use of the admixture. Admixtures shall not contain thiocyanates nor more than 0.05 percent chloride ion and shall be non-toxic after 30 days.
 - a. Air-entraining agent meeting the requirements of ASTM C 260 shall be used. Sufficient air-entraining agent shall be used to provide a total air content of 3 to 5 percent. The District reserves the right, at any time, to sample and test the air-entraining agent received on the job by the Contractor. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement. Air content shall be tested at the point of placement.
 b. Set controlling and water reducing admixtures: Admixtures may be added at the Contractor's option to control the set, effect water reduction, and increase workability. The addition of an admixture
 - reduction, and increase workability. The addition of an admixture shall be at the Contractor's expense. The use of an admixture shall be subject to acceptance by the Engineer. Concrete containing an
admixture shall be first placed at a location determined by the Engineer. Admixtures specified herein shall conform to the requirements of ASTM C 494. The required quantity of cement shall be used in the mix regardless of whether or not an admixture is used.

- 1) Concrete shall not contain more than one water reducing admixture. Concrete containing an admixture shall be first placed at a location determined by the Engineer.
- Set controlling admixture shall be either with or without water-reducing properties. Where the air temperature at the time of placement is expected to be consistently over 80 degrees F, a set retarding admixture shall be used.
- 3) Normal range water reducer shall conform to ASTM C 494, Type A. The quantity of admixture used and the method of mixing shall be in accordance with the Manufacturer's instructions and recommendations.
- 4) High range water reducer shall conform to ASTM C 494, Type F or G. High range water reducer shall be added to the concrete after all other ingredients have been mixed and initial slump has been verified. No more than 14 ounces of water reducer per sack of cement shall be used. Water reducer shall be considered as part of the mixing water when calculating water cement ratio.
- 5) If the high range water reducer is added to the concrete at the job site, it may be used in conjunction with the same water reducer added at the batch plant. Concrete shall have a slump of 3 inches \pm 1/2-inch prior to adding the high range water reducing admixture at the job site. The high range water reducing admixture shall be accurately measured and pressure injected into the mixer as a single dose by an experienced technician. A standby system shall be provided and tested prior to each day's operation of the job site system.
- 6) Concrete shall be mixed at mixing speed for a minimum of 30 mixer revolutions after the addition of the high range water reducer.
- 7) Flyash shall not be used.

2.2 CURING MATERIALS

- A. Materials for curing concrete as specified herein shall conform to the following requirements and ASTM C 309:
 - 1. All curing compounds shall be white pigmented, resin based; Sodium silicate compounds shall not be allowed. Only water-based resin curing compounds shall be used.
 - 2. Polyethylene sheet for use as concrete curing blanket shall be white and shall have a nominal thickness of 6 mils. The loss of moisture when

determined in accordance with the requirements of ASTM C 156 shall not exceed 0.055 grams per square centimeter of surface.

- 3. Polyethylene-coated waterproof paper sheeting for use as concrete curing blanket shall consist of white polyethylene sheeting free of visible defects, uniform in appearance, having a nominal thickness of 2 mils and permanently bonded to waterproof paper conforming to the requirements of Federal Specification UU-B-790A (Int. Amd. 1). The loss of moisture, when determined in accordance with the requirements of ASTM C 156, shall not exceed 0.055 gram per square centimeter of surface.
- 4. Polyethylene-coated burlap for use as concrete curing blanket shall be 4mil thick, white opaque polyethylene film impregnated or extruded into one side of the burlap. Burlap shall weigh not less than 9 ounces per square yard. The loss of moisture, when determined in accordance with the requirements of ASTM C 156, shall not exceed 0.055 grams per square centimeter of surface.
- 5. Curing mats for use in Curing Method 6 as specified herein, shall be heavy shag rugs or carpets or cotton mats quilted at 4 inches on center. Curing mats shall weigh a minimum of 12 ounces per square yard when dry.

2.3 NON-WATERSTOP JOINT MATERIALS

- A. Materials for non-waterstop joints in concrete shall conform to the following requirements:
 - 1. Preformed joint filler for non-water retaining applications shall be a nonextruding, resilient, bituminous type conforming to the requirements of ASTM D 1751.
 - 2. Elastomeric joint sealer shall conform to the requirements of Section 07920.
 - 3. Mastic joint sealer shall be a material that does not contain evaporating solvents; that will tenaciously adhere to concrete surfaces; that will remain permanently resilient and pliable; that will not be affected by continuous presence of water and will not in any way contaminate potable water; and that will effectively seal the joints against moisture infiltration even when the joints are subject to movement due to expansion and contraction. The sealer shall be composed of special asphalts or similar materials blended with lubricating and plasticizing agents to form a tough, durable mastic substance containing no volatile oils or lubricants.

2.4 MISCELLANEOUS MATERIALS

- A. Dampproofing agent shall be an asphalt emulsion.
- B. Bonding agents shall be epoxy adhesives.

2.5 CONCRETE DESIGN REQUIREMENTS

- Α. General: Concrete shall be composed of cement, admixtures, aggregates and water. These materials shall be of the qualities specified. The exact proportions in which these materials are to be used for different parts of the work will be determined during the trial batch. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage and, where deposited in forms, to have good consolidation properties and maximum smoothness of surface. In mix designs, the percentage of sand of the total weight of fine and coarse aggregate shall not exceed 41 for hydraulic structures or 50 for all other structures, unless noted otherwise. The aggregate gradations shall be formulated to provide fresh concrete that will not promote rock pockets around reinforcing steel or embedded items. The proportions shall be changed whenever necessary or desirable to meet the required results at no additional cost to the District. All changes shall be subject to review by the Engineer.
- B. Water-Cement Ratio and Compressive Strength: The minimum compressive strength and cement content of concrete shall be not less than that specified in the following tabulation.

Type of Work	Min 28-Day Compressive Strength (psi)	Max Size Aggregate (in)	Minimum Cement per cu yd (lbs)	Max W/C Ratio (by weight)
Structural Concrete	:			
Roof, floor slabs, columns,5,000 walls and all other concrete items not specified elsewhere		1	658	0.40
12" and thicker walls, slabs5,000 on grade and footings (optional)		1-1/2	658	0.40
Pea Gravel Mix	4,000	3/8	752	0.40
Lean concrete	2,000	1	376	0.60

Note: The Contractor is cautioned that the limiting parameters specified above are not a mix design. Additional cement or water reducing agent may be required to achieve workability demanded by the Contractor's construction methods and aggregates. The Contractor is responsible for any costs associated with furnishing concrete with the required workability. C. Adjustments to Mix Design: The mixes used shall be changed whenever such change is necessary or desirable to secure the required strength, density, workability, and surface finish and the Contractor shall be entitled to no additional compensation because of such changes.

2.6 CONSISTENCY

A. The quantity of water entering into a batch of concrete shall be just sufficient, with a normal mixing period, to produce a concrete which can be worked properly into place without segregation, and which can be compacted by the vibratory methods herein specified to give the desired density, impermeability and smoothness of surface. The quantity of water shall be changed as necessary, with variations in the nature or moisture content of the aggregates, to maintain uniform production of a desired consistency. The consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C 143. The slumps shall be as follows:

Part of Work	Slump (in)	
All concrete, unless noted otherwise	3 inches ± 1 inch	
With high range water reducer added	7 inches ± 2 inches	
Pea gravel mix	7 inches ± 2 inches	
Ductbanks	5 inches ± 1 inch	

2.7 TRIAL BATCH AND LABORATORY TESTS

- Α. Before placing any concrete, a testing laboratory designated by the Engineer shall prepare a trial batch of each class of structural concrete, based on the preliminary concrete mixes submitted by the Contractor. During the trial batch the aggregate proportions may be adjusted by the testing laboratory using the two coarse aggregate size ranges to obtain the required properties. If one size range produces an acceptable mix, a second size range need not be used. Such adjustments shall be considered refinements to the mix design and shall not be the basis for extra compensation to the Contractor. All concrete shall conform to the requirements of this Section, whether the aggregate proportions are from the Contractor's preliminary mix design, or whether the proportions have been adjusted during the trial batch process. The trial batch shall be prepared using the aggregates, cement and admixture proposed for the project. The trial batch materials shall be of a quantity such that the testing laboratory can obtain 3 drying shrinkage, and 6 compression test specimens from each batch. The cost of not more than 3 laboratory trial batch tests for each specified concrete strength will be borne by the District but the Contractor shall furnish and deliver the materials in steel drums at no cost. Any additional trial batch testing required shall be performed at the expense of the Contractor at no increase in cost to the District.
- B. The determination of compressive strength will be made by testing 6-inch diameter by 12-inch high cylinders; made, cured and tested in accordance with ASTM C 192

and ASTM C 39. Three compression test cylinders will be tested at 7 days and 3 at 28 days. The average compressive strength for the 3 cylinders tested at 28 days for any given trial batch shall not be less than 125 percent of the specified compressive strength.

C. A sieve analysis of the combined aggregate for each trial batch shall be performed according to the requirements of ASTM C 136. Values shall be given for percent passing each sieve.

2.8 SHRINKAGE LIMITATION

- A. The maximum concrete shrinkage for specimens cast in the laboratory from the trial batch, as measured at 21-day drying age or at 28-day drying age shall be 0.036 percent or 0.042 percent, respectively. The Contractor shall only use a mix design for construction that has first met the trial batch shrinkage requirements. Shrinkage limitations apply only to structural concrete.
- B. The maximum concrete shrinkage for specimens cast in the field shall not exceed the trial batch maximum shrinkage requirement by more than 25 percent.
- C. If the required shrinkage limitation is not met during construction, the Contractor shall take any or all of the following actions, at no additional cost to the District, for securing the specified shrinkage requirements. These actions may include changing the source or aggregates, cement and/or admixtures; reducing water content; washing of aggregate to reduce fines; increasing the number of construction joints; modifying the curing requirements; or other actions designed to minimize shrinkage or the effects of shrinkage.

2.9 MEASUREMENT OF CEMENT AND AGGREGATE

- A. The amount of cement and of each separate size of aggregate entering into each batch of concrete shall be determined by direct weighing equipment furnished by the Contractor and acceptable to the Engineer.
- B. Weighing tolerances:

MaterialPercent of total weightCement1Aggregates3Admixtures3

2.10 MEASUREMENT OF WATER

A. The quantity of water entering the mixer shall be measured by a suitable water meter or other measuring device of a type acceptable to the Engineer and capable of measuring the water in variable amounts within a tolerance of one percent. The water feed control mechanism shall be capable of being locked in position so as to deliver constantly any specified amount of water to each batch of concrete. A

positive quick-acting valve shall be used for a cut-off in the water line to the mixer. The operating mechanism must be such that leakage will not occur when the valves are closed.

2.11 READY-MIXED CONCRETE

- A. At the Contractor's option, ready-mixed concrete may be used meeting the requirements as to materials, batching, mixing, transporting, and placing as specified herein and in accordance with ASTM C 94, including the following supplementary requirements.
- B. Ready-mixed concrete shall be delivered to the site of the work, and discharge shall be completed within one hour after the addition of the cement to the aggregates or before the drum has been revolved 250 revolutions, whichever is first.
- C. Truck mixers shall be equipped with electrically-actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the resettable, recording type, and shall be mounted in the driver's cab. The counters shall be actuated at the time of starting mixers at mixing speeds.
- D. Each batch of concrete shall be mixed in a truck mixer for not less than 70 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolutions of mixing.
- E. Truck mixers and their operation shall be such that the concrete throughout the mixed batch as discharged is within acceptable limits of uniformity with respect to consistency, mix, and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than one inch when the specified slump is 3 inches or less, or if they differ by more than 2 inches when the specified slump is more than 3 inches, the mixer shall not be used on the work unless the causing condition is corrected and satisfactory performance is verified by additional slump tests. All mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit, and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.
- F. Each batch of ready-mixed concrete delivered at the job site shall be accompanied by a delivery ticket furnished to the Engineer.
- G. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting readymixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the Engineer.

2.12 MANUFACTURERS

- A. Products shall be manufactured by one of the following (or equal):
 - 1. Air Entraining Agent

Micro-Air by Master Builders Daravair by W.R. Grace Sika AEA-15 by Sika Corporation

2. Set Retarding Admixture

Plastocrete by Sika Corporation Pozzolith 300R by Master Builders Daratard by W.R. Grace

3. Set Accellerating Admixture

Plastocrete 161FL by Sika Corporation Pozzutec 20 by Master Builders Daraset by W.R. Grace

4. Normal Range Water Reducer

WRDA 79 by W.R. Grace Pozzolith 322-N by Master Builders Plastocrete 161 by Sika Corporation

5. High Range Water Reducer

Daracem 100 or WRDA 19 by W.R. Grace Sikament FF or Sikament 86 by Sika Corporation Rheobuild 1000 or Rheobuild 716 by Master Builders

6. Curing Compound

Aqua Resincure by Burke Aqua-cure by Euclid Chemical Company Masterkure-W by Master Builders

7. Evaporation Retardant

Confilm by Master Builders Eucobar by Euclid Chemical Company

8. Dampproofing Agent

Hydrocide 600 by Sonneform Sealmastic by W.R. Meadows Damp proofing Asphalt Coating by Euclid Chemical Company

9. Agents for Bonding Freshly-Mixed Plastic Concrete to Hardened Concrete

Sikadur 32 Hi-Mod Epoxy Adhesive by Sika Corporation Concresive liquid (LPL) by Master Builders BurkEpoxy MV by Burke

10. Agents for Bonding Hardened Concrete to Steel

Sikadur 31 Hi-Mod Gel by Sika Corporation BurkEpoxy NS by Burke Concresive Paste (LPL) by Master Builders

11. White Portland Cement

Atlas White

PART 3 - EXECUTION

3.1 **PROPORTIONING AND MIXING**

- A. Proportioning: Proportioning of the concrete mix shall conform to the requirements of Chapter 3 "Proportioning" of ACI 301.
- B. Mixing: Mixing of concrete shall conform to the requirements of Chapter 7 of ACI 301.
- C. Slump: Maximum slumps shall be as indicated.
- D. Retempering: Retempering of concrete or mortar which has partially hardened shall not be permitted.

3.2 PREPARATION OF SURFACES FOR CONCRETING

- A. General: Earth surfaces shall be thoroughly wetted by sprinkling, prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud, and debris at the time of placing concrete.
- B. Joints in Concrete up to 60 Days Old: Concrete surfaces upon or against which concrete is to be placed, where the placement of the concrete has been stopped or interrupted so that, as determined by the ENGINEER, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be given a compacted, roughened surface for good bond. Except where the Drawings call for joint surfaces to be coated, the joint surfaces shall be cleaned of all laitance, loose or defective concrete, foreign material, and roughened to a minimum 1/4-inch amplitude. Such cleaning and roughening shall be accomplished by hydroblasting or sandblasting (exposing aggregate) followed by thorough washing. All pools of water shall be removed from the surface of construction joints before the new concrete is placed.
- C. After the surfaces have been prepared all approximately horizontal construction joints shall be covered with a 6-inch lift of the pea gravel mix indicated above. The

mix shall be placed and spread uniformly. Wall concrete shall follow immediately and shall be placed upon the fresh pea gravel mix.

- D. Placing Interruptions: When placing of concrete is to be interrupted long enough for the concrete to take a set, the working face shall be given a shape by the use of forms or other means, that will secure proper union with subsequent work; provided that construction joints shall be made only where acceptable to the Engineer.
- E. Embedded Items: No concrete shall be placed until all formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been completed and accepted by the Engineer at least 4 hours before placement of concrete. All surfaces of forms and embedded items that have become encrusted with dried grout from concrete previously placed shall be cleaned of all such grout before the surrounding or adjacent concrete is placed.
- F. All inserts or other embedded items shall conform to the requirements herein.
- G. All reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms where shown or by shop drawings and shall be acceptable to the Engineer before any concrete is placed. Accuracy of placement is the responsibility of the Contractor.
- H. Casting New Concrete Against Concrete over 60 Days Old: Where concrete is to be cast against old concrete (any concrete which is greater than 60 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by hydro-blasting or sandblasting (exposing aggregate). The joint surface shall be coated with an epoxy bonding agent unless indicated otherwise by the Engineer.
- I. No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the work. No concrete shall be deposited underwater nor shall the Contractor allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, if required, will be subject to the review of the Engineer.
- J. Corrosion Protection: Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there will be a minimum of 2 inches clearance between said items and any part of the concrete reinforcement. Securing such items in position by wiring or welding them to the reinforcement will not be permitted.
- K. Openings for pipes, inserts for pipe hangers and brackets, and the setting of anchors shall, where practicable, be provided for during the placing of concrete.
- L. Anchor bolts shall be accurately set, and shall be maintained in position by templates while being embedded in concrete.

M. Cleaning: The surfaces of all metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed.

3.3 HANDLING, TRANSPORTING, AND PLACING

- A. General: Placing of concrete shall conform to the applicable requirements of Chapter 8 of ACI 301 and the requirements of this Section. No aluminum materials shall be used in conveying any concrete.
- B. Non-Conforming Work or Materials: Concrete which upon or before placing is found not to conform to the requirements specified herein shall be rejected and immediately removed from the work. Concrete which is not placed in accordance with these Specifications, or which is of inferior quality, shall be removed and replaced by the Contractor at no additional cost to the District.
- C. Unauthorized Placement: No concrete shall be placed except in the presence of duly authorized representative of the Engineer. The Contractor shall notify the Engineer in writing at least 24 hours in advance of placement of any concrete.
- D. Placement in Wall Forms: Concrete shall not be dropped through reinforcement steel or into any deep form, nor shall concrete be placed in any form in such a manner as to leave accumulation of mortar on the form surfaces above the placed concrete. In such cases, some means such as the use of hoppers and, if necessary, vertical ducts of canvas, rubber, or metal shall be used for placing concrete in the forms in a manner that it may reach the place of final deposit without separation. In no case shall the free fall of concrete exceed 4 feet below the ends of ducts, chutes, or budgies. Concrete shall be uniformly distributed during the process of depositing and in no case after depositing shall any portion be displaced in the forms more than 6 feet in horizontal direction. Concrete in forms shall be deposited in uniform horizontal layers not deeper than 2 feet; and care shall be taken to avoid inclined layers or inclined construction joints except where such are required for sloping members. Each layer shall be placed while the previous layer is still soft. The rate of placing concrete in forms shall not exceed 5 feet of vertical rise per hour. Sufficient illumination shall be provided in the interior of all forms so that the concrete at the places of deposit is visible from the deck or runway.
- E. Conveyor Belts and Chutes: All ends of chutes, hopper gates, and all other points of concrete discharge throughout the Contractor's conveying, hoisting and placing system shall be so designed and arranged that concrete passing from them will not fall separated into whatever receptacle immediately receives it. Conveyor belts, if used, shall be of an acceptable type. Chutes longer than 50 feet will not be permitted. Minimum slopes of chutes shall be such that concrete of the specified consistency will readily flow in them. If a conveyor belt is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. All conveyor belts and chutes shall be covered.
- F. Placement in Slabs: Concrete placed in sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement. As the work progresses, the concrete shall be vibrated and carefully worked around the slab

reinforcement, and the surface of the slab shall be screeded in an up-slope direction.

- G. Temperature of Concrete: The temperature of concrete when it is being placed shall be not more than 90 degrees F nor less than 55 degrees F for sections less than 12 inches thick nor less than 50 degrees for all other sections. Concrete ingredients shall not be heated to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the specified minimum temperature. When the temperature of the concrete is 85 degrees F or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, the Contractor shall employ effective means, such as precooling of aggregates and mixing water using ice or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F. The CONTRACTOR shall be entitled to no additional compensation on account of the foregoing requirements.
- H. Cold Weather Placement: Remove all snow, ice and frost from the surfaces, including reinforcement, against which concrete is to be placed. Before beginning concrete placement, thaw the subgrade to a minimum depth of 6 inches. All reinforcement and embedded items shall be warmed to above 32 degrees F prior to concrete placement.]

3.4 PUMPING OF CONCRETE

- A. General: If the pumped concrete does not produce satisfactory end results, the Contractor shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.
- B. Pumping Equipment: The pumping equipment must have 2 cylinders and be designed to operate with one cylinder only in case the other one is not functioning. In lieu of this requirement, the Contractor may have a standby pump on the site during pumping.
- C. The minimum diameter of the hose (conduits) shall be in accordance with ACI 304.2R.
- D. Pumping equipment and hoses (conduits) that are not functioning properly, shall be replaced.
- E. Aluminum conduits for conveying the concrete shall not be permitted.
- F. Field Control: Concrete samples for slump, air content, and test cylinders will be taken at the placement (discharge) end of the line.

3.5 ORDER OF PLACING CONCRETE

A. The order of placing concrete in all parts of the work shall be acceptable to the Engineer. In order to minimize the effects of shrinkage, the concrete shall be placed in units as bounded by construction joints shown. The placing of units shall

be done by placing alternate units in a manner such that each unit placed shall have cured at least 7 days for hydraulic structures and 3 days for all other structures before the contiguous unit or units are placed, except that the corner sections of vertical walls shall not be placed until the 2 adjacent wall panels have cured at least 14 days for hydraulic structures and 7 days for all other structures.

B. The surface of the concrete shall be level whenever a run of concrete is stopped. To insure a level, straight joint on the exposed surface of walls, a wood strip at least 3/4-inch thick shall be tacked to the forms on these surfaces. The concrete shall be carried about 1/2-inch above the underside of the strip. About one hour after the concrete is placed, the strip shall be removed and any irregularities in the edge formed by the strip shall be leveled with a trowel and all laitance shall be removed.

3.6 TAMPING AND VIBRATING

- A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted, throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete during placement. Vibrators shall be Group 3 (per ACI 309) high speed power vibrators (8000 to 12,000 rpm) of an immersion type in sufficient number and with (at least one) standby units as required. Group 2 vibrators may be used only at specific locations when accepted by the Engineer.
- B. Care shall be used in placing concrete around waterstops. The concrete shall be carefully worked by rodding and vibrating to make sure that all air and rock pockets have been eliminated. Where flat-strip type waterstops are placed horizontally, the concrete shall be worked under the waterstops by hand, making sure that all air and rock pockets have been eliminated. Concrete surrounding the waterstops shall be given additional vibration, over and above that used for adjacent concrete placement to assure complete embedment of the waterstops in the concrete.
- C. Concrete in walls shall be internally vibrated and at the same time rammed, stirred, or worked with suitable appliances, tamping bars, shovels, or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly as specified. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the results herein specified within 15 minutes after concrete of the prescribed consistency is placed in the forms. The vibrating head shall be kept from contact with the surfaces of the forms. Care shall be taken not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

3.7 FINISHING CONCRETE SURFACES

A. General: Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, and shall present a finished, smooth, continuous hard surface. Allowable deviations from plumb or level and from the alignment, profiles, and dimensions shown are defined as tolerances and were indicated above.

Tolerances are to be distinguished from irregularities in finish as described below. Aluminum finishing tools shall not be used.

- B. Formed Surfaces: No treatment is required after form removal except for curing, repair of defective concrete, and treatment of surface defects. Where architectural finish is required, it shall be as indicated.
 - 1. Surface holes larger than 1/2 inch in diameter or deeper than 1/4 inch are defined as surface defects in basins and exposed walls.
- C. Unformed Surfaces: After proper and adequate vibration and tamping, all unformed top surfaces of slabs, floors, walls, and curbs shall be brought to a uniform surface with suitable tools. Immediately after the concrete has been screeded, it shall be treated with a liquid evaporation retardant. The retardant shall be used again after each work operation as necessary to prevent drying shrinkage cracks. The classes of finish specified for unformed concrete surfaces are designated and defined as follows:
 - 1. Finish U1 Sufficient leveling and screeding to produce an even, uniform surface with surface irregularities not to exceed 3/8-inch. No further special finish is required.
 - 2. Finish U2 After sufficient stiffening of the screeded concrete, surfaces shall be float finished with wood or metal floats or with a finishing machine using float blades. Excessive floating of surfaces while the concrete is plastic and dusting of dry cement and sand on the concrete surface to absorb excess moisture will not be permitted. Floating shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. Surface irregularities shall not exceed 1/4-inch. Joints and edges shall be tooled where shown or as determined by the Engineer.
 - 3. Finish U3 After the floated surface (as specified for Finish U2) has hardened sufficiently to prevent excess of fine material from being drawn to the surface, steel troweling shall be performed with firm pressure such as will flatten the sandy texture of the floated surface and produce a dense, uniform surface free from blemishes, ripples, and trowel marks. The finish shall be smooth and free of all irregularities.
 - 4. Finish U4 Steel trowel finish (as specified for Finish U3) without local depressions or high points. In addition, the surface shall be given a light hairbroom finish with brooming perpendicular to drainage unless otherwise shown. The resulting surface shall be rough enough to provide a nonskid finish.
- D. Unformed surfaces shall be finished according to the following schedule:

UNFORMED SURFACE FINISH SCHEDULE

Area

Finish

Grade slabs and foundations to be covered with concrete or fill material	U1
Floors to be covered with grouted tile or topping grout	U2
Slabs which are water bearing with slopes 10 percent and less	U3
Sloping slabs which are water bearing with slopes greater than 10 percent	U4
Slabs not water bearing	U4
Slabs to be covered with built-up roofing	U2
Interior slabs and floors to receive architectural finish	U3
Top surface of walls	U3

- E. Floor Sealer/Hardener (Surface Applied):
 - 1. Floors to receive hardener shall be cured, cleaned, and dry with all work above them completed. Not less than 60 days shall have elapsed between casting floors and application of sealer/hardener. Apply zinc and/or magnesium fluosilicate evenly, using 3 coats, allowing 24 hours between coats.
 - 2. The first coat shall be 1/3 strength, second coat 1/2 strength, and third coat 2/3 strength. Each coat shall be applied so as to remain wet on the concrete surface for 15 minutes. If sodium silicate is used, it shall be applied evenly, using 3 coats, allowing 24 hours between coats, and the material shall be applied full strength at the rate of one gallon per 300 square feet. Approved proprietary hardeners shall be applied in conformance with the manufacturer's instruction. After the final coat is completed and dry, surplus hardener shall be removed from the surface by scrubbing and mopping with water.
 - 3. Floor hardener shall be applied where shown.

3.8 ARCHITECTURAL FINISH

- A. General: Architectural finishes shall be required only where specifically indicated. In all other cases the requirements above shall apply.
 - 1. Immediately after the forms have been stripped, the concrete surface shall be inspected and any poor joints, voids, rock pockets, or other defective areas shall be repaired and all form-tie holes filled as specified herein.

- 2. Architectural finishes shall not be applied until the concrete surface has been repaired as required and the concrete has cured at least 14 days.
- 3. All architecturally treated concrete surfaces shall conform to the accepted sample required herein in texture, color, and quality. It shall be the Contractor's responsibility to maintain and protect the concrete finish.
- B. Smooth Concrete Finish
 - 1. The concrete surface shall be wetted, and a grout shall be applied with a brush. The grout shall be made by mixing one-part Portland cement and one part of fine sand that will pass a No. 16 sieve with sufficient water to give it the consistency of thick paint. The cement used in said grout shall be 1/2 gray and 1/2 white Portland cement, as determined by the Engineer. Calcium chloride in the amount of 5 percent by volume of the cement shall be used in the brush coat. The freshly applied grout shall be vigorously rubbed into the concrete surface with a wood float filling all small air holes. After all the surface grout had been removed with a steel trowel, the surface shall be allowed to dry and, when dry, shall be vigorously rubbed with burlap to remove completely all surface grout so that there is no visible paint-like film of grout on the concrete. The entire cleaning operation for any area shall be completed the day it is started, and no grout shall be left on the surface overnight.
 - 2. Cleaning operations for any given day shall be terminated at panel joints. It is essential that the various operations be carefully timed to secure the desired effect which is a light-colored concrete surface of uniform color and texture without any appearance of a paint or grout film.
 - 3. In the event that improper manipulation results in an inferior finish, the Contractor shall rub such inferior areas with carborundum bricks.
 - 4. Before beginning any of the final treatment on exposed surfaces, the Contractor shall treat in a satisfactory manner a trial area of at least 200 square feet in some inconspicuous place selected by the Engineer and shall preserve said trial area undisturbed until the completion of the job.
- C. Sandblasted Concrete Finish
 - 1. Sandblasting shall be done in a safe manner acceptable to local authorities and per OSHA requirements. The sandblasting shall be a light sandblast to remove laitance and to produce a uniform fine aggregate surface texture with approximately 1/32- to 1/16-inch of surface sandblasted off. Corners, patches, form panel joints, and soft spots shall be sandblasted with care.
 - 2. A 3-sq ft sample panel of the sandblasted finish shall be provided by the Contractor for acceptance prior to starting the sandblasting work. The sample panel shall include a corner, plugs, and joints and shall be marked after approval. All other sandblasting shall be equal in finish to the sample panel.

3. Protection against sandblasting shall be provided on all surfaces and materials not requiring sandblasting but within or adjacent to areas being sandblasted. After sandblasting, the concrete surfaces shall be washed with clean water and excess sand removed.

3.9 CURING AND DAMPPROOFING

A. General: All concrete shall be cured for not less than 14 days after placing, in accordance with the methods specified herein for the different parts of the work, and described in detail in the following paragraphs:

Surface to be Cured or Dampproofed	Method
Unstripped forms	1
Wall sections with forms removed	4 or 6
Construction joints between footings and walls, and between floor slab and columns	2
Encasement concrete and thrust blocks	3
All concrete surfaces not specifically provided for elsewhere in this Paragraph	4
Floor slabs on grade in hydraulic structures	5
Slabs not on grade	6

- B. Method 1: Wooden forms shall be wetted immediately after concrete has been placed and shall be kept wet with water until removed. If steel forms are used the exposed concrete surfaces shall be kept continuously wet until the forms are removed. If forms are removed within 14 days of placing the concrete, curing shall be continued in accordance with Method 6, herein.
- C. Method 2: The surface shall be covered with burlap mats which shall be kept wet with water for the duration of the curing period, until the concrete in the walls has been placed. No curing compound shall be applied to surfaces cured under Method 2.
- D. Method 3: The surface shall be covered with moist earth not less than 4 hours, nor more than 24 hours, after the concrete is placed. Earthwork operations that may damage the concrete shall not begin until at least 7 days after placement of concrete.
- E. Method 4: The surface shall be sprayed with a liquid curing compound.
 - 1. Curing compound shall not be used on concrete surfaces to be coated, waterproofed, moisture-proofed, or where any coverings are to be bonded.

- 2. It shall be applied in accordance with the manufacturer's printed instructions at a maximum coverage rate of 200 square feet per gallon and in such a manner as to cover the surface with a uniform film which will seal thoroughly.
- 3. Where the curing compound method is used, care shall be exercised to avoid damage to the seal during the curing period. Should the seal be damaged or broken before the expiration of the curing period, the break shall be repaired immediately by the application of additional curing compound over the damaged portion.
- 4. Wherever curing compound may have been applied by mistake to surfaces against which concrete subsequently is to be placed and to which it is to adhere, said compound shall be entirely removed by wet sandblasting just prior to the placing of new concrete.
- 5. Where curing compound is specified, it shall be applied as soon as the concrete has hardened enough to prevent marring on unformed surfaces, and within 2 hours after removal of forms from contact with formed surfaces. Repairs required to be made to formed surfaces shall be made within the said 2-hour period; provided, however, that any such repairs which cannot be made within the said 2-hour period shall be delayed until after the curing compound has been applied. When repairs are to be made to an area on which curing compound has been applied, the area involved shall first be wet-sandblasted to remove the curing compound, following which repairs shall be made as specified herein.
- 6. At all locations where concrete is placed adjacent to a panel which has been coated with curing compound, the previously coated panel shall have curing compound reapplied to an area within 6 feet of the joint and to any other location where the curing membrane has been disturbed.
- 7. Prior to final acceptance of the Work, all visible traces of curing compound shall be removed from all surfaces in such a manner that does not damage surface finish.
- F. Method 5:
 - 1. Until the concrete surface is covered with curing compound, the entire surface shall be kept damp by applying water using nozzles that atomize the flow so that the surface is not marred or washed. The concrete shall be given a coat of curing compound in accordance with Method 4, herein. Not less than one hour nor more than 4 hours after the coat of curing compound has been applied, the surface shall be wetted with water delivered through a fog nozzle, and concrete-curing blankets shall be placed on the slabs. The curing blankets shall be polyethylene sheet, polyethylene-coated waterproof paper sheeting or polyethylene-coated burlap. The blankets shall be laid with the edges butted together and with the joints between strips sealed with 2-inch wide strips of sealing tape or with edges lapped not less than 3 inches and fastened together with a waterproof cement to form a continuous watertight joint.

- 2. The curing blankets shall be left in place during the 14-day curing period and shall not be removed until after concrete for adjacent work has been placed. Should the curing blankets become torn or otherwise ineffective, the Contractor shall replace damaged sections. During the first 3 days of the curing period, no traffic of any nature and no depositing, temporary or otherwise, of any materials shall be permitted on the curing blankets. During the remainder of the curing period, foot traffic and temporary depositing of materials that impose light pressure will be permitted only on top of plywood sheets 5/8-inch minimum thickness, laid over the curing blanket. The Contractor shall add water under the curing blanket as often as necessary to maintain damp concrete surfaces at all times.
- G. Method 6:
 - 1. The concrete shall be kept continuously wet by the application of water for a minimum period of at least 14 consecutive days beginning immediately after the concrete has reached final set or forms have been removed.
 - 2. Until the concrete surface is covered with the curing medium, the entire surface shall be kept damp by applying water using nozzles that atomize the flow so that the surface is not marred or washed.
 - 3. Heavy curing mats shall be used as a curing medium to retain the moisture during the curing period. The curing medium shall be weighted or otherwise held in place to prevent being dislodged by wind or any other causes and to be substantially in contact with the concrete surface. All edges shall be continuously held in place.
 - 4. The curing blankets and concrete shall be kept continuously wet by the use of sprinklers or other means both during and after normal working hours.
 - 5. Immediately after the application of water has terminated at the end of the curing period, the curing medium shall be removed, any dry spots shall be rewetted, and curing compound shall be immediately applied in accordance with Method 4, herein.
 - 6. The Contractor shall dispose of excess water from the curing operation to avoid damage to the work.
- H. Dampproofing
 - 1. The exterior surface of all buried roof slabs shall be dampproofed as follows.

- 2. Immediately after completion of curing the surface shall be sprayed with a dampproofing agent consisting of an asphalt emulsion. Application shall be in 2 coats. The first coat shall be diluted to 1/2 strength by the addition of water and shall be sprayed on so as to provide a maximum coverage rate of 100 square feet per gallon of dilute solution. The second coat shall consist of an application of the specified material, undiluted, and shall be sprayed on so as to provide a maximum coverage rate of 100 square feet per gallon. Dampproofing material shall be as specified herein.
- 3. As soon as the asphalt emulsion, applied as specified herein, has taken an initial set, the entire area thus coated shall be coated with whitewash. Any formula for mixing the whitewash may be used which produces a uniformly coated white surface and which so remains until placing of the backfill. Should the whitewash fail to remain on the surface until the backfill is placed, the Contractor shall apply additional whitewash

3.10 PROTECTION

- A. The Contractor shall protect all concrete against injury until final acceptance by the District.
- B. Fresh concrete shall be protected from damage due to rain. The Contractor shall provide such protection while the concrete is still plastic and whenever such precipitation is imminent or occurring.

3.11 CURING AND THERMAL PROTECTION IN COLD WEATHER

- A. The Contractor shall be prepared to protect all concrete against freezing. After the first frost or when the mean daily temperature in the vicinity of the worksite falls below 40 degrees F for more than one day, the concrete shall be maintained at a temperature not lower than 50 degrees F for at least 72 hours after it is placed.
- B. Water curing of concrete may be reduced to 6 days during periods when the mean daily temperature in the vicinity of the worksite is less than 40 degrees F. The concrete shall be maintained at not less than 50 degrees F for the entire curing period.
- C. Discontinuance of protection against freezing temperatures shall be such that the drop in temperature of any portion of the concrete will be gradual and will not exceed 40 degrees F in 24 hours. In the spring, when the mean daily temperature rises above 40 degrees F for more than 3 successive days, the specified 72-hour protection at a temperature not lower than 50 degrees F may be discontinued for as long as the mean daily temperature remains above 40 degrees F; provided, that the concrete shall be protected against freezing temperatures for not less than 48 hours after placement.
- D. Where artificial heat is employed, special care shall be taken to prevent the concrete from drying. Use of unvented heaters will be permitted only when unformed surfaces of concrete adjacent to the heaters are protected for the first 24 hours from an excessive carbon dioxide atmosphere by application of curing

compound; provided, that the use of curing compound for such surfaces is otherwise permitted by these Specifications.

3.12 TREATMENT OF SURFACE DEFECTS

- A. As soon as forms are removed, all exposed surfaces shall be carefully examined and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the Engineer. In no case will extensive patching of honeycombed concrete be permitted. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall have them repaired as specified herein. Concrete containing extensive voids, holes, honeycombing, or similar depression defects, shall be completely removed and replaced. All repairs and replacements herein specified shall be promptly executed by the Contractor at its own expense.
- B. Defective surfaces to be repaired shall be cut back from trueline a minimum depth of 1/2-inch over the entire area. Feathered edges will not be permitted. Where chipping or cutting tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of all laitance or soft material, and not less than 1/32-inch depth of the surface film from all hard portions, by means of an efficient sandblast. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of shooting with shotcrete or with cement mortar so that while the repair material is being applied, the surfaces under repair will remain moist, but not so wet as to overcome the suction upon which a good bond depends. The material used for repair proposed shall consist of a mixture of one sack of cement to 3 cubic feet of sand. For exposed walls, the cement shall contain such a proportion of Atlas white portland cement as is required to make the color of the patch match the color of the surrounding concrete.
- C. Holes left by tie-rod cones shall be reamed with suitable toothed reamers so as to leave the surfaces of the holes clean and rough. These holes then shall be repaired in an approved manner with dry-packed cement grout. Holes left by form-tying devices having a rectangular cross-section, and other imperfections having a depth greater than their least surface dimension, shall not be reamed but shall be repaired in an approved manner with dry-packed cement grout.
- D. All repairs shall be built up and shaped in such a manner that the completed work will conform to the requirements of this Section, as applicable, using approved methods which will not disturb the bond, cause sagging, or cause horizontal fractures. Surfaces of said repairs shall receive the same kind and amount of curing treatment as required for the concrete in the repaired section.
- E. Prior to filling any structure with water, all cracks that may have developed shall be "vee'd" as shown and filled with sealant conforming to the requirements of Section 03290. This repair method shall be done on the water bearing face of members. Prior to backfilling, faces of members in contact with fill, which are not covered with a waterproofing membrane, shall also have cracks repaired.

3.13 PATCHING HOLES IN CONCRETE

- A. Patching Small Holes:
 - 1. Holes which are less than 12 inches in their least dimension and extend completely through concrete members, shall be filled as specified herein.
 - 2. Small holes in members which are water-bearing or in contact with soil or other fill material, shall be filled with non-shrink grout. Where a face of the member is exposed to view, the non-shrink grout shall be held back 2 inches from the finished surface. The remaining 2 inches shall then be patched according to the Paragraph above.
 - 3. Small holes through all other concrete members shall be filled with nonshrink grout, with exposed faces treated as above.
- B. Patching Large Holes:
 - 1. Holes which are larger than 12 inches in their least dimension, shall have a keyway chipped into the edge of the opening all around, unless a formed keyway exists. The holes shall then be filled with concrete as specified herein.
 - 2. Holes which are larger than 24 inches in their least dimension and which do not have reinforcing steel extending from the existing concrete, shall have reinforcing steel set in grout in drilled holes. The reinforcing added shall match the reinforcing in the existing wall unless indicated otherwise.
 - 3. Large holes in members which are water bearing or in contact with soil or other fill, shall have a bentonite type waterstop material placed around the perimeter of the hole as specified in the Section 03290 unless there is an existing waterstop in place.

3.14 CARE AND REPAIR OF CONCRETE

A. The Contractor shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the District. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at the Contractor's expense.

END OF SECTION

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

- A. The Work of this Section includes providing grout other than that required for masonry work, complete.
- B. The following types of grout are included in the Work of this Section:
 - 1. Non-Shrink Grout: This type of grout shall be used wherever grout is required, unless another type is specifically indicated.
 - 2. Cement Grout
 - 3. Epoxy Grout
 - 4. Topping Grout and Concrete Fill

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03300 - Cast-in-Place Structural Concrete

1.3 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

- A. Except as otherwise indicated, the current versions of the following apply to the WORK of this Section:
 - CRD-C 621 Corps of Engineers Specification for Non-shrink Grout
 - ASTM C 109 Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in or 50-mm Cube Specimens)
 - ASTM C 531 Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical- Resistant Mortars, Grouts, and Monolithic Surfacings
 - ASTM C 579 Test Methods for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfacings
 - ASTM C 827 Test Method for Early Volume Change of Cementitious Mixtures
 - ASTM D 696 Test Method for Coefficient of Linear Thermal Expansion of Plastics

1.4 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300:

- 1. Manufacturer's literature containing instructions and recommendations on the mixing, handling, placement, and appropriate uses for each type of non-shrink and epoxy grouts proposed for use in the Work.
- 2. Certified test results verifying the compressive strength, shrinkage, and expansion properties for proposed non-shrink and epoxy grouts.

1.5 TESTING DURING CONSTRUCTION

- A. Field Tests:
 - 1. Compression test specimens will be taken during construction from the first placement of each type of grout, and at intervals thereafter as selected by the Engineer to insure continued compliance with these specifications. The specimens will be made by the Engineer or its representative.
 - 2. Compression tests and fabrication of specimens for cement grout and nonshrink grout will be performed as specified in ASTM C 109 at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at 7 days, 28 days, and each additional time period as appropriate.
 - 3. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C 579, Method B, at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at 7 days, and each earlier time period as appropriate.
 - 4. All grout, already placed, which fails to meet the requirements of these specifications, is subject to removal and replacement at the cost of the Contractor.
 - 5. The cost of all laboratory tests on grout will be borne by the District, but the Contractor shall assist the Engineer in obtaining specimens for testing. However, the Contractor shall be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. The Contractor shall supply all materials necessary for fabricating the test specimens.

PART 2 - PRODUCTS

2.1 CEMENT GROUT

- A. Cement Grout: Cement grout shall be composed of one part cement, three parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 days shall be 5000 psi.
- B. Cement grout materials shall be as indicated in Section 03300.

2.2 PREPACKAGED GROUTS

- A. Non-Shrink Grout:
 - 1. Non-shrink grout shall be a prepackaged, inorganic, non-gas-liberating, nonmetallic, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout indicated herein shall be that recommended by the manufacturer for the particular application.
 - 2. Class A non-shrink grouts shall have a minimum 28 day compressive strength of 5000 psi; shall have no shrinkage (0.0 percent) and a maximum 4.0 percent expansion in the plastic state when tested in accordance with ASTM C 827; and shall have no shrinkage (0.0 percent) and a maximum of 0.2 percent expansion in the hardened state when tested in accordance with CRD C 621.
 - 3. Class B non-shrink grouts shall have a minimum 28 day compressive strength of 5000 psi and shall meet the requirements of CRD C 621.
 - 4. Application:
 - a. Class A non-shrink grout shall be used for the repair of all holes and defects in concrete members which are water bearing or in contact with soil or other fill material, grouting under all equipment base plates, and at all locations where grout is specified in the contract documents; except, for those applications for Class B non-shrink grout and epoxy grout indicated herein. Class A non-shrink grout may be used in place of Class B non-shrink grout for all applications.
 - b. Class B non-shrink grout shall be used for the repair of all holes and defects in concrete members which are not water-bearing and not in contact with soil or other fill material, grouting under all base plates for structural steel members, and grouting railing posts in place.
- B. Epoxy Grout:
 - 1. Epoxy grout shall be a pourable, non-shrink, 100 percent solids system. The epoxy grout system shall have three components: resin, hardener, and specially blended aggregate, all premeasured and prepackaged. The resin component shall not contain any non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged.
 - 2. The chemical formulation of the epoxy grout shall be that recommended by the manufacturer for the particular application.

- 3. The mixed epoxy grout system shall have a minimum working life of 45 minutes at 75 degrees F.
- 4. The epoxy grout shall develop a compressive strength of 5000 psi in 24 hours and 10,000 psi in seven days when tested in accordance with ASTM C 579, Method B. There shall be no shrinkage (0.0 percent) and a maximum 4.0 percent expansion when tested in accordance with ASTM C 827.
- 5. The epoxy grout shall exhibit a minimum effective bearing area of 95 percent. This shall be determined by a test consisting of filling a 2-inch diameter by 4inch high metal cylinder mold covered with a glass plate coated with a release agent. A weight shall be placed on the glass plate. At 24 hours after casting, the weight and plate shall be removed and the area in plan of all voids measured. The surface of the grout shall be probed with a sharp instrument to locate all voids.
- 6. The peak exotherm of a 2-inch diameter by 4-inch high cylinder shall not exceed 95 degrees F when tested with 75 degrees F material at laboratory temperature. The epoxy grout shall exhibit a maximum thermal coefficient of 30 x 10⁻⁶ inches/inch/degree F when tested according to ASTM C 531 or ASTM D 696.
- 7. Application: Epoxy grout shall be used to embed all anchor bolts and reinforcing steel required to be set in grout, and for all other applications required in the Contract Documents.

2.3 TOPPING GROUT AND CONCRETE FILL

- A. Grout for topping of slabs and concrete fill for built-up surfaces of tank, channel, and basin bottoms shall be composed of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and mixed as indicated herein. All materials and procedures specified for concrete in Section 03300 shall apply except as indicated otherwise herein.
- B. Topping grout and concrete fill shall contain a minimum of 564 pound of cement per cubic yard with a maximum water cement ratio of 0.45. Where concrete fill is thicker than 3 inches, structural concrete as indicated in Section 03300 may be used when accepted by the Engineer.
- C. Coarse aggregate shall be graded as follows:

U.S. STANDARD <u>SIEVE SIZE</u>	PERCENT BY WEIGHT PASSING
1/2"	100
3/8"	90-100
No. 4	20-55
No. 8	5-30
No. 16	0-10
No. 30	0

- D. Final mix design shall be as determined by trial mix design under supervision of the approved testing laboratory.
- E. Strength: Minimum compressive strength of topping grout and concrete fill at the end of 28 days shall be 3000 psi.

2.4 CURING MATERIALS

A. Curing materials shall be as indicated in Section 03300 for cement grout and as recommended by the manufacturer of prepackaged grouts.

2.5 CONSISTENCY

- A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as required for the particular application.
- B. The slump for topping grout and concrete fill shall be adjusted to match placement and finishing conditions but shall not exceed 4 inches.

2.6 MEASUREMENT OF INGREDIENTS

- A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurement shall not be allowed.
- B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

2.7 MANUFACTURERS

- A. Products shall be of the following manufacture (or equal):
 - 1. Epoxy Grout: BurkEpoxy Anchoring Grout by the Burke Company

PART 3 - EXECUTION

3.1 GENERAL

- A. All surface preparation, curing, and protection of cement grout shall be as specified in Section 03300. The finish of the grout surface shall match that of the adjacent concrete.
- B. The manufacturer of Class A non-shrink grout and epoxy grout shall provide on-site technical assistance upon request.
- C. Base concrete or masonry must have attained its design strength before grout is placed, unless authorized by the Engineer.

3.2 GROUTING PROCEDURES

- A. Prepackage Grouts: All mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.
- B. Base Plate Grouting:
 - 1. For base plates, the original concrete shall be blocked out or finished off a sufficient distance below the plate to provide for a one-inch thickness of grout or a thickness as indicated.
 - 2. After the base plate has been set in position at the proper elevation by steel wedges or double nuts on the anchor bolts, the space between the bottom of the plate and the original pour of concrete shall be filled with non-shrink-type grout. The mixture shall be of a trowelable consistency and tamped or rodded solidly into the space between the plate and the base concrete. A backing board or stop shall be provided at the back side of the space to be filled with grout. Where this method of placement is not practical or where required by the Engineer, alternate grouting methods shall be submitted for acceptance.
- C. Topping Grout:
 - 1. All mechanical, electrical, and finish work shall be completed prior to placement of topping or concrete fill. The base slab shall be given a roughened textured surface by sandblasting or hydroblasting exposing the aggregates to ensure bonding to the base slab.
 - 2. The minimum thickness of grout topping and concrete fill shall be one inch. Where the finished surface of concrete fill is to form an intersecting angle of less than 45 degrees with the concrete surface it is to be placed against, a key shall be formed in the concrete surface at the intersection point. The key shall be a minimum of 3-1/2-inches wide by 1-1/2-inches deep.
 - 3. The base slab shall be thoroughly cleaned and wetted prior to placing topping and fill. No topping concrete shall be placed until the slab is complete free from standing pools or ponds of water. A thin coat of neat Type II cement grout shall be broomed into the surface of the slab just before topping of fill placement. The topping and fill shall be compacted by rolling or tamping, brought to established grade, and floated. Grouted fill for tank and basin bottoms where scraping mechanisms are to be installed shall be screeded by blades attached to the revolving mechanism of the equipment in accordance with the procedures outlined by the equipment manufacturer after the grout is brought to the established grade.
 - 4. Topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement.
 - 5. The surface shall be tested with a straight edge to detect high and low spots which shall be immediately eliminated. When the topping and fill has

SECTION 03315 - GROUT

hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. An approved type of mechanical trowel may be used as an assist in this operation, but the last pass over the surface shall be by hand-troweling. During finishing, no water, dry cement or mixture of dry cement and sand shall be applied to the surface.

3.3 CONSOLIDATION

A. Grout shall be placed in such a manner, for the consistency necessary for each application, so as to assure that the space to be grouted is completely filled.

END OF SECTION

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PART 1 - GENERAL

1.1 DESCRIPTION

This section includes materials, installation, and testing of precast circular concrete manholes for sewers.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. OMWD Standard Drawings
- B. Section 01300 Record Drawings and Submittals
- C. Section 02140 Dewatering
- D. Section 02200 Earthwork
- E. Section 02233 Trenching, Backfilling, and Compacting
- F. Section 03300 Cast-in-Place Concrete
- G. Section 03315 Grout
- H. Section 09801 Manhole and Wet Well Lining

1.3 SUBMITTALS

- A. Submit submittal packages in accordance with Section 01300.
- B. Submit manufacturer's catalog data and design calculations for precast concrete manholes, frames, covers, joint sealant, liners, coatings, and waterproofing. Show dimensions and materials of construction by ASTM reference and grade. Show lettering on manhole covers.

PART 2 - MATERIALS

2.1 PRECAST CONCRETE MANHOLES

- A. Precast components and other appurtenant materials shall be selected from the District's Approved Materials List.
- B. Precast circular concrete manholes shall comply with ASTM C478 except that the wall thickness shall be 6 inches minimum.
- C. Manhole components shall be designed for H-20 highway wheel loading, specific site conditions, and the Standard Drawings.
- D. Manhole bases shall be cast-in-place with a formed recess shaped to match the first precast shaft section. The manhole base shall extend a minimum of 10 inches below the bottom of the lowest pipe and a minimum of 6 inches above the top of the largest pipe.

- E. Manhole shafts shall be fabricated only from 60-inch diameter precast shaft sections, eccentric cone sections and grade rings.
- F. Pipe penetrations for sewer applications shall incorporate a gasketed sandimpregnated PVC collar, as manufactured by GPK Products, Inc. or District approved equal.
- G. Manholes shall be polyvinyl chloride (PVC) lined and polyurethane coated. Precast shaft sections, cone sections and grade rings on PVC lined manholes shall have an integrally-cast PVC T-shaped liner of 0.065-inch minimum thickness per Section 06650. A 100% solids elastomeric polyurethane coating shall be applied to exposed concrete at the interior of cast-in-place bases.

2.2 CRUSHED ROCK BASE AND BACKFILL MATERIALS

Crushed rock base and backfill materials shall be in accordance with Section 02223.

2.3 MANHOLE FRAMES AND COVERS

- A. Manhole frames shall be 36 inches in diameter with two concentric covers, made of composite, corrosion resistant material, with locking lids. Manhole covers shall be manufactured by EJ (formerly GMI) or equal.
- B. Frames and covers shall be designed for H-20 highway wheel loading.
- C. Covers shall have the words "OMWD" "SEWER" cast into the cover. No other lettering will be permitted on the top portion of the cover.
- D. Castings shall be smooth, clean, and free from blisters, blowholes, and shrinkage. Mating surfaces of the frame and cover shall be machined to prevent movement of the lid. Frames and covers shall be match marked in sets before shipping to the site.

2.4 CONCRETE

Concrete used for manholes and appurtenances shall be in accordance with Section 03300.

2.5 JOINT SEALING COMPOUND

- A. Use joint sealant to form a continuous watertight seal on the concrete base and between successive precast concrete manhole sections.
- B. Joint sealing compound shall be a mastic-type material in a flexible rope or rolled form with removable wrapper sized to fit into the key of manhole or sections.

2.6 REPAIR MORTAR AND EPOXY BONDING AGENT

Repair mortar and an epoxy bonding agent shall be used to repair minor surface damage to precast sections or cast-in-place manhole bases at the discretion of the District's Representative. Repair products shall be in accordance with Section 03315.

2.7 MORTAR

Mortar for use on joints between precast sections and for setting manhole cover frames shall be in accordance with Section 03315.

2.8 WATERPROOFING

The waterproofing material shall be Horn Dehydratine 4, Select Shield 301-A, or District approved equal. The material is a black bituminous compound of brush or spray consistency for application on below grade concrete surfaces.

2.9 ALTERNATIVE PRECAST MANHOLE MATERIALS

- 1. Precast polymer concrete manholes and bases can be installed in lieu of precast concrete manholes when the products meet the requirements of this specification and the Contract Documents, with the following exceptions:
 - a. Wall thickness shall comply with ASTM C478.
 - b. Polymer concrete mix design shall consist of thermosetting resin, sand, and aggregate. No Portland cement shall be allowed as part of the mix design matrix. All sand and aggregate shall be inert in an acidic environment.
 - c. Thermosetting resin shall have a minimum deflection temperature of 158° F when tested at 264 psi (1.820 mPa) following Test Method D 648. The resin content shall not be less than 7% of the weight of the sample as determined by test method D 2584. Resin selection shall be suitable for applications in the corrosive conditions to which the polymer concrete manhole structures will be exposed.
 - d. Reinforcement shall use acid resistant reinforcement (FRP Bar) in accordance with ACI 440.1R-06 as applicable for polymer concrete design.
 - e. Polymer concrete manholes shall not be lined or coated.

PART 3 - EXECUTION

3.1 WORK WITHIN EXISTING MANHOLES

Contractor shall comply with all Federal and State regulations for confined space entry. Work inside confined spaces, as defined by the applicable regulations, shall not be undertaken until all the tests and safety provisions of the Code of Federal Regulations 1910.146, and the General Industry Safety Orders of the California Code of Regulations, Title 8, Section 5159, for confined space entry have been performed and the area is verified as safe to enter. District policy prohibits entry into any confined space with Immediately Dangerous to Life and Health (IDLH) conditions except by trained emergency rescue personnel.

3.2 EARTHWORK

Manhole excavation, foundation stabilization (if necessary), placement of base material, backfill and compaction shall be performed in accordance with Sections 02200 and 02223.

3.3 MANHOLE BASE

- A. The invert of cast-in-place bases shall be hand-worked to provide channels conforming in size to the inside diameter of the piping as indicated on the Drawings. The channels shall vary uniformly in size and shape from inlet to outlet. The concrete base shall be shaped with a wood float and shall receive a hard steel trowel finish before the concrete sets. A template shall be used to accurately form the level surface that will receive the first precast section.
- B. During construction of cast-in-place bases, all sewer mains and stub piping shall be in place, including ring-type seals, before concrete placement. Pipe grade and alignment shall be verified immediately upon placement of concrete to assure that the pipelines are in proper position prior to the concrete taking an initial set. The invert elevation and flow line of piping shall be as shown on the Approved Plans and Standard Drawings. The manhole base shall extend a minimum of 10-inch below the bottom of the lowest pipe and a minimum of 6-inch above the top of the largest pipe.
- C. Cast-in-place bases shall set a minimum of 24 hours before the manhole construction is continued. In certain critical situations, the setting time may be reduced upon approval of the District's Representative.

3.4 INSTALLING MANHOLE SECTIONS

- A. The concrete manhole base and successive precast sections will receive a mastic joint sealing compound prior to setting the precast sections in place as shown on the Standard Drawings. Following the vacuum testing as described in this section, the joints will be mortared and tooled to a smooth finish, free of voids. Note that sewer manholes are to be vacuum tested following assembly of the concrete sections, but prior to mortaring the joints, or backfilling.
- B. Manhole components incorporating a PVC liner and polyurethane coating shall be installed and tested in accordance with these specifications, the manufacturer's recommendations, and the Standard Drawings. Upon assembly of the precast sections and vacuum testing as described in this section, the mortaring and finishing of joints shall be performed. The PVC liner seams at the joints shall then be welded. The PVC liner shall be secured by insertion between the uppermost grade ring and the manhole cover frame. Note that PVC lined sewer manholes are to be vacuum tested following assembly of the concrete sections, but prior to mortaring the joints, welding the seams of the PVC liner, or backfilling. The polyurethane coating of all exposed concrete on the manhole base shall follow completion of the entire installation and all construction activity within the manhole.
- C. Assemble the precast sections to the elevation required by the location of the manhole as follows:

- 1. Paved Areas: Top of cover shall be flush with the finished paving surface.
- 2. Traveled Way: Top of cover shall be flush with the existing surface where it is in a traveled way.
- 3. Shoulder Areas: Top of cover shall be 1-inch above the existing surface where outside the limits of a traveled way. Manholes shall not be placed in roadside ditches without the prior approval of the District.
- 4. Unpaved Easements: Top of cover shall be 12 inches above the ground surface. Guard posts around the manhole may be required in this area as directed by the District's Representative.
- D. Secure the manhole frame to the grade ring with mortar.
- E. After the frame is securely set the cover shall be installed. All necessary cleaning of foreign materials from the frames and covers shall be accomplished to ensure a satisfactory fit.
- F. Where manholes are to be given a protective coating, they shall be free of seepage and surface moisture.
- G. Piping installation adjacent to the manhole and connection to the base or shaft sections shall be performed as shown on the Drawings and Standard Drawings. Piping installation into flexible pipe connectors shall be in accordance with the manufacturer's recommendations for assembly, lubricants and limits of deflection.
- H. In order to prevent accidental use of the new sewer before completion and acceptance, the new inlet to existing tie-in manhole(s) and the outlet of the first new upstream manhole(s) shall be sealed with expandable plugs. The District shall approve the specific location of these plugs. Plugs shall be removed at the time of final inspection or as directed by the District's Representative. Removal of all construction debris and water shall be completed prior to removal of plugs.
- I. Brick or mortar bulkheads shall be installed at the manhole end of all unused stub channels over 36 inches beyond manhole base. The bulkheads are intended to prevent ponding of sewage and debris in the unused channels until such time as the manhole stub is connected and normal sewage flow can occur.
- J. New connections to existing manholes, where stubs have not been provided, shall be made by core drilling through the walls or base as directed by the District's Representative. Flexible seals selected from the Approved Materials List and installed in accordance with the Standard Drawings shall be used for the pipe penetration. Apply a protective epoxy coating to the cored concrete and the ends of any exposed reinforcing steel. The coating shall be an epoxy resin product exhibiting a high bond strength to steel and concrete. It shall conform to ASTM C881.
- K. A concrete collar shall be poured around manhole frames in accordance with the Standard Drawings.

L. Replacement of asphalt or concrete pavement shall be in accordance with the requirements of the agency having jurisdiction.

3.5 WATERPROOFING

- A. Waterproofing material shall be applied to the exterior surfaces of manholes in accordance with the manufacturer's recommendations.
- B. Field apply two coats at a rate of 65 square feet per gallon per coat. The material shall be applied to all exterior surfaces within 10 feet of the manhole invert, or as directed by the District's Representative.

3.6 VACUUM TESTING OF MANHOLES

- A. Vacuum testing of manholes is required and shall be performed as directed in the presence of the District's Representative.
- B. Vacuum testing shall be done in accordance with ASTM C1244.
- C. Vacuum testing equipment shall be as manufactured by P.A. Glazier, Inc. or District approved equal.
- D. Manholes shall be tested after assembly and prior to mortaring the joints or backfilling. In the case of manholes incorporating a PVC liner and polyurethane coating, the testing is to take place prior to mortaring the joints, welding the liner seams between sections, applying the coating, or backfilling.
- E. All lift holes shall be plugged with an approved grout prior to testing.
- F. All pipes entering the manhole shall be plugged, and bracing installed, to prevent the plug from being drawn into the manhole.
- G. The test head shall be placed inside the top of the cone section and the seal inflated in accordance with the manufacturer's recommendations.
- H. A vacuum of 10 inches of mercury shall be drawn. The time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass the test if the time taken for the drop is greater than 60 seconds for a 48-inch manhole and 75 seconds for a 60-inch manhole.
- I. If the manhole fails the test, necessary repairs shall be made and the test repeated until acceptable results are obtained. The leak(s) shall be located and repaired according to their nature with material-in-kind.

3.7 PULL TESTING OF PVC LINED MANHOLES

PVC lined manholes shall have field-welded joints pull tested. Field welds shall withstand a pull test of at least 100 lbs per linear inch, applied perpendicularly to the concrete surface for a period of one minute, without evidence of cracks or separations. This test shall be conducted at a temperature of 70°F to 80°F inclusive.

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3.8 HOLIDAY TESTING OF PVC LINED MANHOLES

PVC lined and Polyurethane coated surfaces shall be holiday tested with an electrical holiday detector as manufactured by Tinker and Rasor (Model # AP-W with power pack) with the instrument set at 20,000 volts and used as directed by the District's Representative. All imperfections identified on the PVC lining and polyurethane coating shall be repaired with materials-in-kind and the test shall be repeated until no holidays are evident.

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PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The Contractor shall perform all concrete rehabilitation work necessary to provide an acceptable substrate for the protective lining or to fill voids, structurally reinforce and/or rebuild surfaces, etc. as determined necessary by the Owner. In addition, the Contractor shall perform all related work including surface preparation, corrosion protection, priming, finishing and curing of the rehabilitation work.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Submittals
- B. Section 09801 Manhole and Wet Well Lining

1.3 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

- A. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:
 - 1. References herein to "SSPC Specifications" or "SSPC" shall mean the published standards of SSPC, the Society for Protective Coatings.
 - 2. References herein to "NACE" shall mean the published standards of the National Association of Corrosion Engineers.
 - 3. SSPC (Society for Protective Coatings)
 - 4. NACE (National Association of Corrosion Engineers)
 - 5. ASTM (American Society for Testing and Materials)
 - a. ASTM C109 Test Method for Compressive Strength of Hydraulic Cement Mortars
 - b. ASTM C882 Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete
 - c. ASTM C496 Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
 - d. ASTM C88 Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
 - e. ASTM D638 Tensile Properties of Plastics
 - f. ASTM D790 Flexural Properties of Unreinforced and Reinforced Plastics
 - g. ASTM D695 Compressive Properties of Rigid Plastics
 - h. ASTM D4541 Pull-off Strength of Coatings Using a Portable Adhesion Tester
 - i. ASTM D2584 Volatile Matter Content
 - j. ASTM D2240 Durometer Hardness, Type D
 - k. ASTM D543 Resistance of Plastics to Chemical Reagents

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- I. ASTM C579 Compressive Strength of Chemically Setting Silicate and Silica Chemical Resistant Mortars
- 6. American Concrete Institute (ACI)
 - a. ACI 506.2 Specifications for Material, Proportioning, and Application of Shotcrete
- 7. SSPWC 210-2.3.3 Chemical resistance testing published in the Standard Specifications for Public Works Construction, most recent edition

1.4 CONTRACTOR SUBMITTALS

- A. Submittals shall be made in accordance with the requirements stated in Section 01300.
- B. Technical Data: The Contractor shall submit technical data for materials which document compliance with the requirements of this section.
- C. Installation Recommendations: The Contractor shall provide written installation recommendations from the manufacturer for each of the products to be used in the work covered by this section of the specifications including application, cure time, and surface preparation procedures which permit optimum bond strength with coatings. Specific procedures for the application of an epoxy coating shall be included.
- D. The Contractor shall provide certification of compatibility from all product manufacturers of protective linings, concrete rehabilitation products, grouts, sealants, or other materials used in the manhole rehabilitation process.
- E. The Contractor shall provide Material Safety and Data Sheets (MSDS) and Technical Data Sheets for all compounds utilized in Concrete Rehabilitation.
- F. The Contractor shall provide a written warranty from all manufacturers against defects of materials for a period of one (1) year following Owner acceptance of the installation.
- G. If abrasive blasting is selected as the surface preparation technique, the CONTRACTOR shall submit data sheets, technical information and performance information for the abrasive material.

1.5 QUALITY ASSURANCE

- A. Packaging: The Contractor shall store all products to be used in their original, unopened packaging displaying the manufacturer's name, labels, product identification and batch numbers as applicable. Damaged material must be removed from the site immediately.
- B. All products to be used in the work covered by this Section shall be delivered, stored, and handled in accordance with the product manufacturer's written recommendations.

PART 2 - PRODUCTS

2.1 GENERAL

A. All products proposed for use for all rehabilitation and protective lining work covered in these Contract Documents shall be compatible and be manufactured from the same company or a statement shall be provided from the concrete patch material and protective lining manufacturers certifying their products are mutually compatible with the other products used for this work.

2.2 BONDING AGENT

- A. Bonding agent shall be a solvent-free, moisture-tolerant, epoxy-modified, cementitious product specifically formulated as a bonding agent containing an anticorrosion agent that is compatible with the concrete patch material and manhole protective lining material.
- B. The need for a bonding agent shall be based on the requirements of the concrete patch manufacturer. If it is determined that a bonding agent is not required, the concrete patch manufacturer shall submit a certification to the Owner stating such prior to installation of the project.
- C. Bonding agent material shall meet the following requirements (@ 73 degrees F and 50 percent relative humidity):

Work Life	45 - 120 minutes
Compressive Strength	6,000 psi @ 7 days
Bonding Strength (ASTM C 882)	2,500 psi @ 14 days (moist cure)

- D. All bonding agents for concrete shall conform to the following requirements:
 - 1. Bonding agent shall have a coat window (time until the repair mortar is required to be placed) of at least 8 hours at 68 degrees F.
 - 2. The bonding agent shall not create a vapor barrier.
- E. If the bonding agent is not manufactured by the same company as the protective lining and concrete mortar manufacturer, all manufacturers must certify in writing that their products are compatible. Concrete mortar manufacturer shall certify in writing that the bonding agent used for the project is in accordance with their recommendations for this application and for use with the concrete patch mortar materials.
- F. The manufacturer of the bonding agent shall be approved by the District prior to use.

2.3 CONCRETE PATCH MORTAR

SECTION 03740 – CONCRETE REHABILITATION

- A. Concrete repair materials shall be used to fill voids, structurally reinforce and/or rebuild surfaces as determined necessary by the Owner and the protective lining applicator.
- B. Patch material shall be either of the following and shall be on the written approved list of patch materials provided by the manhole protective lining manufacturer:
 - 1. 100-percent solids, solvent-free epoxy grout specifically formulated for epoxy top coating compatibility that meets the performance requirements specified herein and that has corrosion inhibitor properties and is recommended by the manufacturer for use in sewer manhole repairs. The epoxy grout manufacturer shall provide instructions for trowel or spray application and for epoxy top coating procedures.
 - 2. Factory blended, rapid setting, high early strength, non-shrink and non-sag repair mortar that is specifically formulated to be suitable for epoxy top coating. Repair mortar shall have corrosion inhibitor properties and shall be recommended by the manufacturer for use in sewer manhole repairs.
- C. Patch material shall meet the following minimum requirements (@ 73 degrees F and 50 percent relative humidity):

Work Life	15 minutes minimum
Compressive Strength	4,000 psi @ 7 days
Bonding Strength (ASTM C 882)	2,200 psi @ 28 days

- D. The patch material shall be designed for vertical and overhead applications.
- E. The patch material shall be capable of meeting the minimum and maximum application thicknesses required for rebuilding or repairing the manholes and specified in the Contract Documents.
- F. Repair mortar applicators shall be trained to properly apply the mortar according to manufacturer's recommendations.

2.4 LEAK REPAIR

- A. Leak repair shall be achieved by use of a Portland cement mortar waterstop. The waterstop shall be a blend of selected Portland cements and specially graded aggregates. The materials shall be non-combustible, either before or after cure. The materials shall be supplied in a factory-proportioned unit. The Portland cement mortar shall not produce a vapor barrier.
- B. Leak repair material shall meet the following requirements.
 - 1. Compressive Strength (ASTM C109)

1 day	4,200 psi min
7 days	6,800 psi min

2. Splitting Tensile Strength (ASTM C496)

1 day	600 psi min
7 days	700 psi min

- 3. Sulfate Resistance Test (ASTM C88): no deterioration
- C. Portland cement mortar water stop shall be SikaSet Plug as manufactured by Sika Corporation, or approved equal. If the leak repair material is not manufactured by the same company as the protective lining and concrete patch material manufacturer, all manufacturers must certify in writing that their products are compatible.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Remove all loose material to expose sound concrete at the repair area. Steel brush any exposed reinforcing steel to remove any protective lining or loose material. The surface shall be clean and have an open texture surface by blast cleaning (including sand blasting) or equivalent mechanical means. The surface shall be saturated surface dry, but with no standing water.

3.2 BONDING AGENT APPLICATION

- A. The bonding agent material shall be applied, stored, handled, and transported in strict accordance with the manufacturer's written recommendations.
- B. Mix manufacturer's pre-measured components for bonding agent as recommended by manufacturer. Mix only the quantity of materials that can be applied within the specified pot life of the product. Do not apply bonding agent of any batch after the recommend pot life has elapsed.
- C. The bonding agent slurry shall be worked into the substrate surface with a stiff bristle brush or broom. Work slurry into all surface irregularities to achieve complete coverage.
- D. Apply patch material to bonding agent wet-on-wet or within the manufacturer's recommended open time for bonding agent.

3.3 PATCH MATERIAL APPLICATION

- A. The concrete patch material shall be applied, stored, handled, and transported in strict accordance with the manufacturer's written recommendations.
- B. Mix manufacturer's pre-measured components of patch material as recommended by manufacturer. Mix only the quantity of materials that can be applied within the

SECTION 03740 – CONCRETE REHABILITATION

specified pot life of the product. If patch material is being extended with fine aggregate, mix the aggregate into the material as recommended by manufacturer.

- C. The Contractor shall apply the patch material into the substrate and around any exposed reinforcing bars. The patch material shall be consolidated eliminating any voids. It shall be built-up from the edges of the repair area towards the center. After filling, consolidate patch material and screed surface to match original shape of member as close as possible.
- D. The vertical face of the wall or column shall be cleaned of any fins or burrs on the surface.
- E. The patch material finish shall be "broom finish"
- F. The thickness of the patch shall be in accordance with the minimum and maximum allowable thickness limits as recommended by manufacturer.

3.4 LEAK REPAIR APPLICATION

- A. Prepare surface and apply materials per the manufacturer's written instructions.
- B. Adhere to all limitations and precautions for the instant setting of Portland cement water stop systems stated in the manufacturers technical data sheet and literature.
- C. Do not apply material if it is raining or snowing or if such conditions appear to be imminent. Minimum application temperature is 40 degrees Fahrenheit.
- D. Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified material.

3.5 CURING

- A. After the repair is completed, the Contractor shall be responsible for maintaining a humid environment to allow for proper curing of all surfaces. If necessary, the Contractor shall cover the surface with polyethylene sheet to trap moisture to the surface.
- B. Cure all repair surfaces as specified by the patch material and protective lining manufacturers to ensure compatibility and long-term lining performance.

END OF SECTION

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The Work of this Section includes providing concrete masonry work complete, including reinforcing steel, embedded items, and all other appurtenant work.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 03200 Reinforcement Steel
- B. Section 03300 Cast-in-Place Structural Concrete
- C. Section 05500 Miscellaneous Metalwork

1.3 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

- A. Except as otherwise indicated in this Section of the Specifications, the Contractor shall comply with the Standard Specifications for Public Works Construction (SSPWC), as specified in Section 01090.
- B The Work of this Section shall comply with the current editions of the following codes as adopted by the City Municipal Code:
 - 1. California Building Code (CBC)
- C. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:
 - 1. Commercial Standards

ACI 315	Manual of Standard Practice for Detailing Reinforced Concrete Structures	
ACI 530	Building Code Requirements for Masonry Structures	
ASTM A 615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement	
ASTM C 5	Specification for Quicklime for Structural Purposes	
ASTM C 55	Building Brick, Concrete	
ASTM C 90	Specification for Hollow Load-Bearing Concrete Masonry Units	
ASTM C 140	Method of Sampling and Testing Concrete Masonry	
ASTM C 144	Specification for Aggregate for Masonry Mortar	
ASTM C 145	Solid Load-Bearing Concrete Masonry Units	

ASTM C 150	Specification for Portland Cement	
ASTM C 207	Specification for Hydrated Lime for Masonry Purposes	
ASTM C 270	Specification for Mortar for Unit Masonry	
ASTM C 404	Specification for Aggregates for Masonry Grout	
ASTM C 426	Test Method for Drying Shrinkage of Concrete Block	
ASTM E 476	Grout for Reinforced and Nonreinforced Unit Masonry	
ASTM E 447	Test Method for Compressive Strength of Masonry Prisms	
Masonry Industry Advancement Committee Masonry Design Manual		
Portland Cement Association	Concrete Masonry Handbook	

1.4 SHOP DRAWINGS AND SAMPLES

- A. The following shall be submitted in compliance with Section 01300:
 - Samples of concrete masonry unit colors with texture ranges as specified under products shall be submitted to the Engineer for selection of color. Full size samples of the blocks selected shall be submitted for final approval by the Engineer after color and texture selection. Samples of mortar colors shall be submitted for color selection by the Engineer.
 - 2. Certification shall be submitted showing material compliance with these Specifications. The Engineer's approval shall be obtained prior to delivery of concrete masonry units to the job site.
 - 3. A 4-ft minimum square free-standing sample panel shall be prepared for approval by the Engineer before starting masonry work and shall remain at the work site for reference until all masonry work is completed.
 - 4. Mill Certificates: Steel producer's certificates of mill analysis, tensile and bend tests for reinforcement steel.
 - 5. Drawings shall be submitted for fabrication, bending, and placement of reinforcement bars. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures." Bar schedules, diagrams of bend bars, stirrup spacing, lateral ties and other arrangements and assemblies shall be shown as required for fabrication and placement.

1.5 OWNER'S MANUAL

- A. The following shall be included in the Owner's Manual in compliance with Section 01300:
 - 1. Test reports of mortar and grout.
 - 2. Test reports of masonry prisms.

1.6 FACTORY TESTING OF MASONRY UNITS

A. Concrete block masonry units shall be sampled and tested for compressive strength, absorption and moisture content in accordance with ASTM C 140.

1.7 TESTING OF MORTAR AND GROUT

- A. The Engineer will have the mortar and grout tested in accordance with CBC to assure compliance with the Specifications and the governing codes. Test samples shall be stored in a moist environment until tested, unless directed otherwise by the Engineer or the testing laboratory. Tests shall be in accordance with CBC Standard No. 21 16 for mortar. The grout and mortar strengths shall be not less than the minimum strengths indicated herein.
- B. Tests will be taken at the following times:
 - 1. At the commencement of the masonry work, at least 2 test samples each of mortar and grout taken on 3 successive working days.
 - 2. At any change in materials or job conditions, at least 2 samples of each modified material, grout and mortar.
 - 3. Four random tests each of mortar and grout. The random test samples shall be taken when requested by the Engineer.
 - 4. Additional samples and tests may be required whenever, in the judgment of the Engineer, additional tests (beyond the random tests) are necessary to determine the quality
- C. The Contractor shall store the test samples in a moist environment until tested, unless directed otherwise by the Engineer.
- D. The grout and mortar strengths shall be not less than the minimum strengths specified herein.

1.8 TESTING OF MASONRY PRISMS

- A. The Engineer will have masonry prisms tested to assure compliance with the Specifications and the governing codes.
- B. Tests will be taken at the following times:
 - 1. At the time of construction of the sample panel, as indicated herein, at least five masonry prisms shall be made for each type of block indicated herein; except separate prisms are not required for block which only varies by texture.
 - 2. At any change in materials during construction, at least five masonry prisms shall be made for each type of block affected.
 - 3. One set of at least five masonry prisms shall be made for each masonry structure, besides the structure that the sample panel is part of, or for each week in which block is laid, for each type of block involved, whichever occurs first.
 - 4. Additional sets of at least five masonry prisms may be required whenever, in the judgment of the Engineer, additional tests are necessary to determine the quality of the materials.
- C. The prisms shall be constructed by the Contractor in the presence of the Engineer or the Engineer's representative. The same personnel who are laying the block in the structure shall construct the masonry prisms.
- D. The masonry prisms shall be constructed and will be tested as specified in "Test Methods for Compressive Strength of Masonry Prisms" ASTM E 447-84, Method B, except as modified herein. The prisms shall be composed of one complete cell using full-size blocks which are saw-cut. The minimum ratio of height to smaller width dimension shall be 1.5. The prism shall be at least 15 inches high. A minimum of two horizontal bed joints shall be used to form the prism. The prism shall be grouted, after the required 24-hour minimum cure period, using the same grout used in the walls.
- E. Compression tests will include two prisms tested at 7 days after grouting and three prisms tested at 28 days after grouting.
- F. The average compressive strength of prisms tested at 28 days after grouting, multiplied by the appropriate correction factor as given in the California Building Code, shall not be less than the indicated masonry compressive strength.
- G. If the compressive strength of the prisms, made during the construction of the sample panel and tested as indicated herein, fails to meet the requirement, adjustments shall be made to the mix designs for the mortar, or grout, or both, as needed to produce the specified strength. The masonry units shall also be retested to verify compliance with the requirements of ASTM C 90, Grade N-1.

H. If the compressive strength of the prisms, made during construction of the WORK and tested as indicated herein, fails to meet the requirement, prisms or cores shall be cut from the walls in sufficient numbers and in sufficient locations to adequately determine the strength of the walls. Those portions of the walls represented by specimens failing to meet the required compressive strength shall be subject to removal and replacement.

1.9 SPECIAL INSPECTION

A. Continuous inspection by a special inspector approved by the local building department having jurisdiction will be required where necessary to conform with code requirements. Costs of special inspection shall be paid for by the Contractor. Inspection reports shall be submitted to the Engineer.

1.10 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Cement, lime, and other cementitious materials shall be delivered to the site and stored in dry, weather-tight sheds or enclosures, in unbroken bags, barrels, or other containers, plainly marked and labeled with the manufacturers' names and brands. Mortar and grout shall be stored and handled in a manner which will prevent the inclusion of foreign materials and damage by water or dampness. Masonry units shall be handled with care to avoid chipping and breakage, and shall be stored as directed in the Concrete Masonry Handbook. Materials stored on newly constructed floors shall be stacked in such manner that the uniformly-distributed loading does not exceed 30 psf. Masonry materials shall be kept dry and clean until used.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

- A. Concrete masonry units shall conform to ASTM C 90, hollow open-end load bearing units with maximum linear shrinkage of 0.06 percent from standard to oven-dried condition. Units shall be medium weight units with a net area compressive strength of 2,800 psi unless indicated otherwise.
- B. Concrete masonry units shall be 12-inch by 8-inch by 16-inch modular size, with split faces. Units shall be integrally-colored with color selections from light and medium color range (white, black and dark green not included in color range).
- C. All bond beam, corner, lintel, sill, and other specially shaped blocks shall be provided and used where required or necessary. Specially shaped non-structural blocks may be constructed by saw cutting. Color and texture shall match that of adjacent units.
- D. Concrete masonry units hidden from view entirely may be natural color units the same size as other adjacent masonry units.
- E. Concrete masonry units at interior walls shall be medium weight block 12-inch by 8-inch by 16-inch modular size of color matching the integrally colored block.

2.2 MATERIALS FOR MORTAR AND GROUT

- A. Portland cement shall be Type II, low alkali, conforming to ASTM C 150.
- B. Lime paste shall be made with pulverized quicklime, or with hydrated lime, which shall be allowed to soak not less than 72 hrs before use; except, that hydrated lime processed by the steam method shall be allowed to soak not less than 24 hrs and shall be made by adding the lime to the water. In lieu of hydrated lime paste for use in mortar, the hydrated lime may be added in the dry form. Hydrated lime shall be Type S, conforming to ASTM C 207. Pulverized quicklime shall conform to ANSI/ASTM C 5, shall pass a No. 20 sieve, and 90 percent shall pass a No. 50 sieve.
- C. Sand shall conform to ASTM C 144. Coarse aggregate shall conform to ASTM C 404.
- D. Water for mixing shall be clear potable water.
- E. Reinforcing steel shall be deformed bars conforming to ASTM A 615, Grade 60 for bars No. 3 to No. 18, except as otherwise indicated.
- F. Admixture for mortar shall not be detrimental to the bonding or help the process of efflorescence.

2.3 MANUFACTURERS

- A. Products shall be of the following manufacture and type (or equal):
 - 1. Admixture for Mortar:

Master Builder's "PS 235 or Rheomix 235" Sika Chemical Co. "Sika Red Label"

2. Admixture for Grout:

Sika Chemical Co. "Sika Grout Aid" Type II Master Builder's "Pozzolith" normal

PART 3 - EXECUTION

3.1 GENERAL

- A. Concrete masonry units shall not be placed when air temperature is below 40 degrees F (4 degrees C) and shall be protected against direct exposure to the wind and sun when erected when the ambient air temperature exceeds 99 degrees F (37 degrees C) in the shade with relative humidity less than 50 percent.
- B. Concrete masonry shall conform to the California Building Code, the Masonry Design Manual published by the Masonry Industry Advancement Committee, and other applicable codes and standards of governing authorities.

- C. All work shall conform to the standard of quality established by the Engineer's acceptance of the free-standing sample panel required to be constructed prior to starting the masonry work.
- D. Tolerances for concrete masonry units shall conform to the following:
 - 1. Maximum variation from plumb:
 - a. In walls and corners: 1/4-inch in 10 feet; 3/8-inch in any story or 20 feet maximum; 1/2-inch in 40 feet.
 - b. For external corners and other conspicuous lines: 1/4-inch in any story or 20 feet maximum; 1/2-inch in 40 feet.
 - 2. Maximum variation from level or indicated elevations: 1/4-inch in any bay or 20 feet; 1/2-inch in 40 feet.
 - 3. Maximum variation from plan position indicated on the Drawings: 1/2-inch maximum.
- E. Measurements for mortar and grout shall be accurately made. Shovel measurements are not acceptable. Mortar proportions shall be accurately controlled and maintained.

3.2 INSPECTION

- A. Contractor shall thoroughly examine all substrates, areas and conditions under which installation Work of this Section is to be undertaken and notify Engineer in writing of conditions detrimental to proper, timely, and successful completion of the installation. Installation shall not proceed until unsatisfactory conditions have been corrected.
- B. Inspection by the Contractor shall be required during preparation of masonry wall prisms, sampling and placing of all masonry units, placement of reinforcement, and inspection of grout space immediately prior to closing of cleanouts and during all grouting operations.

3.3 SHORING AND BRACING

- A. All shoring and bracing shall be provided as required for the Work. Shoring and bracing shall be constructed to required shapes and sizes, capable of supporting and sustaining the loads to which they will be subjected without failure or deflection. Shores and bracing shall be left in place until concrete masonry can safely carry all required live and dead loads.
- B. Concrete masonry walls shall be adequately braced to withstand all forces to which they will be subjected during construction. Walls are not designed to be self supporting for lateral loads until attached to floor and roof elements.

3.4 MORTAR

- A. Mortar for concrete block masonry shall be Type S per Table 2 of TMS 602-13/ACI 530.1/ASCE 6-13, with a minimum 28-day compressive strength of 2500 psi. Proportions shall be one part portland cement, 1/4- to 1/2-part lime paste or hydrated lime, and damp, loose sand in an amount (by volume) of not less than 2-1/4 or more than 3 times the sum of the volumes of cement and lime used, with the precise amount of water required to produce the required workability and strength.
- B. Mortar for use with colored masonry units shall have integral color as approved by the Engineer.

3.5 GROUT

- A. Grout shall have a minimum 28-day compressive strength of 2500 psi. Proportions shall be one part portland cement, not more than 1/10-part lime paste or hydrated lime, 2-1/4 to 3 parts damp, loose sand, not more than 2 parts pea gravel, and water in the amount necessary to produce a consistency for pouring without segregation of components. Where the grout space is less than 4 inches, pea gravel shall be omitted.
- B. Admixtures may only be used when approved by the Engineer. When it has been approved for use, admixtures shall be used in accordance with the manufacturer's published recommendations for the grout.

3.6 CONSTRUCTION - GENERAL

- A. All work shall be performed in accordance with the provisions of the applicable code for reinforced concrete hollow-unit masonry.
- B. The Contractor shall set or embed in his work all anchors, bolts, reglets, sleeves, conduits, and other items as required.
- C. All block cutting shall be by machine.
- D. Masonry units shall be supported off the ground and shall be covered to protect them from rain. Only clean, dry, uncracked units shall be incorporated into the Work. Concrete masonry units shall not be wetted.
- E. All reinforcing steel shall be cleaned of all loose rust and scale, and all oil, dirt, paint, laitance, or other substances which may be detrimental to or reduce bonding of the steel and concrete.
- F. Immediately before starting work, the concrete upon which the masonry will be laid shall be cleaned with water under pressure.
- G. A full mortar joint for first course shall be provided.
- H. Units shall be shoved tightly against adjacent units to assure a good mortar bond.

3.7 EQUIPMENT

A. All equipment for mixing and transporting the mortar and grout shall be clean and free from set mortar, dirt, or other foreign matter.

3.8 MIXING

A. Mortar shall be mixed by placing 1/2 of the water and sand in the operating mixer, after which the cement, lime, and remainder of the sand and water shall be added. After all ingredients are in the mixer, they shall be mechanically mixed for not less than 5 minutes. Retempering shall be done on the mortar board by adding water within a basin formed within the mortar, and the mortar reworked into the water. Mortar which is not used within one hour shall be discarded.

3.9 ERECTION OF CONCRETE BLOCK MASONRY

- A. Masonry work shall be erected in-plane, plumb, level, straight, and true to dimensions shown and executed in accordance with acceptable practices of the trade.
- B. Concrete masonry units shall be laid with full-face shell mortar beds. Vertical head joints shall be solidly filled with mortar from face of unit to a distance behind the face equal to not less than the thickness of longitudinal face shells. Cross-webs of starting course courses shall be solidly bedded in mortar.
- C. Unless noted or shown otherwise, masonry shall be laid up in straight uniform courses with running bonds.
- D. All masonry shall be erected to preserve the unobstructed vertical continuity of the cells measuring not less than 3-inch by 3-inch in cross-section. Walls and cross webs shall be fully bedded in mortar. All head and end joints shall be solidly filled with mortar for a distance in from the face of the wall or unit not less than the thickness of the longitudinal face shells.
- E. Where horizontal reinforced beams are shown, special units shall be used or regular units shall be modified to allow for placement of continuous horizontal reinforcement bars. Small mesh expanded metal lath or wire screening shall be used in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or units shall be provided with solid bottoms.

3.10 JOINTS

A. Vertical and horizontal joints shall be uniform and approximately 3/8-inch wide. Exterior joints and interior exposed block joints shall be concave-tooled to a dense surface. Special care shall be used in tooling joints so as to match existing construction. Interior or exterior non-exposed masonry and masonry behind plaster shall have flush joints.

3.11 CLEANOUTS

A. Cleanout openings shall be provided at the bottoms of all cells to be filled at each lift or pour of grout, where such lift or pour is over 4 ft in height. Any overhanging mortar or other obstructions or debris shall be removed from the insides of such cell walls. The cleanouts shall be sealed before grouting and after inspection. Cleanout openings shall match the finished wall in exposed masonry.

3.12 REINFORCEMENT

- A. General: Reinforcement bars shall not be used with kinks or bends not shown on the drawings or final shop drawings, nor shall bars be used with reduced cross-section due to excessive rusting or other causes.
- B. Reinforcement shall be positioned accurately at the spacing indicated. Vertical bars shall be supported and secured against displacement. Horizontal reinforcement shall be placed as the masonry work progresses. Where vertical bars are indicated in close proximity, a clear distance shall be provided between bars of not less than the normal bar diameter or 1-inch, whichever is greater.
- C. Reinforcement bars shall be spliced where shown; bars shall not be spliced at other points unless acceptable to the Engineer. In splicing vertical bars or attaching to dowels, ends shall be lapped, placed in contact and wire tied. Not less than the minimum lap indicated shall be provided, or if not indicated, as required by governing code.
- D. Splices shall be welded where indicated. Contractor shall comply with the requirements of AWS D1.4 for welding materials and procedures.
- E. Prefabricated horizontal joint reinforcement shall be embedded as the work progresses, with a minimum cover of 5/8-inch on exterior face of walls and 1/2-inch at other locations. Units shall be lapped not less than 6 inches at ends. Prefabricated "L" and "T" units shall be used to provide continuity at corners and intersections. Units shall be cut and bent as recommended by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
- F. Anchoring: Reinforced masonry Work shall be anchored to supporting structures as indicated. Where required, reinforced masonry walls shall be anchored to non-reinforced masonry walls where they intersect.
- G. Deep cut bond beam blocks shall be used where horizontal reinforcing steel is embedded. H-block bond beams may be used at locations other than openings.
- H. Knock-out openings shall have no steel or joint reinforcing running through the opening. Head, jambs, and sill blocks shall be used to provide an even finish surface to install the window unit when blocks are removed. Joints at head, jambs, and sills shall be stacked and continuous.
- I. Vertical reinforcement shall be held in position at top and bottom and at intervals not exceeding 192 diameters of the reinforcement.

3.13 GROUTING

- A. All cells and bond beam spaces shall be filled solidly with grout unless indicated otherwise. Grouting shall not be started until the wall has cured for 24 hours. Grout shall not be poured in more than 8-ft lifts.
- B. All grout shall be consolidated at time of pouring by puddling or vibrating. Where the grouting operation has been stopped for one hour or longer, horizontal construction joints shall be formed by stopping the grout pour 1-1/2 inches below the top of the uppermost unit.

3.14 PROTECTION

A. Wall surfaces shall be protected from droppings of mortar or grout during construction.

3.15 FINISHING AND CLEANING

- A. Masonry shall not be wet-finished unless exposed to extreme hot weather or hot wind and then only by using a nozzle-regulated fog spray sufficient only to dampen the face but not of such quantity to cause water to flow down over the masonry.
- B. Finish masonry shall be cleaned and pointed in a manner satisfactory to the Engineer, based upon the standards established by the approved sample panel.
- C. All exposed to view interior and exterior colored masonry work shall be cleaned by light sandblasting to remove all stains and other imperfections.
- D. All exposed masonry surfaces of openings and window and door openings such as sills, heads, and jambs shall be finish block surfaces, not formed surfaces, unless indicated otherwise. Closed bottom bond beam blocks shall be used at heads and sills. Pour holes may be used at the sill under window frame and where approved by the Engineer.

END OF SECTION

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PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The Work of this Section includes providing structural steel and related appurtenances.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 09900 – Painting and Coating

1.3 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

- A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC), as specified in Section 01090.
- B The Work of this Section shall comply with the current editions of the following codes as adopted by the City Municipal Code:
 - 1. California Building Code
- C. Except as otherwise indicated, the applicable sections of the current editions of the documents indicated apply to the Work of this Section.
 - 1. AISC M011 Manual of Steel Construction for Shop and Field Welding
 - 2. AISC S326 Design, Fabrication and Erection of Structural Steel for Buildings
 - 3. ASTM A36 Structural Steel
 - 4. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless, Grade B
 - 5. ASTM A283 Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars
 - 6. ASTM A307 Carbon Steel Externally Threaded Standard Fasteners, Grade A
 - 7. ASTM A320 Alloy-Steel Bolting Materials for Low Temperature Service, Type 304
 - 8. ASTM A325 High-Strength Bolts for Structural Steel Joints
 - 9. ASTM A490 Heat-Treated Structural Steel Bolts
 - 10. ASTM A500 Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes, Grade B

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- 11. ASTM A501 Hot-Formed Welded and Seamless Carbon Streel Structural Tubing
- 12. ASTM A666 Austenitic Stainless Steel, Sheet, Strip, Plate and Flat Bar for Structural Applications, Grade A, Type 304
- 13. AWS-B3.0 Welding Procedures and Performance Qualifications
- 14. AWS-D1.1 Structural Welding Code--Steel
- 15. AWS-W1 Welding Metallurgy

1.4 SHOP DRAWINGS AND SAMPLES

- A. The following shall be submitted in compliance with Section 01300:
 - 1. Shop drawings, including details, dimensions, details of match markings and all information necessary for fabrication.
 - 2. Welding procedures and welder qualifications.

1.5 OWNER'S MANUAL

- A. The following shall be included in the Owner's Manual in compliance with Section 01300:
 - 1. Certificates that steels comply with the indicated standards.
 - 2. Certificates that welding operators and procedures comply with the indicated requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials for structural steel members and connection, unless otherwise indicated, shall comply with the following:

1.	Standard rolled steel sections	ASTM A992, Grade 50 wide flanges
2.	Standard rolled steel sections	ASTM A36 channels, angles & other
3.	Pipe columns	ASTM A53, Grade B
4.	Structural steel tubing	A500, Grade B (Fy = 46ksi) or ASTM A501
5.	Structural bars, plates and	ASTM A36 or A283 similar items

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Stainless steel
ASTM A666, Grade A, Type 316L
Stainless steel bolts, nuts
ASTM A320, Type 316 and washers
High strength steel bolts
ASTM A325 or ASTM A490

2.2 FABRICATION

A. Fabrication shall be in accordance with AISC S326 and indicated requirements. All structural steel welding in off-site fabrication shops shall be continuously inspected by a Certified Special Inspector. The continuous inspection will be waived if the work is done in a shop certified by the Council of American Building Officials (CABO), or listed by the International Code Council (ICC) Evaluation Services, Inc. This shall be at no extra cost to the Owner.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 - 1. Structural assemblies and shop and field welding shall meet the requirements of AISC M011 and AISC S326.
 - 2. Measurements and dimensions shall be verified at the site.
 - 3. Bolt holes shall be 1/16 inch larger than the nominal size of bolts. Where thick metals are indicated, holes shall be sub-punched and drilled or reamed.
 - 4. Dissimilar metals shall be protected from galvanic corrosion by means of pressure tapes, coatings or isolators.
 - 5. Bolts shall not be permitted to drift and holes shall not be enlarged to correct misalignment. In the event of mismatching of holes, new materials shall be provided.
 - 6. Structural steel completely encased in concrete shall not be galvanized or painted and shall have a clean surface for bonding to concrete.
 - 7. Damaged structural steel shall be replaced. Use of salvaged, reprocessed, or scrap materials shall not be permitted.
- B. Welding:
 - 1. Welding shall be performed by operators who have been qualified by tests as prescribed by AWS-W1 Sect. 7, to perform the type of welding indicated. Welding shall comply with AWS Code for Arc Welding in Building

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Construction, Section 4, Workmanship. Electrodes shall be matching per AWS.

- 2. Continuous seal welds shall be applied on structural steel designed to be exposed to weather or submerged in water or wastewater. Continuous seal welds shall be applied on both sides of structural steel designed to be submerged in water or wastewater.
- C. Bolted Connections:
 - 1. Where bolted connections are indicated, they shall comply with AISC Specifications for Framed Beam Connections for bearing type connections. The threaded portion of bolts shall not occur at shear planes.

3.2 CORROSION PROTECTION

- A. Unless otherwise indicated, all structural steel, including that used in the fabrication of process equipment, shall be surface prepared and coated in accordance with Section 09900 and shall include the following operations:
 - 1. Exterior and interior edges of flame-cut pieces shall be ground smooth.
 - 2. Sharp edges and punched holes shall be ground smooth.
 - 3. Uneven or rough welds shall be ground smooth.

3.3 TOUCH-UP AND REPAIR

A. After installation, damaged surfaces of shop-primed structural steel shall be cleaned and touched-up with same material used for shop coat.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install steel roof deck complete as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Structural steel is included in Section 05120.
- B. Miscellaneous metal is included in Section 05500.
- C. Roofing, flashing and insulation are included in Division 7.

1.3 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

- A. Steel Deck Institute (SDI)
 - 1. SDI Specifications and Commentary for Steel Roof Deck.
- B. American Society for Testing and Materials (ASTM)
 - 1. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron, Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM A780 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- C. American Iron and Steel Institute (AISI)
 - 1. AISI SG03-3 North American Specification for the Design of Cold-Formed Steel Structural Members.
- D. American Welding Society (AWS)
 - 1. AWS D1.3 Structural Welding Code Sheet Steel.
- E. International Code Council (ICC)
- F. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.4 SUBMITTALS

- A. Shop Drawings: Submit, in accordance with Section 01300, shop drawings showing:
 - 1. Location and size of all members

SECTION 05311 - STEEL ROOF DECK

- 2. Projections and openings.
- 3. Fastener types and layout patterns.
- 4. Erection marks. Mark each bundle to correspond to the shop drawings.
- B. Product Data: Submit, in accordance with Section 01300, product data showing:
 - 1. Materials, finishes and details of construction of all members.
 - 2. Manufacturer's load table including design thickness in inches and section properties, gravity load carrying capability at the span used, diaphragm shear capacity and ICC-ESR Evaluation Report.
- C. Quality Assurance/Control:
 - 1. Certification from the Steel Deck Institute (SDI) that the steel roof deck is designed in accordance with the SDI.
 - 2. Certification for welders.
 - 3. Written Welding Procedure Specifications (WPS's) in accordance with AWS D1.3 and SDI requirements for each different welded joint proposed for use whether prequalified or qualified by testing.
 - 4. Electrode manufacturer's data for actual electrodes proposed. Data shall include manufacturer's recommended welding parameters for each electrode to be used.

1.5 QUALITY ASSURANCE

- A. Steel roof deck shall conform to the requirements of the SDI.
- B. Field welding shall be done by certified welders and shall be in accordance with AWS D1.3 and the AISI.
 - 1. Qualify welders in accordance with AWS D1.3 for each process, position, and joint configuration.
 - 2. WPS's for each joint type shall indicate proper AWS qualification and be available where welding is performed.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Handle material with cranes and derricks. Do not dump material off cars or trucks, or handle in any way likely to cause damage.
- B. Store material off the ground with one end elevated to provide drainage. Protect from the elements with a waterproof covering, ventilated to avoid condensation.

C. Material with excessive damage, in the opinion of the Engineer, shall not be incorporated in the work. Remove and replace them with new undamaged material at no additional cost to the Owner.

1.7 PROJECT/SITE REQUIREMENTS

- A. Notify the Engineer in writing of any inaccuracies in alignment or level of structural steel. Correct inaccuracies before the deck is placed at no additional cost to the Owner.
- B. Coordinate sizes and locations of HVAC openings and hatch penetrations with architectural, structural, mechanical, or HVAC drawings, using the approved curb and equipment details.
- C. Coordinate size, location and details of all penetrations with the Drawings, other trades and details of approved equipment.
- D. Provide reinforcement and miscellaneous framing for all penetrations as shown on the Drawings and as specified herein.

1.8 **DEFINITIONS**

- A. Transverse supports supports which are perpendicular to the direction of the deck ribs.
- B. Longitudinal support supports which are parallel to the direction of the deck ribs.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel roof deck shall conform to the SDI Specifications for Steel Roof Deck and to the AISI.

North American Specification for the Design of Cold-Formed Steel Structural Members.

- B. The depth, type and gauge of steel roof deck shall be as shown on the Drawings. Unless otherwise noted, steel roof deck shall be 1-1/2-in deep, 36-in wide, Type HSB.
- C. Steel deck shall be as manufactured by Verco Manufacturing Company or equal. For a proposed deck to be considered equal, the deck gauge, fastening pattern to supports, and side lap connections must be sufficient to provide diaphragm shears greater than or equal to those published in ICC-ESR Evaluation Report 1735P for the deck specified using the same spans, welding pattern, and type and spacing of side lap connections shown on the Drawings. An ICC-ESR Evaluation Report will be required to substantiate all values.

- D. Steel roof deck and accessories shall be manufactured from steel conforming to ASTM A653, designation SS, Grade 33 or higher.
- E. Steel roof deck and accessories shall be galvanized in accordance with ASTM A653, coating designation G90.
- F. Provide minimum 20 gauge galvanized closure strips, eave plates, ridge plates, etc. as shown on the Drawings and as specified herein. Provide reinforcing plates same gauge as deck for openings 6-in and larger but less than 12-in in greatest dimension.
- G. Provide galvanized touch-up to repair damaged surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install steel roof deck as shown on the Drawings, in accordance with manufacturer's instructions and in accordance with approved shop drawings. Where possible, extend deck sheets over a minimum of three spans.
- B. End laps of steel roof deck shall be at least 2-in long and shall occur over transverse supporting members.
- C. Fasten deck to all supporting steel by arc spot (puddle) welds of the surface diameter indicated and specified below:
 - 1. Weld Diameter: 3/4-in, nominal.
 - 2. Weld Spacing: Weld edge ribs of panels at each support. Space and locate additional welds as indicated on the Drawings.
 - 3. Weld Washers: Install weld washers at each location.
- D. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of ½ of the span or 12 inches, and as follows:
 - 1. Fasten with a minimum of 1-1/2-in long weld.
- E. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.
- F. Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

- G. Coordinate size, location and details of all penetrations with the Drawings, other trades and details of approved equipment. Pipe and conduit openings in the steel roof deck shall be reinforced according to the manufacturer's recommendation.
 - 1. Cutting and Fitting
 - a. Cut and fit steel roof deck units and accessories around projections through steel roof deck.
 - b. Cut openings in steel roof deck true to dimensions using metal saws or drills. Do not use cutting torches.
 - c. Make cuts neat, square and trim. Make cuts free of burrs.
 - d. Reinforce openings 6-in and larger but less than 12-in in greatest dimension with a 24-in by 24-in flat plate, same gauge thickness as deck, centered on the opening.
- H. Do not attach suspended ceilings, light fixtures, ducts, piping, conduits or other utilities to steel roof deck.
- I. Do not use deck for storage or work platforms until permanently secured into position.
- J. Construction loads shall not exceed safe capacity of deck and supporting construction.

3.2 FIELD TESTING

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field test and inspection and prepare test reports.
- B. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- C. Remove and replace work that does not comply with specified requirements.

3.3 FIELD PAINTING

- A. Clean and repair all steel surfaces which have become abraded or where galvanizing has been damaged due to welding and/or erection procedures.
- B. Repair abraded or damaged galvanized areas using the touch-up material specified above to produce a dry film thickness of not less than 6 mils. Conduct all repairs of galvanizing in accordance with ASTM A780.

3.4 INSPECTION

- A. Field welding will be inspected visually and by non-destructive testing by AWS certified welding inspectors provided by the Owner.
- B. The Engineer and the certified welding inspector will inspect steel roof deck in the field for compliance with this Section and the approved shop drawings. The

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Engineer and the certified welding inspector may reject or require repair or refabrication of any steel roof deck or accessories not meeting these requirements.

END OF SECTION

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

- A. The Work of this Section includes providing miscellaneous metalwork and appurtenances including the following:
 - 1. Anchor Bolts
 - 2. Power Driven Pins
 - 3. Bolts
 - 4. Seat Angles, Supports and Brackets
 - 5. Iron Castings
 - 6. Gratings
 - 7. Floor and Cover Plates
 - 8. Stairs
 - 9. Safety Stair Treads
 - 10. Access Hatches
 - 11. Pipe Columns
 - 12. Fall Prevention System
 - 13. Manhole Frames and Covers

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 03300 Cast-in-Place Concrete
- C. Section 03315 Grout
- D. Section 03461 Precast Concrete Manholes
- E. Section 05120 Structural Steel
- F. Section 05510 Metal Stairs and Handrails
- G. Section 09900 Painting and Coating

1.3 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

- A. The Work of this Section shall comply with the current editions of the following codes as adopted by the City Municipal Code:
 - 1. California Building Code
- B. Except as otherwise indicated in this Section of the Specifications, the Contractor shall comply with the Standard Specifications for Public Works Construction (SSPWC), as specified in Section 01090.
- C. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

1. Federal Specifications:

QQ-F-461 C (1)	Floor Plate, Steel, Rolled
MIL-6-18015	(Ships) Aluminum Planks, (6063-T6)

2. Commercial Standards:

AISC MO11	Manual of Steel Constructions
AASHTO HS-20	Truck Loading
ASTM A36	Specification for Structural Steel
ASTM A 48	Specification for Gray Iron Castings
ASTM A 53	Specification for Pipe, Steel, Black and Hot- Dipped, Zinc-Coated Welded and Seamless
ASTM A 123	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 125	Specification for Steel Springs, Helical, Heat Treated
ASTM A 153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A283	Specification for Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars
ASTM A 307	Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile
ASTM A320	Specification for Alloy-Steel Bolting Materials for Low-Temperature Service
ASTM A489	Carbon Steel Eyebolts
ASTM A 569	Specification for Steel, Carbon, (0.15 Maximum Percent) Hot Rolled, Sheet and Strip, Commercial Quality
ASTM A 575	Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
ASTM B 98	Specification for Copper-Silicon Alloy Rod, Bar, and Shapes
ASTM B 210	Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes

ASTM B 221	Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes
ASTM B 438	Specification for Sintered Bronze Bearings (Oil- Impregnated)
ANSI/AWS D1.1	Structural Welding Code - Steel
NFPA 101	Life Safety Code
NAAMM	Metal Stairs Manual

1.4 SHOP DRAWINGS AND SAMPLES

- A. The following shall be submitted in compliance with Section 01300:
 - 1. Shop drawings showing connection details and locations proposed for power driven pins.
 - 2. Shop drawings of miscellaneous metalwork including seat angles, supports and guides.
 - 3. Shop drawings showing proposed use of adhesive anchors.
 - 4. Data indicating load capacities, chemical resistance and temperature limitations of power driven pins.
 - 5. Manufacturer's catalog data for manhole frame, covers, and each type of anchor.
 - 6. Welding procedures and welder qualifications.

1.5 OWNER'S MANUAL

- A. The following shall be included in the Owner's Manual in compliance with Section 01300:
 - 1. Manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 MISCELLANEOUS METALWORK

- A. Materials: Except as otherwise indicated, products fabricated of structural steel shapes, plates and bars shall comply with the requirements of ASTM A 36.
- B. Corrosion Protection: Miscellaneous metalwork of fabricated steel, which will be used in a corrosive environment or will be submerged shall be stainless steel. Other miscellaneous steel metalwork shall be hot-dip galvanized after fabrication except as otherwise indicated.

- C. Stainless Steel: Stainless steel metalwork shall be of Type 316 L stainless steel. Stainless steel shall not be torch heated for welding. The Contractor shall submit welding methods and procedures. All welded stainless steel shall be passivated after welding by immersing in a pickling solution of 6 percent nitric acid and 3 percent hydrofluoric acid. Temperature and detention time for passivation shall be sufficient for removal of oxidation and ferrous contamination without etching of surface. The passivated steel shall undergo a complete neutralization by immersion in a detergent rinse followed by clean water wash, or shall be buffed with Scotch Brite EXL (or equal) for removal of weld discoloration and heat tint.
- D. Welding: Welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" and supplemented by other standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards.

In assembly and during welding, the component parts shall be adequately clamped, supported and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall comply with the AWS Code. Upon completion of welding, weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. Sharp corners of material which is to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

E. Galvanizing: Where galvanizing is indicated, structural steel plates shapes, bars and fabricated assemblies shall be thoroughly cleaned of rust and scale and shall be galvanized in accordance with the requirements of ASTM A 123. Any galvanized part that becomes warped during the galvanizing operation shall be straightened. Bolts (except ASTM A325), anchor bolts, nuts and similar threaded fasteners, after being properly cleaned, shall be galvanized in accordance with the requirements of ASTM A 153.

2.2 ANCHOR BOLTS

- A General: Anchor bolts shall comply with the following:
 - 1. Anchor bolts shall be fabricated of materials complying with SSPWC Subsections 206-1.4.1 and 209-2.2 and as follows:

Steel bolts	ASTM A325
Fabricated steel bolts	ASTM A36
Stainless steel bolts, nuts, washers	ASTM A320, Type 316

2. Anchor bolt holes in equipment support frames shall not exceed the bolt diameters by more than 25 percent, up to a maximum oversizing of 1/4 inch. Unless otherwise indicated, minimum anchor bolt diameter shall be 1/2 inch. Anchor bolts for equipment shall be 316 stainless steel and shall be provided with leveling nuts which shall be tightened against flat surfaces to not less than 10 percent of the bolt's safe tensile stress.

- 3. Tapered washers shall be provided where mating surface is not square with the nut.
- 4. Expansion, wedge, or adhesive anchors set in holes drilled in the concrete after the concrete is placed is not permitted as substitution for anchor bolts except where otherwise indicated. Upset threads shall not be acceptable.
- 5. ASTM A307 anchor bolts are prohibited.
- B. Adhesive Anchors: Unless otherwise indicated, drilled concrete or masonry anchors shall be adhesive anchors. Substitutions will not be considered unless accompanied with ICC report verifying strength and material equivalency. Except as otherwise indicated, adhesive anchors shall comply with the following:
 - 1. Epoxy adhesive anchors may be provided for drilled anchors where exposed to weather, in submerged, wet, splash, overhead, and corrosive conditions, and for anchoring handrails and reinforcing bars. Threaded rod shall be stainless steel Type 316.
- C. Expanding-Type Anchors: Expanding-type anchors, where indicated, shall be Type 316 stainless steel. Size shall be as shown. Expanding-type anchors are prohibited from use in corrosive areas and in deteriorating concrete

2.3 POWER DRIVEN PINS

A. Materials: Power-driven pins for installation in concrete or steel in interior locations of nonprocess areas shall be heat-treated steel alloy complying with AISI 1062 or 4063 and shall be zinc-plated. Pins shall have capped or threaded heads capable of transmitting the shank loads. Pins that are connected to steel shall have longitudinal serrations around the circumference of the shank.

2.4 BOLTS

- A. Bolt Requirements: Bolts shall comply with the following:
 - 1. The nuts shall be capable of developing the full strength of the bolts. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads. Bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.
 - 2.. The length of all bolts shall be such that after joints are made up, each bolt shall extend through the entire nut, but in no case more than 1/2-inch beyond the nut.
- B. Standard Service Bolts (Not Buried or Inside Tanks or Channels): Except where otherwise indicated, bolts and nuts shall be steel and shall be galvanized after fabrication. Threads on galvanized bolts and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing. Except as otherwise indicated herein, steel for bolts, anchor bolts and cap screws

shall be in accordance with the requirements of ASTM A 325, or threaded parts of ASTM A 36. ASTM A 325 bolts and nuts shall not be galvanized.

- C. Bolts Buried or Inside Tanks or Channels: Unless otherwise indicated, bolts, anchor bolts, nuts and washers which are buried, submerged, or below the top of the wall inside any hydraulic structure shall be of Type 316 stainless steel.
- D. Unless otherwise indicated, eyebolts shall conform to ASTM A 489.

2.5 SEAT ANGLES, SUPPORTS AND BRACKETS

- A. Seat angles over slide gate guides shall be welded to the guides. Seat angles for supports for floor plates, clips for precast panels and brackets for piping shall be steel, hot-dip galvanized after fabrication unless otherwise indicated. Over tanks and channels seat angles and brackets shall be Type 316 L stainless steel.
- B. Seat angles for grating shall be aluminum or steel as indicated, except that Type 316 L stainless steel shall be used over tanks and channels. Guides for slide gates shall be Type 316 L stainless steel.

2.6 IRON CASTINGS

A. Castings shall conform to the requirements of ASTM A 48 unless otherwise indicated. Castings weighing less than 100 pounds shall be hot-dip galvanized after machining. Castings weighing greater than 100 pounds shall be galvanized where indicated.

2.7 GRATINGS

- A. General: Both bearing bars and cross bars shall be continuous. Openings shall be banded with bars having the same dimensions as the bearing bars. Perimeter edges shall be banded with bars flush at the top surface of the grating and 1/4 inch clear of the bottom surface. Bars terminating against edge bars shall be welded to the edge bars when welded construction is used. When crimped or swaged construction is used, bars at edges shall protrude a maximum of 1/16 inch and shall be peened or ground to a smooth surface. No single piece of grating shall weigh more than 80 pounds unless otherwise indicated.
- B. Rough weld beads and sharp metal edges on gratings and plates shall be ground smooth. Welds exposed to view shall be uniform and neat. Welds to be galvanized shall be sandblasted prior to galvanizing.
- C. Holes shall be punched 1/16 inch larger than the nominal size of the bolts, unless otherwise indicated. Whenever needed, because of the thickness of the metal, holes shall be subpunched and reamed or shall be drilled. Cutting, drilling, punching, threading and tapping shall be performed prior to hot-dip galvanizing.
 - 1. Aluminum: Aluminum grating bearing bars and aluminum floor plates and cover plates shall be of alloy 6061-T6 conforming to ASTM B221. Aluminum grating cross bars shall be of an alloy conforming to either ASTM B221 (extrusions) or B210 (drawn).

Unless otherwise indicated, grating shall be fabricated of aluminum. Bearing bars shall be punched to receive the cross bars. After insertion in the bearing bars, cross bars shall be deformed by a hydraulic press or similar means to permanently lock the bars into the bearing bar openings. Fabrication methods employing bending or notching of bearing or cross bars will not be permitted.

2. Steel: Steel grating bearing bars and cross bars shall be of welding quality mild carbon steel conforming to ASTM A569. Steel floor plates and cover plates shall be of structural quality steel conforming to ASTM A36.

Steel grating shall be used only where indicated. Steel grating shall be hot-dip galvanized. Notching, slotting, or cutting the top or bottom edges of bearing bars to receive cross bars will not be permitted unless each intersection of bars is fully welded to restore each bearing bar to its full cross-sectional strength.

2.8 FLOOR AND COVER PLATES

A. Plates shall be set flush with surrounding floor. No single piece of floor and cover plate shall weigh more than 80 pounds unless specifically detailed otherwise. Floor and cover plates over tanks and channels shall be Type 316 stainless steel.

2.9 STAIRS

A. Unless otherwise indicated, stairs shall be aluminum per Section 05510.

2.10 SAFETY STAIR TREADS

A. Safety stair treads shall be provided on stairs or where indicated and shall be 4 inches wide aluminum. Aluminum stair treads shall have isolation coating to prevent direct contact with concrete surfaces per Section 09900.

2.11 ACCESS HATCHES

- A. Prefabricated access hatches shall have single or double leaf doors as indicated by the Drawings. The doors shall be 1/4-inch aluminum diamond pattern plate with welded stiffeners, as necessary, to withstand H20 loading. Hatches shall have a 1/4-inch aluminum channel frame with a perimeter anchor flange or strap anchors for concrete embedment around the perimeter. Unless otherwise noted on the Drawings, use pivot torsion bars for counterbalance or spring operators for easy operation along with automatic door hold open. Doors shall open to 90 degrees. Hardware shall be durable and corrosion resistant with Type 316 stainless steel hardware used throughout. Provide removable lock handle. Finish shall be the factory mill finish for aluminum doors and frames with bituminous coating on the exterior of the frames in contact with concrete. Hatches shall be weathertight and have a 1-1/2–in drainage coupling to the channel frame. Access hatches shall be Type J or Type JD aluminum hatches by Bilco Company, or approved equal.
- B. Provide manufacturer's guarantee against defects in materials or workmanship for
a period of 5 years from date of purchase.

2.12 PIPE COLUMNS

A. Pipe column steel shall conform to the requirements of ASTM A 53, Grade B.

2.13 FALL PREVENTION SYSTEM

A. The fall prevention system shall include safety belt and other components for a complete and fully operational fall prevention system.

2.14 MANHOLE FRAMES AND COVERS

A. See Section 03461.

2.15 MANUFACTURERS

- A. Products of the type or model (if any) indicated shall be manufactured by one of the following (or equal):
 - 1. Epoxy Adhesive Anchors:

Hilti HIT HY-200	(ICC ESR-3187)
Simpson Set-XP	(ICC ESR-2508)

3. Expanding-Type Anchors:

Hilti Kwik Bolt TZ	(ICC ESR-1917)
Simpson Strong Bolt 2	(ICC ESR-3037)

4. Steel Gratings:

Irving Type IWA Gary Type GW

5. Floor and Cover Plates:

Alcoa C-102 Aluminum Tread Plate Reynolds Diamond Tread Plate

6. Access Hatches:

Bilco Company

7. Safety Stair Treads:

Wooster Products, Incorporated Alumogrit, Type 101 American Abrasive Metals Company Alumalum, Style A Safe-T-Metal Company Incorporated Style AX American Mason Safety Tread Company [] 8. Fall Prevention System:

Research and Trading Corporation, Wilmington, Delaware Everest Lifeline System Model No. 6006 North Consumer Products, Inc., California Saf-T-Climb

- 9. Manhole Frames and Covers: See Section 03461.
- 10. Field Repairs to Galvanizing:

"Galvinox" "Galvo-Weld"

11. Aluminum Grating:

Gary Galok Seidelhuber

PART 3 - EXECUTION

- 3.1 GENERAL
 - A. Fabrication and Erection: Except as otherwise indicated, the fabrication and erection of structural steel shall conform to the requirements of the American Institute of Steel Construction "Manual of Steel Construction."
 - B. General: Fieldwork, including cutting and threading, shall not be permitted on galvanized items. Dissimilar metals shall be protected from galvanic corrosion by means of pressure tapes, coatings or isolators. Grouting of anchor bolts with nonshrink or epoxy grouts, where indicated, shall be in accordance with Section 03315.
 - 1. Drilling of bolts or enlargement of holes to correct misalignment will not be allowed.
 - 2. Metalwork to be embedded in concrete shall be placed accurately and held in correct position while the concrete is placed or, if indicated, recesses or blockouts shall be formed in the concrete. The surfaces of metalwork in contact with or embedded in concrete shall be thoroughly cleaned. Recesses may be neatly cored in the concrete after it has attained its design strength and the metalwork grouted in place. Embedments shall comply with Section 03300.
 - 3. Holes shall be punched 1/16 inch larger than the nominal size of the bolts, unless otherwise indicated. Whenever needed, because of the thickness of the metal, holes shall be subpunched and reamed or shall be drilled.
 - 4. Fabrication including cutting, drilling, punching, threading and tapping required for miscellaneous metal or adjacent work shall be performed prior to hot-dip galvanizing.

3.2 INSTALLATION OF ANCHOR BOLTS

- A. After anchor bolts have been embedded, their threads shall be protected by grease and the nuts run on.
- B. Installation of adhesive, capsule and expansion anchors shall comply with the following:
 - 1. All installation recommendations by the anchor system manufacturer shall be followed carefully, including maximum hole diameter.
 - 2. Use shall be limited to applications where exposure to fire or exposure to concrete or rod temperature above 120 degrees F is not indicated. Overhead applications (such as pipe supports) shall not be allowed.
 - 3. Use shall be limited to locations where exposure to acid concentrations higher than 10 percent, to chlorine gas, or to machine or diesel oils, is not indicated.
 - 4. Concrete temperature (not air temperature) shall be compatible with curing requirements recommended by adhesive manufacturer. Anchors shall not be placed in concrete below 25 degrees F.
 - 5. Anchor diameter and grade of steel shall comply with equipment supplier specifications. Anchor shall be threaded or deformed full length of embedment and shall be free of rust, scale, grease, and oils.
 - 6. Adhesive capsules of different diameters may be used to obtain proper volume for the embedment, but no more than two capsules per anchor may be used. When installing different diameter capsules in the same hole, the larger diameter capsule shall be installed first. Any extension or protrusion of the capsule from the hole is prohibited.
 - 7. Holes shall have rough surfaces, such as can be achieved using a rotary percussion drill.
 - 8. Holes shall be blown clean with compressed air and be free of dust or standing water prior to installation.
 - 9. Anchor shall be left undisturbed and unloaded for full adhesive curing period.

3.3 INSTALLATION OF SEAT ANGLES, SUPPORTS AND GUIDES

A. Seat angles shall be set flush with the floor.

3.4 INSTALLATION OF POWER DRIVEN PINS

A. Power-driven pins shall be installed by a craftsman who is certified by the manufacturer as being qualified to install the manufacturer's pins. Pins shall be driven in one initial movement by an instantaneous force that has been carefully

selected to attain the required penetration. Driven pins shall conform to the following requirements where "D" = Pin's shank diameter:

Material	Pin's Shank Material's	Minimum Space Penetration in	From Pin's CL to	Minimum	
Penetrated	Minimum	Supporting	Edge of Penetrated	Pin	
by Pin	Thickness	Material	Material	Spacing	
Concrete	16D	6D minimum	14D	20D	
Steel	1/4-inch	Steel thickness	4D	7D	

3.5 INSTALLATION OF GRATING, FLOOR AND COVER PLATES

A. Grating, floor and cover plates shall be field measured for proper cutouts and proper sizes.

3.6 INSTALLATION OF STAIRS AND LADDERS

A. Stairs and ladders shall be fitted accurately and field measured where necessary.

3.7 INSTALLATION OF SAFETY STAIR TREADS

A. Unless otherwise indicated, safety stair treads shall be installed on all concrete stairs. Treads shall be secured to concrete with suitable anchors at 15 inches on centers and not more than 4 inches from the ends. Rubber tape, 1/8-inch thick, shall be provided at both ends and cut to fit shape of tread prior to concrete placement.

3.8 INSTALLATION OF ACCESS HATCHES

A. Unless otherwise indicated, the Work of this Section includes a 1/2-inch drain line from each access hatch to the nearest floor drain or the existing wet well.

3.9 INSTALLATION OF DRILLED ANCHORS

A. Drilled anchors shall be installed in strict accordance with the manufacturer's instructions. Holes shall be roughened with a brush on a power drill, cleaned and dry. Drilled anchors shall not be installed until the concrete has reached the indicated 28-day compressive strength. Adhesive anchors shall not be loaded until the adhesive has reached its indicated strength in accordance with the manufacturer's instructions.

3.10 INSTALLATION OF MANHOLE FRAMES AND COVERS

A. See Section 03461.

END OF SECTION

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. Furnish all labor, materials, equipment and incidentals necessary and install aluminum stairs complete with anchors and brackets, including integral handrails and posts when applicable, as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 03300 Cast-in-Place Concrete
- B. Section 05500 Miscellaneous Metalwork

1.3 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
- B. Aluminum Association (AA)
 - 1. AA 6061-T6 Aluminum Sheet and Plate.
 - 2. AA ASM 35 Aluminum Sheet Metal Work in Building Construction
 - 3. AA ADM 1 Aluminum Design Manual
- C. American Welding Society (AWS)
 - 1. AWS D1.2 Structural Welding Code Aluminum.
- D. American National Standards Institute (ANSI)
 - 1. ANSI A202.1 Metal Bar Grating Manual for Steel and Aluminum Gratings and Stair Treads.
- E. Building Officials and Code Administrators Congress International, Inc. (BOCA)
- F. Occupation Safety and Health Administration (OSHA)
- G. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.4 SUBMITTALS

A. Submit, in accordance with Section 01300, complete shop drawings and calculations. Calculations and Shop Drawings shall be sealed by a licensed professional engineer. Calculations shall not be required for stair stringers and

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main landing framing members called out on plans. Submittals shall indicate construction details, sizes, of metal sections, thicknesses of metal, profiles, attachments, dimensions and field joints, method of support from structure, work to be built-in or provided by other sections and finishes to conform to the Drawings and this Section. Indicate welded connections, both shop and field, using standard AWS welding symbols. Indicate net weld lengths. Submittals shall include the following:

- 1. Two samples, each 8-in square in area, of each type finished material.
- 2. Manufacturer's certification that materials meet specification requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum: ASTM B221, Alloy 6061-T6, Finish AA-C22A31.
- B. Components
 - 1. Stringers: Aluminum
 - 2. Headers: Aluminum
 - 3. Treads: Aluminum
 - 4. Risers: Aluminum
 - 5. Platforms: Aluminum
 - 6. Railings: Aluminum
 - 7. Handrails: Aluminum
 - 8. Fasteners: ASTM A320 Type 316

2.2 GENERAL FABRICATION

- A. Verify dimensions on site prior to shop fabrication. Detail stair risers, treads and landings to conform with the requirements of OSHA latest edition and CBC 2016.
- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: 100 lbf/sq. ft.
 - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to L/360

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or 1/4 inch, whichever is less.

- C. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Infill load and other loads need not be assumed to act concurrently.
- D. Seismic Performance: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Component Importance Factor is 1.25.
- E. Shop assemble sections in largest practical sizes, easily handled through building openings.
- F. Accurately form and fit components and connections. Grind exposed edges and welds smooth and flush.
- G. Accurately form components required for proper anchorage of stairs and landings to each other and to building structure.

2.3 FABRICATION OF SOLID TREAD AND RISER STAIRS AND LANDINGS

- A. Fabricate stair with risers and treads as indicated per plans using structural aluminum channels, angles, plates and extrusions for stringers, treads and all supports.
- B. Treads: Extruded or cast aluminum with integral nosing to form a one-piece structural unit.
 11-1/16-in wide tread shall be I-Bar Grating by Borden Metal Products Co.; Intertec Corp. or equal.
- C. Properly secure treads to stringers with 3/8-in stainless steel bolts and washers or weld to stringer. All other fasteners are to also be stainless steel.
- D. Landings: Fabricate landings as shown per plan.

PART 3 - EXECUTION

3.1 ERECTION

- A. Erect stairs square, level, plumb and free from distortion or defects detrimental to appearance and performance.
- B. Provide necessary anchors, plates, angles, hangers and struts as required for connecting stairs to the structure.
- C. Provide isolation washers at all bolted connections where dissimilar metals occur.
- D. All aluminum surfaces in contact with concrete or dissimilar metals where electrolysis may occur shall be coated with a minimum 2 coats bituminous paint on the contact surface.
- E. Ensure alignment with adjacent construction. Coordinate with related work to ensure no interruption in installation.
- F. Perform necessary cutting and altering for the installation of work of other Sections. Do not perform any other additional cutting without review of the Engineer.
- G. Field bolt and weld to match standard of shop bolting and welding. Hide bolts and screws whenever possible. Where not hidden, use flush countersunk fastenings, unless indicated otherwise. Make mechanically fastened joints flush hairline butted. Grind welds smooth and flush.

END OF SECTION

SECTION 07175 - WATER REPELLENT COATING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Scope includes application of waterproof sealer on all exterior wall surfaces.

1.2 QUALITY ASSURANCE

- A. <u>Manufacturer's Certification</u>: Prior to start of installation of the work of this Section, and during progress of that work, secure a visit to the job site by an authorized representative of the manufacturer of the water repellent coating material, who shall inspect and shall certify:
 - 1. That the surfaces to which water repellent coating was applied were in a condition suitable for that application;
 - 2. That the materials applied conform to the specified requirements;
 - 3. That the materials were applied in complete accordance with the manufacturer's current recommendations.

1.3 SUBMITTALS

- A. Submit manufacturer's product data.
- B. <u>Certification</u>: Upon completion of the work of this Section, and as a condition of its acceptance, deliver to the Owner the certification required under Paragraph 1.01.A above.
- C. <u>Warranty</u>: Accompanying the certification, deliver to the Owner the manufacturer's standard warrantee, stating that the water repellent coating will remain intact and resist water for a period of five years following date of application. If the surface coated shows moisture penetration on structural sound areas, the manufacturer will supply materials to recoat such problems with coatings at no charge to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. <u>Water Repellent Coating</u>: Clear penetrating water repellent coating as follows:
 - 1. "Okon W-2", by Okon, Inc.,
 - 2. "Chemstop Barricade Regular", by Tamms Industries Co.,
 - 3. "Rainguard Super", by Rainguard Products Co.,

PART 3 - EXECUTION

3.1 INSPECTION

Examine the areas and conditions under which work of this Section will apply. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 APPLICATION

- A. <u>Preparation</u>: Properly and thoroughly prepare all surfaces to receive water repellent coating, complying with the manufacturer's recommended application rates.
- B. <u>Application</u>: Apply the specified material in strict accordance with the manufacturer's recommendations, covering all exposed stucco and masonry areas.

3.3 WATER TEST

The applicator under the manufacturer's supervision shall test a representative wall area. Conduct the test with a garden spray nozzle located at 10 feet from the wall so that water will strike the wall at approximately 45° downward angle. Spray water on the wall for two hours. If the inside face of the wall shows traces of moisture, apply another coat of clear water repellent to the entire area and re-test the wall. Repeat this procedure until no trace of moisture is present.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install concrete roofing tiles, nails, underlayment, and mortar as shown on the Drawings and specified herein, in accordance with the requirements of the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 07600 Flashing and Sheet Metal

1.3 SUBMITTALS

- A. Submit Shop Drawings indicating details of hip and ridge configurations. Include methods of fastening.
- B. Submit manufacturer's product data.
- C. Submit samples of concrete roof tiles to indicate range of color variation.
- D. Prepare sample panel of tile on roof deck for Engineer's review. Sample panel to be 15 rows wide by minimum of 8 tile high.
- E. <u>Guarantee</u>: Provide the Owner with a written fifty year "No Dollar Limit" manufacturer's guarantee against any and all defects in materials on those items furnished and installed. Provide the Owner with a written five-year contractor's guarantee against any and all defects in workmanship on those items furnished and installed.
- F. <u>Certifications</u>: Prior to commencement of construction, Contractor shall submit a letter from the manufacturer's warranty department which indicates the following:
 - 1. All contractor documents relating to the roof system have been reviewed and are acceptable.
 - 2. All materials specified are physically and chemically compatible with each other, and the system, as designed, is suitable for the specified warranty.
 - 3. The address and location of the project.
- G. <u>Applicator Qualifications</u>: Submit certification from the roofing material manufacturer that the applicator has been approved by the manufacturer, has a minimum of five years experience installing the specified roof system, and provide a list of similar installations performed by the applicator using the specified roofing system.

1.3 DELIVERY, STORAGE AND HANDLING

- A. All material shall be stored and handled in a manner which will prevent damage.
- B. Material shall be stored in original containers and shall be clearly marked with manufacturer's name.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. <u>Roofing Tile</u>: Standard weight concrete roof tile, "Capistrano" Roofing Tile, as manufactured by Eagle Roofing Products, or approved equal. Color shall be as indicated, with matching eave closure strips at all eaves.
- B. <u>Roofing Nails</u>: Simplex or Stronghold with 5/16" (minimum) diameter square head and annular threaded shank of a length sufficient to penetrate sheathing 3/4". All fasteners shall be hot-dipped galvanized.
- C. <u>Underlayment</u>: No. 30 asphalt saturated felt.
- D. <u>Mortar Materials</u>: As per manufacturer's recommendations.
- E. <u>Flashing</u>: In accordance with Section 07600.
- F. Roof Insulation
 - 1. General: Preformed roof insulation boards manufactured by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.
 - 2. Perlite Board Insulation: ASTM C 728, rigid, mineral-aggregate thermal insulation board composed of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal coated.
 - a. Basis of Design Product: DuraBoard by Johns Manville
 - b. Install no boards thicker than 1.5". If insulation package required is thicker than 1.5", install in multiple layers.
 - C. Tapered Insulation: ASTM C 1289, provide factory-tapered insulation boards fabricated to slopes indicated.
 - D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.
 - E. Insulation Accessories
 - a. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.

- b. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- c. Cold Fluid-Applied Adhesive: Manufacturer's No VOC, twocomponent cold fluid-applied adhesive formulated to adhere roof insulation to substrate.
- d. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
- e. Insulation Cant Strips: ASTM C 728, perlite insulation board.
- f. Wood Nailer Strips: Comply with requirements in Division 6.
- g. Tapered Edge Strips: ASTM C 728, perlite insulation board.
- h. Substrate Joint Tape: 6- or 8-inch- wide, coated, glass-fiber joint tape.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. <u>Underlayment</u>: Apply two layers of No. 30 felt at right angles to roof pitch.
 - 1. Horizontal laps shall be 4" with sidelaps 6" minimum.
 - 2. Underlayment shall be securely nailed per manufacturer s recommendations.
 - 3. Turn felt up not less than 6" at vertical surfaces or as required under flashing.
 - 4. Apply a double layer of felt over ridges and mansards by overlapping not less than 12".
- B. <u>Insulation</u>:
 - 1. Comply with roofing system manufacturer's written instructions for installing roof insulation.
 - 2. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing membrane system with vertical surfaces or angle changes more than 45 degrees.
 - 3. Install tapered insulation under area of roofing to conform to slopes indicated.
 - 4. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.

- a. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- 5. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or more, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
 - a. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
- 6. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- 7. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
- 8. Adhered Insulation and Cover Board: Install each layer of insulation and adhere to substrate as follows:
 - a. Set each layer in a two-part cold fluid-applied adhesive.
- 9. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints a minimum of 6 inches in each direction from joints of insulation below. Loosely butt cover boards together. Tape joints if required by roofing system manufacturer.
 - a. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- C. <u>Tile Attachment</u>: Provide additional batten boards and framing members as required or recommended by the manufacturer for the proper installation of the roofing tiles.
- D. <u>Roofing Tiles</u>: Lay tile at right angles to eaves, beginning at eaves at working toward ridge. Install tiles in accordance with manufacturer s recommendations.
 - 1. Where tile joins ridges, voids shall be filled with cement mortar.
- E. Trim tile shall be used on all hips and ridges, nailed to a nailing strip and wet-bedded in cement mortar.
- F. All tile in contact with mortar shall be immersed in water for three minutes before laying to assure an adequate bond with mortar.
- G. To avoid color patterning, checkerboarding, spotting and stairstepping;
 - 1. Roof load tiles from different pallets.

- 2. After the installation of each 100 roofing tiles make a visual inspection from the ground level.
 - a. Verify that tile courses follow straight and true lines.
 - b. Verify that the color range is smooth with no abrupt changes.
- 3. Correct any color or installation problems before proceeding with the installation.

3.2 CLEANING UP

Upon completion of work of this section, and as a condition of acceptance, completely remove from the job site all tools, equipment, debris, and surplus materials pertaining to this portion of the work.

END OF SECTION

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PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install flashing and sheet metal as shown on the Drawings and specified herein, in accordance with the requirements of the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 07320 Concrete Roofing Tiles
- C. Section 09900 Painting and Coating

1.3 QUALITY ASSURANCE

A. <u>Quality Standards</u>: In addition to complying with all pertinent codes and regulations, comply with all pertinent recommendations contained in "Architectural Sheet Metal Manual", current edition, of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA).

1.4 SUBMITTALS

- A. Submit complete materials list of all items proposed to be furnished and installed under this section.
- B. Submit shop drawings showing layout, joining, profiles, and anchorages of fabricated work, including major counter flashings, copings, fascias and expansion joint systems, and interface of the work with the work of adjacent trades.

1.5 JOB CONDITIONS

A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. <u>Zinc-Coated Steel</u>: Commercial quality with 0.20% copper, ASTM A 525 except ASTM A 527 for lock-forming, G90 hot-dip galvanized, mill phosphatised where indicated for painting, 22 gage minimum except as otherwise indicated.
- B. <u>Solder</u>: For use with steel, provide 50 50 tin/lead solder (ASTM B 32), with rosin flux.
- C. <u>Fasteners</u>: Same metal as flashing and sheet metal or, other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.

SECTION 07600 - FLASHING AND SHEET METAL

- D. <u>Bituminous Coating</u>: Fed. Spec. TT-C-494 or SSPC-Paint 12, solvent type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
- E. <u>Mastic Sealant</u>: Polyisobutylene; nonhardening, nonskinning, non-drying, nonmigrating sealant.
- F. <u>Elastomeric Sealant</u>: Generic type recommended by manufacturer of metal and fabricator of components being sealed; comply with Fed. Spec. TT-S-0027, TT-S-00230, or TT-S-001543.
- G. <u>Metal Accessories</u>: 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 gage required for performance.
- H. <u>Roofing Cement</u>: ASTM D 2822, asphaltic.

2.2 FABRICATED UNITS

- A. <u>Metal Fabrication</u>:
 - 1. Shop-fabricate work to greatest extent possible.
 - 2. Comply with details shown, and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices.
 - 3. Fabricate for waterproof and weather-resistant performance with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of the work.
 - 4. Form work to fit substrates.
 - 5. Comply with material manufacturer instructions and recommendations for forming material.
 - 6. Form exposed sheet metal work without excessive oil-canning, buckling and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.
 - a.) Install additional framing and supports as required to provide acceptable installation.
- B. <u>Seams</u>: Fabricate nonmoving seams in sheet metal with flat-lock seams, tin edges to be seamed, form seams, and solder.
- C. <u>Expansion Provisions</u>: Where lapped or bayonet-type expansion provisions in work cannot be used, or would not be sufficiently water and weatherproof, form

SECTION 07600 - FLASHING AND SHEET METAL

expansion joints of intermeshing hooked flanges, not less than 1" deep, filled with mastic sealant concealed within joints.

- D. <u>Sealant Joints</u>: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.
- E. <u>Separations</u>: Provide for separation of metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer and/or fabricator.
- F. <u>Finish</u>: Finish of all exposed work under this section shall be in accordance with Section 09900.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations, and with SMACNA "Architectural Sheet Metal Manual".
 - 1. 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.
 - 2. Install work such that all laps, joints and seams will be permanently watertight and weatherproof.
- B. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.

3.2 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes.
- B. <u>Protection</u>: Installer shall advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction, to ensure that work will be without damage or deterioration, other than natural weathering, at time of substantial completion.

END OF SECTION

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PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and apply sealants as shown on the Drawings and described herein, in accordance with the requirements of the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 07600 Flashing and Sheet Metal

1.3 QUALITY ASSURANCE

- A. Qualifications of Installers:
 - 1. Proper installation of sealants requires installers to be thoroughly trained and experienced in the necessary skills and thoroughly familiar with the specified requirements.
 - 2. For installation of sealants throughout the Work, use only personnel who have been specifically trained in such procedures and who are completely familiar with the joint details shown on the Drawings and the installation requirements called for in this Section.
- B. Adhesion Tests: Manufacturer shall perform adhesion tests on substrates.

1.4 SUBMITTALS

- A. Submit the following:
 - 1. A complete materials list showing all items proposed to be furnished and installed under this Section.
 - 2. Specifications, color charts, installation instructions, and general recommendations from the materials manufacturers showing procedures under which it is proposed that the materials will be installed.
 - 3. Certification that materials conform with the specified materials.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver to the job site in unopened containers or cartons, each bearing product name and color.
- B. Store materials in waterproof, dry sheds. Do not permit material to freeze or be stacked in such a way as to cause damage to the containers.

1.6 WARRANTY

A. Provide a warranty to the Owner, signed by the applicating contractor or firm, agreeing to make any repairs or replacements required because of faulty materials or workmanship, at no additional cost to the Owner, for a period of three years from date of completion of the Work. Exterior Work that does not remain weathertight and all Work which does not retain all properties inherent in the product will be considered faulty.

1.7 MISCELLANEOUS CAULKING AND SEALING WORK

A. The entire extent of sealing work is not necessarily fully or individually described here or on the drawings. Sealing shall be provided wherever required to prevent light leakage as well as moisture leakage. Refer to drawings for conditions and related parts of the work.

PART 2 - PRODUCTS

2.1 SEALANTS

- A. Type A Sealant: A-A-1556, Class A, Type II, multi-component polyurethane sealant, Tremco "Dymeric", Mameco "Vulkem 227", Sika Corp. "Sikaflex 2C N/S", or equal.
- B. Type B Sealant: A-A-1556, Type 2, non-sag, chemically curing, 25-35 Shore A hardness, single component, synthetic-rubber, solvent release type, polyurethane base sealant, Mameco "Vulkem 116", Tremco "Dymonic", Sika Corp. "Sikaflex 1A or 15LM", or equal.
- C. Type C Sealant: A-A-1556, Type 1, Class A, 25-40 Shore A hardness, multi-component, polyurethane, self-leveling joint sealant. Vulkem "245", Sonneborn Bldg. Products, Inc. "Sonalstic Paving Joint Sealant", Sika Corp. "Sikaflex 2C S/L", or equal.
- D. Type D Sealant: Fed. Spec. TT-S-1657, Type 1 or 2, butyl-base sealant, PTI 707, Tremco "Butyl", or equal.
- E. Acoustic Sealant: Fed. Spec. TT-S-1657 butyl sealer, pre-extruded, non-hardening, non-skinning mastic of sufficient dimension to maintain constant contact with adjoining surfaces (not less than 3/8 inch diameter or 1/4 by 1/2 inch if in flat form), packaged in rolls. Tremco "Acoustical Sealant", Lowery's "10A Acoustical Sealer", or equal.
- F. Primer, if required, shall be non-staining and as recommended by the sealant manufacturer.
- G. Backup: Shall be a polyethylene foam rod of rope, closed cell and 25% wider than the joint width.
- H. Bond breaker, if required, shall be as recommended by the sealant manufacturer.

- I. Solvents or cleaning agents shall be as recommended by the sealant manufacturer.
- J. Colors:
 - 1. Color of sealants shall match color of adjacent work. Colors for each sealant installation will be selected from manufacturer's standard colors by the Engineer.
 - 2. In concealed installation, standard gray or black sealant may be used.

PART 3 - EXECUTION

3.1 WORKMANSHIP

- A. At the start of the installation the manufacturer shall supply instruction in the use of his product to insure proper installation.
- B. As work progresses, immediately remove sealant that may be adhered to adjacent materials.

3.2 JOINT DIMENSIONS

- A. Joint dimension shall be as shown on the drawings. In joints up to 1/4 inch in width the depth of the sealant shall be the same as the joint width.
- B. In open joints over 1/4-inch wide, the depth of the sealant shall be approximately one-half the width of the joint, but in no case less than 1/4 inch deep.
- C. When open joints exceed the depth requirements, insert backup material to the necessary depth stated above. If not, place bond breaker tape in bottom of joint.
- D. When perimeter joints around frames that are to be sealed do not have built-in stops, insert backup material to provide a joint with a minimum depth of 3/8 inch and a maximum depth of 1/2 inch.

3.3 APPLICATION

- A. Back-up Material: Install in clean dry joints at the proper depth to provide sealant dimensions as specified earlier.
- B. Masking: If required, shall be applied in continuous strips aligned with joint edge. Remove tape immediately after joints have been tooled.
- C. Primer: If required, shall be used where recommended by the Sealant manufacturer.
- D. Sealant: Shall be applied under pressure to clean dry joint, using hand or power guns, or other approved methods.

- 1. Nozzles shall be of the proper size and shape to form the required bead and completely fill the joint. Joint shall be filled from the bottom, making sure air bubbles are not left in the joint.
- 2. Joints shall be tooled as directed or approved, using lubricants recommended by the manufacturer. Joints shall be slightly concave and recessed at least 1/8" from the top of the joint.

3.4 SEALANT APPLICATION SCHEDULE

- A. Type A: In general, at exterior or perimeters of openings in exterior walls such as concrete-to-concrete, metal-to-metal, metal-to-concrete, masonry, or stucco.
- B. Type B: In general, at interior or perimeters of openings in exterior walls such as metal-to-metal, metal-to-concrete, masonry, or stucco.
- C. Type C: In general, for use on areas subject to foot or vehicle traffic.
- D. Type D: In general, for interior wall penetrations for piping or conduit which are to be covered by escutcheon or other trim or plate.
- E. Acoustic Sealant: In general, for sound retardant sealant at sound-rated partitions or partitions with sound-retardant material therein.

3.5 MISCELLANEOUS SEALING WORK

- A. The entire extent of sealing work is not necessarily fully or individually described herein. Sealing shall be provided wherever required to prevent light leakage as well as moisture leakage. Refer to drawings for conditions and related parts of the work.
- B. All penetrations and openings in exterior walls shall be sealed in compliance with CAC Title 24 standards.

3.6 CLEANING

A. At the completion of this work, all surfaces adjoining joints shall be cleaned of all excess sealant and left in a neat condition subject to the approval of the Architect.

END OF SECTION

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide steel doors and frames and related items, complete and operable, in accordance with the Contract Documents.

1.2 WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 08710 Finish Hardware
- C. Section 09900 Painting and Coating

1.3 **REFERENCE SPECIFICATIONS, CODES AND STANDARDS**

- A. The Work of this Section shall comply with the current editions of the following codes and standards as adopted and recognized by the City of Encinitas.
 - 1. International Building Code (IBC)
 - 2. California Building Code (CBC)
 - 3. California Code of Regulations, Title 24
 - 4. Americans With Disabilities Act (ADA)
- B. Materials and installation of steel doors and frames shall be in accordance with the following specifications:

1.	ANSI/SDI-100	Steel Door Institute, "Recommended Specifications Standard Steel Doors and Frames"
2.	ANSI/SDI-119	"Performance Test Procedures for Steel Door Frames and Frame Anchors"
3.	SDI-100	Steel Door Institute, Recommended Specifications for Standard Steel Doors and Frames
4.	SDI-105	Recommended Erection Instructions for Steel Frames
5.	SDI-107	Hardware on Steel Doors (Reinforcement- Application)
6.	SDI-110	Standard Steel Doors and Frames for Modular Masonry Construction
7.	SDI-117	Manufacturing Tolerances - Standard Steel Doors and Frames

C. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

1.	ASTM A366	Specification for Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
2.	ASTM B117	Method of Salt Spray (Fog) Testing
3.	ASTM D1735	Method for Water Foc Testing of Organic Coatings
4.	ASTM E90	Method for Laboratory Measurement of Airborne- Sound Transmission Loss of Building Partitions.
ANSI A	115 Door and Fr	ame Preparation Series

- UL Standards Underwriter's Laboratories, Inc.
- D. Trade Standards:
 - 1. "Recommended Locations for Builder's Hardware", Door and Hardware Institute.
 - 2. National Association of Architectural Metal Manufacturers (NAAMM).
 - 3. Steel Door Institute (SDI).

1.4 CONTRACTOR SUBMITTALS

- A. The CONTRACTOR shall provide the following submittals in accordance with the requirements in Section 01300 Submittals.
- B. Shop Drawings: Shop drawings shall be submitted for both fabrication and installation of hollow metal doors and frames, showing details of the products and systems and connections to adjoining materials. Shop drawings shall include the following:
 - 1. Details of each frame type and each variation of opening condition with specific information on connections to adjoining materials. Anchorage and accommodation of accessory items shall be shown as they occur.
 - 2. Elevations shall be provided of each door design and type with specific information defining glass lites, louvers and other accessory items.
 - 3. Details shall be provided of construction, joints, connections and location and installation requirements of finish hardware and any supplemental reinforcement which may be necessary.
 - 4. Indicate coordination with other Sections as necessary for the provision and installation of glazing in doors as and where indicated.

- 5. A schedule shall be provided of all doors and frames, sizes, types, louvers and glass using the same reference numbers for details and openings as those on the Drawings.
- 6. Schedules shall show hardware as indicated in Section 08710 Finish Hardware, or as indicated on the Drawings.
- C. Manufacturer's Literature: Manufacturer's literature, including any engineering calculations that may be required in this Section, recommended installation instructions and maintenance procedures, and catalogue cuts and certified Sound and Thermal Coefficients.

1.5 QUALITY ASSURANCE

- A. Doors, frames, and related accessory items shall be the products of a single manufacturer, and shall be compatible with no shop or field modifications to individual products.
- B. Manufacturer's certification that products comply with the Specifications indicated.

1.2 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Shipping: Doors and frames shall be shipped and stored with temporary stiffeners and spacers in place to prevent distortion.
- B. Delivery: Doors and frames shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.
- C. Storage: Doors and frames shall be carefully stored on wood blocking in an area that is protected from the elements. Storage shall be in a manner that will prevent damage or marring of finish.

PART 2 -- PRODUCTS

2.1 MATERIALS AND FABRICATION B GENERAL

- A. Shop Fabrication and Assembly: All steel doors and frames shall be shop fabricated and shop assembled per referenced standards except as amended herein. Custom shapes and sizes shall be provided as defined; interior metal primed for painting; exterior metal zinc coated and primed for painting; and reinforced for hardware where necessary. Temporary stiffeners, spacers, and other accessories necessary to facilitate handling and accurate erection shall be provided. After fabrication, all tool marks and other surface imperfections shall be filled and ground smooth.
- B. Fire Rating and Labeling: Doors and frames indicated as fire-rated shall bear an Underwriter's Laboratories (UL) label indicating the type of rating for which they are certified. Designs and construction of such products shall have specific UL approval according to current procedures for the fire rating, either 3-hour, 1-1/2-

hour, 3/4-hour, or 20-minute as indicated. Steel doors and frames for fire-rated openings shall conform to Underwriters' Laboratories listing and shall be UL labeled.

- C. Materials for Doors and Frames: All doors and frames shall be fabricated entirely of galvanized steel, and shall be fabricated from prime quality, commercial grade, cold-rolled steel conforming to ASTM A366, Type II or III.
- D. Priming and Painting: Doors and frames shall be chemically treated to ensure maximum paint adhesion and shall have all exposed surfaces painted with a rust-inhibitive primer after fabrication. Prime coat shall be capable of passing a 120-hour salt spray test in accordance with ASTM B117, and a 250-hour humidity test in accordance with ASTM D1735.
- E. Hardware: Doors and frames shall be reinforced and drilled or tapped for fully templated mortised hardware; and shall be reinforced with plates for surfacemounted hardware, meeting ANSI A115 requirements. Hardware shall be as indicated in Section 08710 – Finish Hardware.

2.2 METAL FRAMES

- A. Pressed Metal Frames: Pressed steel frames for doors and other openings shall be combination buckled frame and trim of type and sizes indicated. Metal shall be 14-gauge galvanized steel for exterior doors, and 16-gauge cold rolled steel for interior doors. Frames shall be of the welded unit type. Special frames, oversized frames, and frames with transom shall be provided where indicated.
- B. Frame Jamb Depths, Trim Profile, Stops, and Backbends: Frame jamb depths, trim profile, stops, and backbends shall be as indicated on the Drawings and on the shop drawings.
- C. Frames for Out-Swinging Doors: Frames for out-swinging exterior doors shall be provided with gutter-type dip edge at head, minimum 16-gauge galvanized steel, and extending 1- inch beyond door opening, both sides.

2.3 FRAME ANCHORS

- A. Floor Anchors: Floor anchors shall be welded inside each frame jamb head, and holes shall be provided for floor anchorage. Minimum thickness of floor anchors shall be 14-gauge.
- B. Anchors for Masonry/Concrete Installations: Frames for installation in masonry and concrete walls shall be provided with adjustable jamb anchors of the T-strap, stirrup and strap, or wire type. The number of anchors provided per frame jamb and head shall be as follows:
 - 1. Frames Up to 7-Feet 6-Inches in Height: Three anchors.
 - 2. Frames Over 7-Feet 6-Inches to 8 Feet 0 Inch in Height: Four anchors.

- 3. Frames Over 8-Feet 0-inch in Height: One anchor for each 2-feet 0-inch or fraction in height.
- 4. Frame head anchors shall be not less than those required by the Reference Standards.
- C. Anchors for Stud Wall Installation: Frames for installation in stud partitions shall be provided with steel anchors of suitable design for job conditions. They shall be not less than 18-gauge thickness; and shall be securely welded inside each jamb and head as follows:
 - 1. Frames Up to 7-Feet 6-Inches in Height: Three anchors.
 - 2. Frames Over 7-Feet 6-Inches to 8-Feet 0-Inch in Height: Five anchors.
 - 3. Frames Over 8-Feet 0-Inch in height: Five anchors plus one additional for each 2-feet 0-inch or fraction over 8-feet 0-inch.
 - 4. Frame head anchors shall be not less than those required by the Reference Standards.

2.4 DUST COVER BOXES AND MORTAR GUARDS

A. Dust cover boxes or mortar guards of not less than 24-gauge steel shall be provided at all hardware mortises on frames to be set in masonry, concrete, drywall, or plaster walls.

2.5 SILENCER HOLES

A. Appropriate holes for silencers shall be provided in the door frames which are not designated to receive weatherstripping, seals, or sound seals.

2.6 DOORS

- A. Design and Construction: Steel doors shall be of hollow metal construction and shall be of full flush design with no visible seams. Exterior hollow metal doors shall be of 16-gauge, cold-rolled, stretcher-leveled steel. Interior hollow metal doors shall be of 18-gauge, cold- rolled, stretcher-leveled steel. All doors shall have flush seamless face sheets with continuously and fully welded seam edges. Doors shall be rigid and neat in appearance, and shall be free from warpage or buckle. Corner bends shall be true and straight and shall be of not less than the minimum radius for the gage of metal used. The door top and bottom shall be internally reinforced by steel members welded in place. Tops of exterior doors shall be provided with flush, water and weather tight, top enclosures. Bottoms of out- swinging exterior doors shall be provided with bottom rail drip flashing convex shape of minimum 16-gauge galvanized steel. Door stiles shall be wide enough to accommodate heavy-duty mortise type locks.
- B. Door and Transom Cores: Doors and transom cores shall be water-resistant honeycomb with minimum R value of 4. Fire rated doors shall be solid or fiber

mineral core doors as required to meet applicable code and Reference Standards requirements.

2.7 MANUFACTURERS

- A. Steel doors and frames shall be manufactured by the following manufacturers, or equal.
 - 1. Republic Builders Products, McKenzie, TN 38201
 - 2. The Steelcraft Manufacturing Co., Cincinnati, OH 45242
 - 3. The Ceco Corporation, Door Division, Oakbrook Terrace, IL 60181

PART 3 -- EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall thoroughly examine substrates on which hollow metal doors and frames will be installed and conditions under which work of this Section will be performed.
- B. Starting work shall imply acceptance of existing conditions as satisfactory to successful completion of this Work.

3.2 CONSTRUCTION

- A. General: All work shall be in accordance with manufacturer's published recommendations and specifications.
- B. Coordination: All work shall be coordinated with appropriate related subcontractors work to assure a proper installation. Field conditions and dimensions shall be verified prior to fabrication.

3.3 FRAME INSTALLATION

- A. Setting Frames: Frames shall be set plumb and square in a true plane, and be securely anchored to the adjoining construction. Steel shims shall be provided and shall be set tight and rigidly attached between frame anchors and structure. All finished metal frames shall be strong and rigid; neat in appearance; and square, true, and free of defects, warp, or buckle.
- B. Molded Members: Molded members, trims, and stops, shall be clean cut, straight, and shall be of a uniform profile throughout their lengths.
- C. Corner Joints: Corner joints shall have all contact edges tightly closed with all trim faces mitered, welded, and finished smooth. The use of gussets will not be permitted.

3.4 DOOR INSTALLATION

A. Install doors in accordance with SDI-100 except as indicated in this Section.

- B. Doors shall be installed plumb, square, and level with diagonal distortion of no more than 1/16 inch. Doors shall operate freely, but not loosely. They shall be free from rattling while in a closed position.
- C. The door clearances shall be plus 3/32-inch or minus 1/32-inch and shall not exceed the limits specified in the manufacturer's printed recommendations.
- D. Any door that becomes warped more than 3/16-inch out-of-plane shall be replaced.
- E. Doors and door finish hardware shall be removed and reinstalled as a part of the requirement for painting.

3.5 FINISH HARDWARE

- A. Doors and frames to receive mortised and concealed finish hardware in accordance with final finish hardware schedule shall be prepared according to templates provided by the hardware supplier. Comply with applicable requirements of ANSI A115 for door and frame preparation for hardware.
- B. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at the Project site.
- C. Locate finish hardware as indicated on the final shop drawings or, if not indicated, in accordance with "Recommended Locations for Builder's Hardware", published by the Door and Hardware Institute.

3.6 ADJUST AND CLEAN

- A. Finished surfaces of doors, frames and related accessories shall be free from damage, flaws, blemishes or other defects detrimental to appearance. Surfaces, joints and exposed trim hall be in correct position and alignment and be uniform in plane, color, texture and finish.
- B. Final Adjustments: Check and readjust operating finish hardware items, leaving hollow metal doors and frames undamaged and in complete and proper operating condition.

** END OF SECTION **

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PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install finish hardware as shown on the Drawings and specified herein, in accordance with the requirements of the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 08110 Metal Doors and Frames

1.3 QUALITY ASSURANCE

- A. Manufacturer: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.
- B. Items of hardware not definitely specified herein but necessary for completion of the work shall be provided. Such items shall be of type and quality suitable to the service required and comparable to adjacent hardware. Where size or shape of members is such as to prevent the use of types specified, hardware shall be furnished of suitable types having as nearly as practicable the same operation and quality as the type specified.

1.4 SUBMITTALS

- A. Comply with pertinent provisions of Section 01300.
- B. Product Data: Submit manufacturers technical product data for each item of hardware. Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and for maintenance of operating parts and finish.
- C. Hardware Schedule: Submit hardware schedule in manner indicated below.
 - 1. Submit five (5) typewritten copies of the schedule of hardware. Schedule shall be arranged sequentially by door number with the hardware type identified. Hardware shall not be ordered for purchase until the schedule has been reviewed by the Engineer.
 - 2. Submit catalog cuts of each item.
 - 3. Check door thicknesses, details of trim, clearance for hinges, strikes, closers, fastener requirements, and fire rating requirements before preparing schedule.
 - 4. Submit keying schedule.

SECTION 08710 - FINISH HARDWARE

- 5. Review of the schedule by the Engineer shall not be construed as certifying the schedule as being complete.
- D. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware.

1.5 KEYING

- A. All cylinders shall be Best, 7-pin interchangeable core and keyed to match existing factory registered Grand Masterkey system. All seven pins to be operational. Provide removable cores with all locks. Furnish permanent cores to Owner for final installation.
- B. Temporary cores (construction cores) shall be installed by contractor for security purposes. Temporary cores shall be keyed alike and interchangeable with Best cores.
- C. Contractor shall provide Owner with copies of control key and operating key upon project completion.
- D. All keys and cores shall have visual key control.
- E. All keys shall be stamped "Do Not Duplicate".
- F. SDG&E service entrance and exterior gate hardware shall have SDGE lock installed. Cylinder to be keyed to Schlage keyway VTQP AA-10. Three keys are to be provided with lock. All keys shall be turned over to the Owner. Contractor shall obtain locks from any contracted SDGE locksmith for installation.

PART 2 - PRODUCTS

2.1 FINISHES

A. Refer to hardware schedule in Part 3.

2.2 MANUFACTURERS

A. Refer to hardware schedule in Part 3.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations.
- B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate

SECTION 08710 - FINISH HARDWARE

removal, storage and reinstallation or application of surface protection with finishing work specified in the Division-9 sections. Do not install surface-mounted items until finishes have been completed on the substrate.

- C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

3.2 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application.
- B. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in each space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- C. Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

3.3 MANUFACTURER'S REFERENCE CODE:

Approved Substitutions:

- 1. Hager Stanley, Bommer
- 2. Best Folger Adams
- 3. Dorma L.C.N. 4040, Norton 7500
- 4. Quality B.B.W., Trimco
- 5. Pemko Reese, Ultra
- 6. Glynn-Johnson Rixson, A.B.H.
- 7. Door Controls G-J, Ives
- 8. Von Duprin
3.4 HARDWARE GROUPS:

A. HW-1

2	EA	Anchor Hinge	AB7508 5 x 4.5	630	Hager
6	EA	Hinge	3CB1HW 5 x 4.5 NRP	630	lves
1	SET	Auto Flush Bolt	FB31P	630	lves
1	EA	Dust Proof Strike	DP2	626	lves
1	EA	Lockset	L9080P 03A x STK 7/8" LTC	630	Schlage
1	EA	Astragal	357SP	600	Pemko
2	EA	Overhead Holder	900H	630	G-J
1	SET	Seals	S88W – H & J		Pemko
2	EA	Door Sweep	315CN	AL	Pemko
1	EA	Rain Drip	346C	AL	Pemko
1	EA	Threshold	158A	AL	Pemko

B. HW-2:

EA	Anchor Hinge	AB7508 5 x 4.5	630	Hager
EA	Hinge	3CB1HW 5 x 4.5 NRP	630	lves
SET	Auto Flush Bolt	FB31P	630	lves
EA	Dust Proof Strike	DP2	626	lves
EA	Storeroom Lock	L9080P 03A x VTQP Keyway x STK 7/8" LTC	630	Schlage
EA	Astragal	357SP	600	Pemko
EA	Overhead Holder	900H	630	G-J
SET	Seals	S88W – H & J		Pemko
EA	Door Sweep	315CN	AL	Pemko
EA	Rain Drip	346C	AL	Pemko
EA	Threshold	158A	AL	Pemko
	EA EA EA EA EA EA EA EA EA EA	 EA Anchor Hinge EA Hinge SET Auto Flush Bolt EA Dust Proof Strike EA Storeroom Lock EA Astragal EA Overhead Holder SET Seals EA Door Sweep EA Rain Drip EA Threshold 	EAAnchor HingeAB7508 5 x 4.5EAHinge3CB1HW 5 x 4.5 NRPSETAuto Flush BoltFB31PEADust Proof StrikeDP2EAStoreroom LockL9080P 03A x VTQP Keyway x STK 7/8" LTCEAAstragal357SPEAOverhead Holder900HSETSealsS88W – H & JEADoor Sweep315CNEARain Drip346CEAThreshold158A	EAAnchor HingeAB7508 5 x 4.5630EAHinge3CB1HW 5 x 4.5 NRP630SETAuto Flush BoltFB31P630EADust Proof StrikeDP2626EAStoreroom LockL9080P 03A x VTQP Keyway x STK 7/8" LTC630EAAstragal357SP600EAOverhead Holder900H630SETSealsS88W – H & J588W – H & JEADoor Sweep315CNALEARain Drip346CALEAThreshold158AAL

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
 - 2. Suspension systems for interior gypsum ceiling.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Provide materials and construction identical tothose tested according to ASTM E 119.

2.2 FRAMING SYSTEMS

- A. Steel Studs and Runners: ASTM C 645.
 - 1. Minimum Base-Metal Thickness: 0.033 inch
 - 2. Depth: 3-5/8 inches and 6 inches
- B. Slip-Type Head Joints: Where indicated, provide one of the following in thickness notless than indicated for studs and in width to accommodate depth of studs:
 - 1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inchdeepflanges, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
 - 2. Double-Runner System: ASTM C 645 top runners, inside runner with 2inch- deep flanges and fastened to studs, and outer runner sized to friction fit inside runner.
 - 3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes due to deflection of structure above.
 - a. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Cemco

SECTION 09111- NON-LOAD-BEARING STEEL FRAMING

- 2) Dietrich Metal Framing
- 3) MBA Building Supplies;
- 4) Superior Metal Trim; Superior Flex Track System (SFT).
- C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Minimum Base-Metal Thickness: .033 inch
- D. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges.
 - 1. Depth: As indicated on Drawings
 - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimumuncoated-steel thickness of 0.033 inch
 - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062inch-diameter wire, or double strand of diameter wire.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062inchdiameterwire, or double strand of 0.048-inch- diameter wire.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch indiameter.
- C. Flat Hangers: Steel sheet, 1 by 3/16 inch
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of
 0.053 inch) and minimum 1/2-inch- wide flanges.
 - 1. Depth: 1-1/2 inches
- E. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
 - 2. Steel Studs and Runners: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 0.033 inch
 - b. Depth: 2-1/2 inches

2.4 AUXILIARY MATERIALS

A. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holdingpower, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 thatapply to framing installation.
 - 2. Portland Cement Plaster Assemblies: Also comply with requirements inASTM C 1063 that apply to framing installation.
 - 3. Gypsum Veneer Plaster Assemblies: Also comply with requirements inASTM C 844 that apply to framing installation.
 - 4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 thatapply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.2 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals atexterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.

- b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
- c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
- 3. Other Framed Openings: Frame openings other than door openings the same asrequired for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
- 4. Screw to wood framing.
- 5. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.3 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greaterthan spacings required by referenced installation standards for assembly types.
- B. Isolate suspension systems from building structure where they abut or are penetratedby building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects withinceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resultinghorizontal forces by bracing, countersplaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - 3. Do not attach hangers to steel roof deck.
 - 4. Do not attach hangers to permanent metal forms. Furnish cast-inplace hangerinserts that extend through forms.

SECTION 09111- NON-LOAD-BEARING STEEL FRAMING

- 5. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
- 6. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Seismic Bracing: Sway-brace suspension systems with hangers used for support
- E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes andtransversely between parallel members that will receive finishes.

** END OF SECTION**

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PART 1 - - GENERAL

1.1 WORK OF THIS SECTION

- A. This Section includes the following:
 - 1. Interior gypsum wallboard.
 - 2. Tile backing panels

1.2 RELATED SECTIONS

- A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.
 - 1. Section 09111 Non Load Bearing Steel Framing

1.3 **DEFINITIONS**

A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 CONTRACTOR SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or 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 to prevent sagging.

PART 2 - - PRODUCTS

2.1 MANUFACTURERS

- 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 (or equal):
 - 1. Gypsum Board and Related Products:
 - a. G-P Gypsum Corp.
 - b. National Gypsum Company.
 - c. United States Gypsum Co.

2.2 INTERIOR GYPSUM WALLBOARD

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints ineach area and correspond with support system indicated.
- B. Gypsum Wallboard: ASTM C 36.
 - 1. Type X:
 - a. Thickness: 5/8 inch.
 - b. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
 - c. Location: Vertical surfaces, unless otherwise indicated.
 - d. Finish: orange peel
- C. Sag-Resistant Gypsum Wallboard (ceiling): ASTM C 36, manufactured to have moresag resistance than regular-type gypsum board.
 - 1. Thickness: 1/2 inch (at ceilings only)
 - 2. Long Edges: Tapered.
 - 3. Location: Ceiling surfaces.
- D. Water-Resistant Gypsum Backing Board: ASTM C 1396/C 1396M, with manufacturer'sstandard edges.
- 1. Manufacturers: Subject to compliance with requirements, available manufacturersoffering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Gypsum.
 - b. CertainTeed Corp.
 - c. Georgia-Pacific Gypsum LLC.
 - d. Lafarge North America Inc.
 - e. PABCO Gypsum.
 - f. Temple-Inland.
 - g. USG Corporation.
- 2. Core: 5/8 inch, Type X

2.3 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
 - 2. Shapes:
 - a. Cornerbead: Use at outside corners, unless otherwise indicated.
 - b. Bullnose Bead: Use at outside corners where indicated.

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- c. LC-Bead: J-shaped; exposed long flange receives joint compound; use atexposed panel edges.
- d. L-Bead: L-shaped; exposed long leg receives joint compound; use whereindicated.
- e. U-Bead: J-shaped; exposed short flange does not receive joint compound; use at exposed panel edges.
- f. Expansion (Control) Joint: Use where indicated.
- g. Curved-Edge Cornerbead: With notched or flexible flanges; use at curvedopenings.

2.4 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475.
- B. Joint Tape:
 - 1. Interior Gypsum Wallboard: Paper.
 - 2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that iscompatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surfaceareas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable toppingcompound.

2.5 ACOUSTICAL SEALANT

- A. Available Products: Subject to compliance with requirements, products that may beincorporated into the Work include, but are not limited to, the following (or equal):
 - 1. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
 - b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
 - 2. Acoustical Sealant for Concealed Joints:

- a. Ohio Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant.
- b. Pecora Corp.; BA-98.
- c. Tremco, Inc.; Tremco Acoustical Sealant.
- B. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining,latex sealant complying with ASTM C 834 that effectively reduces airborne soundtransmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
- C. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel membersfrom 0.033 to 0.112 inch thick.

PART 3 - - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollowmetal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.
- B. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting endjoints of adjacent panels not less than one framing member.
- C. Install gypsum panels with face side out. Butt panels together for a light contact at edgesand ends with not more than 1/16 inch of open space between panels. Do not force intoplace.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Donot place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

- E. Attach gypsum panels to steel studs so leading edge or end of each panel is attached toopen (unsupported) edges of stud flanges first.
- F. Attach gypsum panels to framing provided at openings and cutouts.
- G. Form control and expansion joints with space between edges of adjoining gypsum panels.
- H. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smokeratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- I. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- J. STC-Rated Assemblies: Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
- K. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
 - 1. Space screws a maximum of 12 inches o.c. for vertical applications.
- L. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.

3.3 PANEL APPLICATION METHODS

- A. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) horizontally (perpendicular to framing), unless otherwise indicated or required by fire- resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternatecourses of board.
- B. At stairwells and other high walls, install panels horizontally, unlessotherwise indicated or required by fire-resistance-rated assembly.Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

3.5 FINISHING GYPSUM BOARD ASSEMBLIES

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
 - 1. Level 5: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound over entire surface.
- E. Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

3.6 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and othersurfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns. Texture to be 'Orange Peel' finish.
- C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture finish manufacturer's written recommendations.

3.7 FIELD QUALITY CONTROL

- A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architectwill conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing untildeficiencies have been corrected.
 - 1. Notify Architect seven days in advance of date and time when Project, or part ofProject, will be ready for above-ceiling observation.
 - 2. Before notifying Architect, complete the following in areas to receive gypsum boardceilings:
 - a. Installation of 80 percent of lighting fixtures, powered for operation.
 - b. Installation, insulation, and leak and pressure testing of water pipingsystems.
 - c. Installation of air-duct systems.
 - d. Installation of air devices.
 - e. Installation of mechanical system control-air tubing.
 - f. Installation of ceiling support framing.

** END OF SECTION**

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PART 1 - GENERAL

1.1 WORK OF THIS SECTION

- A. The Work of this section includes the lining of new and existing sewer manholes and wet wells. The Contractor shall coordinate his work so as not to interfere with the existing sanitary sewer service. Lining shall consist of preparing the interior surface of each manhole or wet well, application of repair mortar where needed to restore damaged surfaces, application of epoxy primer, and polyurethane lining and all incidentals necessary to complete the work contained in these technical provisions in accordance with SSPWC Section 502-5.3 and the requirements of the Contract Documents.
- B. The Contractor shall furnish all traffic control, labor, materials, tools, and equipment necessary to complete all work in accordance with these Contract Documents and at the direction of the Owner.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 01563 Sewer Bypass Pumping
- E. Section 03740 Concrete Rehabilitation

1.3 CONTRACTOR SUBMITTALS

- A. Submittals shall be made in accordance with the requirements set forth in Section 01300.
- B. The Contractor shall submit copies of manufacturer's technical data and installation instructions for protective coating system required.
- C. The Contractor shall submit copies of manufacturer's written instructions for recommended maintenance practices. Include the following information:
 - 1. Product name and number.
 - 2. Name, address and telephone number of manufacturer and local distributer.
 - 3. Detailed procedures for routine maintenance and cleaning.
 - 4. Detailed procedures for repairs.

1.4 QUALITY ASSURANCE

A. Packaging: The Contractor shall store all products to be used in their original packaging. The packaging shall indicate the manufacturer and product contained.

- B. All products to be used in the work covered by this section of the specifications shall be delivered, stored, and handled in accordance with the product manufacturer's written recommendations.
- C. Manufacturer and applicator both shall demonstrate a minimum of five (5) years of experience and five (5) successfully completed projects of similar magnitude and nature as this project. Experience and project references shall include project name, project number where applicable, agency or Owner, contact name, phone number, and project description. All Applicators shall be certified or licensed by the protective coating materials manufacturer.
- D. Provide each component of protective coating produced by a single manufacturer, including recommended underlayment and resurfacing compound, filler compounds and corrosion resistant lining.
- E. Upon completion of the Work under this Section, submit a statement to Engineer, signed by Contractor and the protective Coating Applicator stating that the installed protective coating complies with the requirements of the Specifications, and that the installation and materials comply with the manufacturer's printed recommendations related to the condition of installation and use.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver material in manufacturer's original unopened and undamaged packages. Clearly identify manufacturer, brand name, manufactured date or lot number on each package. Packages showing indications of damage that may affect condition of contents are not acceptable.
- B. Store materials in original packaging under protective cover and protect from damage. Stack and store all containers including fillers at temperatures recommended by the manufacturer.
- C. Handle materials in such a manner as to prevent damage to products or finishes.

1.6 JOB CONDITIONS

A. Maintain proper substrate and air temperature before, during and after installation as required by Manufacturer and detailed in Manufacturer's technical data sheets and installation instructions or in writing from the Manufacturer. Provide adequate ventilation during application and curing periods.

PART 2 - PRODUCTS

2.1 MANHOLE OR WETWELL PROTECTIVE LINING

A. Mortar repair materials used for existing manholes or wet wells to be rehabilitated shall be in accordance with section 03740.

2.2 LINING MANUFACTURERS

A. The manhole or wet well protective lining shall be a two-component, 100% solid, non-solvent hybrid polyurethane coating, with a shore "D" hardness of 57 at 77-

SECTION 09801 — MANHOLE AND WET WELL LINING

degree Fahrenheit, such as Sancon 100 as manufactured by Sancon Engineering, Huntington Beach, California, or Zebron #386 as manufactured by Zebron Corporation, Newport Beach, California.

2.3 MATERIAL

- A. Sancon 100 and Zebron #386 material shall be the high-build type capable of application thickness, as specified, without runs or sags, and shall be capable of passing ASTM D-1737 for flexibility, using cylinder mandrel of 0.5 inch (12.7 millimeter). The flash point of the fluid mixture shall be 450 degrees Fahrenheit open Zahn cup.
 - 1. The coating material shall meet the following resistive specifications:

Solution	Concentration
Acetic Acid	5%
Sulferic Acid	20%
Sodium Hydroxide	5%
Ammonium Hydroxide	5%
Nitric Acid	1%
Ferric Acid	1%
Soap	0.1%
Detergent (Limear Alkyl Benzyl Sulfonite or LAS)	0.1%
Bacteriological	BOD not less than 700
	PPM
Petroleum Oils and Greases	N/A
Vegetable and Animal Oils	N/A

*Volumetric percentages of concentrated C.P. grade reagents.

The color shall be white or cream. The complete coating shall be impermeable to sewer gases and liquids and nonconductive to bacterial or fungus, growth. The lining shall be capable of repair at any time during its life.

- 2. The limits of a newly installed manhole protective lining shall be from 3inches below the flow line to the base of the manhole frame and cover. The Contractor shall install a temporary flow through sewer plug or another temporary flow bypass system deemed adequate by the Contractor and as needed to allow the proper installation and curing of the repair mortar, primer, and protective lining.
- Prior to application of the lining, all surfaces shall receive a one (1) to three (3) mil thickness 100% solids non-solvent, moisture tolerant epoxy primer as manufactured by Sancon Engineering, Inc., Huntington Beach, CA or Zebron Corporation, Newport Beach, CA. Lining must have passed chemical resistance test of the SSPWC.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Surface preparation shall be performed in accordance with section 03740.
- B. Contractor shall remove existing linings in their entirety prior to performing concrete rehabilitation and new lining application.
- C. New and existing concrete structures to receive protective coating system must be capable of withstanding imposed loads. All oil, grease and chemical contaminants must be removed from the surface. Surfaces must be firm, free of standing water, form release agents and existing coating. Suitable surface preparation methods include abrasive blasting, hydro blasting, mechanical scrapping and hand tool grinding to remove surface contaminants.

3.2 WATER TIGHTNESS

- A. The end cuts of the liner inside the manhole or wet well shall be fully sealed to prevent water entering into the space between the host pipe and the liner.
- B. Do not apply the lining materials to the frame. Rather, cut a ¼" by ¼" groove in the concrete, or concrete mortar, and fill the groove with the lining material. This will create a toe-in termination point for the lining.

3.3 LINING APPLICATION

- A. The lining application shall be performed only by workers approved by the manufacturer as trained and experienced with the specified material. The lining shall be applied by high pressure airless equipment approved by the lining manufacturer. The equipment shall be in good working order to insure correct proportioning and mixing of the components.
- B. Protective coating systems shall be installed when ambient air and surface temperature is between 50F and 90F. Store material within a range of 60F to 85F range for 48 hours prior to use. Application and storage temperatures outside of this range will require written instruction from the Manufacturer.
- C. Application in direct sunlight and/or with rising surface temperatures will result in blistering of the materials due to expansion of entrapped air or moisture (out-gassing) in the concrete. In such cases, it will be necessary to postpone the application until later in the day when the temperature of the substrate is falling. Concrete surfaces that have been in direct sunlight must be shaded for at least 24 hours prior to application and remain shaded until the initial set has taken place. Consult Manufacturer for application schedule guidelines specific to temperature conditions and possible sealer application recommendations to reduce outgassing.
- D. The lining shall be applied to a thickness of 125 mils (1/8-inch) in one continuous coat without seams, free from any holes or defects. The lining shall be installed from three (3) inches below the low-flow water level to the base of ring and cover. The lining shall be installed over dry concrete below the water level by using appropriate by-pass equipment. Coating in trough shall not be thicker than 125 mils to ensure smooth taper from trough to shelf. A mandrel shall be inserted into upstream and downstream pipe to insure the accessibility.

- E. During lining application, the Contractor shall take wet gauge thickness readings as required to insure correct lining thickness.
- F. Installed epoxy lining protective coating and shall be tested for pinholes after a minimum 24-hour cure at a temperature of 70F. Pinhole testing shall be accomplished in accordance with ASTM D4787 using a Tinker Razor Holiday Detector, San Gabriel, CA, Model AP/W, or an approved equal device. Test voltage of 100 volts/mil of coating thickness shall be applied. All pinholes shall be marked and repaired using manufacturer's approved Patch Kit, or other approved method.
- G. Adhesion testing shall be performed on a minimum of 1 structure or 15 percent of all coated structures, whichever is greater. Adhesion testing shall be conducted after a minimum 24-hour cure of the Epoxy Lining Protective Coating at 70F. A minimum of two measurement of bond strength of the protective coating to the substrate shall be made. Bond strength shall be measured in accordance with ASTM D7234-05. Prior to the pull test, the tester shall utilize a scoring device to cut through the coating until the substrate is reached. The pull tests in each structure shall meet or exceed 200 psi and shall include substrate adhered to the back of the dolly or no visual signs of coating material in the test hole. Any areas detected to have less than 200 psi bond strength to concrete shall be removed and/or repaired by the CONTRACTOR in accordance with the manufacturer's recommendations and at no additional cost to the AGENCY.
- H. The uniform lining shall be free from porosity, without bubbles or pinholes and uniform in color. All areas in question shall be removed and reworked and patched.
- I. Before accepting the finished product, testing with a holiday or porosity detector shall be made by the Contractor, and any pinholes found shall be patched.
- J. Application of the lining shall not take place when exposed to rain, fog or high winds. It is the Contractor's responsibility to insure protection of the work from the above mentioned conditions.

3.4 ADJUSTMENTS AND CLEANING

- A. At the completion of the Work, Contractor shall remove all materials and debris associated with the Work of this Section.
- B. Clean all surfaces not designated to receive protective coating. Restore all other work in a manner acceptable to Engineer.
- C. All finished protective coating shall be protected from damage until Final Acceptance of the Work. Protective coating damaged in any manner shall be repaired or replaced at the discretion of Engineer, at no additional cost to Owner.
- D. Clean all protective coating as recommended by the manufacturer to provide finished Work acceptable to Owner, just prior to Final Acceptance.

3.5 TEMPORARY FLOW THROUGH PLUG OR BYPASS SYSTEM

- A. The Contractor shall provide, install, maintain, and remove all temporary flow bypassing equipment and materials needed to complete the manhole or wet well rehabilitation work in accordance with the Contract Documents and Section 01563. The Contractor shall be responsible for selection of all means and methods to bypass flows as necessary to perform the work. The Contractor shall also install a temporary rack at the manhole directly downstream of the manhole that the temporary bypass equipment is being used to prohibit the passage of any loose or unanchored equipment from entering the downstream sewer system.
- B. The Contractor shall submit a plan to the Owner for approval before beginning work describing the flow bypassing equipment to be used, how it is to be installed, maintained, and removed, including any precautionary measures. Submittal shall show how the Contractor will monitor and prevent the obstruction of flow in the flow bypass equipment and shall also include the equipment and procedures that will be used to prohibit the passage of any loose or unanchored equipment from entering the sewer system. All products, equipment, and materials used to complete the Work shall be able to withstand the active sewer conditions and shall be able to handle flows specified in the Contract Drawings.

3.6 MANHOLE OR WETWELL INSPECTION, TESTING, AND REPAIR ON INSTALLED LINING SYSTEM

A. Initial inspection and testing shall be performed per SSPWC Section 502-6 by the Owner. Any liner repairs that are necessary will be performed by the Contractor at their expense until the complete lining system complies with the requirements of the Contract Documents. All costs for inspection and testing after the initial inspection and testing shall be at the Contractor's expense and at no additional cost to the Owner.

3.7 MANHOLE LINING WARRANTY

A. The Contractor shall provide a five (5) year warranty for all manhole or wet well lining labor, material, and workmanship from the time the lining has been tested and approved by the Owner.

END OF SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section includes the installation of specially formulated internal porcelain linings for handling sewage, grease, scum and sludge.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. OMWD Standard Drawings
- B. Section 01300 Record Drawings and Submittals
- C. Section 09900 Painting and Coating
- D. Section 15144 Pressure Testing of Piping OMWD Standard Specification
- E. Section 15141 Disinfection of Piping OMWD Standard Specification
- F. Section 15056 Ductile Iron Pipe

1.3 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01300.
- B. Submit installation schedule.
- C. Submit manufacturer's catalog data and descriptive literature.
- D. Submit testing procedures and acceptance criteria.

1.4 SAMPLES

A. Submit a sample of the approved lining to the Engineer for use as a comparison guide at the jobsite.

1.5 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

- A. The publication listed below forms part of this specification to the extent reference and is referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standard unless otherwise called for.
 - 1. ASTM C283 Standard Test Method for Resistance of Porcelain Enameled Utensils to Boiling Acid

PART 2 – MATERIALS

2.1 GLASS MATERIAL

- A. The glass lining material shall consist of special glasses and inorganic materials applied to internal surfaces.
- B. A minimum of two linings shall be applied and each shall be separately fired to a maturing temperature exceeding 1300 degrees Fahrenheit. The firings shall form an integral molecular chemical/mechanical bond with the base metal.
- C. Subsequent coatings will form an integral molecular bond with the previous coat. The resulting bond shall be sufficient to withstand a metal yield of 0.001 inch/inch without damage to the glass.

2.2 MATERIAL PROPERTIES

- A. The entire lining system shall be 0.008 to 0.12 inches thick as tested with magnetic coating thickness test equipment.
- B. It shall have a hardness exceeding 5 on the MOHS scale and a density from 2.5 to 3 grams per cubic centimeter.
- C. The lining shall be capable of withstanding an instantaneous thermal shock of 350 degrees Fahrenheit without crazing, blistering or spalling. It shall be resistant to corrosion by solutions with a pH between 3 and 10 at 125 degrees F.
- D. It shall show a weight loss of not more than 3 milligrams per square inch when tested in accordance with ASTM C 283-54.
- E. There shall be no visible loss of surface gloss after immersion of a normal production run sample in an 8% sulfuric acid solution at 148 degrees F for a period of 10 minutes.
- F. Pin holes, crazing or fish scales which expose the metal substrate shall be limited to 0.01% of the total glass surface. The visual appearance of the glass lining should be similar to bright and clean opaque window glass.

2.3 APPROVED MANUFACTURES

A. Glass linings shall be Vitco Corp. Type SG-14, or approved equal.

PART 3 – EXECUTION

3.1 HANDLING

A. All handling and/or lifting of glass lined pipe and fittings must be done on the exterior only. Do not lift internally with hooks, forks, chains or other means which will damage the lining.

3.2 FIELD CUTTING

A. Field cutting of the glass lined pipe shall be limited to only one piece per production run. This cut is for closure purposes only, unless otherwise specified or shown on the drawings.

3.3 CUTS

A. Cuts shall be made using a high-speed abrasive wheel type cut off saw. Cut edges should be repaired using high solids epoxy, repair material available from the manufacturer.

3.4 TESTING

- A. Purpose: All glass lined pipe shall be tested for continuity utilizing a Holiday Detector, which determines the continuity of the glass lining and indicates the relative quality of the process. This method is commonly referred to as "Spark Test."
- B. Equipment: The Holiday Detector consists of a Tinker & Rasor electronic device designed to locate holidays (pinholes, voids, fish scales, etc.) in the non-conducting Porcelain Enamel Lining. It functions by applying a 67.5 volt potential current across the glass lining. Any pinholes or other holidays in the glass lining will close the circuit and produce an audible signal from the detector for any resistance less than 10,000 ohms. The current is applied through a circular sponge which has been wetted using water containing approximately 1% of a wetting agent such as Kodak "Photo-Flo."
- C. Procedure: For testing long pipe sections, the diameter of the wetted sponge shall exceed the diameter of the pipe so that the sponge is in full circumferential contact with the Porcelain Enamel Lining of the pipe. The sponge is attached to a rod that allows the sponge to be pushed through at least 50% of the pipe. Any discontinuities will result in an audible signal, which will be recorded with regard to the position along the pipe. Testing is performed from both ends of the pipe. Special techniques are required at the exposed pipe ends, which are not porcelain coated. If, due to excess water on the sponge, the electric current short circuits to the end of the pipe resulting in an audible signal (typically within 3-inches of the pipe end), the test personnel shall also make a visual inspection to determine if discontinuities exist.
- D. Acceptance Criteria: The pipe or fittings as tested by the procedure shall be rejected from shipment if testing reveals more than isolated voids due to casting irregularities which represent more than 0.01 percent of the total glassed surface (no more than 1-2 pinholes per fitting or a average of 5 or less per 20-feet of pipe). Rejected pipe shall be evaluated for additional coating with Porcelain Enamel or for total reblasting, reprocessing, and retesting.

END OF SECTION

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PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. The Contractor shall provide painting and coatings, complete and in place, in accordance with the Contract Documents.
- B. Definitions:
 - 1. The term "paint," "coatings," or "finishes" as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, and all other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat.
 - 2. The term "DFT" means minimum dry film thickness.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 09801 Manhole and Wet Well Lining

1.3 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

- A. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:
 - 1. References herein to "SSPC Specifications" or "SSPC" shall mean the published standards of SSPC, the Society for Protective Coatings.
 - 2. References herein to "NACE" shall mean the published standards of the National Association of Corrosion Engineers.
 - 3. References herein to "ANSI/AWWA" shall mean the published standards of the American Water Works Association including:
 - a. ANSI/AWWA C205 Cement-Mortar Protective Lining and Coating for Steel Water Pipe 4 in. (100mm) and Larger Shop Applied
 - ANSI/AWWA C209 Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
 - c. ANSI/AWWA C210 Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
 - d. ANSI/AWWA C213 Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
 - e. ANSI/AWWA C214 Tape Coating Systems for the Exterior of Steel Water Pipelines
 - f. ANSI/AWWA C217 Cold-Applied Petrolatum Tape and Petroleum Wax Tape Coatings for Exterior of Special Sections, Connections, and Fittings for Buried Steel Water Pipelines

- 4. Federal Specifications:
 - a. OSHA 1910.144 Safety Color Code for Marking Physical Hazards
- 6. ASTM Standards:
 - a. C-309 Liquid Membrane-Forming Compounds for Curing Concrete
- 7. Regulatory Agency Requirements: Coatings for surfaces in contact with raw or potable water shall impart no taste or odor to the water nor result in any organic or inorganic content in excess of the maximum contaminant level established by applicable laws or regulations including NSF Standards. All coatings shall be approved by the local Air Pollution Control District. The Contractor shall revise painting systems specified herein to provide manufacturer's regulatory agency approved coating system where required. All painting systems shall be VOC compliant. Equivalent systems are to be submitted at no additional costs to meet any new regulations.
- B. The Work of this Section shall comply with the current edition of the Uniform Building Code
- C. Inspection records of shop or field-applied coatings and linings for buried or submerged items shall be submitted within 15 days after the work has been accepted.

1.4 SUBMITTALS

- A. The following shop drawings shall be submitted in compliance with Section 01300:
 - 1. Submit coating manufacturer's technical and material safety data sheets for the products to be applied. Data sheets shall show the following information at a minimum, but shall show all data necessary to indicate conformance to specifications:
 - a. Percent solids by volume.
 - b. Minimum and maximum recommended dry-film thickness per coat for prime, intermediate, and finish coats.
 - c. Recommended surface preparation.
 - d. Recommended thinners.
 - e. Statement verifying that the specified prime coat is recommended by the manufacturer for use with the specified intermediate and finish coats.
 - f. Application instructions including recommended equipment and temperature limitations.
 - g. Curing requirements and instructions.
 - h. Colors (where applicable).
 - 2. Submit the name of the company and abrasive to be used, the generic type of abrasive, the CARB certification, and product data sheets.

1.5 QUALITY ASSURANCE

- A. All materials of a specified painting system, including primer, intermediate, and finish coats, shall be produced by the same manufacturer. Thinners, cleaners, driers, and other additives shall be as recommended by the paint manufacturer for the particular coating system.
- B. Deliver paints to the jobsite in the original, unopened containers.

1.6 SPECIAL CORRECTION OF DEFECTS REQUIREMENTS

A. Warranty Inspection: A warranty inspection may be conducted during the eleventh month following completion of all coating and painting work. The Contractor and a representative of the coating material manufacturer shall attend this inspection. All defective work shall be repaired in accordance with these Specifications and to the satisfaction of the Owner. The Owner may, by written notice to the Contractor, reschedule the warranty inspection to another date within the 2-year correction period, or may cancel the warranty inspection altogether. If a warranty inspection is not held, the Contractor is not relieved of its responsibilities under the Contract Documents.

1.7 SAFETY AND HEALTH REGULATIONS

- A. General: In accordance with the requirements of OSHA Safety and Health Standards for Construction (29CFR1926) and the applicable requirements of regulatory agencies having jurisdiction, as well as manufacturer's printed instructions and appropriate technical bulletins and manuals, the Contractor shall provide and require use of personnel protective lifesaving equipment for persons working in or about the project site.
- B. Head and Face Protection and Respiratory Devices: Equipment shall include protective helmets which shall be worn by all persons while in the vicinity of the Work. In addition, workers engaged in or near the work during sandblasting shall wear OSHA approved eye and face protection devices and air purifying, halfmask or mouthpiece respirators. Barrier creams shall be used on any exposed areas of skin.
- C. Ventilation: Where ventilation is used to control hazardous exposure, all equipment shall be explosion-proof. Forced air ventilation shall be provided to reduce the concentration of air contaminant to a safe limit. Air circulation and exhausting of solvent vapors shall be continued until coatings have fully cured.
- D. Sound Levels: Whenever the occupational noise exposure exceeds maximum allowable sound levels, the Contractor shall implement furnish and require the use of approved ear protective devices.
- E. Illumination: Adequate illumination shall be provided while Work is in progress, which may include explosion-proof lights, scaffolding and electrical equipment. Whenever required by the Engineer, the Contractor shall provide additional illumination to cover all areas to be inspected. The level of illumination for inspection purposes shall be determined by the Engineer.

F. Temporary Ladders and Scaffolding: All temporary ladders and scaffolding shall conform to applicable safety requirements. They shall be erected where requested by the Engineer to facilitate inspection and shall be moved by the Contractor to locations as requested by the Engineer.

PART 2 – MATERIALS

2.1 GENERAL

A. Coating products shall conform to San Diego Air Pollution Control District Rule 67.0, which limits volatile organic compounds per gallon of coating product. The following index lists the various painting and coating systems by service and generic type.

No.	Title	Generic Coating					
Submerged Metal Coating System							
5	Submerged or Intermittently Submerged Metal, Potable and Raw Water	Ероху					
Expos	Exposed Metal Coating Systems						
10	Exposed Metal, Corrosive Environment	High Build Epoxy (2 Coat System) with Polyurethane Topcoat					
15	Exposed Metal, Atmospheric Weathering Environment	Acrylic					
20	Exposed Metal, Exterior	Epoxy with Urethane Topcoat					
PVC, CPVC and FRP Coating System							
41	PVC, CPVC and FRP, Ultraviolet Exposure	Polyurethane					
Metal in Contact with Concrete Coating System							
51	Aluminum and Concrete	Ероху					
Plaster, Wood, Masonry and Drywall Coating System							
60	Plaster, Wood, Masonry and Drywall	Acrylic Latex					
Concrete Floor Coating							
70	Slip Resistant Floor Coating	Urethane/epoxy					

PAINT COATINGS SYSTEM INDEX

B. These systems are specified in detail in the following paragraphs. For each coating, the required surface preparation, prime coat, intermediate coat (if required), topcoat, and coating thicknesses are described. Mil thicknesses shown are minimum dry-film thicknesses. At least two manufacturer's products are listed for each system.

C. Concrete in contact with wastewater shall be PVC lined in accordance with Section 09801.

2.2 SUBMERGED METAL COATING SYSTEM

- A. System No. 5 Submerged Metal, Potable or Recycled Water:
 - 1. Type: Epoxy
 - 2. Service Conditions: For use with steel structures, piping, valves, or equipment in potable or recycled water.
 - 3. Surface Preparation: Submit manufacturer's recommended surface preparation for District's review.
 - 4. Coating System: Submit proposed material with manufacturer data sheets. Apply the manufacturer's recommended number of coats to attain the specified minimum coating thickness. District reserves the right to require thickness up to 12 mils total at no additional cost. Color of topcoat: white. Each coat shall be different color than the one preceding it.

2.3 EXPOSED METAL COATING SYSTEMS

- A. System No. 10 Exposed Metal, Corrosive Environment:
 - 1. Type: High-build epoxy finish coat having a minimum volume solids of 60%, with an inorganic zinc prime coat and a pigmented polyurethane finish coat having a minimum volume solids of 52%.
 - 2. Service Conditions: For use with metal structures, pipes, or valves subjected to water condensation; chemical fumes; and chemical contact.
 - 3. Surface Preparation: Submit manufacturer's recommended surface preparation for District's review.
 - 4. Coating System: Submit proposed material with manufacturer data sheets. Apply the manufacturer's recommended number of coats to attain the specified minimum coating thickness. District reserves the right to require thickness up to 12 mils total at no additional cost. Color of topcoat: white. Each coat shall be different color than the one preceding it.
- B. System No. 15 Exposed Metal, Atmospheric Weathering Environment:
 - 1. Type: One component acrylic enamel having a minimum volume solids content of 35% with an acrylic inorganic zinc primer.
 - 2. Service Conditions: For use on interior and exterior metal and piping subject to sunlight, weathering, and water condensation.
 - 3. Surface Preparation: Submit manufacturer's recommended surface preparation for District's review.

- 4. Coating System: Submit proposed material with manufacturer data sheets. Apply the manufacturer's recommended number of coats to attain the specified minimum coating thickness. District reserves the right to require thickness up to 12 mils total at no additional cost. Color of topcoat: white. Each coat shall be different color than the one preceding it.
- C. System No. 20 Exposed Metal, Exterior:
 - 1. Type: High-build epoxy prime coat with a pigmented high-build aliphatic or acrylic polyurethane finish coat.
 - 2. Service Conditions: For use on exterior metal piping appurtenances, such as valve box lids, hydrant heads, and guard posts.
 - 3. Surface Preparation: Submit manufacturer's recommended surface preparation for District's review.
 - 4. Coating System: Submit proposed material with manufacturer data sheets. Apply the manufacturer's recommended number of coats to attain the specified minimum coating thickness. District reserves the right to require thickness up to 12 mils total at no additional cost. Color of topcoat: white. Each coat shall be different color than the one preceding it.

2.4 PVC, CPVC AND FRP COATING SYSTEM

- A. System No. 41 -- PVC, CPVC and FRP, Ultraviolet Exposure:
 - 1. Type: Epoxy primer with a minimum volume solids of 54% and a pigmented Polyurethane enamel having a minimum volume solids of 52%.
 - 2. Service Conditions: PVC or CPVC piping and FRP exposed to sunlight.
 - 3. Surface Preparation: Submit manufacturer's recommended surface preparation for District's review.
 - 4. Coating System: Submit proposed material with manufacturer data sheets. Apply the manufacturer's recommended number of coats to attain the specified minimum coating thickness. District reserves the right to require thickness up to 12 mils total at no additional cost. Color of topcoat: white. Each coat shall be different color than the one preceding it.

2.5 METAL IN CONTACT WITH CONCRETE, COATING SYSTEM

- A. System No. 51 Aluminum insulation from Concrete and Carbon Steel:
 - 1. Type: High solids epoxy or phenolic epoxy having a minimum volume solids of 80% (ASTM D2697).
 - 2. Service Conditions: Coat areas of aluminum grating, stairs, framing, structural members, or aluminum fabrications in contact with concrete or carbon steel with this system.

- 3. Surface Preparation: Submit manufacturer's recommended surface preparation for District's review.
- 4. Coating System: Submit proposed material with manufacturer data sheets. Apply the manufacturer's recommended number of coats to attain the specified minimum coating thickness. District reserves the right to require thickness up to 12 mils total at no additional cost. Color of topcoat: white. Each coat shall be different color than the one preceding it.

2.6 PLASTER, WOOD, MASONRY AND DRYWALL COATING SYSTEM

- A. System No. 60 Plaster, Wood, Masonry and Drywall, Normal Exposure:
 - 1. Type: Acrylic latex coating having a minimum volume solids of 40%.
 - 2. Service Conditions: For use in coating weather-exposed or enclosed concrete masonry, drywall, wood, and plaster.
 - 3. Surface Preparation: Submit manufacturer's recommended surface preparation for District's review.
 - 4. Coating System: Submit proposed material with manufacturer data sheets. Apply the manufacturer's recommended number of coats to attain the specified minimum coating thickness. District reserves the right to require thickness up to 12 mils total at no additional cost. Color of topcoat: white. Each coat shall be different color than the one preceding it.

2.7 CONCRETE FLOOR COATING SYSTEM

- A. System No. 70 Slip Resistant Floor Coating, Corrosive Environment:
 - 1. Type: Urethane/epoxy.
 - 2. Service Conditions: For use in coating interior concrete floors in a corrosive environment.
 - 3. Surface Preparation: Submit manufacturer's recommended surface preparation for District's review.
 - 4. Coating System: Tnemec Series 241 MVT primer/basecoat with Tnemec Series 237 Power-Tread grout coat and top coat (total minimum system DFT = 1/8-inch), or District approved equal. Submit proposed material with manufacturer data sheets. Apply per manufacturer's recommendations and at the recommended number of coats to attain the specified minimum coating thickness. Color of topcoat: white. Each coat shall be different color than the one preceding it. Primer/basecoats which are considered "moisture sensitive" will not be accepted. The proposed primer/basecoat shall be able to withstand a minimum of 20 lbs of moisture vapor transmission per ASTM F 1869.

PART 3 – EXECUTION

3.1 WEATHER CONDITIONS

- A. Do not paint in the rain, wind, snow, mist, and fog or when steel or metal surface temperatures are less than 5 degrees F above the dew point.
- B. Do not apply paint when the relative humidity is above 85% or the temperature is above 90 degrees F.
- C. Do not paint when temperature of metal to be painted is above 120 degrees F.
- D. Do not apply paints if air or surface temperature is below 40 degrees F or expected to be below 40 degrees F within 24 hours.
- E. Do not apply epoxy, acrylic latex, and polyurethane paints on an exterior or interior surface if air or surface temperature is below 60 degrees F or expected to drop below 60 degrees F in 24 hours.

3.2 SURFACE PREPARATION

- A. Do not sandblast or prepare more surface area than can be coated in one day. Remove all sharp edges, burrs, and weld spatter. Do not sandblast PVC, CPVC, or FRP piping or equipment. Do not sandblast epoxy, enamel coated, or fusionbonded epoxy pipe that has already been factory coated, except to repair scratched or damaged coatings.
- B. Surface preparation shall conform to the SSPC specifications as follows:

Solvent Cleaning	SP 1
Hand Tool Cleaning	SP 2
Power Tool Cleaning	SP 3
White Metal Blast Cleaning	SP 5
Commercial Blast Cleaning	SP 6
Brush-Off-Blast Cleaning	SP 7
Pickling	SP 8
Near-White Blast Cleaning	SP 10

- A. Wherever the words "solvent cleaning," "hand tool cleaning," "wire brushing," or "blast cleaning" or similar words are used in these specifications or in paint manufacturer's specifications, they shall be understood to refer to the applicable SSPC (Steel Structure Painting Council, Surface Preparation Specifications, ANSI A159.1) specifications listed above.
- B. Dust blasting is defined as cleaning the surface through the use of very fine abrasives, such as siliceous or mineral abrasives, 80 to 100 mesh. Apply a fine etch to the metal surface to clean the surface of any contamination or oxide.
- C. Remove oil and grease from metal surfaces in accordance with SSPC-SP 1. Use clean cloths and cleaning solvents and wipe dry with clean cloths. Do not leave a film or greasy residue on the cleaned surfaces before sandblasting.

- D. Remove weld spatter and weld slag from metal surfaces and grind smoothly rough welds, beads, peaked corners, and sharp edges in accordance with SSPC-SP 2 and SSPC-SP 3.
- E. Neutralize welds with a chemical solvent that is compatible with the specified coating materials. Use clean cloths and chemical solvent. Wipe dry with clean cloths. Do not leave a residue on the cleaned surfaces.

3.3 ABRASIVE BLAST CLEANING

- A. Use dry abrasive blast cleaning for metal surfaces. Do not use abrasives in automatic equipment that have become contaminated. When shop or field blast cleaning with handheld nozzles, do not recycle or reuse blast particles.
- B. After blast cleaning and prior to application of coating, dry clean surfaces to be coated by dusting, sweeping, and vacuuming to remove residue from blasting. Apply the specified primer or touch-up coating within the period of an eight-hour working day. Do not apply coating over damp or moist surfaces. Reclean prior to application of primer or touch-up coating any blast cleaned surface not coated within said eight-hour period.
- C. Keep the area of the work in a clean condition and do not permit blasting particles to accumulate and constitute a nuisance or hazard.
- D. During blast cleaning, prevent damage to adjacent coatings. Schedule blast cleaning and coating such that dust, dirt, blast particles, old coatings, rust, mill scale, etc., will not damage or fall upon wet or newly coated surfaces.

3.4 PROCEDURES FOR ITEMS HAVING SHOP-APPLIED PRIME COATS

A. Handle shop-primed items with care during unloading, installation, and erection operations to minimize damage. Do not place or store shop-primed items on the ground or on top of other work unless ground or work is covered with a protective covering or tarpaulin. Place shop-primed items above the ground upon platforms, skids, or other supports.

3.5 FIELD TOUCH-UP OF SHOP-APPLIED PRIME COATS

- A. Remove oil and grease surface contaminants on metal surfaces in accordance with SSPC-SP 1. Use clean rags wetted with a degreasing solution, rinse with clean water, and wipe dry.
- B. Remove dust, dirt, salts, moisture, chalking primers, or other surface contaminants that will affect the adhesion or durability of the coating system. Use a high-pressure water blaster or scrub surfaces with a broom or brush wetted with a solution of trisolium phosphate, detergent, and water. Before applying intermediate or finish coats to inorganic zinc primers, remove any soluble zinc salts that have formed by means of scrubbing with a stiff bristle brush. Rinse scrubbed surfaces with clean water.
- C. Remove loose or peeling primer and other surface contaminants not easily removed by the previous cleaning methods in accordance with SSPC-SP 7. Take

care that remaining primers are not damaged by the blast cleaning operation. Remaining primers shall be firmly bonded to the steel surfaces with blast cleaned edges feathered.

- D. Remove rust, scaling, or primer damaged by welding or during shipment, storage, and erection in accordance with SSPC-SP 10. Take care that remaining primers are not damaged by the blast cleaning operation. Remaining primers shall be firmly bonded to the steel surfaces with blast cleaned edges feathered.
- E. Use repair procedures on damaged primer which protects adjacent primer. Blast cleaning may require the use of lower air pressure, smaller nozzles, and abrasive particle sizes, short blast nozzle distance from surface, shielding, and/or masking.
- F. After abrasive blast cleaning of damaged and deflective areas, remove dust, blast particles, and other debris by dusting, sweeping, and vacuuming; then apply the specified touch-up coating.
- G. Surfaces that are shop primed with inorganic zinc primers shall receive a field touch-up of organic zinc primer to cover all scratches or abraded areas.
- H. Other surfaces that are shop primed shall receive a field touch-up of the same primer used in the original prime coat.

3.6 PAINT MIXING

A. Prepare multiple-component coatings using all of the contents of the container for each component as packaged by the paint manufacturer. Do not use partial batches. Do not use multiple-component coatings that have been mixed beyond their pot life. Provide small quantity kits for touchup painting and for painting other small areas. Mix only the components specified and furnished by the paint manufacturer. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

3.7 PROCEDURES FOR THE APPLICATION OF COATINGS

- A. Conform to the requirements of SSPC-PA 1. Follow the recommendations of the coating manufacturer including the selection of spray equipment, brushes, rollers, cleaners, thinners, mixing, drying time, temperature and humidity of application, and safety precautions.
- B. Stir, strain, and keep coating materials at a uniform consistency during application. Apply each coating evenly, free of brush marks, sags, runs, holidays, and other evidence of poor workmanship. Use a different shade or tint on succeeding coating applications to indicate coverage where possible. Finished surfaces shall be free from defects or blemishes.
- A. Do not use thinners unless recommended by the coating manufacturer. If thinning is allowed, do not exceed the maximum allowable amount of thinner per gallon of coating material. Stir coating materials at all times when adding thinner. Do not flood the coating material surface with thinner prior to mixing. Do not reduce coating materials more than is absolutely necessary to obtain the proper application characteristics and to obtain the specified dry-film thicknesses.

- B. Remove dust, blast particles, and other debris from blast cleaned surfaces by dusting, sweeping, and vacuuming. Allow ventilator fans to clean airborne dust to provide good visibility of working area prior to coating applications. Remove dust from coated surfaces by dusting, sweeping, and vacuuming prior to applying succeeding coats.
- C. Apply coating systems to the specified minimum dry-film thicknesses as measured from above the peaks of the surface profile.
- D. Apply primer immediately after blast cleaning and before any surface rusting occurs, or any dust, dirt, or any foreign matter has accumulated. Reclean surfaces by blast cleaning that have surface colored or become moist prior to coating application.
- E. Apply a brush coat of primer on welds, sharp edges, nuts, bolts, and irregular surfaces prior to the application of the primer and finish coat. The brush coat shall be done prior to and in conjunction with the spray coat application. Apply the spray coat over the brush coat.

3.8 SURFACES NOT TO BE COATED

- A. The following surfaces shall not be painted and must be protected during painting of adjacent areas unless otherwise noted on the Drawings or in other Specification sections:
 - 1. Steel to be encased in concrete or masonry
 - 2. Cement mortar coated pipe and fittings
 - 3. Stainless steel
 - 4. Metal plates/nameplates or letters
 - 5. Concrete surfaces
 - 6. Fencing
 - 7. Copper tubing, red brass piping and PVC piping except where such piping occurs in rooms where the walls are painted, or required for color coding
 - 8. Electrical fixtures except for factory coatings
 - 9. Grease fittings
 - 10. Buried pipe unless specifically required in the piping specifications
 - 11. Plastic and fiberglass surfaces
 - 12. Aluminum handrails, stairs and grating, unless in contact with concrete
 - 13. Platform gratings, stair treads, door thresholds, and other walking surfaces
- 14. Roofing
- 15. Galvanized steel

3.9 PROTECTION OF SURFACES NOT TO BE PAINTED

- A. Remove, mask, or otherwise protect hardware, lighting fixtures, switchplates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.
- B. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process. Mask openings in motors to prevent paint and other materials from entering the motors.

3.10 SURFACES TO BE COATED

- A. Coat mechanical equipment as described in the various mechanical equipment specifications. Color shall match the color of the connecting piping.
- B. Coat aboveground and exposed piping or piping in vaults and structures as described in the various piping specifications. Color shall be as indicated or as selected by the Construction Manager.
- C. Coat valves as described in the various valve specifications. Above ground valves or valves in vaults and structures shall match the color of the connecting piping.
- D. Coat aluminum surfaces in contact with concrete per System No. 51.
- E. Coat exposed surfaces of enclosures, guard posts, marker posts, fire hydrants, valve boxes, and test boxes as described in the particular specifications for the above items.

3.11 SHOP AND FIELD INSPECTION AND TESTING

- A. General: Furnish the Owner a minimum of 3 days advance notice of the start of any field surface preparation work or coating application work, and a minimum of 7 days advance notice of the start of any shop surface preparation work.
- B. All inspection, testing, and operation of inspection tools for field-applied coatings and linings shall be performed only in the presence of the Construction Manager, unless the Owner has granted prior approval to perform such Work in its absence.
- C. At no additional cost to the Owner, the inspection shall be performed by a third-party inspection agency acceptable to the Owner and certified in the inspection of coating and lining application procedures.
- D Inspection by the Engineer, or the waiver of inspection of any particular portion of the Work, shall not relieve the Contractor of its responsibility to perform the Work in accordance with these Specifications.

- E. For external or internal application of lining or coating materials for buried or submerged piping systems, the Contractor shall supply inspection procedures for use by the Owner. Procedures shall be supplied in advance of starting work.
- F. Inspection Devices: Furnish, until final acceptance of such coatings, inspection devices in good working condition for the detection of holidays and measurement of dry-film thicknesses of protective coatings. Dry-film thickness gauges shall be made available for the Engineer's use at all times while coating is being done, until final acceptance of such coatings. Furnish the services of a trained operator of the holiday detection devices until the final acceptance of such coatings. Holiday detection devices shall be operated only in the presence of the Engineer.
- G. Holiday Testing: Holiday test all coated ferrous surfaces, other surfaces which will be submerged in water or other liquids, or surfaces which are enclosed in a vapor space in such structures and surfaces coated with any of the submerged and severe service coating systems. Areas which contain holidays shall be marked and repaired or recoated in accordance with the coating manufacturer's printed instructions and then retested. Electrical inspection for linings and coatings shall be in accordance with applicable NACE standards RPO 188 and/or RPS 274.
 - Coatings with Thickness Exceeding 20 Mils: For surfaces having a total dry film coating thickness exceeding 20 mils: pulse-type holiday detector such as Tinker & Rasor Model AP-W, D.E. Stearns Co. Model 14/20, or equal shall be used. The unit shall be adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the specified coating thickness.
 - 2. Coatings with Thickness of 20 Mils or Less: For surfaces having a total dry film coating thickness of 20 mils or less, Tinker & Rasor Model M1 nondestructive type holiday detector, K-D Bird Dog, or equal shall be used. The unit shall operate at less than 75 V. For thicknesses between 10 and 20 mils, a non-sudsing type wetting agent, such as Kodak Photo-Flo, or equal, shall be added to the water before wetting the detector sponge.
- H. Film Thickness Testing: On ferrous metals, the dry film coating thickness shall be measured in accordance with the SSPC "Paint Application Specification No. 2" using a magnetic-type dry film thickness gauge such as Mikrotest model FM, Elcometer model 111/1EZ, or equal. Each coat shall be tested for the correct thickness. No measurements shall be made until at least 8 hours after application of the coating. On nonferrous metals and other substrates, the coating thicknesses shall be measured at the time of application using a wet film gauge.
- I. Surface Preparation: Evaluation of blast cleaned surface preparation work will be based upon comparison of the blasted surfaces with the standard samples available from the NACE, using NACE standards TM-01-70 and TM-01-75.
- J. Third-Party Inspection: At no additional cost to the Owner, the inspection of coatings and linings for submerged and buried service conditions shall be performed by a third-party inspection agency acceptable to the Engineer and certified in the inspection of coating and lining application procedures.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Extent of painting work is indicated on drawings and schedules, and as herein specified.
- B. This specification provides requirements for the preparation for and application of architectural finishes only. Work includes painting and finishing of interior and exterior exposed items and surfaces including gypsum wall board, metal doors and frames, louvers, sheet metal items, etc. throughout project, except as otherwise indicated. Painting of non-architectural items is specified in Section 09900.
- C. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of work.
- D. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.
- E. Surfaces to be Painted: Except where natural finish of material is specifically noted as a surface not to be painted, paint exposed surfaces whether or not colors are designated in "schedules". Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas. If color or finish is not designated, Architect will select these from standard colors or finishes available.
- F. Following categories of work are not included as part of field-applied finish work.
 - 1. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing or installer-finishing is specified for such items.
 - 2. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, foundation spaces, furred areas, pipe spaces, and shafts.
 - 3. Finished Metal Surfaces: Unless otherwise indicated, metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting.
 - 4. Operating Parts: Unless otherwise indicated, moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting.
 - 5. Items specified in Section 09900.
- G. Following categories of work are included under other sections of these specifications:

SECTION 09910 - ARCHITECTURAL PAINTING

- 1. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, metal fabrication, metal doors and frames, and similar items.
- 2. Unless otherwise specified, shop priming of fabricated components such as architectural woodwork, wood casework, and shop-fabricated or factory-built mechanical and electrical equipment or accessories is included under other sections of these specifications.
- 3. Mechanical and Electrical Work: Painting of mechanical and electrical work is specified in Division 15 and 16, respectively.
- H. Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 09900 Painting and Coating

1.3 QUALITY ASSURANCE

- A. <u>Single Source Responsibility</u>: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.
- B. <u>Coordination of Work</u>: Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Upon request from other trades, furnish information or characteristics of finish materials provided for use, to ensure compatible prime coats are used.

1.4 SUBMITTALS

- A. <u>Manufacturer's Data</u>:
 - 1. Complete materials list of all items proposed to be furnished and installed under this Section.
 - 2. Manufacturers' specifications and other data required to demonstrate compliance with the specified requirements.
 - 3. For information only, submit two copies of manufacturer's specifications and application instructions for each material.
- B. <u>Samples</u>: Following the selection of colors and glosses by the Engineer, submit samples for the Engineer's review of color and texture only Provide a listing of material and application for each coat of each finish sample.

SECTION 09910 – ARCHITECTURAL PAINTING

- 1. On 12" x 12" hardboard, provide two samples of each color and material, with texture to simulate actual conditions. Resubmit samples as requested by Engineer until acceptable sheen, color, and texture is achieved.
- 2. On actual wood surfaces, provide two 4" x 8" samples of natural and stained finish. Label and identify each as to location and application.
- 3. On actual wall surfaces and other exterior and interior building components, duplicate painted finishes of prepared samples. Provide full-coat finish samples on at least 100 sq. ft. of surface, as directed, until required sheen, color and texture is obtained; simulate finished lighting conditioning for review of in-place work.

1.5 **PRODUCT HANDLING**

- A. Deliver all materials to the job site in original, new, and unopened containers bearing the manufacturer's name and label.
- B. Provide proper storage to prevent damage to, and deterioration of, paint materials.
- C. Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.
- D. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

1.6 JOB CONDITIONS

- A. <u>Surface Temperatures</u>: Do not apply solvent-thinned paints when the temperature of surfaces to be painted and the surrounding air temperature are below 45 degrees F, unless otherwise permitted by the manufacturer's printed instructions.
- B. <u>Weather Conditions</u>: Do not apply paint in rain, fog, or mist; or when the relative humidity exceeds 85%; or to damp or wet surfaces; unless otherwise permitted by the manufacturer's printed instructions. Applications may be continued during inclement weather within the temperature limits specified by the paint manufacturer during application and drying periods.

1.7 REGULATORY REQUIREMENTS

A. All material and application of material shall comply with all air pollution control regulations.

1.8 EXTRA STOCK

- A. <u>Amount</u>: Upon completion of the work of this Section, deliver to the Owner an extra stock equaling 10% of each color, type, and gloss of paint used on the Work, but not more than five gallons for each.
- B. <u>Packaging</u>: Tightly seal each container and clearly label with the contents and location used.

1.9 GUARANTEE

A. Guarantee the painting work, in writing, against peeling, fading, cracking, blistering, or crazing for a period of two years from the time the Notice of Completion is filed.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Principal paint materials, unless otherwise indicated, shall be as manufactured by Sherwin-Williams, Dunn-Edwards Corp., or equal.
- B. <u>Colors and Glosses</u>: The Engineer will select colors to be used in the various types of paint specified and will be the sole judge of acceptability of the various glosses obtained from the materials proposed to be used in the Work.
- C. <u>Undercoats and Thinners</u>: Provide undercoat paint produced by the same manufacturer as the finish coat. Use only the thinners recommended by the paint manufacturer, and use only to the recommenced limits. Insofar as practicable, use undercoat, finish coat, and thinner material as parts of a unified system of paint finish.

2.2 APPLICATION EQUIPMENT

- A. For application of the approved paint, use only such equipment as is recommended for application of the particular paint by the manufacturer of the particular paint.
- B. Compatibility: Prior to actual use of application equipment, use all means necessary to verify that the proposed equipment is actually compatible with the material to be applied and that the integrity of the finish will not be jeopardized by use of the proposed application equipment.

2.3 OTHER MATERIALS

A. All other materials, not specifically described but required for a complete and proper installation of the work of this Section, shall be new first-quality of their respective kinds, and as selected by the Contractor subject to the approval of the Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. <u>Inspection</u>: Prior to installation of the work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence. Verify that painting may be completed in strict accordance with the original design and with the manufacturer's recommendations.
- B. <u>Discrepancies</u>: Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.
- C. <u>Moisture Content</u>: Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Plaster and Gypsum Wallboard: 12 percent.
 - 2. Masonry, Concrete and Concrete Unit Masonry: 12 percent.
 - 3. Interior Wood: 15 percent, measured in accordance with ASTM D2016.
 - 4. Exterior Wood: 15 percent, measured in accordance with ASTM D2016.

3.2 MATERIALS PREPARATION

- A. Mix and prepare painting materials in strict accordance with the manufacturer's recommendations.
- B. Store materials not in actual use in tightly covered containers.
- C. Maintain containers used in storage, mixing, and application of paint in a clean condition, free from foreign materials and residue.
- D. <u>Stirring</u>: Stir all materials before application to produce a mixture of uniform density, and as required during the application of materials. Do not stir into the material any film which may form on the surface. Remove the film and, if necessary, strain the material before using.

3.3 SURFACE PREPARATION

- A. Perform all preparation and cleaning procedures in strict accordance with the paint manufacturer's recommendations.
- B. Remove all removable items which are in place and are not scheduled to receive paint finish, or provide surface-applied protection prior to surface preparation and painting operations.
- C. Following completion of painting in each space or area, reinstall the removed items by using workmen skilled in the necessary trades.

SECTION 09910 – ARCHITECTURAL PAINTING

- D. Clean each surface to be painted prior to applying paint or surface treatment.
- E. Remove oil and grease with clean cloths and cleaning solvents of low toxicity and a flash point in excess of 100 degrees F, (38 degrees C) prior to start of mechanical cleaning.
- F. Schedule the cleaning and painting so that dust and other contaminants from the cleaning process will not fall onto wet newly painted surfaces.
- G. <u>Preparation of Metal Surfaces</u>:
 - 1. Thoroughly clean all surfaces until they are completely free from dirt, oil, and grease. Clean cutting oil from exposed pipes.
 - 2. On galvanized surfaces, use solvent for the initial cleaning and then treat the surface thoroughly with phosphoric acid etch. Remove all etching solution before proceeding.
 - 3. Allow to dry thoroughly before application of paint.
 - 4. Apply primer the same day pretreatment is applied.

3.4 PAINT APPLICATION

- A. On all removable panels and all hinged panels, paint the back sides to match the exposed sides.
- B. Apply one heavy coat of flat black paint on all construction visible through screen vents and grilles.
- C. <u>Drying</u>: Allow sufficient drying time between coats. Modify the period as recommended by the material manufacturer to suit adverse weather conditions.
- D. <u>Brush and Roller Application</u>: Apply all coats onto the surfaces in an even film. Cloudiness, spotting, holidays, laps, brush or roller marks, runs, sags, ropiness, and other surface imperfections will not be acceptable.
- E. <u>Spray Application</u>: Wherever spray application is used, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double back with spray equipment for the purpose of building up film thickness of two coats in one pass.
- F. Completed work shall match the approved samples for color, texture, and coverage. Remove, refinish, or repaint all work not in compliance with specified requirements.

3.5 PAINTING SCHEDULE – EXTERIOR

Sherwin-Williams

Dunn-Edwards

A. <u>Ferrous Metal – Semi-Gloss</u>:

SECTION 09910 – ARCHITECTURAL PAINTING

1st Coat:	B66-1310 ProCryl	ENPR00 Enduraprime
2nd Coat:	B66-650 ProInd Acrylic	W9 Syn-Lustro
3rd Coat:	B66-650 ProInd Acrylic	W9 Syn-Lustro

B. <u>Galvanized Metal – Semi-Gloss</u>:

Pretreatment	GLL Clean n Etch	GE123 Galv- Etch
1st Coat:	B66-1310 ProCryl	UGPR00 Ultragrip
2nd Coat:	B66-650 ProInd Acrylic	W9 Syn-Lustro
3rd Coat:	B66-650 ProInd Acrylic	W9 Syn-Lustro

C. Concrete and Concrete Block (CMU) - Flat:

D. <u>Wood – Semi-Gloss:</u>

1st Coat:	B51-600 Preprite ProBlock	UGPR00 Ultragrip
2nd Coat:	A8 A100 Latex	SSHL50 Spartashield
Enamel 3rd Coat: Enamel	A8 A100 Latex	SSHL50 Spartashield

3.6 PAINTING SCHEDULE - INTERIOR

A. See Section 09912.

END OF SECTION

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PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Gypsum Board.
 - 2. Concrete
 - 3. Concrete Masonry Unit (CMU)

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each finish and for each color and texture required.
- C. Product List: Printout of current "MPI Approved Products List" for each product categoryspecified in Part 2, with the proposed product highlighted.

1.3 QUALITY ASSURANCE

- A. MPI Standards:
 - 1. Products: Complying with MPI standards indicated and listed in "MPI ApprovedProducts List."
 - 2. Preparation and Workmanship: Comply with requirements in "MPI ArchitecturalPainting Specification Manual" for products and paint systems indicated.
- B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Owner representative will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

1.4 EXTRA MATERIALS

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
 - 1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of eachmaterial and color applied.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

- A. Material Compatibility:
 - 1. Provide materials for use within each paint system that are 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, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. Chemical Components of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and thefollowing chemical restrictions; these requirements do not apply to primers or finishes thatare applied in a fabrication or finishing shop:
 - 1. Nonflat Paints and Coatings: VOC content of not more than 150 g/L.
 - 2. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percentby weight of total aromatic compounds (hydrocarbon compounds containing one ormore benzene rings).
 - 3. Restricted Components: Paints and coatings shall not contain any of the following:
 - a. Acrolein.
 - b. Acrylonitrile.
 - c. Antimony.
 - d. Benzene.
 - e. Butyl benzyl phthalate.
 - f. Cadmium.
 - g. Di (2-ethylhexyl) phthalate.
 - h. Di-n-butyl phthalate.
 - i. Di-n-octyl phthalate.
 - j. 1,2-dichlorobenzene.
 - k. Diethyl phthalate.
 - I. Dimethyl phthalate.
 - m. Ethylbenzene.
 - n. Formaldehyde.
 - o. Hexavalent chromium.
 - p. Isophorone.
 - q. Lead.
 - r. Mercury.
 - s. Methyl ethyl ketone.
 - t. Methyl isobutyl ketone.
 - u. Methylene chloride.

- v. Naphthalene.
- w. Toluene (methylbenzene).
- x. 1,1,1-trichloroethane.
- y. Vinyl chloride.
- C. Colors: As selected by Engineer from manufacturer's full range.

2.2 BLOCK FILLERS

- A. Interior/Exterior Latex Block Filler: MPI #4.
 - 1. VOC Content: E Range of E2.

2.3 WOOD PRIMERS

- A. Interior Latex-Based Wood Primer.
 - 1. VOC Content: E Range of E1.
 - 2. Environmental Performance Rating: EPR 1.

2.4 LATEX PAINTS

- A. Interior Latex:
 - 1. VOC Content: E Range of E1.
 - 2. Environmental Performance Rating: EPR 2.

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 performanceof work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisturemeter as follows:
 - 1. Wood: 15 percent.
 - 2. Gypsum Board: 12 percent.
 - 3. Masonry: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION AND APPLICATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers asrequired to produce paint systems indicated.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharplines and color breaks.
- D. 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.
- E. At completion of construction activities of other trades, touch up and restore damaged ordefaced painted surfaces.

3.3 INTERIOR PAINTING SCHEDULE

- A. Dimension Lumber Substrates, Nontraffic Surfaces:
 - 1. Latex System: MPI INT 6.2D.
 - a) Prime Coat: Interior latex-based wood primer.
 - b) Intermediate Coat: Interior latex matching topcoat.
 - c) Topcoat: Interior latex (semigloss).
- B. Gypsum Board Substrates:
 - 1. Latex System: MPI INT 9.2A.
 - a) Prime Coat: Interior latex matching topcoat.
 - b) Intermediate Coat: Interior latex matching topcoat.
 - c) Topcoat: Interior latex (semigloss).
- C. Concrete Substrates, Traffic Surfaces:
 - 1. Concrete Stain System:
 - a) First Coat: Stain, interior, for concrete floors
 - b) Topcoat: Stain, interior, for concrete floors
- D. CMU Substrates:
 - 1. Latex System:

- a) Block Filler: Block filler, latex, interior/exterior
- b) Intermediate Coat: Latex, interior, matching topcoat.
- c) Topcoat: Latex, interior, (Gloss Level 4)
- d) Topcoat: Latex, interior, gloss, (Gloss Level 6, except minimum gloss of 65units at 60 degrees)

*** END OF SECTION ***

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PART 1 – GENERAL

1.1 DESCRIPTION

Furnish and install fixed louvers with components (head, jamb, blades, sill, and mullion) as shown on the Drawings and specified herein, in accordance with the requirements of the Contract Documents. Fixed louvers shall also include removable dust filters as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Submittals
- B. Section 05500 Miscellaneous Metals

1.3 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

Air Movement and Control Association (AMCA) Publication 511

1.4 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300:
 - 1. Shop drawings with a layout indicating louver sizes, materials, coatings, available colors, and components.
 - 2. Prior to fabrication, submit to Owner published louver performance data bearing the AMCA certified ratings seal for air performance and water penetration. Submit free field noise reduction data for acoustical louvers.
 - 3. The Contractor must submit manufacturer's certification stating that products attenuate to the stated minimum sound as indicated in the attached schedule.

1.5 QUALITY ASSURANCE

All louvers shall bear the AMCA certified ratings seal for air performance and water penetration.

PART 2 – MATERIALS

2.1 LOUVERS

- A. All louvers shall be 8-inch deep 6063T5 extruded aluminum frame with thickness of 0.100-inch and 0.080-inch blade with perforated aluminum interior surface as manufactured by Ruskin, Model ACL845, or approved equal.
- B. All louvers shall be of aluminum construction with Kynar finish and have Ruskatherm blanket for acoustical insulation.

2.2 FASTENINGS

Fasteners for exterior applications shall be Type 316 stainless steel. Provide types, gauges, and lengths to suit unit installation conditions. Use Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

2.3 ANCHORS AND INSERTS

Use Type 316 stainless steel anchors and inserts for exterior installations. Use stainless steel expansion bolt devices for drilled-in-place anchors. Provide inserts to be set into concrete or masonry work.

2.4 FABRICATION

- A. Provide louvers and accessories of design, materials, sizes, depth, arrangement, and metal thicknesses indicated or, if not indicated, as required for optimum performance with respect to airflow; water penetration; air leakage, where applicable (for adjustable units, if any); strength; durability; and uniform appearance.
- B. Louver design and fabrication shall incorporate structural supports required to withstand 70 mile per hour wind load.
- C. Fabricate frames including integral sills with tolerances for installation, including application of sealants in joints between louvers and adjoining work.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. 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.

2.5 LOUVER SCREENS

- A. Provide removable bird screens of 2-inch mesh Type 316 stainless steel for all louvers.
- B. Fabricate screen frames of same metal and finish as louver units to which secured, unless otherwise indicated.
- C. Provide screen mounted in extruded aluminum U-frame placed on interior face of louver with sheet metal screws.

2.6 METAL FINISHES

A. Finish for all louvers shall be 1.2 mils Kynar 5007 or equal factory applied, baked on film in accordance with AAMA 605.2 A Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels. Custom color to match architect sample.

- B. Apply finishes in factory after products are assembled. Before finish application, louvers shall be thoroughly cleaned and pre-treated by complete submersion in alkali cleaner, detergent, deoxidization, amorphous chrome phosphate conversion coating and acidulated final rinse.
- C. Protect finishes on exposed surfaces with protective covering prior to shipment. Remove scratches and blemishes which are visible after completing finishing process from exposed surfaces.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Follow all manufacturer's installation instructions. All louvers shall be shipped to the project site as one piece.
- B. Coordinate all dimensions and installation requirements with ventilation, structural, and architectural plans.

END OF SECTION

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PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install fire extinguishers and cabinets as shown on the Drawings and specified herein, in accordance with the requirements of the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 – Record Drawings and Submittals

1.3 SUBMITTALS

A. Submit fully detailed shop drawings giving sizes, methods of attachment, and all required accessories in accordance with Section 01300.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Pack accessories individually in a manner to protect accessory and its finish.
- B. Protect adjacent or adjoining finished surfaces and work from damage during installation of work of this section.

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHER CABINET AND FIRE EXTINGUISHER

- A. Fire Extinguisher Cabinet: Potter-Roemer Co., 7024-F, or equal. Cold rolled steel cabinet, trims and door frames, with factory finish baked enamel, surfaced mounting style.
- B Fire Extinguisher: Potter-Roemer Co., #3006. Provide quantity as indicated.

PART 3 - EXECUTION

3.1 **PREPARATION**

- A. Deliver inserts and rough-in frames to jobsite at appropriate time for buildingin. Provide templates and rough-in measurements as required.
- B. Before starting work notify Engineer in writing of any conflicts detrimental to installation or operation of units.
- C. Verify with Engineer exact location of accessories.

3.2 INSTALLATION

A. Install fire extinguishers and fire extinguisher cabinets in accordance with approved shop drawings.

SECTION 10520 - FIRE EXTINGUISHERS & CABINETS

- B. Install true, plumb and level, securely and anchored to substrate.
- C. Provide approved identification to meet City and State Fire Marshal's requirements.

END OF SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

A. The Contractor shall provide all tools, supplies, materials, equipment, and all labor necessary for the furnishing, construction, installation, testing, and operation of all equipment and appurtenant Work, complete and operable, as shown in the Drawings and specified herein, in accordance with the requirements of the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01600 Materials and Equipment
- B. Section 01300 Record Drawings and Submittals
- C. Section 05500 Miscellaneous Metalwork
- D. Section 09900 Painting and Coating
- E. Section 15000 Piping Components
- F. Section 15020 Pipe Supports
- G. Section 16100 Electrical General Provisions

1.3 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

- A. Commercial Standards: All equipment, products, and their installation shall be in accordance with the following standards, as applicable, and as indicated in each Section:
 - 1. American Society for Testing and Materials (ASTM)
 - 2. American Public Health Association (APHA)
 - 3. American National Standards Institute (ANSI)
 - 4. American Society of Mechanical Engineers (ASME)
 - 5. American Water Works Association (AWWA)
 - 6. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)
 - 7. American Welding Society (AWS)
 - 8. American Gear Manufacturers Association (AGMA)
 - 9. American Iron and Steel Institute (AISI)

SECTION 11000 - EQUIPMENT GENERAL PROVISIONS

- 10. National Fire Protection Association (NFPA)
- 11. Federal Specifications (FS)
- 12. National Electrical Manufacturers Association (NEMA)
- 13. Antifriction Bearing Manufacturers Association (AFBMA)
- 14. Mechanical Power Transmission Association (MPTA)
- 15. Rubber Manufacturers Association (RMA)
- 16. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
- 17. Hydraulic Institute Standards (HYI)
- 18. Institute of Electrical and Electronic Engineers (IEEE)
- 19. Instrument Society of America (ISA)
- 20. International Standards Organization (ISO)
- 21. Manufacturer's published recommendations and specifications
- 22. General Industry Safety Orders (CAL OSHA)
- B. The following codes have been referred to in this Section:
 - 1. Uniform Mechanical Code
 - 2. Uniform Plumbing Code
 - 3. Uniform Fire Code
 - 4. National Electrical Code
 - 5. Uniform Building Code
- C. The following standards have been referred to in this Section:

1.	ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800
2.	ANSI B46.1	Surface Texture (Surface Roughness, Waviness, and Lay)
3.	ANSI S12.6	Measurement of the Real-Ear Attenuation of Hearing Protectors at Hearing Protectors

4. ANSI/ASME B1.20.1 General Purpose Pipe Threads (Inch)

SECTION 11000 – EQUIPMENT GENERAL PROVISIONS

 ASTM A 167 Standard Specification for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet and Strip
ASTM A 276 Standard Specification for Stainless Steel Bars and Shapes

1.4 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300:
 - 1. Tools: The Contractor shall obtain from the manufacturer a list of special wrenches and other special tools necessary for the assembly, adjustment, and dismantling of the equipment. All tools shall be of best quality hardened steel forgings with bright finish. Wrench heads shall have work faces dressed to fit nuts. All tools shall be suitable for professional work and manufactured by a recognized supplier of professional tools such as Snap On, Crescent, Stanley, or equal. After approval, Contractor shall furnish such tools neatly mounted in a labeled tool box of suitable design provided with a hinged cover.
 - 2. Spare Parts: In accordance with these Specifications, the Contractor shall obtain from the manufacturer and submit to the Owner a list of suggested spare parts for each piece of equipment. After approval, the Contractor shall furnish such spare parts suitably packaged, identified with the equipment number, and labeled. Contractor shall also furnish the name, address, and telephone number of the nearest distributor for each piece of equipment. All spare parts are intended for use by the Owner after expiration of the correction period.
 - 3. The Contractor shall submit operations and maintenance information for each piece of equipment, including the following:
 - a. Manufacturer's catalog including installation instructions.
 - b. Manufacturer's operating and maintenance procedures including lubricating instructions.
 - c. Manufacturer's certification that products comply with the indicated requirements.
 - d. Certification that products have been factory-tested.
 - e. Certification that the equipment has been field-tested and the equipment complies with the indicated requirements.
 - f. Equipment tolerances and required clearances.
 - g. Electrical data including control and wiring diagrams.
 - h. Warranty information, address and telephone number of local service representative.
 - 4. Earthquake Design and Restraint: All manufactured equipment supplied under this contract shall be designed, constructed and attached to resist stresses produced by seismic forces specified in this Section. Equipment that does not vibrate during normal operation shall be rigidly attached.

Equipment that vibrates during normal operation shall be attached by means of isolators with mechanical stops that limit movement in all directions, unless it can be demonstrated by calculations that such stops are not required. Equipment or portions of equipment that move during normal operation shall be restrained with mechanical devices that prevent displacement unless it can be demonstrated by calculations that such restraints are not required.

- a. The requirements specified in this Section apply to all machinery, mechanical and electrical equipment, instrumentation panels, and electrical panels, including but not limited to:
 - 1) All tanks.
 - 2) HVAC equipment.
 - 3) All electrical equipment and panels.
 - 4) All instrumentation panels.
- b. Minimum Earthquake Forces: Except as provided herein, the minimum design earthquake forces shall be those prescribed for Essential Facilities by the 1997 edition of the Uniform Building Code as published by the International Conference of Building Officials, 5360 South Workman Mill Road, Whittier, California, 90601.
- c. Submit shop drawings, details and data required in this Section.
- d. Installation Certificate Report in accordance with requirements set forth in Subsection 11000-3.8B.

1.5 QUALITY ASSURANCE

- A. Inspection, Startup, and Field Adjustment: The Contractor shall demonstrate that all equipment meets the specified performance requirements. Contractor shall provide the services of an experienced, competent, and authorized service representative of the manufacturer of each item of major equipment who shall visit the site to perform the following tasks:
 - 1. Assist the Contractor in the installation of the equipment.
 - 2. To inspect, check, adjust if necessary and approve the equipment Installation.
 - 3. To start-up and field-test the equipment for proper operation, efficiency, and capacity.
 - 4. To perform necessary field adjustments during the test period until the equipment installation and operation are satisfactory to the Construction Manager.
 - 5. To instruct the Owner's personnel in the operation and maintenance of the equipment. Instruction shall include step-by-step trouble shooting procedures with all necessary test equipment

- B. Costs: The costs of all inspection, startup, testing, adjustment, and instruction Work performed by said factory-trained representatives shall be borne by the Contractor. The Owner will pay for costs of power and water. When available, the Owner's operating personnel will provide assistance in the field testing.
- C. Public Inspection: It shall be the responsibility of the Contractor to inform the local authorities, such as building and plumbing inspectors, Fire Marshall, OSHA inspectors, and others, to witness all required tests for piping, plumbing, fire protection systems, pressure vessels, and safety systems to obtain all required permits and certificates, and pay all fees.
- D. Tolerances: Tolerances and clearances shall be as shown on the shop drawings and shall be closely adhered to. Machine Work shall in all cases be of high-grade workmanship and finish, with due consideration to the special nature or function of the parts. Members without milled ends and which are to be framed to other steel parts of the structure may have a variation in the detailed length of not greater than 1/16-inch for members 30 feet or less in length, and not greater than 1/8-inch for members over 30 feet in length.
- E. Machine Finish: The type of finish shall be the most suitable for the application and shall be shown in micro-inches in accordance with ANSI B46.1. The following finishes shall be used:
 - 1. Surface roughness not greater than 63 micro-inches shall be required for all surfaces in sliding contact.
 - 2. Surface roughness not greater than 250 micro-inches shall be required for surfaces in contact where a tight joint is not required.
 - 3. Surface roughness not greater than 500 micro-inches shall be required for other machined surfaces.
 - 4. Contact surfaces of shafts and stems which pass through stuffing boxes and contact surfaces of bearings shall be finished to not greater than 32 micro-inches.
- F. Manufacturer's Experience: Unless otherwise directed by the Engineer, all equipment furnished shall have a record of at least 5 years of successful, trouble free operation in similar applications, from the same manufacturer.
- G. Warranty: Unless otherwise specified, all equipment shall have a minimum of oneyear full parts and service warranty.

PART 2 – MATERIALS

2.1 GENERAL REQUIREMENTS

A. General: Only products meeting the indicated requirements shall be provided.

- B. Manufacturers: Products shall be new, of current manufacture, and shall be the products of reputable manufacturers specializing in the manufacture of such products.
- C. Products: Materials shall be suitable for the intended purpose and free of defects and shall be recommended by the manufacturer for the application indicated.
- D. High Noise Level Locations: The Contractor shall provide one personal hearing protection station, as indicated herein, at each high noise level location. Said locations are defined as follows:
 - 1. Outdoor Location: Any single equipment item or any group of equipment items that produce noise exceeding OSHA noise level requirements for a 2-hour exposure. Where such equipment is separated by more than 20-feet, measured between edges of footings, each group of equipment shall be provided with a separate hearing protection station.
 - 2. Indoor Location:
 - a. Any single equipment item, or any group of equipment items, located within a single room not normally occupied, that produces noise exceeding OSHA noise level requirements for a 2-hour exposure.
 - b. Any single equipment item, or any group of equipment items, located within a single room normally occupied by workers that produces noise exceeding OSHA noise level requirements for an 8-hour exposure.
 - 3. Personal Hearing Protection Station: At each station, the Contractor shall supply, in their original unopened packaging, three pairs of high attenuation hearing protectors. The ear protectors shall be capable of meeting the requirements of ANSI S12.6 and shall produce a noise level reduction of 25-dBA at a frequency of 500-Hz. The hearing protectors shall have fluid filled ear cushions and an adjustable, padded headband. The protectors shall be stored in a weatherproof, labeled, steel cabinet, furnished by the Contractor and mounted in an approved location near the noise protection station.
- E. Service Factors: Service factors shall be applied in the selection or design of mechanical power transmission components. Unless otherwise calculated, the minimum service factor shall be 1.25. Where load classifications are not indicated, best modern practice shall be used.
- F. Welding: Unless otherwise indicated, all welding shall conform to the following:
 - 1. All welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards governing same.

SECTION 11000 – EQUIPMENT GENERAL PROVISIONS

- 2. In assembly and during welding, the component parts shall be adequately clamped, supported, and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified by the AWS code. Upon completion of welding, all weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. All sharp corners of material which is to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.
- G. Painting and Coating: All equipment shall be painted or coated in accordance with Section 09900 – Painting and Coating, unless otherwise indicated. Nonferrous metal and corrosion-resisting steel surfaces shall be coated with grease or lubricating oil. Coated surfaces shall be protected from abrasion or other damage during handling, testing, storing, assembly, and shipping.
- H. Protection of Equipment: All equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling, and storage. All equipment shall be protected from exposure to corrosive fumes and shall be kept thoroughly dry at all times. Fans, blowers, pumps, motors, drives, electrical equipment, and other equipment having anti-friction or sleeve bearings shall be stored in weather tight storage facilities before installation. For extended storage periods, plastic equipment wrappers should be avoided, to prevent accumulation of condensate in gears and bearings.
- I. Identification of Equipment Items: Each item of equipment shipped shall have a legible identifying mark corresponding to the equipment number indicated for the particular item.
- J. Vibration Level: All reciprocating equipment shall be provided with restrained spring-type vibration isolators or pads per manufacturer's written recommendations.
- K. Shop Fabrication: Shop fabrication shall be performed in accordance with the Contract Documents and the approved shop drawings.

2.2 EQUIPMENT SUPPORTS AND FOUNDATIONS

- A. Equipment Supports: All equipment supports, anchors, and restrainers shall be adequately designed by the Contractor/equipment supplier for static, dynamic, wind, and seismic loads. The design horizontal seismic force shall be the greater of: that noted in the general structural notes or as required by the governing building code, or 10 percent of gravity. Submitted design calculations for equipment supports must bear the signature and seal of an engineer registered in California.
- B. A heavy cast-iron or welded steel base shall be provided for each item of equipment which is to be installed on a concrete foundation.
 - 1. Mount equipment assemblies, unless otherwise specified, or shown on the Drawings on a single, heavy-cast-iron or welded steel bedplate.

- 2. The plates shall have a minimum thickness of 1/2 inch.
- C. Equipment Foundations: Equipment foundations shall be as per manufacturer's written recommendations. All mechanical equipment, tanks, and control cabinets shall be mounted on concrete bases as shown on standard structural details. Where shown, adhesive anchors with double nuts for leveling shall be used to anchor equipment bases to concrete bases. Anchor rods, nuts and bolts shall be 316 stainless steel and in conformance with ASTM 167 and ASTM 276.
- D. Shop Drawings: Shop drawings shall be submitted to the Engineer for review in accordance with the requirements of Section 01300. Shop drawings will be considered incomplete unless clear, concise calculations are presented showing equipment anchorage forces and the capacities of the anchorage elements provided by the Contractor.

2.3 PIPE HANGERS, SUPPORTS, AND GUIDES

All pipe connections to equipment shall be supported, anchored, and guided to avoid stresses and loads on equipment flanges and equipment. Supports and hangers shall be in accordance with Section 15020.

2.4 FLANGES AND PIPE THREADS

All flanges on equipment and appurtenances provided under this Section shall conform to ANSI B16.1, Class 125 unless otherwise indicated. All pipe threads shall be in accordance with ANSI/ASME B1.20.1, and with requirements of Section 15000.

2.5 BOLTS AND FASTENERS FOR PIPING

Bolts and pipe fasteners for exposed ferrous piping shall conform to Section 15000 and Section 05500.

2.6 FLEXIBLE CONNECTORS FOR EQUIPMENT

- A. Flexible connectors shall be installed in all piping connections to engines, blowers, compressors, and other vibrating equipment and in piping systems to accommodate slight angular misalignment, parallel misalignment, end float, and to cushion shock loads in accordance with Section 15000.
- C. The Contractor shall have the equipment manufacturer select or recommend the size and type of coupling required to suit each specific application.
- D. Couplings shall be keyed to the shaft. Keys, keyways, and fits shall conform to ISO/R773. Flexible couplings with cylindrical bores shall have interference fits as specified in ISO/R286. Coupling hubs shall be furnished with tapped puller holes.
- E. Where universal type couplings are specified, they shall be of the needle bearing type construction, equipped with commercial type grease fittings.

2.7 V-BELT DRIVES

- A. V-belts and sheaves shall be of the best commercial grade and shall conform to ANSI, MPTA, and RMA Standards.
- B. Unless otherwise indicated, sheaves shall be machined from the finest quality gray cast iron.
- C. All sheaves shall be statically balanced. In some applications where vibration is a problem, sheaves shall be dynamically balanced. Sheaves operating at belt speeds exceeding 6,500 fpm may be required to be of special materials and construction.
- D. To facilitate installation and disassembly, sheaves shall be furnished complete with taper-lock or QD bushings as required.
- E. Finish bored sheaves shall be furnished complete with keyseat and set screws.
- F. Sliding motor bases shall be provided to adjust the tension of V-belts.

2.8 DRIVE GUARDS

All power transmission, prime movers, machines, shaft extensions, and moving machine parts shall be guarded to conform with the OSHA Safety and Health Standards (29CFR1910, as adopted and amended by the State of California). The guards shall be constructed of minimum 10-gauge expanded, flattened steel with smooth edges and corners, galvanized after fabrication and securely fastened. Where required for lubrication or maintenance, guards shall have hinged and latched access doors.

2.9 GASKETS AND PACKINGS

Gaskets shall be in accordance with the requirements of Section 15000. Gaskets containing asbestos will not be permitted.

2.10 NAMEPLATES

Equipment nameplates of Type 316 stainless steel shall be engraved or stamped and fastened to the equipment in an accessible location with No. 4 or larger oval head Type 316 stainless steel screws or drive pins. Nameplates shall contain the manufacturer's name, model, serial number, size, characteristics, and appropriate data describing the machine performance ratings.

2.11 SAFETY REQUIREMENTS

Where Work areas are located within a flammable or toxic gas environment, suitable gas detection, ventilating, and oxygen deficiency equipment shall be provided. Workers shall be equipped with approved breathing apparatus.

2.12 OVERLOAD PROTECTION

A. General: Unless otherwise indicated in individual equipment Sections, all equipment drives incorporating overload protection shall be provided with an overload protection device as follows:

- 1. Mechanical System: The overload protection shall be a mechanical device to provide for reliable protection in the event of excessive overload. It shall be a ball detent type designed for long term repeatability and life. It shall be infinitely adjustable by a single adjusting nut. Once set it shall be tamperproof, and incorporate a torque monitoring and control system. It shall activate an alarm set for 85 percent, and a motor cutout switch set for 100 percent of maximum continuous running torque. A visual torque indication shall be provided and oriented so that it may be read from the walkway. The dial shall be calibrated from 0 to 100 percent of maximum continuous running torque. The design of the torque limiter should initiate the mechanical disengagement of the drive upon overload. Each unit shall be suitable for outdoor/corrosive environments with a protective finish, corrosion inhibiting lubricants and a Type 316 stainless steel cover.
- Electronic System: As an alternative to the mechanical system, the overload protection may be an Electronic Torque Monitoring Control System capable of displaying torque, rpm's, one level of overload, and two levels of overload of the drive system. It shall incorporate a time-delay for start-up and a voltage monitoring and compensation circuit for up to <u>+</u>15 percent variation.
- 3. The overload device shall be housed in an enclosure with NEMA rating in accordance with the area designations of Section 16100. A visual torque dial shall be provided and oriented so that it can be easily read from the walkway.
- 4. The torque monitoring system shall be calibrated to: alarm and shut down the system in the event the torque drops to 50 percent of normal running; alarm at 85 percent of maximum continuous running torque and shut down the motor at maximum continuous running torque of the equipment. The system shall be calibrated at the factory of the equipment manufacturer and it shall be capable of monitoring twice the maximum continuous running torque of the equipment.
- B. Manufacturers, or approved equal:
 - 1. American Autogard Corporation.

PART 3 – EXECUTION

3.1 **PROTECTION**

- A. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling and storage in accordance with the manufacturer's recommendations.
 - 1. Protect equipment from exposure to the elements. Keep thoroughly dry and clean at all times.

SECTION 11000 – EQUIPMENT GENERAL PROVISIONS

- 2. Store blowers, motors, electrical equipment, and other equipment having anti-friction or sleeve bearings in weathertight storage facilities such as warehouses. Turn shafts during storage as recommended by the manufacturer to prevent bearing set.
- 3. Clean and restore all materials and equipment showing evidence of rust, dirt contamination, or other surface or subsurface deterioration to the Engineer's satisfaction before installation.
- B. Protect painted surfaces against impact, abrasion, discoloration, and other damage.
 - 1. Repaint and repair damaged surfaces to the satisfaction of the Construction Manager before acceptance in accordance with the requirements of Section 09900.
- C. Protect electrical equipment, controls, and insulation against moisture or water damage.
- D. The Contractor shall maintain equipment storage facilities in accordance with the provisions of Section 01600.
- E. Store all equipment in the designated storage facilities from delivery until installation.
- F. Periodically exercise all mechanical equipment, whether in the Contractor's designated storage facility before final installation, or whether installed but not yet placed into service or accepted by the Owner, in accordance with procedures prescribed by each manufacturer.

3.2 EQUIPMENT INSTALLATION

- A. Install all equipment in full accordance with the equipment manufacturer's recommendations and good practice.
 - 1. Where specified in other sections of this specification, factory-trained service personnel shall be on-site to supervise the installation.
 - 2. Sufficient notice shall be given to the Engineer before equipment installation in order that the Engineer or his representative may be present during installation.
- B. General installation requirements:
 - 1. Examine equipment for damage in shipping and handling. The examination shall include checking for corrosion, poor workmanship, dirt or deleterious substances, and poor fits.
 - 2. Level the base plate or bedplate.
 - 3. Install equipment.

- 4. Check alignment of couplings.
- 5. If grout has been used, check alignment and levelness after the grout has set.
- 6. Check direction of rotation and correct, if necessary, to insure proper operation.
- 7. Ensure that all submerged or intermittently submerged powered equipment does not have power and control cable splices of any kind inside wells or pits.
- 8. Include oil and grease for equipment lubrication in initial operation.

3.3 PLACING EQUIPMENT IN OPERATION

- A. Before being placed in operation, equipment shall be inspected by the manufacturer's factory-trained personnel.
 - 1. Correct all defects discovered during this inspection before initial equipment start-up.
 - 2. Remove internal coatings applied at the factory if required.
 - 3. Lubricate equipment per manufacturer's recommendations and ensure operating levels are correct.
- B. Conduct full-load operations test in the presence of the Construction Manager and the results of such tests shall be recorded.
 - 1. Unsatisfactory performance shall be corrected and tests shall be repeated until the equipment performance meets the Specifications.
 - 2. The Contractor shall furnish all power, materials, services, test equipment and labor required to successfully complete all full load equipment testing specified.
 - 3. The Contractor shall certify in writing to the Engineer, in triplicate, that all tests were conducted in accordance with these Specifications and that all components within each system successfully function as required.
- C. The Contractor shall notify the Construction Manager seven (7) calendar days in advance of the time when the equipment will be placed into operation.
- D. During the course of initial operation, the Contractor shall instruct the Owner's personnel in the proper operation and maintenance of the equipment, as specified herein.

3.4 COUPLINGS

SECTION 11000 - EQUIPMENT GENERAL PROVISIONS

A. The Contractor shall have the equipment manufacturer select or recommend the size and type of coupling required to suit each specific application; installation shall be per equipment manufacturer's printed recommendations.

3.5 INSULATING CONNECTIONS

A. All insulating connections shall be installed in accordance with the manufacturer's printed instructions.

3.6 PIPE HANGERS, SUPPORTS, AND GUIDES

A. Hangers, supports, seismic bracing and guides shall be spaced in accordance with Section 15020.

3.7 PACKAGED EQUIPMENT

A. When any system is furnished as pre-packaged equipment, the Contractor shall coordinate with subcontractors all necessary space and structural requirements, clearances, utility connections, signals, and outputs.

3.8 INSTALLATION CHECK

- A. Provide an experienced, competent, and authorized representative of the manufacturer or supplier of each major item of equipment to check, adjust if necessary, and approve the equipment installation.
 - 1. In each case, the equipment supplier's representative shall be present when the equipment is placed in operation.
 - 2. The Contractor shall have the equipment supplier's representative revisit the job site as often as necessary until all problems are corrected and the equipment installation and operation is satisfactory to the Construction Manager.
- B. Each equipment supplier's representative shall furnish through the Contractor, a written report certifying that the equipment:
 - 1. Has been properly installed and lubricated;
 - 2. Is in accurate alignment;
 - 3. Is free from all stress imposed by connecting piping or anchor bolts;
 - 4. Has been operated successfully under full load conditions for a 24-hour Period without interruption; and
 - 5. Is ready for continuous operation under specified conditions.
- C. Equipment manufacturers shall furnish the services of competent, factory-trained personnel during the warranty period specified to inspect, service, and repair the equipment where required.

SECTION 11000 – EQUIPMENT GENERAL PROVISIONS

- 1. Service requests shall be answered and acted upon promptly.
- 2. This requirement shall not include normal maintenance and service of equipment, which will be the responsibility of the Owner.
- D. All costs for this work shall be included in the price bid by the Contractor.

END OF SECTION
PART 1 – GENERAL

1.1 DESCRIPTION

A. This section includes all labor, material, tools, incidentals, and equipment necessary to furnish, install, test and place in operation dry-pit submersible pumps/motors as specified herein and as shown on the Contract Drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01043 Coordination with District's Operation
- B. Section 01300 Record Drawings and Submittals
- C. Section 01660 Systems Start-up and Testing
- D. Section 01730 Operation and Maintenance Data
- E. Section 09900 Painting and Coating
- F. Section 09961 Fusion Bonded Epoxy Coatings and Linings OMWD Standard Specifications
- G. Section 11000 Equipment General Provisions
- H. Division 15 Mechanical
- I. Section 16920 Motor Control Center
- J. Division 17 Instrumentation and Controls

1.3 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

A. Except as otherwise indicated, the current editions of the following standards apply to the work of this Section:

1. ANSI	/ASME B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
2. ANSI	/ASME B16.5	Pipe Flanges and Flanged Fittings Dimensions
3. ANSI	/IEEE 112	Test Procedure for Polyphase Induction Motors and Generators
4. ANSI	/IEEE 115	Test Procedure for Synchronous Machines
5. ANSI,	/NEMA MG 1	Motor and Generator
6. ANSI	/NEMA MG 12.53	Motor Testing
7. ASTN	M A278	Gray Iron Castings for Pressure-Containing
4S RANCH NBHD1 SPS REP	LACEMENT PROJECT	SEWAGE PUMPS AND MOTORS SECTION 11060 - 1 OF 7

SECTION 11060 - SEWAGE PUMPS AND MOTORS

Parts for Temperatures Up to 650°F

8.	ASTM A395	Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures
9.	ASTM B62	Composition Bronze or Ounce Metal Castings
10.	ASTM B584	Copper Alloy Sand Castings for General Applications
11.	Hydraulic Institute, Inc. (HI)	Test Code for Centrifugal Pumps

1.4 SUBMITTALS

- A. The following shop drawings and data for all pumps, motors, and variable frequency drives shall be submitted in accordance with Section 01300:
 - 1. Name of manufacturer and type or model. Submit manufacturer's catalog data, dimensions, and materials of construction by ASTM reference and grade and information on linings and coatings.
 - 2. Pump performance curves showing head, capacity, horsepower demand, and pump efficiency over the entire operating range of the pump. Pump manufacturer shall indicate the design operating conditions and requirements on the performance curves. The performance curve shall show the limits of operation without cavitation or excessive vibration.
 - 3. Manufacturer's written certification that pumping units are suitable for the in-series pumping conditions described in the Contract Documents.
 - 4. Manufacturer's catalog data shall include dimensions, motor weight, nominal horsepower, NEMA design, enclosures, frame size, winding insulation class, voltage, phase, and frequency ratings, service factor, full load current at rated horsepower for application voltage, fUI load speed, minimum full load efficiency, nominal efficiencies at ½ and ¾ loads, power factor at ½, ¾, and full load, and bearing data with recommended lubricants if applicable.
 - 5. Outline drawings showing pump, motor, drive, couplings, drive arrangement.
 - 6. Complete electrical schematic diagrams.
 - 7. Installation, check out instructions and initial start-up procedures.
 - 8. Wiring, control schematics, and control logic diagrams.
 - 9. Manufacturer's certification of proper installation shall be submitted.

B. Operation and maintenance information shall be submitted on all pumps in accordance with Section 01730.

1.5 QUALITY ASSURANCE

A. The pumps shall be new and of current manufacture. No pump shall be purchased for use on the project prior to the return of approved shop drawings submitted by the Contractor pursuant to the provisions of Section 01300.

1.6 WARRANTY

A. The Manufacturer shall provide a five-year pro-rated warranty with no run time limit for the pump/motor.

PART 2 – PRODUCTS

2.1 GENERAL

- A. The Contractor shall provide, install and test dry-pit submersible pumping units complete with electric motors and all accessories, controls and appurtenances as shown in the plans and specified herein or as required for a complete and operable pumping system. One additional pump of the specified capacity shall be provided for use as a spare. Each pumping unit shall be rated for the operating conditions:
 - 1. Duty Point: 840 gpm @ 130 feet TDH
- B. The design of each pumping unit shall be identical and each shall suitable for use in series pumping as shown on the Contract Drawings. Submit manufacturer's certification that pumping units supplied are suitable for the in-series pumping conditions in which they are installed.
- C. The submersible pumping units shall be self-contained, integral pump/motor units designed to operate at continuous full load in a dry-pit condition.
- D. Minimum pump efficiency shall be 66%.

2.2 PUMP/MOTOR COMPONENTS

- A. Major pump components such as volute, front head, and lower bearing housing shall be ductile iron A395 60-40-18, with smooth surfaces devoid of blow holes or other irregularities. Flanges shall be rated 250lbs. The lifting handle shall be of stainless steel. All exposed nuts or bolts shall be AISI type 316 stainless steel construction. All metal surfaces coming into contact with the wastewater shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.
- B. Each of the sewage pumps and motors shall be suitable for the high pressure condition of the second pump in the pumps-in-series trains. If a spare pump is

SECTION 11060 - SEWAGE PUMPS AND MOTORS

purchaes, it too, shall be suitable for the high pressure condition. The intent is that all purchased pumps be interchangeable.

- C. Volute: The pump volute shall be a single piece ductile iron A395 60-40-18, nonconcentric design with smooth passages of sufficient size to pass solids that may enter the impeller. Minimum inlet and discharge size shall be as shown on the drawings and specified herein. The volute shall have a replaceable suction cover wear ring in which are cast spiral-shaped, sharp-edged groove(s) or wear ring/liner. The wear rings shall be hardened 400 stainless steel series and provide effective sealing between the impeller and the volute housing.
- D. Suction Elbow: The pump suction elbow shall be made of ductile iron A395 60-40-18, with smooth surfaces devoid of blow holes or other irregularities. The suction elbow shall have an inspection cover/service hatch.
- E. Pump Shaft: Pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The shaft shall be 416 stainless steel or stainless-steel ASTM A479 S43100-T.
- F. Impeller: The impeller shall be constructed of close-grained cast iron, with nonclog design. Impellers shall be statically and dynamically balanced. The impeller shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in waste water.
- G. Bearings: The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two-row angular contact bearing to compensate for axial thrust and radial forces. The minimum L_{10} bearing life shall be 50,000 hours at any usable portion of the pump curve.
- H. Mechanical Seal: Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall have one stationary and one positively driven rotating, corrosion and abrasion resistant tungsten-carbide vs silicon carbide seal face. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall have one stationary and one positively driven rotating, corrosion and abrasion resistant tungsten-carbide vs silicon carbide seal face.
- I. Shaft Seal: Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load.
- J. The cable entry seal design shall insure a watertight and submersible seal. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be separated

SECTION 11060 - SEWAGE PUMPS AND MOTORS

by a stator lead sealing gland or terminal board, which shall isolate the interior from foreign material gaining access through the pump top.

- K. Motor: The pump motor shall be an explosion proof, NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty handling pumped media of 40°C (104°F) and capable of no less than 10 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 125°C (260°F) shall be embedded in the stator end coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The junction chamber containing the terminal board, shall be hermetically sealed from the motor by an elastomer compression seal. Connection between the cable conductors and stator leads shall be made with threaded compression type binding posts permanently affixed to a terminal board.
- L. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C. A performance chart shall be provided upon request showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out. The motor shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.
- M. Power Cable: The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater. The Contractor shall supply an appropriate length of cable for the cable to reach from the pump to its disconnection box and other electrical equipment. No splicing of cable shall be allowed in the field.
- N. Manufacturers: Fairbanks Nijhuis, Flygt, or District approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. All pumps, motors, and drives shall be installed in accordance with the manufacturer's written recommendations submitted and approved with the shop drawings and in accordance with the Contract Documents.
- B. The manufacturer's authorized service representative shall visit the site for up to 2 days to complete the following and to certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted, and readied for operation.
 - 1. Witness the proper installation of the equipment.
 - 2. Witness the inspection, checking, and adjusting the equipment.
 - 3. Witness startup and field testing operations.
 - 4. Instruct the Owner's personnel in the operation and maintenance of the equipment, including step-by-step troubleshooting with necessary test equipment. Instruction and materials shall be specific to the models of equipment provided. The representative shall have at least two (2) years' experience or training with equipment provided.

3.2 PUMP TESTING

- A. Inspection and Testing Costs: The Contractor shall be responsible for all costs associated with inspection and testing of materials (including witness testing), products, or equipment at the place of manufacture. Provide for one Owner's Representative to visit each factory for factory-witness testing.
- B. Pump performance testing shall be completed in accordance with applicable Hydraulic Institute standards. The acceptance Grade shall be 1E in accordance with ANSI/HI 14.6.
- C. Field Tests
 - 1. The Contractor shall be responsible for field testing all pumps after installation to demonstrate satisfactory operation. Field testing shall be witnessed by a representative of the Owner. The Contractor shall notify the Owner 5 days in advance of the field tests. After each pumping system has satisfied the requirements, the Contractor shall certify in writing that it has been satisfactorily tested and that all final adjustments have been made. Certification shall include the date of the field tests, a listing of all persons present during the tests, and the test data. The Contractor shall bear all costs of field tests, including related services of the Manufacturer's representative, except for power and water, which the Owner will bear.
- C. Acceptance Testing

SECTION 11060 - SEWAGE PUMPS AND MOTORS

- 1. The Contractor shall run the pump station including controls for up to 30 days to demonstrate proper operation. The Contractor shall bear all costs of field tests, including related services of the Manufacturer's representative, except for power and water, which the Owner will bear.
- D. In the event of failure of any pump to meet any of the above requirements or efficiencies, the Contractor shall make all necessary modifications, repairs, or replacements to conform to these specifications at no additional compensation from the Owner.

END OF SECTION

SECTION 11295 – SLUICE AND WEIR GATES

PART 1 – GENERAL

1.1. DESCRIPTION

- A. Furnish all labor, material, tools, incidentals, and equipment necessary to procure and install all sluice gates as specified herein and as shown on the Contract Drawings.
- B. Gate Schedule:

Gate ID	Gate Type	Size (W X H)	Invert Elevation	Operating Floor Elevation	Head*	Mounting
		(in x in)	(ft)	(ft)		
Wet Well Overflow	Slide	24 x 24	403.00	421.50	S	Face Mount

*Unseating (U), Seating (S)

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 01660 Systems Start-up and Testing
- C. Section 01730 Operation & Maintenance Manuals
- D. Section 11000 Equipment General Provisions
- E. Division 15 Mechanical

1.3 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

- A. Except as otherwise indicated, the current editions of the following standards apply to the work of this Section:
 - 1. AWWA C561 Fabricated Stainless Steel Slide Gates

1.4 SUBMITTALS

- A. Manufacturer's catalog information and data, dimensional data and materials of construction by ASTM reference and grade.
- B. General arrangement drawings
- C. Manufacturer's certification of proper installation shall be submitted.
- D. Contractor's certification of satisfactory field testing shall be submitted.
- E. Operation and Maintenance manual in compliance with Section 01730.

1.5 QUALITY ASSURANCE

- A. The sluice and weir gates specified in this section shall be furnished by and be the product of one manufacturer.
- B. Manufacturer shall have installations of like or similar application with a minimum of 5 years of service in a similar environment.
- C. Gates are to be engineered and manufactured under the certification of ISO-9001, or the manufacturer's in-house sluice/slide gate quality assurance manual.

1.6 **PERFORMANCE**

- A. Leakage
 - 1. Sluice gates shall be substantially water tight under the design head conditions. Under the design unseating head, the leakage for heads of 20 feet or less shall not exceed 0.05 gallon per minute per foot of perimeter.
- B. Design Head
 - 1. The sluice gates shall be designed to withstand the design head shown in the gate schedule.
- C. Seal Performance Test
 - 1. The gate's sealing system should have been tested through a cycle test in an abrasive environment and should slow that the leakage requirements are still obtained after 100,000 cycles with a minimum deterioration.

PART 2 – PRODUCTS

2.1 GENERAL

A. Gates shall be non self-contained of the non-rising stem configuration as indicated on the Drawings.

2.2 SLUICE GATE

- A. Frame
 - 1. The gate frame shall be constructed of structural members or formed plate welded to provide a rigid one-piece frame. The guide slot shall be made of UHMWPE.

- B. Slide
 - 1. The slide shall consist of a flat plate reinforce with formed plates or structural member to limit its deflection to 1/720 of the gates' span under the design head.
- C. Guides and Seals
 - 1. The guides shall be made of UHMWPE (ultra-high polyethylene of the selfadjusting type. A continuous compression cord shall ensure contact between of the IUHWMPE guide and the gate in all positions. The sealing system shall maintain efficient sealing in any position of the slide and allow the water to flow only in the opened part of the area.
 - 2. The bottom seal shall be made of resilient neoprene set into the bottom member of the frame and shall form a flush-bottom.
- D. Stem and Couplings
 - 1. The operating stem shall be of stainless steel designed to transmit in compression at least 2 times the rated output of the operating manual mechanism with a 40 lbs effort on the crank. The stem shall have a slenderness ratio (L/r) less than 200. The threaded portion of the stem shall have machined cut threads of the Acme type. The stem design shall not be less than 1.25 times the output thrust of the portable actuator electric motor in the stalled condition. For stems in more than one piece the different solid sections shall be joined together by stainless steel couplings. The couplings shall be grooved and keyed and shall be of greater strength than the stem.
- E. Stem Guide
 - 1. Stem guides shall be fabricated from type 316L stainless steel. The guide shall be equipped with UHMPE bushing. Guides shall be adjustable and spaced in accordance with the manufacturer's recommendation the L/r ratio shall not be greater than 200.
- F. Lift Nut
 - 1. The Lift Nut shall be bronze in accordance with ASTM B584 (CA 863, CA 865) or ASTM B505 (UNS C95800).

SECTION 11295 – SLUICE AND WEIR GATES

2.4 MATERIALS OF CONSTRUCTION

Frame, stem guides, slide, stem extension	Stainless steel ASTM A-240 type 316L
Side seals, stem guide liner	Ultra-high molecular weight polyethylene (UHMWPE) ASTM D2 4020
Compression cord	Nitrile ASTM D2000 M6BG 708, A14, B14, E014, E034
Bottom seal	Neoprene ASTM D2000 Grade 2 BDC 510
Threaded stem	Stainless steel ASTM A-240 type 316L
Fasteners	Stainless steel ASTM A-240 type 316L
Gasket	EDPM ASTM 1056
Couplings	Stainless steel ASTM A-240 type 316L
Lift nut	Bronze ASTM B584 (CA 863, CA 865) or ASTM B505 (UNS C95800)

2.5 MANUFACTURERS

A. Waterman, Fontaine, or District approved equal.

PART 3 – EXECUTION

3.1 GENERAL

A. Gates and appurtenances shall be handled and installed in accordance with the manufacturer's recommendations.

3.2 FIELD TESTING

- A. Following the completion of each gate installation, the gate shall be operated through at least two complete open/close cycles.
- B. Gates shall pass the leakage requirements found in Part 1.
- C. Gates and appurtenances shall be handled and installed in accordance with the manufacturer's recommendations.

END OF SECTION

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. This section includes materials, testing, and installation of a surge control system. The system will include both new materials and the existing surge tank and air compressor provided by the Owner. The Contractor shall be responsible for supplying a Surge System Control Panel and all other materials required to accomplish all functions applicable to the surge control system in order to protect the pump station, discharge, and suction piping from transient surges.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 09900 Painting and Coating
- C. Section 15000 Piping Components
- D. Section 15132 Pressure Gauges

1.3 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300:
 - 1. Submit layout drawings showing dimensions of equipment and accessories. Provide piping diagram showing configuration and location of all valves and appurtenances.
 - 2. Submit manufacturer's data for Surge System Control Panel.
 - 3. Submit manufacturer's catalog data on gages and valves.

1.4 MANUFACTURER'S SERVICES

- A. Provide equipment manufacturer's services at the jobsite for a minimum of two man-days to perform the following list, travel time excluded:
 - 1. Installation assistance and inspection of surge control system.
 - 2. Field testing and adjustment of the surge control system operations.
 - 3. Instruct the Owner's personnel in the operation and maintenance of the surge control system.

1.5 MANUFACTURERS

A. The Surge System Control Panel manufacturer shall be experienced in the design and operation of surge control systems. The control panel shall be supplied by PULSCO, or Owner approved equal.

1.6 EQUIPMENT WARRANTY

A. Provide equipment warranty for a period of one year following Owner's acceptance. The supplier shall guarantee all new equipment items against defects in materials and workmanship. Repairs and/or replacement of defective items shall be performed at no cost to the Owner.

PART 2 – MATERIALS

2.1 GENERAL

- A. The Owner will provide the existing vertical surge tank (pressure vessel) and existing air compressor. The Contractor shall inspect the equipment at the site to determine what rehabilitation is required to return the equipment to operating condition. At a minimum the Contractor shall perform the following:
 - 1. Surge Tank
 - a. Remove all connections from the existing surge tank and remove tank from its foundation.
 - b. Verify the internal condition of the tank. If any damage, corrosion, or defects are found, notify the Owner immediately.
 - c. Pressure test tank.
 - d. Remove and reapply the internal lining in accordance with Section 09900, System No. 5.
 - e. Remove and reapply coating in accordance with Section 09900, System No. 15.
 - f. Reinstall tank where shown on the drawings.
 - g. Install new piping, valves, gages, and appurtenances as shown on the drawings.
 - 2. Air Compressor
 - a. Inspect motor, mechanical components, and air tank. If damage, corrosion, or defects are found, notify the Owner immediately.
 - b. Repair damaged coatings, as required.
 - c. Perform regular maintenance activities as recommended by the manufacturer.
 - d. Install temporary piping and appurtenances as necessary, and test air compressor's operation under proposed operating conditions.
- B. The Contractor shall provide a new Surge System Control Panel in accordance with the requirements herein and test the entire Surge Control System together prior to testing with the pump station. The Contractor is responsible for providing an operational Surge Control System based upon the requirements herein and the Contract Documents.

2.2 HYDRAULIC DESIGN CRITERIA

A. The system for which the surge control system is to be provided consists of a sewage pump station and associated discharge pipeline system. All final hydraulic

SECTION 11400 - SURGE CONTROL EQUIPMENT

design criteria shall be per the project pressure surge analysis report available for review for reference purposes only.

2.3 PRESSURE VESSEL

- A. The Contractor shall rehabilitate and install the existing Owner provided surge tank.
- B. Existing connections which are not required for operation shall be plugged.
- C. The tank shall have a concrete foundation and be anchored as shown on the structural drawings.
- D. The tank is to be connected to a drain line and the discharge pipeline as shown on the drawings.

2.3 SAFETY RELIEF VALVE

A. Safety relief valve shall comply with the ASME Boiler and Pressure Vessel Code. Valve shall be bronze and shall have a pressure rating of 400 psig WOG. Valve shall have a bottom NPT inlet and shall have incorporated a calibrated spring set to allow the valve to open at the vessel design pressure. Valve shall be a Kunkle Model 913 or approved equal.

2.4 PRESSURE GAUGES

A. See Section 15132.

2.5 SURGE SYSTEM CONTROL PANEL

- A. The surge system control panel shall operate the air compressor and solenoid valves to fill or draw air in the surge tank based upon pressure and level signals from tank to maintain the liquid level. See drawings for configuration of piping, valves, gages, and appurtenances.
- B. The surge control system PLC control panel shall be in a NEMA 4X UL Listed wall mounted enclosure. The enclosure shall be mounted near the air compressor as shown on the Contract Drawings.
- C. The PLC control panel will be equipped with a door mounted digital display for continuous indication of liquid volume and corresponding liquid level in real time, and all required level control and alarm set points, including air compressor running status, compressor fail alarm, and low oil level alarm.
- D. The level control system is based upon an ultrasonic level sensor with 4-20mA output and backed up by a differential pressure transmitter with 4-20mA signal proportional to level outputs.
- E. The level control system shall include a solenoid valve on the air supply piping to recharge the surge vessel.

F. The control panel shall connect to the station PLC and the District's SCADA system and provide the same remote monitoring and control functionality as is available locally at control panel.

PART 3 – EXECUTION

3.1 PAINTING AND COATING

- A. Apply coating at shop and test for pinholes or "holidays" prior to reinstallation.
- B. Apply primer at shop. Finish paint shall be field applied by Contractor in accordance with Section 09900.

3.2 CONTROL DESCRIPTION

- A. The surge control system shall automatically maintain the liquid level (liquid to air ratio) in the surge vessel.
- B. Surge Tank System
 - 1. The Surge System Control Panel shall monitor the level signal sent by the level sensor/differential pressure transmitter and use that to initiate air charging of the surge vessel.
 - a. Under steady state or no flow conditions, the surge vessel shall contain 65% air, equivalent to liquid level [x], to be determined during installation.
 - b. If the liquid level in the surge vessel increases to [x] above steady state, the surge tank control panel shall signal the solenoid valve to open. Time delays shall be used to prevent air additions during minor fluctuations that last a short period of time. The valve shall remain open until the liquid level is at steady state, at which time the surge tank control panel shall signal the solenoid valve to close.
 - c. If the liquid level in the surge vessel falls to [x] below the steady state, air shall be automatically vented from the surge vessel. Time delays shall be used to prevent air venting during minor fluctuations that last a short period of time.
- C. Air Compressor System
 - 1. The air compressor control panel shall monitor and automatically the air pressure in the air receiver at the design pressure, provided its H-O-A switch is in the AUTO position. When in the HAND position, the air compressor shall run continuously. When in the OFF position, the compressor shall not operate.
 - a. If the pressure in the air receiver falls [x] psi below the design pressure, the air compressor shall automatically start. The compressor shall operate until the air receiver reaches the design pressure.

SECTION 11400 - SURGE CONTROL EQUIPMENT

b. The compressor shall be shutdown by the motor thermal overload, or low oil level. An alarm condition shall energize a local alarm light, which shall be monitored by the Surge System Control Panel.

3.2 FIELD TESTING

A. Test the surge control system by simulating a power outage with all duty pumps in operation. Attach pressure detector with strip chart recorder to record maximum and minimum surge pressures at the pump station. Results of all testing shall be provided to the Engineer prior to final acceptance.

END OF SECTION

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PART 1 – GENERAL

1.1 DESCRIPTION

This section includes all labor, material, tools, incidentals, and equipment necessary to furnish and install submersible non-clog pumps and motors as specified herein and as shown on the Contract Drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Submittals
- B. Section 01730 Operation and Maintenance Data
- C. Section 09900 Painting and Coating
- D. Section 11000 Equipment General Provisions
- E. Section 15000 Piping Components

1.3 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

A. Except as otherwise indicated, the current editions of the following standards apply to the work of this Section:

1.	ANSI/ASME B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
2.	ANSI/ASME B16.5	Pipe Flanges and Flanged Fittings Dimensions
3.	ANSI/IEEE 112	Test Procedure for Polyphase Induction Motors and Generators
4.	ANSI/IEEE 115	Test Procedure for Synchronous Machines
5.	ANSI/NEMA MG 1	Motor and Generator
6.	ANSI/NEMA MG 12.53	Motor Testing
7.	ASTM A278	Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650°F
8.	ASTM A395	Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures
9.	ASTM B62	Composition Bronze or Ounce Metal Castings
10.	ASTM B584	Copper Alloy Sand Castings for General Applications

SECTION 11600 – SUBMERSIBLE PUMPS AND MOTORS

11. Hydraulic Institute, Inc. (HI) Test Code for Centrifugal Pumps

1.4 SUBMITTALS

- A. The following shop drawings and data for all pumps and motors shall be submitted in accordance with Section 01300:
 - 1. Name of manufacturer and type or model. Submit manufacturer's catalog data, dimensions, and materials of construction by ASTM reference and grade and information on linings and coatings.
 - 2. Pump performance curves showing head, capacity, horsepower demand, net positive suction head required, and pump efficiency over the entire operating range of the pump. Pump manufacturer shall indicate the design operating conditions and requirements on the performance curves. The performance curves shall cover maximum diameter, rated and minimum diameter impellers. All performance curves shall show the limits of operation without cavitation or excessive vibration.
 - 3. Manufacturer's catalog data shall include dimensions, motor weight, nominal horsepower, NEMA design, enclosures, frame size, winding insulation class, voltage, phase, and frequency ratings, service factor, full load current at rated horsepower for application voltage, full load speed, minimum full load efficiency, nominal efficiencies at ½ and ¾ loads, power factor at ½, ¾, and full load, and bearing data with recommended lubricants if applicable.
 - 4. Outline drawings showing pump, motor and couplings.
 - 5. Complete electrical schematic diagrams.
 - 6. Installation and check out instructions including leveling, alignment, grouting, lubrication, and initial start up procedures.
 - 7. Wiring, control schematics, and control logic diagrams.
 - 8. The Contractor shall submit signed, dated, and certified factory test data for each pump system prior to shipment of equipment showing that the equipment is in compliance with the Contract Documents.
 - 9. Manufacturer's certification of proper installation shall be submitted.
 - 10. Contractor's certification of satisfactory field testing shall be submitted.
- B. Operation and maintenance information shall be submitted on all pumps in accordance with Section 01730.

1.5 QUALITY ASSURANCE

- A. The pumps shall be new and of current manufacture. No pump shall be purchased for use on the project prior to the return of approved shop drawings submitted by the Contractor pursuant to the provisions of Section 01300.
- B. The Contractor shall be responsible for the satisfactory operation of the pumping units under the specified operating conditions, and all necessary propellers, baffles, vanes, and appurtenances furnished with the pumping units.
- C. The pump manufacturer shall be responsible for all components and for the satisfactory installation and operation for a completely assembled unit, including the motor and pump.

PART 2 – MATERIALS

2.1 GENERAL

- A. The pump manufacturer shall be responsible for all components and for the satisfactory installation and operation for a completely assembled unit, including the pump, motor and any driven machinery. All components of each pump system provided shall be entirely compatible. Each pumping system shall include all mechanisms, couplings, motors, controls, mountings, appurtenances, and all other items necessary for a complete and operable pumping system in accordance with the Contract Documents.
- B. Unless otherwise indicated, the pump and motor shall be provided as one unit from a single manufacturer. Where two or more pump systems of the same type, size, and operating points are required, the systems shall be identical and provided by the same manufacturer. The supplier shall examine the site conditions, intended applications, and operation of the pumping system to verify that the pumping system satisfies the requirements set forth in the Contract Documents.
- C. The required horsepower at any point on the specified operating points shall not exceed the rated nameplate horsepower of the motor or engine.
- D. The pump rated and normal flows shall straddle the pumps best efficiency point (BEP).
- E. All pumps and motors shall be equipped with type 316 stainless steel nameplates indicating serial numbers, manufacturer's name and model number. Nameplates for pumps shall also contain rated head and flow, impeller size, and pump speed. Nameplates for motors shall be engraved with NEMA Standard motor data in conformance with NEMA MG-1-10.40.
- F. All equipment weighing 265 pounds or more shall have suitable lifting eyes for installation and removal.
- G. All single phase 120, 208, 230 V motors shall have integral thermal overload protection or shall be inherently current limited.

- H. All motors greater than 2 hp shall have bearings designed for a minimum rated L-10 life of 10 years or 100,000 hours, whichever comes first. Horizontal motors larger than 2 hp shall be furnished with re-lubricatable ball bearings. Vertical motors larger than 2 hp shall be furnished with re-lubricatable ball, spherical, roller, or plate type thrust bearings. Lubrication shall be per manufacturer's recommendation for smooth operation and long life of the bearings. If water cooling is required for the thrust bearings, cooling water lines shall be provided complete with shut-off valve, strainer, solenoid valve, flow indicator, thermometer, throttling valve and, where subject to freezing, insulation with heat tracing.
- I. All motors shall have a temperature switch with normally closed contact. Switch leads can be in the same connection box as the power leads.

2.2 SUBMERSIBLE SUMP PUMP AND MOTOR

- A. The Contractor shall provide and install submersible sump chopper pumps with enclosed, submersible electric motors and all appurtenances, controls, control panels, complete and operable, in accordance with the Contract Documents.
- B. Construction of sump chopper pumps shall conform to the following requirements:
 - 1. Pump casing: Cast iron
 - 2. Impeller: Ductile iron or bronze
 - 3. Bearings: Permanently lubricated ball and sleeve type
 - 4. Shaft: Stainless Steel
 - 5. Seal: Mechanical, carbon/ceramic
 - 6. Pumps: Lined and coated in accordance with Section 09900
 - 7. Service: Wastewater
- C. Bearings and Lubrication: Bearings shall be capable of carrying all radial and axial loads imposed by the pump and motor and shall be rated to provide a minimum bearing life of 25,000 hours at any design operating point within the allowable operating region. Bearings shall be permanently and continuously lubricated.
- D. Shaft Seals: For motor frame size 180 and above, the inner mechanical seal shall be constructed with a solid block carbon rotating seal face and a solid block silicon carbide stationary seal face. The outer mechanical seal shall be constructed with a solid block silicon carbide rotating seal face and a solid block silicon carbide stationary face. All metal components of the inner and outer seals shall be stainless steel.
- E. Pump: The impeller shall be non-clog vortex, open design and shall have large passages to provide smooth flow transition and unimpeded passage of large

SECTION 11600 – SUBMERSIBLE PUMPS AND MOTORS

spherical solids. Solids passing capability of the impeller offered shall be clearly indicated on the manufacturer's performance curve. The pump shall be capable of passing $\frac{1}{2}$ " spherical solids.

- F. The motors shall be enclosed, suitable for submerged conditions with armored cable and thermal overload protection conforming to the following requirements:
 - 1. Volts: 240
 - 2. Phase: 1
 - 3. Hertz: 60
 - 4. Close-grained cast iron, ASTM A-48, Class 30 or better
- G. Manufacturers, or approved equal.
 - 1. Zoeller.
- H. Control Panel
 - 1. The control panel shall be designed for duplex pump operation in a leadlag sequence. See drawings for configuration of piping, valves, gages, and appurtenances.
 - 2. The PLC control panel shall be in a NEMA 4X UL Listed wall mounted enclosure. The enclosure shall be mounted near the sump as shown on the Contract Drawings.
 - 3. The level monitoring system shall be designed for wastewater service. The system shall have four (4) switches with weights and stainless steel brackets.
 - 4. The control panel shall connect to the station PLC and the District's SCADA system and provide the same remote monitoring functionality as is available locally at the control panel.
 - 5. See Control Description in Paragraph 3.3.

2.3 SUBMERSIBLE CONDITIONING PUMP AND MOTOR

- A. The Contractor shall provide and install a submersible conditioning chopper pumps with enclosed, submersible electric motors and all appurtenances, controls, control panels, complete and operable, in accordance with the Contract Documents.
- B. Construction of conditioning pump shall conform to the following requirements:
 - 1. Casing: Shall be of volute design, spiraling outward to the Class 125 flanged centerline discharge. Casing shall be ductile cast iron with all water passages to be smooth, and free of blowholes and imperfections for good

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flow characteristics. Casing shall include a replaceable Rockwell C 60 alloy steel cutter to cut against the rotating impeller pump-out vanes for removing fiber and debris.

- 2. Impeller: Shall be semi-open type with pump out vanes to reduce seal area pressure. Chopping/maceration of materials shall be accomplished by the action of the cupped and sharpened leading edges of the impeller blades moving across the cutter bar at the intake openings, with a set clearance between the impeller and cutter bar of 0.015-0.025" cold. Impeller shall be cast alloy steel heat treated to minimum Rockwell C 60 and dynamically balanced. The impeller shall be keyed to the shaft and shall have no axial adjustments and no set screws.
- 3. Cutter Bar Plate: Shall be recessed into the pump casing and shall contain at least 2 shear bars extending diametrically across the intake opening to within 0.010-0.030" of the rotating cutter nut tooth, for the purpose of preventing intake opening blockage and wrapping of debris at the shaft area. Chopper pumps utilizing individually mounted shear bars shall not be acceptable. Cutter bar shall be alloy steel heat-treated to minimum Rockwell C 60.
- 4. Cutter Nut: The impeller shall be secured to the shaft using a cutter nut, designed to cut stringy materials and prevent binding using a raised, rotating cutter tooth. The cutter nut shall be cast alloy steel heat treated to minimum Rockwell C 60.
- 5. Upper Cutter: Shall be threaded into the casing or back pull-out adapter plate behind the impeller, designed to cut against the pump-out vanes and the impeller hub, reducing and removing stringy materials from the mechanical seal area. Upper cutter shall be cast alloy steel heat treated to minimum Rockwell C 60. The upper cutter teeth are positioned as closely as possible to the center of shaft rotation to minimize cutting torque and nuisance motor tripping. The ratio of upper cutter cutting diameter to shaft diameter in the upper cutter area of the pump shall be 3.0 or less.
- 6. Pump Shafting: Shafting shall be heat treated alloy steel, with a minimum diameter of 1.5 inches in order to minimize deflection during solids chopping.
- 7. Bearing Housing: Shall be ductile cast iron, and machined with piloted bearing fits for concentricity of all components. Piloted motor mount shall securely align motor on top of bearing housing.
- 8. Thrust Bearings: Shaft thrust in both directions shall be taken up by two back-to-back mounted single-row angular contact ball bearings, or a matched set of face to face tapered roller bearings, with a minimum L-10 rated life of 100,000 hours. Overhang from the centerline of the lower thrust bearing to the seal faces shall be a maximum of 1.7". A third mechanical seal (two in motor) shall also be provided to isolate the bearings from the pumped media. The third seal, as well as the thrust bearings shall be oil

bath lubricated in the bearing housing by ISO Grade 46 oil. Shaft overhang exceeding 1.7 inches from the center of the lowest thrust bearing to the seal faces shall be considered unacceptable.

- 9. Pump Mechanical Seal: The mechanical seal shall be located immediately behind the impeller hub to maximize the flushing available from the impeller pump-out vanes. The seal shall be a cartridge-type mechanical seal with Viton O-rings and silicon carbide (or tungsten carbide) faces. This cartridge seal shall be pre-assembled and pre-tested so that no seal settings or adjustments are required from the installer. Any springs used to push the seal faces together must be shielded from the fluid to be pumped. The cartridge shall also include a 17-4PH, heat-treated seal sleeve and a ductile cast iron seal gland.
- 10. Automatic Oil Level Monitor: An oil level switch shall be mounted at the top of the wet well, with a hose feeding down to the side of the bearing housing to monitor oil level and shut off the motor in event of low oil level. A relay shall be included for mounting in the motor control panel.
- 11. Shaft Coupling: The submersible motor shall be close coupled directly to the pump shaft using a solid sleeve coupling, which is keyed to both the pump and motor shafts. Slip clutches and shear pins between the shaft and the motor are considered unacceptable.
- 12. Stainless Steel Nameplate: Shall be attached to the pump giving the manufacturer's model and serial number, rated capacity, head, speed and all pertinent data.
- 13. Submersible Motor: The submersible motor shall be U/L or FM listed and suitable for Class I, Group C & D, Division I hazardous locations, rated at 5 HP HP, 1800 RPM, 480 Volts, 60 Hertz and 3 phase, 1.15 service factor (1.0 for Continuous In-Air) with Class F insulation. Motor shall have tandem mechanical seals in oil bath and dual moisture sensing probes. Moisture probes must be connected to indicate water intrusion. The lower motor seal shall be exposed only to the lubricant in the pump bearing housing, with no exposure to the pumped media. Motor shall include two normally closed automatic resetting thermostats connected in series and embedded in adjoining phases. The thermostats must be connected per local, state, and/or the National Electric Code to maintain hazardous location rating and to disable motor starter if overheating occurs. Motor frame shall be cast iron, and all external hardware and shaft shall be stainless steel. Motor shall be sized for non-overloading conditions.
- 14. Mounting System: Pump shall be provided with mounting stand allowing relocation of pump via a cable chain. The cable chain shall be attached to the wall of the wet well to facilitate removal and relocation.
- 15. Surface Preparation: Solvent wash and a single coat of Tnemec 431 epoxy applied at 5 MDFT minimum (except motor).

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- C. Manufacturers, or approved equal.
 - 1. Vaughan.
- D. See control description in Paragraph 3.4.

PART 3 - EXECUTION

3.1 GENERAL

- A. All pumps and motors shall be installed in accordance with the manufacturer's written recommendations submitted and approved with the shop drawings and in accordance with the Contract Documents.
- B. The manufacturer's authorized service representative shall visit the site for as long as necessary to complete the following and to certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted, and readied for operation.
 - 1. Witness the proper installation of the equipment.
 - 2. Witness the inspection, checking, and adjusting the equipment.
 - 3. Witness startup and field testing operations.
 - 4. Instruct the District's personnel in the operation and maintenance of the equipment, including step-by-step troubleshooting with necessary test equipment. Instruction and materials shall be specific to the models of equipment provided. The representative shall have at least two year's experience or training with equipment provided.

3.2 PUMP TESTING

- A. Inspection and Testing Costs: The Contractor shall be responsible for all costs associated with inspection and testing of materials (including witness testing), products, or equipment at the place of manufacture. Provide for one District's Representative to visit each factory for factory-witness testing.
- B. Field Tests
 - 1. The Contractor shall be responsible for field testing all pumps after installation to demonstrate satisfactory operation without causing excessive noise, cavitation, vibration, and overheating of the bearings. Proper alignment shall also be verified during field tests to ensure freedom from binding, scraping, shaft runout, or other defects. Field testing shall be witnessed by the District Representative. The Contractor shall notify the Owner 5 days in advance of the field tests. After each pumping system has satisfied the requirements, the Contractor shall certify in writing that it has been satisfactorily tested and that all final adjustments have been made. Certification shall include the date of the field tests, a listing of all

persons present during the tests, and the test data. The Contractor shall bear all costs of field tests, including related services of the Manufacturer's representative, except for power and water, which the Owner will bear.

- 2. The Contractor shall be responsible for field testing all motors to check for any deviation from rated voltage, phase or frequency; or improper installation. The motor shall be checked for proper phase and ground connections. The Contractor shall verify that multi-voltage motors are connected for proper voltage. Winding and bearing temperature detectors and space heaters shall be checked for functional operation. Motors shall be tested for proper rotation before connection to the driven equipment. Insulation shall be tested in accordance with NEMA MG-1. The test voltage shall be 1000 VAC plus twice the rated voltage of the motor.
- D. In the event of failure of any pump to meet any of the above requirements or efficiencies, the Contractor shall make all necessary modifications, repairs, or replacements to conform to these specifications at no additional compensation from the Owner.

3.3 SUMP PUMP CONTROL DESCRIPTION

- A. The PLC shall call the lead pump to start/stop based on the float level sensing system in the sump. The pumps shall operate in a lead/lag sequence. The PLC shall alternate the lead pump based on subsequent stops.
- B. The level set points shall be calibrated in the field. Alarms to SCADA shall occur at the high and high-high level set points.

3.4 CONDITIONING PUMP CONTROL DESCRIPTION

- A. The control panel shall operate the conditioning pump when the station pumps are not operating (during wet well filling).
- B. An HOA switch shall be provided for the pump. When set to 'off', the pump shall not operate. When set to 'hand', the pump shall operate, bypassing control signals. When set to 'Auto', the pump shall operate according to the following control logic.
 - 1. The pump shall turn on after a 30 second delay from the 'stop' call to the station's duty pump group. The pump shall run continuously while the station pumps are off. The pumps shall turn off when the 'start' call is sent to the station's duty pump group.
 - 2. The pump shall stop operation on a station low-low level alarm.

END OF SECTION

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PART 1 – GENERAL

1.1 DESCRIPTION

- A. The Contractor shall furnish all labor, materials and services to design, fabricate, install, and test the underhung crane system as specified herein and in accordance with the Contract Documents. The Contractor shall coordinate all disciplines required to perform the crane system installation.
- B. Installation, 125% field load test, and Cal-OSHA certification and operator training.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 11000 Equipment General Provisions
- C. Section 16010 Basic Electrical Requirements

1.3 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

- A. Definitions of terms used in this Section shall be as used in the Glossary of ANSI MH27.1 as prepared by the Monorail Manufacturers Association (MMA). The latest editions of the following specifications and codes shall be conformed to the extent applicable for the application under consideration:
 - 1. For all equipment: NFPA-70 National Electric Code (N.E.C)
 - 2. For underhung bridge cranes and monorail systems: ANSI B30.11 Safety Standard for Monorails and Underhung Cranes, ANSI MH27.1 Specifications for Underhung Cranes and Monorail Systems
 - 3. For hoists: ANSI B30.16 Safety Standard for Overhead Hoists, HMI Standard (Underhung), ANSI/ASME HST-1 Performance Standards for Electric Chain Hoists
 - 4. Specifications for Design, Fabrication and Erection of Steel for Buildings of the American Institute of Steel Constriction (AISC)
 - 5. American Welding Society (AWS) D14.1 Specifications for Welding Industrial and Mill Cranes and D1.1 Code for Welding in Building Construction
 - 6. Occupational Safety and Health Act (OSHA)

1.4 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300.
 - 1. Replacement parts lists and maintenance manuals for equipment after shipment. These manuals shall include key component breakaway

SECTION 14630 – BRIDGE CRANE

pictures for ease of parts ordering, catalog cut pages, part numbers, subassembly details, and periodic inspection and maintenance requirements recommendations.

- 2. Drawings showing plan, elevation and sectional views of the bridge crane system.
- 3. Complete wiring diagrams, showing all electrical devices, numbered terminal strips and wiring.
- 4. Actual wire rope breaking strength certification and magnetic particle inspection report for hood and nut.

1.5 QUALITY ASSURANCE

All materials shall be new and the completed overhead handling system shall be the product of one crane manufacturer regularly engaged in the production of such equipment.

PART 2 – MATERIALS

2.1 GENERAL

- A. The bridge crane system shall be controlled from a pendant pushbutton station and be furnished complete with all required safety devices and overload protection. The power supply shall be from enclosed, UL-listed conductor bar systems. The rails shall be specially fabricated steel sections, firmly anchored to the structure as indicated and as required by the UBC for seismic loads and in accordance with AISC design manual recommendations. The track deflection shall not exceed 1/800 of the span or 1-1/4", whichever is least. The completed crane system shall be the product of one crane manufacturer regularly engaged in the manufacture of such equipment.
- B. All equipment shall be designed for minimum "Class C" (Moderate Service) as specified in the ANSI MH27.1 Specifications and operate in normal ambient temperatures (0 to 40 degrees Celsius) and normal indoor conditions, free from excessive dust, moisture and corrosive fumes.
- C. All material shall be cleaned of loose rust, mill scale and foreign matter per SP2/SP3. Crane bridges, hoists, trolleys, runways and suspension fittings shall be shop painted with one coat of primer and manufacturer's standard machinery enamel finish. Equipment must be adequately protected against damage and runs in shipment.
- D. Where powered hoists are used, an impact allowance shall be included in design calculations for carriers (trolleys), cranes and runway monorail tracks. The impact allowance shall be $\frac{1}{2}$ % of the rated load for each foot per minute (1.6% of the rated load for each meter per minute) of hoisting speed, with a minimum allowance of 15% and maximum of 50%.

2.2 TRACK AND FITTINGS

- A. The track shall be a specially fabricated section with a special rolled bottom section having a raised flat tread with a minimum bottom flange width of 3 1/4". Bottom flange shall have a minimum ultimate tensile strength of 125,00 p.s.i. with a minimum Brinell hardness of 225. Track shall be straight, with factory prepared ends. No rough-cut ends will be permitted. Holes shall be factory punched or drilled.
- B. The track size shall be computed based on the load positioned on the track system to produce the most severe conditions of stress and deflection.
- C. The total track deflection shall not exceed 1/800th of the span or 1 1/4", whichever is the least.
- D. Track end stops shall be of the bolted type and shall be capable of withstanding the impact of a fully loaded crane or carrier traveling at 50% of the full load speed.
- E. Standard structural shapes or modifications of structural shapes will not be accepted for the track.

2.3 TRACK SUSPENSIONS

- A. All necessary bolt and other fittings from which the track system is suspended, shall be provided as part of the overhead track system. Track hanger supports shall be spaced as per the drawings or as specified.
- B. Means shall be provided to allow for minimum 1" vertical adjustment of the track both before and after the system has been put in operation so that the track can be erected and maintained level.
- C. All suspension fittings shall be furnished with ASTM A-325 mounting bolts.

2.4 TRACK ELECTRIFICATION

- A. Conductor bar shall be roll formed electro-galvanized steel sections, rated 110 amps continuous. Insulation cover shall be rigid, bright orange PVC, self-extinguishing, with an operating temperature of 150° F.
- B. Conductors are to be complete with mounting clips, end caps, splices with covers and power feeds.
- C. Current collectors shall be the sliding double shoe type, spring-loaded and so designed that sparking and loss of contact will be minimized.
- D. Separate conductors shall be provided for each phase. More than one conductor in a single enclosure will not be permitted.

2.5 TROLLEYS

- A. Crane and truck trolley assemblies shall be articulating type, such that the articulated connection shall permit rotational movement in all three axes. Load bars shall be cradled in yokes in such a manner to assure that all wheels are in contact with the operating flange at all times.
- B. Yokes shall be ductile castings, forgings or steel and shall be fixture machined.
- C. Design shall be such as to facilitate easy installation or removal of wheels at any point along the track system without removing the carrier assembly from the track.
- D. Trolley wheels shall be made from high strength forged or machined steel, 5" minimum tread diameter. The wheel tread shall be accurately machined to assure concentricity of axle and tread, and hardened to 425 Brinell. Wheels are to be furnished with electroplate finish, black oxide, or equal treatment, in lieu of paint.
- E. Wheel bearings shall be double row precision ball or taper roller bearings, lubricated and sealed at assembly, and fitted with external grease fittings. Bearings must have a minimum B-10 life of 5,000 hours.
- F. Flangeless wheels with side guide rollers may be provided in lieu of flanged wheels.

2.6 CRANE END TRUCKS

- A. End trucks shall consist of steel weldments bolted direct to the crane bridge member, providing a rigid and square connection.
- B. The ratio of crane span to wheelbase shall be a minimum of 10:1.
- C. Restraining lugs shall be provided to limit drop of end truck to not more than 1" in the event of wheel, yoke, axle, or load bar failures. Restraining lugs shall be placed on both sides of the rail so that if failure occurs, the rail is centrally loaded about the vertical axis.
- D. End trucks shall be provided with energy absorbing bumpers at all outboard ends.
- E. End trucks wheelbase shall be 60" with an overall length of 72".

2.7 CRANE DRIVES

- A. The following type of crane drive shall be used on the crane as a means of power to propel the crane:
 - 1. Crane shall be driven by individual motorized trolley drives mounted on two or more end tucks, which provide traction dependent upon wheel loads. Both motorized trolley wheels shall be driven simultaneously through a specially machined drive pinion. Drive wheels shall have hardened treads and employ side guide rollers.

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- 2. Motors shall be squirrel cage inverter duty type, totally enclosed. Motor shall be provided with lifetime lubricated anti-friction bearings, unless otherwise specified.
- 3. Drive motors shall be provided with a magnetic disc type electric motor brake.

2.8 CROSS BRIDGE ELECTRIFICATION

- A. The following type of electrical power system shall be employed as a means of supplying power and control for hoist and crane travel motions.
 - 1. Festooned system consisting of multiconductor flat cables suspended from trolleys operating on a rigid trolley track mounted parallel to the bridge girder. Trolleys are to be equipped with cable saddles and clamps. The ends of each wire are to be prepared and tagged for field connection to the hoist and shall include a flat cable connector for adapting to the control panel.
 - 2. Factory mounting and wiring of festooned systems is required.

2.9 CRANE CONTROLS

- A. Controls for the crane are to include the following features:
 - 1. Controls shall be housed in a NEMA 12 enclosure for protection against dust and moisture.
 - 2. A fused manual disconnect switch, housed in the bridge enclosure with a lockable handle shall be provided and wired into the incoming circuit from the runway power collectors.
 - 3. A magnetic mainline contactor is to be provided and operated from the pushbutton station.
 - 4. All motor starters shall be adequately sized for crane duty consistent with horsepower requirements and shall be of the reversing type, fully magnetic, with mechanical and electrical interlocks.
 - 5. Each motor shall be provided with thermal overload protection.
 - 6. Fusing shall be provided on the secondary side of the control circuit transformer.
 - 7. Electromotive Systems Impulse adjustable frequency crane control with dynamic braking shall be provided for controlling acceleration and deceleration. Across the line starting is not acceptable.
 - 8. The complete control panel is to be factory mounted and wired. All wires within the panel are to be marked and terminated on numbered terminal strips.

- 9. All wiring shall be in rigid conduit with threaded fittings wherever possible. Flexible cable may be used on short runs where rigid conduit is not practical.
- 10. Control panel is to be assembled and wired in a UL approved shop and shall be UL labeled accordingly.
- 11. A compass placard shall be mounted at crane mid-span, visible from the floor, and correspond to the pushbutton control station markings.

2.10 HOISTS

- A. Crane supplier shall furnish as part of their contract a hoist of the type most suitable for the particular application under consideration. Such hoist shall comply with ANSI/ASME HST-1 and ANSI B30.16. Hoist capacities, speeds and lift shall be as shown on the drawings.
- B. Hoists and appurtenances shall be designed to withstand all stresses imposed under safe operating conditions while handling loads within the rated capacity. Load bearing parts shall be designed such that the static stress, calculated for rated load, shall not exceed 20% of the ultimate strength of the material.
- C. Hoist shall be electric chain type.
- D. Hoist is to be furnished complete with a suitable pushbutton control station. Pushbutton arrangement is to be supplied with strain relief protection. Control actuators shall be dead-man type with speed adjustment of multispeed control obtainable by progressive depression of the push button elements to increase motor speed and spring return to off position.
- E. The hoist braking system shall include a weight overload device and an electric motor brake capable under normal operating conditions with rated load to stop and hold the load when controls are released. In the event of complete power failure, the load shall be stopped and held.
- F. All bearing shall be heavy duty, antifriction type with a minimum B10 life of 5,000 hours. Motor bearings shall be lifetime lubricated, sealed ball bearings.
- G. All gearing shall be forged heat-treated alloy steel machined for smooth, quiet operation. All gearing must meet AGMA quality specifications.
- H. Bottom block shall be completely shrouded for safety and fabricated from steel. Sheaves must be forged or rolled steel, running on antifriction bearings. Hooks are to be forged steel supported by antifriction thrust bearings and permit 360° rotation. Hooks shall be equipped with latches unless the application makes the use of the latch impractical. When required, a latch shall be provided to bridge the opening of the hook for the purpose of retaining slings, chains, etc., under slack conditions.

- I. Motors shall be totally enclosed, specifically designed for hoist service, capable of starting and operating under any condition within the designed capacity, provided with Class F insulation and thermal overload protection.
- J. Hoist shall incorporate an adjustable upper and lower limit switch to stop hoist motion when the block reaches its highest position.
- K. Electric hoist controls shall comply with N.E.C. requirements for the application being considered and shall include control circuit fusing and contactors mechanically and electrically interlocked.
- L. Hoist trolley shall be hoist manufacturer's standard motor-geared trolley with trolley drop lugs, energy absorbing bumpers and wheels with a minimum hardness of 320 BHN.
- M. Trolley control shall be single speed.

2.11 CRANE ASSEMBLY AND TEST

Cranes shall be factory assembled and a no load running test of controls and drive machinery to ensure proper operation shall be performed. The cranes will be disassembled only as necessary for shipment.

2.12 SYSTEM MARKING

All major components of the system shall be marked at the factory to assure prompt and proper field identification.

2.13 PAINTING

- A. All material shall be cleaned of loose rust, mill scale and foreign matter per SP2/SP3.
- B. Crane bridges, hoist, trolleys, runways and suspension fittings shall be shop painted with one coat of primer and manufacturer's standard machinery enamel finish.
- C. Equipment must be adequately protected against damage and rust in shipment.

2.14 MANUFACTURERS

- A. Manufactures, or approved equal:
 - 1. TC American

PART 3 - EXECUTION

3.1 INSTALLATION

A. All bridge crane equipment shall be installed in conformance with the manufacturer's published or written instructions. All bridge crane equipment shall

comply with the requirements of State of California, Division of Occupational Safety and Health (DOSH). Cranes shall be factory-assembled and given a no-load test. All major components of the system shall be marked at the factory to assure prompt and correct field identification.

- B. After completion of the Work, the Contractor shall test all hoist and crane equipment in the presence of the manufacturer's field representative, who shall certify, in writing, that the equipment meets all applicable standards and specifications and verify their rated load-carrying capacity.
- C. The Contractor shall have the bridge cranes examined by an authorized certificating agent and obtain the necessary certificate complying with the requirements of DOSH.

END OF SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

- A. The Contractor shall furnish and install all piping systems shown and specified, in accordance with the requirements of the Contract Documents. Each system shall be complete with all necessary fittings, hangers, supports, anchors, seismic restraints, joints, couplings, valves, accessories, heat tracing, insulation, lining and coating, testing, disinfection, excavation, backfill and encasement, to provide a functional installation.
- B. The piping shown in the drawings is intended to define the general layout, configuration, routing, method of support, pipe size, and pipe type. The drawings are not pipe construction or fabrication drawings. It is the Contractor's responsibility to develop the details necessary to construct all mechanical piping systems, to accommodate the specific equipment provided, and to provide and install all spools, spacers, adapters, connectors, and other appurtenances for a complete and functional system.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 09952 Cold Applied Wax Tape Coating and Polyethylene Sheet of Tube Encasement OMWD Standard Specifications
- C. Section 09900 Painting and Coating
- D. Section 15020 Pipe Supports
- E. Section 15144 Pressure Testing of Piping OMWD Standard Specifications

1.3 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

- A. Uniform Mechanical Code
- B. Uniform Plumbing Code
- C. Uniform Fire Code
- D. Commercial Standards: All equipment, products, and their installation shall be in accordance with the following standards, as applicable, and as indicated in each Section:
 - 1. American Society for Testing and Materials (ASTM)
 - 2. American National Standards Institute (ANSI)
 - 3. American Society of Mechanical Engineers (ASME)
 - 4. American Water Works Association (AWWA)
SECTION 15000 – PIPING COMPONENTS

- 5. American Welding Society (AWS)
- 6. American Iron and Steel Institute (AISI)
- 7. National Fire Protection Association (NFPA)
- E. The following standards have been referenced in this Section:
 - 1. ANSI/ASME B1.20.1 Pipe Threads, General Purpose (inch)
 - 2. ANSI B16.42 Ductile Iron Pipe Flanges and Flanged Fittings, Class 150 only
 - 3. ANSI B16.5 Pipe Flanges and Flanged Fittings
 - 4. AWWA C110 Ductile Iron and Gray-Iron fittings for Water
 - 5. AWWA C 115 Flanged ductile-iron pipe with Ductile-Iron or Gray-Iron Threaded Flanges
 - 6. AWWA C213 Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
 - 7. ASTM/AWWA C219 Bolted, Sleeve-Type Couplings for Plain-End Pipe
 - 8. ASTM B43 Standard Specification for Seamless Red Brass Pipe, Standard Sizes
 - 9. ASTM B62 Standard Specification for Composition Bronze or Ounce Metal Castings
 - ASTM A193 Standard Specification for Alloy-Steel and Stainless-Steel Bolting Materials for High Temperature or High Pressure
 - ASTM A194 Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
 - ASTM D 1784 Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
 - ASTM D 2000 Standard Classification System for Rubber Products in Automotive Applications

1.4 SUBMITTALS

10.

11.

12.

13.

A. The Contractor shall submit complete shop drawings and certificates, test reports, affidavits of compliance, of all piping systems for review by the Engineer in

SECTION 15000 – PIPING COMPONENTS

accordance with the requirements in Section 01300, and as indicated in the individual piping sections. The shop drawings shall include dimensions and details on pipe joints, fittings, fitting specials, harnessed joints, valves, and appurtenances, and shall include design calculations and material lists. The submittals shall include detailed layout, spool, or fabrication drawings which show all pipe spools, spacers, adapters, connectors, fittings, pipe supports and seismic restraints necessary to accommodate the equipment and valves provided in a complete and functional system.

- B. The Contractor shall submit the following:
 - 1. Manufacturer's product data.
 - 2. Manufacturer's installation instructions.
 - 3. Manufacturer's certification of compliance.
 - 4. Statement from the pipe fabricator certifying that all pipe will be fabricated subject to a Quality Control Program.
 - 5. Outline of Quality Control Program.

1.5 QUALITY ASSURANCE

- A. Inspection: All pipe shall be subject to inspection at the place of manufacture. The Contractor shall notify the Engineer in writing of the date for the start of each phase of pipe production and the dates for the proof of design tests. The notification shall be given at least 14 days prior to the start of the pipe manufacture. During the manufacture of the pipe, the Engineer shall be given access to all areas where manufacturing is in progress and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.
- B. Tests: Except where otherwise indicated, all materials used in the manufacture of the pipe shall be tested in accordance with the applicable specifications and standards. The Contractor shall perform all tests at no additional cost to the Owner. Copies of all test reports shall be furnished to the Engineer.

1.6 MANUFACTURER'S SERVICE REPRESENTATIVE

Where the assistance of a manufacturer's service representative is advisable in order to obtain perfect pipe joints, supports, or special connections, the Contractor shall furnish such assistance at no additional cost to the Owner.

1.7 MATERIAL DELIVERY, STORAGE, AND PROTECTION

All piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition and shall be stored off the ground to provide protection against oxidation caused by ground contact. All defective or damaged materials shall be replaced with new materials.

1.8 CLEANUP

After completion of the Work, all remaining pipe cuttings, joining and wrapping materials, and other scattered debris, shall be removed from the site by the Contractor. The entire piping system shall be handed over to the Owner in a clean and functional condition.

PART 2 – MATERIALS

2.1 GENERAL

- A. All pipes, fittings, and appurtenances shall be furnished in accordance with the requirements of the applicable Sections of Divisions 2 and 15 and this Section.
- B. Pipe Supports: All pipes shall be adequately supported in accordance with the requirements of Section 15020, and as indicated.
- C. Lining: The thickness, application, and curing of pipe lining shall be in accordance with the requirements of the applicable Sections of Divisions 2, 9 and 15, unless otherwise indicated.
- D. Coating: The thickness, application, and curing of pipe coating shall be in accordance with the requirements of the applicable Sections of Division 2, 9, and 15 unless otherwise indicated. Pipes installed above ground or in structures shall be field-painted in accordance with Section 09900.
- E. Pressure Rating: All piping systems shall be designed for the maximum expected pressure as defined in Section 15144 or as indicated on the piping schedule.

2.2 PIPE FLANGES

- A. Provide flat faced ductile iron flanges with serrated facings conforming to AWWA C110 and ANSI B16.42 Class 150.
- B. Flanged pipe and fittings shall be shop fabricated, not field fabricated. Threaded flanges shall comply with AWWA C115 and ANSI B16.42. Prior to assembly of the flange onto the pipe, apply a thread compound to provide a leak-free connection. Individually fit and machine tighten each flange in the shop. Bolt holes of flanges shall straddle the horizontal and vertical centerline of the pipe.
- C. Blind Flanges: Blind flanges shall be ductile iron and in accordance with AWWA C115.
- D. Flange Coating: All machined faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.
- E. Flange Gaskets: Gaskets shall be asbestos-free, flat face, 1/8-inch thick, Buna-N having a hardness of 55 to 65 durometer. Provide Garlock "Bluegard," Klinger "Klingersil C4400," or District approved equal. Gaskets shall be suitable for a working pressure of 200 psi at a temperature of 250 degrees F.

2.3 BOLTS AND NUTS

- A. Bolts and nuts for ANSI B16.42 Class 150 flanges shall be Type 316 stainless steel conforming to ASTM A 193, Grade B8M, for bolts and ASTM A 194, Grade 8M, for nuts.
- B. Provide 316 stainless steel washers for each nut.

2.4 THREADED INSULATING CONNECTIONS

- A. General: Threaded insulating bushings, unions, or couplings, as appropriate, shall be used for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are involved.
- B. Materials: Threaded insulating connections shall be of nylon, Teflon, polycarbonate, polyethylene, or other nonconductive materials, and shall have ratings and properties to suit the service and loading conditions.
- C. Manufacturers: Isojoint as manufactured by Advance Products & Systems Inc. or approved equal.

2.5 SLEEVE-TYPE COUPLINGS

- Α. Construction: Sleeve-type couplings shall be provided where indicated on the Drawings, in accordance with ANSI/AWWA C219 unless otherwise indicated on the Drawings, and shall be of steel with Type 316 stainless steel bolts, without pipe stop, and shall be of sizes to fit the pipe and fittings. The middle ring shall be not less than 1/4-inch in thickness and shall be either 5 or 7-inches long for sizes up to and including 30-inches for stainless steel couplings, and 16-inches long for long-sleeve couplings. The followers shall be single-piece contoured mill section welded and cold-expanded as required for the middle rings. They shall be of sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressures without excessive rolling. The shape of the follower shall be of such design as to provide positive confinement of the gasket. Bolts and nuts for buried couplings shall be Type 316 stainless steel. Bolts and nuts for exposed couplings shall conform to the requirements specified elsewhere and shall be coated in accordance with Section 09900 - Painting and Coating. Buried sleeve-type couplings shall be fusion bonded epoxy lined and coated at the factory in accordance with AWWA C213, and shall also receive a petroleum/wax tape coating in accordance with Standard Section 09952.
- B. Pipe Preparation: The ends of the pipe, where indicated, shall be prepared for flexible steel couplings. Plain ends for use with couplings shall be smooth and round for a distance of 12-inches from the ends of the pipe, with outside diameter not more than 1/64-inch smaller than the nominal outside diameter of the pipe. The middle ring shall be tested by cold-expanding a minimum of one percent beyond the yield point, to proof-test the weld to the strength of the parent metal. The weld of the middle ring shall be subjected to air test for porosity.
- C. Gaskets: Gaskets for sleeve-type couplings shall be rubber-compound material that will not deteriorate from age or exposure to air under normal storage or use

SECTION 15000 – PIPING COMPONENTS

conditions. Gaskets for wastewater and sewerage applications shall be Buna "N," grade 60, or equivalent suitable elastomer. Gaskets shall be immune to attack by impurities normally found in water or wastewater. All gaskets shall meet the requirements of ASTM D 2000, AA709Z, meeting Suffix B13 Grade 3, except as noted above. All gaskets shall be compatible with the piping service and fluid conveyed. The rubber in the gasket shall meet the following specifications:

- 1. Color Jet Black.
- 2. Surface Nonblooming.
- 3. Durometer Hardness 74 ± 5 .
- 4. Tensile Strength 1,000 psi minimum.
- 5. Elongation 175 percent minimum.
- D. Manufacturers, or Equal:
 - 1. Dresser, Style 38.
 - 2. Ford Meter Box Co., Inc., Style FC1 or FC3.
 - 3. Smith-Blair, Style 411.

2.6 DISMANTLING JOINTS

- A. Dismantling joints shall be of the restrained flanged adaptor type allowing for longitudinal adjustment. Non-restrained, seal only flanged adaptors will not be acceptable. The dismantling joint shall be pressure rated to 250 psi.
- B. The flanged spool and end ring and body shall be of ductile iron, coated in accordance with Section 09900. Flanges shall be Class 150 in accordance with ANSI B16.42.
- C. All nuts, bolts and tie rods shall be 316 stainless steel.
- D. The gasket shall be Buna-N.

2.7 PIPE THREADS

All pipe threads shall be in accordance with ANSI/ASME B1.20.1

2.8 PIPE UNIONS

Screw unions may be employed on pipelines 2-1/2-inches in diameter and smaller. Pipes and fittings made of non-ferrous metals shall be isolated from ferrous metals by nylon insulating pipe bushings, unions or couplings manufactured by Smith-Blair, Pipe Seal and Insulator Co. or approved equal.

2.9 RED BRASS PIPE

Brass pipe shall conform to the requirements of the "Specifications for Seamless Red Brass Pipe, Standard Sizes" (ASTM B43).

2.10 INSULATING BUSHINGS

For working pressures from zero to 200 psi, use soft nylon insulating bushings to avoid galvanic or electrolytic deterioration wherever dissimilar metals are connected. Bushings shall be as manufactured by Corrosion Control Products Company or District approved equal.

2.11 INSULATING COUPLINGS

For working pressures from zero to 300 psi, use insulating couplings to avoid galvanic or electrolytic corrosion wherever dissimilar metals are connected. Couplings shall be steel; lined with an inert, non-conductive, linen impregnated laminate material; both ends female iron pipe threads; and rated to 300 psi working pressure at 225°F. Exterior surface of coupling is uncoated, bare steel. Couplings shall be Lochinvar V-Line as supplied by Corrosion Control Products Company or District approved equal.

2.12 SERVICE SADDLES - BRONZE, 2 INCHES AND SMALLER

- A. Perform wet taps on existing asbestos cement pipe, ductile iron pipe, and PVC pressure pipe with working pressures 200 psi or less. Provide service saddles that have been specifically designed to fit the type, size, and class of pipe of the installation.
- B. Provide service saddles with full width, cast bronze bodies conforming to ASTM B 62, O-ring gaskets, and iron pipe threads. Provide Type 304 stainless steel double band straps with four bolts or a single wide strap with four bolts. All stainless steel shall be fully passivated for enhanced corrosion resistance. Use tapping machines and cutting tools that have been specifically designed for the type of pipe to be drilled.
- C. Service saddles for use on existing pipe with working pressures 200 psi or less shall be Ford Style 202BS, Romac Industries Style 202BS, or District approved equal.

2.13 TAPPING SLEEVES

- A. Perform wet taps on existing asbestos cement pipe, ductile iron pipe, and PVC pressure pipe with working pressures 150 psi or less. Provide tapping sleeves that have been specifically designed to fit the type, size and class of pipe of the installation.
- B. Tapping sleeves shall be of Type 304 stainless steel construction with two half sleeves and flanged outlet. Sleeve halves shall be bolted together with stainless steel bolts and nuts. Gaskets shall completely surround the pipe to be tapped and be the same length as the sleeves. Gaskets shall be SBR conforming to ASTM D 2000. Flanged outlet shall be flat faced conforming to ANSI B16.5, Class 150. Use

SECTION 15000 – PIPING COMPONENTS

tapping machines and cutting tools that have been specifically designed for the type of pipe to be tapped.

C. Tapping sleeves for use on pipe with working pressures 150 psi or less shall be Ford Stainless Tapping Sleeve Style FAST, Romac Industries SST or SST-DB, or District approved equal.

2.14 WELD-ON OUTLETS

- A. Perform dry taps on existing welded steel pipe unless the District cannot take the pipeline out of service. Prior to making the tap, submit to the District a letter outlining the procedures to be followed.
- B. Use a manufactured steel wrapper plate, outlet pipe, and flange. Cement mortar line the outlet pipe prior to the installation and cement mortar coat the wrapper and outlet pipe after welding to the existing steel pipe.

2.15 STRAINERS

- A. Strainer ends shall be screwed where the strainer is 2 inches and less and flanged where the strainer is 2 $\frac{1}{2}$ inches and larger.
- B. The body shall be Class 125, WSP, PVC and shall conform to ASTM D1784
- C. The screen shall be type 316 stainless steel with a free area not less than $2\frac{1}{2}$ times the inlet area. Perforations shall be 1/16 inch (1/32 inch for chemical service.
- D. Strainers for seal or flushing water connections shall be bronze with screwed ends. Strainers shall be self-cleaning "Y" type design, with stainless steel mesh screen.
- E. Strainers shall be as manufactured by Hayward Manufacturing Co. or approved equal.

2.16 EMERGENCY SHOWER AND EYEWASH STATION

- A. The emergency eyewash and shower shall be an integrated system containing both the eyewash and shower in one standalone unit.
- B. The emergency shower shall be activated by a stainless-steel pull rod with a triangular handle. The shower head shall be green ABS plastic. The shower shall be capable of maintaining a 20 gpm flow. The shower valve shall be a type 316 stainless steel stay-open ball valve with stainless steel ball and stem.
- C. The eyewash shall be a soft-flo type with ABS plastic anti-surge heads and shall be capable of maintaining a 1.2 gpm flow. The eyewash yoke shall be made of type 304 stainless steel. The eyewash valve shall be a type 316 stainless steel sty-open ball valve with a stainless-steel ball and stem.
- D. The emergency eyewash and shower shall be as manufacture by Haws Corporation, Model 8336, or approved equal.

2.17 QUICK COUPLERS

A. Where a quick coupler is called for it shall be stainless steel with a Buna-N gasket as manufactured by Pride Cast Metals, Inc.

PART 3 – EXECUTION

3.1 GENERAL

- A. All pipes, fittings, and appurtenances shall be installed in accordance with the requirements of Divisions 2 and 15. The lining manufacturer shall take full responsibility for the complete, final product and its application. All pipe ends and joints at screwed flanges shall be epoxy-coated, to assure continuous protection.
- B. Where core drilling is required for pipes passing through existing concrete, core drilling locations shall be determined by radiograph of concrete construction to avoid damage to embedded raceways and rebars.

3.2 RAISED FACE AND FLAT FACE FLANGES

A. Where a raised face flange connects to a flat-faced flange, remove the raised face of the flange.

3.3 INSTALLING ABOVEGROUND OR EXPOSED PIPING

- A. Provide pipe hangers and supports as detailed in the Drawings and in Section 15020.
- B. Install pipe without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment.

3.4 INSTALLING FLANGED PIPING

- A. Set pipe with the flange bolt holes straddling the pipe horizontal and vertical centerline. Install pipe without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment. Before bolting up, align flange faces to the design plane within 1/16-inch per foot measured across any diameter. Align flange bolt holes within 1/8-inch maximum offset.
- B. Clean bolts, nuts, washers and flange faces by wire brushing before installing gasket and adjoining flange. Inspect gasket seating surfaces, gasket, each bolt, nut, washer, and facing on which the nuts will rotate. Replace any damaged item.
- C. Assemble all bolts, nuts, and washers in the flange, then tighten nuts in a progressive diametrically opposite sequence, and torque with a calibrated torque wrench. All clamping torque shall be applied to the nuts only.
- D. Bolt lengths shall extend completely through their nuts. Any which fail to do so shall be considered acceptably engaged if the lack of complete engagement is not more than one thread.

- E. Do not use more than one gasket between contact faces in assembling a flanged joint.
- F. Place washers under all nuts. Place washers under bolt heads where the flanges have been fusion bonded epoxy coated. Do not damage coated surfaces during installation.
- G. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight. Replace galled, cracked, or distorted bolts and nuts.
- H. After testing, coat exposed surfaces of bolts, nuts, and washers to be buried with primer for wax tape coating per Standard Section 09952.

3.5 INSTALLING SLEEVE TYPE COUPLINGS

- A. Clean oil, grease, scale, and dirt from pipe ends. Repair any damage or holidays in the shop applied coating before installing couplings. Clean gaskets in flexible pipe couplings, transition couplings, and flanged coupling adapters before installing.
- B. Clean sleeve bolts and nuts by wire brushing before installing in follower rings. Lubricate threads of bolts and nuts with oil or graphite prior to installation. Tighten nuts uniformly and in a progressive diametrically opposite sequence, and torque with a calibrated torque wrench.
- C. If couplings leak under pressure testing, loosen or remove the nuts and sleeve bolt, reset or replace the gaskets, reinstall or retighten the bolts and nuts, and retest the coupling. Couplings shall be watertight.
- D. After testing, wrap sleeve bolts and nuts of buried couplings with wax tape coating per Standard Section 09952.

3.6 WAX TAPE COATING AND POLYETHYLENE ENCASEMENT

Wax tape coating and polyethylene encasement shall be in accordance with Standard Section 09952.

3.7 PRESSURE TESTING

All piping components shall be pressure tested at the same time that the connecting pipelines are pressure tested. See Standard Section 15144 for pressure testing requirements.

3.8 DISINFECTION

Disinfection of potable water lines and the piping components therein shall be performed in accordance with Standard Section 15141.

END OF SECTION

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PART 1 – GENERAL

1.1 WORK OF THIS SECTION

A. The Contractor shall provide pipe supports, seismic restraints, hangers, guides, and anchors, complete, in accordance with the requirements of the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 09900 Painting and Coating
- C. Section 15000 Piping Components

1.3 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

- A. Applicable commercial standards are defined in Section 15000.
- B. The following standards have been referenced in this Section:
 - 1. ANSI/ASME B31.1 Power Piping

1.4 CONTRACTOR SUBMITTALS

- A. General: Submittals shall be in accordance with Section 01300 and Section 15000.
- B. Shop Drawings: Shop drawings shall include the following information:
 - 1. Pipe supports, restraints, hangers, anchors, and guides
 - 2. Calculations for special supports and anchors.

PART 2 – MATERIALS

2.1 GENERAL REQUIREMENTS

- A. Code Compliance: All piping systems and pipe connections to equipment shall be properly anchored and supported to prevent undue deflection, vibration, dislocation due to seismic events and line pressures, and stresses on piping, equipment, and structures. All supports and parts thereof shall conform to the requirements of ANSI/ASME B31.1 Power Piping, except as supplemented or modified below. Supports for plumbing piping shall be in accordance with the latest edition of the applicable plumbing code or local administration requirements.
- B. Structural Members: Wherever possible, pipes shall be supported from structural members. Where it is necessary to frame structural members between existing members, such supplementary members shall be provided at no additional cost to the Owner. All supplementary members shall be in accordance with the

SECTION 15020 – PIPE SUPPORTS

requirements of the building code and the American Institute of Steel Construction and shall be acceptable to the Engineer.

- C. Pipe Hangers: Pipe hangers shall be capable of supporting the pipe in all conditions of operation, allowing free expansion and contraction of the piping, and preventing excessive stress on equipment. All hangers shall have a means of vertical adjustment after erection. Hangers shall be designed to prevent becoming disengaged by any movement of the supported pipe. Hangers subject to shock, seismic disturbances, or thrust imposed by the actuation of safety valves, shall include hydraulic shock suppressors. All hanger rods shall be subject to tensile loading only.
- D. Hangers Subject to Horizontal Movements: At hanger locations where lateral or axial movement is anticipated, suitable linkage shall be provided to permit such movement. Where horizontal pipe movement is greater than 1/2-inch, or where the hanger rod deflection from the vertical is greater than 4 degrees from the cold to the hot position of the pipe, the hanger rod and structural attachment shall be offset in such a manner that the rod is vertical in the hot position.
- E. Spring-Type Hangers: Spring-type pipe hangers shall be provided for piping subject to vibration or vertical expansion and contraction, such as engine exhausts and similar piping. All spring-type hangers shall be sized to the manufacturer's printed recommendations and the loading conditions encountered. Variable spring supports shall be provided with means to limit misalignment, buckling, eccentric loading, or to prevent overstressing of the spring, and with means to indicate at all times the compression of the spring. Supports shall be capable of accommodating at least four times the maximum travel due to thermal expansion.
- F. Thermal Expansion: Wherever expansion and contraction of piping is expected, a sufficient number of expansion loops or joints shall be provided, together with the necessary rolling or sliding supports, anchors, guides, pivots, and restraints permitting the piping to expand and contract freely in directions away from the anchored points. All components shall be structurally suitable to withstand all loads imposed.
- G. Riser Supports: Where practical, risers shall be supported on each floor with riser clamps and lugs, independent of the connected horizontal piping.
- H. Freestanding Piping: Free-standing pipe connections to equipment such as chemical feeders and pumps shall be firmly attached to steel frames fabricated from angles, channels, or I-beams anchored to the structure. Exterior, free-standing overhead piping shall be supported on fabricated pipe stands consisting of pipe columns anchored to concrete footings, with horizontal, welded steel angles and U-bolts or clamps securing the pipes.
- I. Materials of Construction:
 - 1. General: All pipe support assemblies, including framing, hardware, and anchors, shall be Type 316 stainless steel.

SECTION 15020 – PIPE SUPPORTS

- 2. Submerged Supports: All submerged piping, as well as piping, conduits, and equipment in hydraulic structures within 24-inches of the water level, shall be supported with support assemblies, including framing, hardware, and anchors, constructed of fiberglass reinforced plastic and Type 316 stainless steel, unless otherwise indicated.
- 3. Corrosive Areas: All piping in chemical and corrosive areas shall be supported with support assemblies, including framing, hardware, and anchors, constructed of Type 316 stainless steel or FRP, unless otherwise indicated.
- J. Point Loads: Any meters, valves, heavy equipment, and other point loads on PVC, FRP, and other plastic pipes, shall be supported on both sides, according to manufacturer's recommendations to avoid undue pipe stresses and failures. To avoid point loads, all supports on PVC, FRP, and other plastic piping shall be equipped with extra wide pipe saddles or Type 316 stainless steel shields.
- K. Noise Reduction: To reduce transmission of noise in piping systems, all copper tubes in buildings and structures shall be wrapped with a 2-inch wide strip of rubber fabric or similar, suitable material at each pipe support, bracket, clip, or hanger.

2.2 SUPPORT SPACING

- A. Supports for piping shall be spaced to prevent excessive sag, bending, and shear stresses in the piping, with special consideration given where components such as flanges and valves impose concentrated loads. Pipe support spacing shall not exceed the maximum spans in the tables below. For temperatures other than ambient temperatures and for other piping materials or wall thicknesses, the pipe support spacings shall be modified in accordance with the pipe manufacturer's recommendations. Vertical supports shall be provided to prevent the pipe from being overstressed from the combination of all loading effects.
 - 1. Support Spacing for Ductile-Iron Pipe:

Nominal Pipe Diameter (inches)	<u>Maximum Span (feet)</u>
All diameters	Two supports per pipe length or
	10 feet (one of the 2 supports located at joint)

2. Support Spacing for Copper Tubing:

Nominal Pipe Diameter (inches)	<u>Maximum Span (feet)</u>
$\frac{1}{2}$ to $1 - \frac{1}{2}$	6
2 to 4	10
6 and greater	12

SECTION 15020 – PIPE SUPPORTS

3. Support Spacing for Schedule 80 PVC Pipe:

Nominal Pipe Diameter	Maximum Span
(inches)	<u>(at 100 degrees F)</u>
1/2	4
3/4	4.5
1	5
$1 - \frac{1}{4}$	5.5
$1 - \frac{1}{2}$	5.75
2	6.25
3	7.5
4	8.25
6	10
8	11
10	12.25
12	13.25

4. Support Spacing for Fiberglass Reinforced Plastic (FRP) Pipe:

	Maximum Span
Nominal Pipe Diameter	(at 100 degrees F)
<u>(inches)</u>	<u>(feet)</u>
2	8.8
3	10
4	11
6	12.7
8	13.4
10	14
12	15.4
14	16.2
16	17.3
18 and greater	18
-	

2.3 MANUFACTURED SUPPORTS

- A. Stock Parts: Designs shall exemplify good engineering practice and use stock or production parts. Such parts shall be locally available, new, of best commercial quality, designed and rated for the intended purpose.
- B. Manufacturers, or equal:
 - 1. Unistrut
 - 2. Bergen-Paterson Pipesupport Corp., Woburn, MA
 - 3. Grinnell Corp., Exeter, PA

2.4 COATING

A. Other Coatings: Other than stainless steel or non-ferrous supports, all supports shall receive protective coatings in accordance with the requirements of Section 09900.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: All pipe supports, seismic restraints, hangers, brackets, anchors, guides, and inserts shall be fabricated and installed in accordance with the manufacturer's printed instructions and ANSI/ASME B31.1 - Power Piping. All concrete inserts for pipe hangers and supports shall be coordinated with the formwork.
- B. Appearance: Pipe supports and hangers shall be positioned to produce an orderly, neat piping system. All hanger rods shall be vertical, without offsets. Hangers shall be adjusted to line up groups of pipes at the proper grade for drainage and venting, as close to ceilings or roofs as possible, and without interference with other work.

3.2 FABRICATION

A. Quality Control: Pipe hangers, supports, and seismic restraints shall be fabricated and installed by experienced welders and fitters, using the best welding procedures available. Fabricated supports shall be neat in appearance without sharp corners, burrs, and edges.

END OF SECTION

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PART 1 – GENERAL

1.1 WORK OF THIS SECTION

A. The Contractor shall perform cleaning, flushing, and testing of all hydraulic structures and appurtenant piping.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 00810 Special Provisions
- B. Section 01300 Record Drawings and Submittals
- C. Section 03300 Cast-In-Place Concrete
- D. Section 09801 Manhole and Wet Well Lining
- E. Section 15144 Pressure Testing of Pipe OMWD Standard Specification

1.3 SUBMITTALS

- A. All submittals shall be in strict accordance with the requirements of Section 01300.
- B. The Contractor shall submit a written testing schedule, including proposed plans for water conveyance, control, disposal, and disinfection for approval a minimum of 7 days before testing is to start.

PART 2 – MATERIALS

2.1 MATERIALS REQUIREMENTS

Temporary valves, bulkheads, or other water control equipment and materials shall be as determined by the Contractor subject to the Engineer's review. No materials shall be used which would be injurious to the construction or its future function.

PART 3 – EXECUTION

3.1 GENERAL

- A. Water for testing and disinfecting will be furnished by the District; however, the Contractor shall make all necessary provisions for conveying the water from the District-designated source to the points of use.
- B. All hydraulic structures and appurtenant pressure piping shall be tested.
- C. Hydraulic testing of the operating wet well shall be performed after installation of the lining and coating system specified in the Contract Documents.
- D. Releases of water from structures, after testing has been completed, shall be acceptable to the Construction manager.

3.2 PRELIMINARY CLEANING AND FLUSHING

A. Before testing, all hydraulic structures shall be cleaned by thoroughly hosing down all surfaces with a high-pressure hose and nozzle of sufficient size to deliver a minimum flow of 50 gpm. All water, dirt, and foreign material accumulated in this cleaning operation shall be discharged from the structure or otherwise removed.

3.3 TESTING OF HYDRAULIC STRUCTURES

- A. General: Testing shall be performed prior to backfilling, except where otherwise acceptable to the Construction Manager. Testing shall not be performed sooner than 14 days after all portions of structure walls and associated roof systems have been completed. The test shall consist of filling the structure with water to the maximum operating water surface. The rate of filling shall not exceed 24 inches of depth per day. All visible leakage shall be repaired. The cost of the first test shall be borne by the District. If the structure fails the test, all subsequent testing shall be borne by the Contractor.
- B. Leakage Test and Repairs: After the structure has been filled, the water loss leakage test shall be performed as follows: an initial water level reading shall be made. Seven days following the initial reading, a second reading shall be made. The structure shall be considered to have passed the test if water loss during the 7-day period, as computed from the two water level readings, does not exceed 0.2 percent of the total volume of water in the structure, after allowance is made for evaporation loss. If intermediate readings or observed leakage indicate that the allowable leakage will be exceeded, the test may be terminated before the end of the 7-day period and appropriate action taken to correct the problem before commencing a new 7-day test period. Should the structure fail to pass the test, the test shall be repeated for up to three additional 7-day test periods at the Contractor's cost.
- C. If, at the end of 28 days, the structure still fails to pass the leakage test, the Contractor shall empty the structure as acceptable to the Construction Manager and shall examine the interior for evidence of any cracking or other conditions that might be responsible for the leakage. Any cracks shall be "vee'd" and sealed in accordance with Section 03300. Any evidence of leakage shall be repaired. Following these operations, test the hydraulic structure again. The structure will not be accepted as completed until the water loss leakage test is passed and all visible leakage repaired.

3.4 TESTING OF APPURTENANT PIPING

A. Piping appurtenant to hydraulic structures shall be tested as indicated in Standard Section 15144.

END OF SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section includes materials, installation, and testing of ductile iron pipe and fittings, 48 inches and smaller.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. OMWD Standard Drawings
- B. Section 01300 Record Drawings and Submittals
- C. Section 02140 Dewatering
- D. Section 02223 Trenching, Backfilling, and Compacting
- E. Section 09952 Cold Applied Wax Tape Coating and Polyethylene Sheet of Tube Encasement OMWD Standard Specifications
- F. Section 09870 Glass Linings and Coatings
- G. Section 09900 Painting and Coating
- H. Section 15000 Piping Components
- I. Section 15144 Pressure Testing of Piping OMWD Standard Specifications

1.3 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

A. The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

1.	ANSI B16.42	Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300
2.	AWWA C110	Ductile-Iron and Gray-Iron Fittings for Water
3.	AWWA C111	Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
4.	AWWA C144	Standard Specification for Aggregate for Masonry Mortar
5.	AWWA C151	Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids

1.4 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01300.
- B. Provide an affidavit of compliance with standards referenced in this Specification, e.g. AWWA C151.
- C. Submit manufacturer's literature on ductile iron pipe and fittings including dimensions, thickness, weight, coating, lining, and a statement of inspection and compliance with the acceptance tests of AWWA C151 and C110, respectively.
- D. Submit dimensions of push-on joints and other joints which do not conform to rubber gasket joints in accordance with AWWA C111.
- E. Submit tabulated layout schedule and drawing location and dimensions of pipe and fittings including:
 - 1. Pipe station and top of pipe elevation at each change of grade and alignment.
 - 2. Elements of curves and bends, both in horizontal and vertical alignment, including elements of the resultant true angular deflection in cases of combined curvature.
 - 3. The limits of each reach of pipe thickness class and of restrained joints.
 - 4. The limits of each reach of concrete encasement or encasement in casing.
 - 5. Locations and details of bulkheads for field hydrostatic testing of the pipeline.
 - 6. Locations of closures for length adjustment and for construction convenience.
 - 7. Locations of manholes and other points of access for placement of mortar lining at field joints and removal of test bulkheads.
 - 8. Locations of valves and other mechanical equipment.
- F. Submit joint details.
- G. Submit calculations and/or test data proving that the proposed restrained joint arrangement can transmit the required thrust.
- H. Submit copy of manufacturer's quality control check of pipe material and production.
- I. Submit test report on physical properties of rubber compound used in the gaskets.
- J. Submit manufacturer's catalog data and descriptive literature on marking tape.

1.5 INSPECTION AND FIELD VERIFICATION

- A. The Engineer may inspect materials, productions, and testing of pipes, fitting, and special pieces at manufacturer's plant.
- B. Where new pipelines are to be connected to existing waterlines of the District, the Contractor shall verify in the field the location, elevation, pipe material, pipe outside diameter, and any other characteristics of the existing waterline before proceeding with the installation. This field verification shall be performed in the presence of the Construction Manager.

PART 2 – MATERIALS

2.1 DUCTILE IRON PIPE

A. Pipe shall be ductile iron conforming to AWWA C151. Provide pipe in nominal 18or 20-foot laying lengths.

2.2 PIPE WALL THICKNESS

- A. Minimum wall thickness for pipe having push-on joints, restrained push-on joints or, plain ends shall be Class 52, unless otherwise shown on the Drawings.
- B. Minimum wall thickness for pipe having threaded flanges shall be Class 53.

2.3 FITTINGS

- A. Provide ductile iron push-on or restrained push-on joint fittings as indicated in the Drawings conforming to AWWA C110 with a rated working pressure of 250 psi.
- B. Where flanged fittings are indicated on the drawings, provide ductile iron fittings conforming to AWWA C110 and ANSI B16.42, Class 150 with a rated working pressure of 250 psi. Flanges shall be in accordance with Section 15000.
- C. Material for blind flanges shall be ductile iron.
- D. Material for fittings with welded on bosses shall have a Charpy notch impact value of minimum 10-ft-lbs under the conditions defined in AWWA C151.
- E. Bosses on glass lined fittings shall be installed prior to application of the glass lining.

2.4 LINING AND COATING FOR PIPE AND FITTINGS

- A. Where indicated on the Drawings line interior of pipe and fittings with glass lining per Section 09870.
- B. Coat exterior of buried pipe and fittings with an asphalt material per AWWA C151. Apply coating in shop. Polyethylene encase buried pipe and fittings per Standard Section 09952.

- C. Coat the exterior of exposed pipe per Section 09900, System No. 10.
- D. Coat blind flanges per Specification Section 09900, System No. 5. Apply coating in shop.
- E. Coat the ends of plain end pipe where flexible pipe couplings are to be installed per Specification Section 09900, System No. 5. Apply coating in shop.

2.5 FLANGES

A. Flanges shall be in accordance with Section 15000.

2.6 BOLTS, NUTS AND GASKETS FOR FLANGES

A. Bolts, nuts and gaskets for flanges shall be in accordance with Section 15000.

2.7 SLEEVE-TYPE COUPLINGS

A. Sleeve-type couplings shall be in accordance with Section 15000.

2.8 TYPE OF PIPE JOINTS

- A. Joints in aboveground piping or piping located in vaults and structures to be flanged, unless flange adapters are specifically indicated and shown on the Drawings.
- B. Joints in buried piping shall be of restrained push-on or push-on per AWWA C111 except where flanged joints are required to connect to valves, meters, and other equipment. Provide unrestrained buried joints except where restrained joints are specifically shown on the Drawings. Restrained push-on joints shall be American Cast Iron Pipe Company "Flex-Ring, "Lok-Ring," or "Lok-Fast," U.S. Pipe "TR Flex, "or District approved equal. Push-on joints shall be American Cast Iron Pipe Company "Flex-Ring," or District approved equal.
- C. Provide plain end pipe where flexible pipe couplings are to be used.

2.9 WAX TAPE COATING AND POLYETHYLENE ENCASEMENT

A. Wax tape coating and polyethylene encasement shall be in accordance with Section 09952.

2.10 CEMENT MORTAR

A. Cement mortar for buttering and pointing the inside joints shall consist of one-part cement to 1 ½ parts sand by damp loose volume. The quantity of mixing water shall be no more than necessary for handling and placing. Cement shall conform to ASTM C150, Type II. Sand shall conform to ASTM C144 for masonry sand.

2.11 MARKING TAPE

A. Use marking tape consisting of one layer of aluminum foil laminated between two colored layers of inert plastic film. The lamination bond should be strong enough that the layers cannot be separated by hand. Tape shall be a minimum of 5 mils thick and 6 inches wide. Elongation shall be a minimum of 600-percent. Tape shall bear a continuous, printed message every 16 to 36 inches warning of the installation buried below. Tape shall be Terra Tape, Linetec, or District approved equal.

PART 3 – EXECUTION

3.1 PRODUCT MARKING

A. Plainly mark each length of straight pipe to identify the ductile iron wall thickness and date of manufacturer. Mark the spigot end of restrained joint pipe to show clearly the required depth of insertion into the bell.

3.2 DELIVERY AND TEMPORARY STORAGE OF PIPE

- A. Limit onsite pipe storage to a maximum of one week. Place the pipe alongside the trench and secure it from rolling. Support the pipe on wooden blocks, sandbags, mounds of sand, or other suitable supports. Do not roll or drop the pipe on the ground or allow the pipe to fall from the pipe trailer trucks.
- B. Avoid cracking of the glass lining. If necessary, use plastic sheet bulkheads to close pipe ends and keep lining moist.
- C. Do not install pipe or fittings with damaged linings. Pipe or fittings with damaged glass linings shall be rejected and replaced in accordance with Section 09870.

3.3 HANDLING OF PIPE

A. Lift pipes with mechanical equipment using wide belt slings. Do not use cable slings or chains. Do not move pipe by inserting any devices or pieces of equipment into the pipe barrel.

3.4 SANITATION OF PIPE INTERIOR

- A. During laying operations, do not place tools, clothing, or other materials in the pipe.
- B. When pipelaying is not in progress, including the noon hour, close the ends of the installed pipe with a plug to deter entry by vermin or children.

3.5 INSTALLING PIPE IN TRENCH

- A. See Section 02223 for earthwork requirements.
- B. Inspect each pipe and fitting before lowering into the trench. The Construction Manager will inspect all pipe prior to installation for damage to the interior protective coatings. Patch damaged areas in the field with material similar to the original. Clean ends of pipe thoroughly. Remove foreign matter and dirt from the inside of pipe and keep clean during and after laying.

- C. Handle pipe in a manner to avoid any damage to the pipe. Do not drag pipe over the ground, drop it onto the ground, or drop any object on it. Do not drop or dump pipe into trenches.
- D. Laying tolerances for the installed pipe shall not vary greater than 0.3-foot horizontally, or greater than 0.1 foot vertically from the alignment and elevations shown on the Drawings.
- E. Grade the bottom of the trench to the line and grade to which the pipe is to be laid, with allowance for pipe thickness. Remove hard spots that would prevent a uniform thickness of pipe base material (imported sand). Before laying each section of the pipe, check the grade with a straightedge and correct any irregularities found. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between the bell holes, except that the grade may be disturbed for the removal of pipe handling slings.
- F. At the location of each joint, dig bell holes in the bottom of the trench and at the sides to permit visual inspection of the entire joint and to prevent the pipe from being supported by the bell end or fitting.
- G. Keep the trench in a dewatered condition during pipelaying. Removal of water shall be in conformance with Section 02140.

3.6 INSTALLING POLYETHYLENE ENCASEMENT

A. Wrap buried pipe, fittings, and flanged joints with polyethylene material per Standard Section 09952. Use only tube type for pipe. Complete the wrap prior to placing concrete anchors, collars, supports or thrust blocks per Section 02223. Repair polyethylene material damaged during construction.

3.7 ASSEMBLING PIPE JOINTS

- A. The spigot and integral bell shall be dirt free and slide together without displacing the rubber ring gasket. Lay the pipe section with the integral bell facing the direction of laying.
- B. Clean the groove of the bell of all foreign materials. Insert the gasket into the groove of the bell prior to installation. Observe the correct direction of the shaped gasket. Feel that the gasket is completely and evenly seated in the groove.
- C. Lubricate the exposed gasket surface and the beveled spigot up to the full insertion length with the lubricant supplied by the pipe manufacturer. If the lubricated pipe end touches dirt, clean the pipe and reapply lubricant.
- D. Insert the spigot into the bell and force it slowly into position.
- E. Check that the rubber ring gasket has not left the groove during assembly by passing a feeler gage around the completed joint.

3.8 INSTALLING BURIED FITTINGS

- A. The Construction Manager will inspect all fittings prior to installation for damage to the interior protective coatings. Fittings with damage to glass linings shall be rejected and replaced per Section 09870.
- B. For push-on joint fittings, clean the bell ends of the fitting of all foreign material and dirt. Insert the gasket in the groove of the bell and make sure the gasket faces the correct direction. Feel that the gasket is completely and evenly seated in the groove. When pipe is cut in the field, bevel the plain end prior to installation. Lubricate the exposed gasket surface and the beveled pipe spigot with the same lubricant supplied by the pipe manufacturer. Insert the spigot into the bell and force it slowly into position. Keep the joint straight while pushing. Make joint deflection after the joint is assembled.

3.9 JOINT DEFLECTIONS FOR BURIED PIPE

A. When necessary to deflect pipe from a straight line in either the horizontal or vertical plane, do not exceed the following joint deflection angles for unrestrained buried pipe or fittings. The angles shown are for each joint and are maximum deflections.

Nominal Pipe Size (inches)	Push-On Joint (degrees)
4	4
6	4
8	4
10	4
12	4
14	2-1/2
16	2-1/2
18	2-1/2
20	2-1/2
24	2-1/2
30	2-1/2
36	2-1/2
42	1-1/2
48	1-1/2

B. For restrained joints, do not exceed 80% of the manufacturer's recommended maximum deflection.

3.10 INSTALLING PIPE IN VAULTS

A. Install aboveground or exposed piping in accordance with Section 15000.

3.11 INSTALLING FLANGED JOINTS

B. Flanged joints shall be installed in accordance with Section 15000.

3.12 INSTALLING FLEXIBLE PIPE COUPLINGS

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A. Install flexible pipe couplings per Specification Section 15000.

3.13 INSTALLING MARKING TAPE

- A. After the pipe zone and the first 12 inches in the trench zone have been backfilled and compacted, place the marking tape on the compacted backfill and center over the pipe.
- B. Run tape continuously along the trench and tie ends of pipe together. Wrap marking tape around valve box extension pipes and continue along pipe.

3.14 PAINTING AND COATING

A. Coat exterior surfaces of bare ductile iron pipe in vaults per Section 09900. Apply finish coats in the field.

3.15 PRESSURE TESTING

A. See Standard Section 15144 for pressure testing requirements.

END OF SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section includes materials and installation of polyvinyl chloride (PVC) pipe and fittings with iron pipe size outside diameters for miscellaneous applications. Size range is ¹/₂- to 6-inch nominal size.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. OMWD Standard Drawings
- B. Section 01300 Record Drawings and Submittals
- C. Section 02223 Trenching, Backfilling and Compacting
- D. Section 15141 Disinfection of Piping OMWD Standard Specifications
- E. Section 15144 Pressure Testing of Piping OMWD Standard Specifications

1.3 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01300.
- B. Submit manufacturer's catalog data and descriptive literature for PVC conduit, pipe, fittings, solvent, and miscellaneous materials. Show dimensions and materials of construction by specification reference and grade.

PART 2 – MATERIALS

2.1 PVC PIPE

A. Provide PVC pipe in accordance with the schedules as shown on the Drawings. PVC pipe shall be Schedule 40 or 80, Type I, Grade I (Class 12454-B), conforming to ASTM D 1784 and D 1785.

2.2 NIPPLES

A. Short nipples shall be the same as the PVC pipe.

2.3 FITTINGS

- A. Provide fittings that have the same schedule as the PVC pipe.
- B. Fittings shall be Schedule 40 conforming to ASTM D 2466 for socket-type.
- C. Fittings shall be Schedule 80 conforming to ASTM D 2464 for threaded type and ASTM D 2467 for socket type.

2.4 JOINTS

A. Pipe and fitting joints shall be solvent welded except where threaded joints are required.

SECTION 15058 - POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

B. Solvent cement for socket joints shall comply with ASTM D 2564 and F 656.

PART 3 – EXECUTION

3.1 GENERAL

- A. Do not install PVC pipe when the temperature is below 40 degrees F or above 90 degrees F.
- B. Store fittings indoors in their original cartons.
- C. Store solvent cement indoors or, if outdoors, shade from direct sunlight exposure. Do not use solvent cements which have exceeded the shelf life marked on the storage container.
- D. Before installation, check pipe and fittings for cuts, scratches, gouges, buckling, kinking, or splitting on pipe ends. Remove any pipe section containing defects by cutting out the damaged section as a complete cylinder.

3.2 INSTALLATION

A. Do not drag PVC pipe over the ground, drop it into the ground, or drop objects on it. Cut pipe ends square and remove all burrs, chips, and filings before joining pipe or fittings. Bevel solvent welded pipe ends as recommended by the pipe manufacturer.

3.3 SOLVENT WELDED JOINTS

- A. Prior to solvent welding, remove fittings and couplings from their cartons and expose them to the air for at least one hour to the same temperature conditions as the pipe.
- B. Wipe away loose dirt and moisture from the ID and OD of the pipe end and the ID of the fitting before applying solvent cement. Do not apply solvent cement to wet surfaces.
- C. Make up solvent welded joints per ASTM D 2855.
- D. Allow at least 8 hours of drying time before moving solvent welded joints or subjecting the joints to any internal or external loads or pressures.

3.4 INSTALLING BURIED PIPE

- A. See Section 02223 for earthwork requirements. Use imported sand in the pipe base and pipe zone.
- B. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.
- C. Grade the bottom of the trench to the line and grade to which the pipe is to be laid. Remove hard spots that would prevent a uniform thickness of pipe base material.

SECTION 15058 - POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

Before laying the pipe, check the grade with a straightedge and correct any irregularities found.

D. Do not backfill the pipe trench until the solvent welded joints have set. Support the pipe uniformly and continuously over its entire length on firm, stable bedding. Do not use blocking to change pipe grade or to support pipe in the trench.

END OF SECTION

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PART 1 – GENERAL

1.1 DESCRIPTION

A. This section includes materials, testing, and installation of manually operated valves, check valves, air and vacuum valves, air-release valves, and combination air-release valves.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 01730 Operation and Maintenance Data
- C. Section 09952 Cold Applied Wax Tape Coating and Polyethylene Sheet of Tube Encasement OMWD Standard Specifications
- D. Section 09900 Painting and Coating
- E. Section 15000 Piping Components
- F. Section 15106 Check Valves
- G. Section 15108 Combination Air Release and Vacuum Valves OMWD Standard Specifications
- H. Section 15141 Disinfection of Piping OMWD Standard Specifications
- I. Section 15144 Pressure Testing of Piping OMWD Standard Specifications

1.3 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

- A. Except as otherwise indicated, the current edition of the following standard applies to the Work of this section:
 - 1. ASTM B62-Standard Specification for Composition Bronze or Ounce Metal Castings

1.4 CONTRACTOR SUBMITTALS

- A. Contractor shall furnish submittals in accordance with the requirements of Section 01300. The following submittals are required:
 - 1. Submit Shop Drawings, manufacturer's catalog data and detail construction sheets showing all valve parts and describing material of construction by material and specification (such as AISI, ASTM, SAE, or CDA). Submittal shall include valve dimensions including laying lengths and dimensions and orientation of valve operators. Information shall be submitted on valve handles, handwheels, position indicators, limit switches, integral control systems, needle valves, and control systems. Submittals shall also indicate valve linings and coatings with

SECTION 15100 – VALVES

manufacturer's and paint numbers listed. Contractor shall indicate the size, quantity and pressure rating of valves, including the class and drilling pattern of the flanges where applicable.

- 2. Manufacturer's certification that products comply with the requirements set forth in the Contract Documents.
- 3. Manufacturer's certification that all linings and coatings have been factory tested and comply with the indicated requirements.
- 4. A schedule of valves to be labeled, indicating in each case the valve location and the proposed wording for the label.
- 5. For valves requiring certified tests, submit certified test results.
- 6. Operation and maintenance data shall be submitted in accordance with the requirements set forth in Section 01730 and shall include, but not be limited to, the following information:
 - a. Manufacturer's installation and operating instructions.
 - b. Manufacturer's maintenance procedures.
 - c. List of special tools.
 - d. Schedule of valves indicating valve identification and location.
 - e. Spare Parts List: A spare parts list shall be provided with information for each valve assembly.
 - f. Factory Test Data: Where indicated, signed, dated, and certified factory test data for each valve requiring certification shall be submitted before shipment of the valve. The data shall also include certification of quality and test results for factory-applied coatings.

PART 2 – MATERIALS

2.1 GENERAL

- A. All valves shall be new and of current manufacture. Valves shall be furnished and installed by the Contractor at the location and in accordance with the type of ends as shown on the Plans and as herein specified.
- B. Where the valve operating nut is more than 5 feet below the valve box lid, provide an extension stem to bring the operating nut to a point 6 inches below the surface of the lid. Construct stem of steel using pipe, bar stock, and plates to the dimensions shown on the District's Standard Drawings. Field verify required stem length prior to fabrication. Hot dip galvanize completed stem after fabrication.
- C. The manufacturer shall have manufactured tight-closing values of the value type intended for use for a period of at least five years.
- D. The Contractor shall furnish and install each specific type of valve from a single manufacturer and use it throughout the Work.
- E. All valves shall have a rated working pressure of at least 150 psi except where a

SECTION 15100 – VALVES

higher pressure is specified either on the Drawings on in the Specifications. All valves shall be certified to meet the test pressure as specified and shall have a rated working pressure that exceeds the full working pressure specified.

- F. Connections: Valves shall have flanged, hub, screwed, or special connector ends as shown on the Plans. Where not indicated, the valves shall have the same type of connection as the pipeline in which valves are to be installed and conform to the Specifications.
- G. All bolts, nuts and washers shall be in accordance with Section 15000.
- H. Polyethylene Encasement: Unless otherwise specified on the Plans, all valves for underground installation shall be encased in two layers of 8 mil polyethylene wrap in accordance with AWWA C105.
- I. Painting and Coating: All valves referenced in this section shall be painted and coated, interior and exterior, in accordance with Section 09900.
- J. Provide a valve box for each buried valve consisting of a frame, lid, and one-piece extension pipe. Construct frame and lid of cast iron and design for traffic loading. Castings shall be smooth, clean, and free from blisters, blowholes, and shrinkage. Machine bearing surfaces of frame and lid to provide a close fit without rocking. Cast on the lid the words "OMWD" and "WATER" or "SEWER". Frame and lid shall be Parkson Inc. PS400, South Bay Foundry SBF 1208, or District approved equal. Extension pipe shall be 8-inch diameter, polyvinyl chloride (PVC), plastic irrigation pipe (PIP) conforming to Soil Conservation Service specification SCS 430 DD with a pressure rating of 100 psi, a pipe stiffness dimension ration (SDR) of 41, and an outside diameter of 8.160 inches.

2.2 COMBINATION AIR VALVES

Combination air valves shall be provided and installed in accordance with approved plans and Standard Section 15108.

2.3 CHECK VALVES

Swing check valves shall be provided and installed in accordance with approved plans and Section 15106.

2.4 MISCELLANEOUS VALVES

- A. Corporation stops shall be Ford Ballcorp Type FB1700, James Jones J-1931, or District approved equal. Stops shall be bronze (ASTM B 62) with inlet male iron pipe threads and outlet female iron pipe threads. Stops shall have an outlet fitting to adapt from iron pipe threads to copper. Use either flared tube fittings for working pressures from zero to 150 psi, or solder joint fittings for working pressures from zero to 300 psi.
- B. For 1-inch and 2-inch bronze ball valves with working pressures from zero to 300 psi, use Ford Ball Valve Curb Stop B11, James Jones J-1905, or District approved equal. Valves shall be bronze (ASTM B 62) with both ends female iron pipe threads

and full port. Provide brass handles, use Ford HB-34 and HB-67S, James Jones, or District approved equal.

- C. For 1/2-inch bronze ball valves with working pressures from zero to 600 psi, use NIBCO T-580-70, Stockham T-2285-BR-R-70, or District approved equal. Valves shall have threaded ends, two piece bronze body, standard port, bronze trim, chrome plated ball, and blowout proof stem. Use a lever handle for non-buried installations and a tee handle for buried installations.
- D. Hose Bibbs and Valves: Hose bibbs shall be furnished and installed in the locations shown on the Plans and shall be of the sizes required. They shall be brass hose valves, Crane 58 or approved equal. Hose valves shall be Crane 117 or approved equal, with National Standard threads, cap, and chain.
- E. Bronze angle valves, 2 inches and smaller, shall be NIBCO T-335Y, Stockham B-222T, or District approved equal. Valves shall be bronze (ASTM B 62), union bonnet, angle design, 300 psi WOG rated with both ends female iron pipe threads.
- F. Bronze angle valves (hydrant heads) shall be James Jones J-344 H.P. or District approved equal. Valves shall be bronze (ASTM B 62) with 4-inch inlet female iron pipe threads and 2-1/2-inch outlet male national standard hose threads with cap and chain.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Flanges shall be cleaned by wire brushing before installing flanged valves. Flange bolts and nuts shall be cleaned by wire brushing, and threads lubricated with oil and graphite. Nuts shall be tightened uniformly and progressively. If flanges leak under pressure testing, nuts and bolts shall be loosened or removed, the gasket reseated or replaced, the bolts and nuts reinstalled or retightened, and joints retested. Joints shall be watertight.
- B. Threaded joints shall be cleaned by wire brushing or swabbing. Teflon joint compound or Teflon tape shall be applied to pipe threads before installing threaded valves. Joints shall be watertight.
- C. Install all valves and appurtenances in accordance with manufacturer's instructions.
- D. Install all valves so that operating handwheels or wrenches may be conveniently turned from operating floor but without interfering with access, and as approved by the Engineer.
- E. Unless otherwise approved, install all valves plumb and level. Install valves free from distortion and strain caused by misaligned piping, equipment or other causes.

3.2 INSTALLING VALVE BOXES

A. Place and compact trench backfill to the height of the valve stem. Set the one

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piece extension pipe over the operating nut and center in place. Maintain the extension pipe in a vertical position during backfilling. Slip the valve box frame over the extension pipe and adjust both to finish grade. Pour a concrete ring around the valve box frame. Concrete shall be Class C per Section 03000. In paved areas, top of concrete ring shall be 1-inch below finish grade of adjacent surfaces. In non-paved areas, top of valve box frame and concrete ring shall be flush with the natural or finish grade. Where paved, overlay the concrete ring with 1-inch compacted thickness of asphalt concrete pavement. Valve box frame and lid shall be flush with the finish surface of the pavement.

B. Install all valve boxes plumb, and centered with the bodies directly over the valves.

3.3 WAX TAPE COATING AND POLYETHYLENE ENCASEMENT

Wax tape coating and polyethylene encasement shall be in accordance with Standard Section 09952.

3.4 VALVE PRESSURE TESTING

Valves shall be hydrostatically tested in conjunction with the pipeline in which they are connected in accordance with Standard Section 15144.

3.5 **DISINFECTION**

Disinfection of valves for water service shall be in accordance with Standard Section 15141.

END OF SECTION

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PART 1 – GENERAL

1.1 DESCRIPTION

A. This section includes installation of manually operated eccentric plug valves, actuators, and appurtenances, as shown in the Drawings and specified herein, in accordance with the requirements of the Contract Documents. The Contractor shall be responsible for supplying all required components, including valve and actuator, materials, testing, and installation for a complete and functional valve installation.

1.2 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

A. The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. References shall be made to the latest edition of said standards unless otherwise called for.

1.	AWWA C210	Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
2.	AWWA C213	Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
3.	AWWA C504	Rubber-Seated Butterfly Valves
4.	AWWA C550	Protective Epoxy Interior Coatings for Valves and Hydrants
5.	ANSI/ASME B16.1	Cast Iron Pipe Flanges and Flanged Fittings
6.	ANSI/ASME B16.5	Pipe Flanges and Flanged Fittings
7.	ANSI/ASME B16.47	Large Diameter Steel Flanges: NPS 26 through NPS 60
8.	ASME B16.34	Valves – Flanged and Buttwelding End
9.	ASME B16.10	Face to Face Dimensions
10.	ANSI/AWWA C111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and /A21.11 Fittings
11.	ANSI/AWWA C504	Rubber-Seated Butterfly Valves
12.	ANSI/AWWA C540	Power Activating Devices for Valves and Sluice Gates
13.	ASTM A126	Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings

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- 14. ASTM A216 Standard Specification for Steel Castings, Carbon Suitable for Fusion Welding for High Temperature Service
- 15. ASTM A351 Standard Specification for Steel Castings Austenitic, Austenitic-Ferric (Duplex), and Pressure-Containing Parts
- 16. ASTM A515 Standard Specification for Pressure Vessels, Plates, Carbon Steel, for Intermediate and Higher Temperature Service
- 17. ASTM A536 Standard Specification for Ductile Iron Castings
- 18. ASTM A743 Standard Specification for Castings, Iron Chromium, Iron-Chromium-Nickel, Corrosion Resistant for General Purposes
- 19. ASTM Materials of Construction
- 20. MSS-SP-25 Standard Marking System for Valves, Fittings, Flanges and Unions
- 21. MSS-SP-6 Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings
- 22. API 598 Valve Inspection and Testing (Low Pressure Closure Test)
- 23. API 6D Specification for Pipeline Valves (Seat Leakage)
- 24. API 607 Fire-Test for Quarter Turn Valves
- 25. ISO 5752 Face to Face Dimensions Series 13 (150) Series 14 (300/600)

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 01730 Operation and Maintenance Data

1.4 SERVICE APPLICATION

A. Plug valves shall be suitable for water or wastewater service.

1.5 SUBMITTALS

- A. The following items shall be submitted for review and approval by the Owner prior to ordering or delivery of plug valves:
 - 1. An affidavit from the valve manufacturer showing the following:
 - a. Actuators used were furnished and installed by the valve manufacturer.
 - b. Valves have successfully passed hydrostatic testing per AWWA C504 and coatings testing by the valve manufacturer.
 - 2. The valve manufacturer's catalog data showing the size to be used, valve dimensions, pressure rating and materials of construction.
 - 3. Actuator manufacturer's catalog data and detail construction sheets showing the dimensions, materials, number of turns, and required torque input of the actuator to be used.
 - 4. Manufacturer's catalog data and proof of NSF certification on the lining materials to be used.

1.6 SIZING OF VALVES

A. Valves shall be the same size as the line in which they are installed unless otherwise shown on the Drawings.

1.7 VALVE ENDS

- A. Valve ends shall be as shown on the Drawings or as directed by the Engineer.
- B. Flanged valves shall have flanges with drilling to ANSI B16.1, Class 125. Nuts, bolts and washers for flanges shall conform to Section 15000.
- C. Maximum working pressure of the flange shall be as specified in AWWA or ASME/ANSI. Flanges shall be integrally cast per AWWA C110.

1.8 VALVE TESTING

- A. Plug valves shall be hydrostatically tested and coatings holiday detected prior to shipment to the field. Valves delivered to the site prior to successful hydrostatic testing and holiday detection will be subject to rejection.
- B. Plug valves shall be tested against the seat at the full rated working pressure and a hydrostatic shell test at twice the rated working pressure. Certified copies of individual test shall be submitted. Certified copies of proof-of-design tests shall be submitted.
- C. Valve shall be tested in accordance with ASME B16.34-1996 and API 598-1196. When specified, the valves shall be tested for seat leakage from both sides of the disc. Written test certificates shall be available upon request.

1.9 DELIVERY, STORAGE AND HANDLING

A. Valves shall be delivered and stored in accordance with AWWA C504 and AWWA C550. The port openings shall be covered with plastic, cardboard or wood while in transit and during storage in the field. These covers shall remain in place until the valve is ready to be installed. Valves shall not be stored in contact with bare ground. Valves shall not be stacked.

1.10 POLYETHYLENE WRAP

A. Polyethylene wrap shall be as specified in Standard Section 09952.

PART 2 – MATERIALS

2.1 ECCENTRIC PLUG VALVES

- A. Eccentric Plug valves shall be of the tight closing, resilient faced, non-lubricating variety and shall be of eccentric design such that the valves pressure member (plug) rises off the body seat contact area immediately upon shaft rotation during the opening movement. Valves shall be drip-tight at the rated working pressure of 187 psi. The valve closing member should rotate approximately 90 degrees from the full-open to full-close position and vice-versa.
- B. The valve body shall be constructed of ductile iron.
- C. Eccentric Plug Valves shall have a rectangular shaped port. Port areas for shall be a minimum 80% of full pipe area.
- D. Valve seat surface shall be welded-in overlay, cylindrically shaped of not less than 90% pure nickel. Seat area shall be raised, with raised area completely covered with weld to insure proper seat contact.
- E. The valve plug shall be constructed of ductile iron. The plug shall have a cylindrical seating surface that is offset from the center of the plug shafts. The plug shafts shall be integral. The entire plug shall be 100% encapsulated with Buna-N rubber in all valve sizes. The rubber compound shall be approximately 70 (Shore A) durometer hardness. The rubber to metal bond must withstand 75 pounds pull under test procedure ASTM D-429-73 Method B.
- F. Shaft bearing, upper and lower, shall be sleeve type metal bearings, sintered, oil impregnated, and permanently lubricated Type 316 stainless steel conforming to ASTM A743 Grade CF-8M. Thrust bearings shall be PTFE.
- G. Plug valve shaft seals shall be on the multiple V-ring type (Chevron) and shall be adjustable. All packing shall be replaceable without removing the bonnet or actuator and while the valve is in service. Shaft seals shall be made of Buna N.
- H. Valves shall be Eccentric Plug Valves as manufactured by DeZurik or Districtapproved equal.

2.2 MANUAL VALVE ACTUATORS

- A. All valve actuators shall be watertight, designed for buried or submerged uses. Actuators shall be fully gasketed, sealed, and factory packed with grease.
- B. As directed by the Owner, actuators for valves located above ground or in vaults and structures shall have hand wheels, unless otherwise shown on the Drawings. Minimum hand wheel diameter shall be 12". The actuator shall be equipped with a dial indicator, which shows the position of the valve disc. The Owner may require the use of a 2" square operating nut in some cases.
- C. Above ground valves 8 inches and larger shall be provided with gear actuators. Buried valves 6 inches and larger shall be provided with gear actuators.
- D. Actuators shall have travel stops, which can be adjusted in the field without having to remove the actuator from the valve.
- E. Actuators shall be sized for opening and closing the valve at the valve's full rated working pressure and at a flow velocity of 16 ft/s.
- F. Actuators shall accept a minimum of 300 foot-pounds of input torque at the full open and full closed positions without damage to the actuator or the valve.
- G. Actuators for valves shall be provided with a 2" square-operating nut when buried or when indicated on the Drawings.
- H. Actuators equipped with 2" operator nuts shall require a maximum input torque of 150 foot-pounds to operate the valve. A maximum input torque of 80 foot-pounds shall be required to operate valves with hand wheels.
- I. Actuators shall be of the same manufacturer as the valve.
- J. Actuators shall be installed, adjusted, tested and certified by the valve manufacture prior to shipping.
- K. Actuators shall require a maximum of one hundred (100) input turns for the complete ninety-degree (90°) movement of the disc.
- L. Actuators shall receive an epoxy coating on the exterior surface as described in this Section.
- M. Valves actuators shall be totally enclosed and sealed worm gear actuator with position indicator (above ground service only) and externally adjustable open and closed stops. The worm segment gear shall be ASTM A536 Grade 65-45-12 ductile iron with a precision bore and keyway for connection to the valve shaft. Bronze radial bearings shall be provided for the segment gear and worm shaft. Alloy steel roller thrust bearings shall be provided for the hardened worm.

2.3 EPOXY LINING AND COATING

- A. Epoxy linings and coatings for valves and actuators shall be provided in accordance with AWWA C210, C213 and C550, with the following modifications:
 - 1. Epoxy lining and coating of valve surfaces shall be performed by the manufacturer in a facility with qualified personnel, where the environment can be controlled. Epoxy lining and coating of valves in the field is prohibited.
 - 2. Repairs made to shop-applied coatings shall be performed in a facility with qualified personnel, where the environment can be controlled. The facility shall be one that is approved by the valve manufacturer.
 - 3. Surface preparation shall be as detailed in SSPC-SP5 White Metal Blast Cleaning.
 - 4. Liquid epoxy lining and coating materials shall be listed in the NSF Listing for Drinking Water Additives, Standard 61, certified for use in contact with potable water.
 - 5. The minimum dry film thickness for epoxy linings shall be 0.203mm (0.008" or 8 mils). Liquid epoxy lining shall be applied in two (2) coats in accordance AWWA C210.
 - 6. Powder epoxy coating materials shall contain one hundred percent (100%) solids, in accordance with AWWA 213.

2.4 GATE WELLS AND EXTENSION STEMS

Gate wells and extension stems for buried valves shall be in accordance with the Contract Documents and OMWD Standard Drawings.

2.5 CONCRETE

Concrete used for anchor or thrust blocks shall be in accordance with Division 3.

2.6 POLYETHYLENE WRAP

Polyethylene wrap shall be in accordance with Standard Section 09952.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install valves with the bolt holes straddling the vertical and horizontal centerlines of pipe, with the operating nut in the vertical position, unless otherwise noted on the Drawings.
- B. Valves shall be installed per the manufacturer's recommendation in accordance with the applicable specification for the piping material and joint type being used for the valve and the water main.

SECTION 15101 – PLUG VALVES

- C. Flanges shall be cleaned by wire brushing before installing flanged valves. Flange bolts and nuts shall be cleaned by wire brushing, and threads lubricated with oil and graphite. Nuts shall be tightened uniformly and progressively. If flanges leak under pressure testing, nuts and bolts shall be loosened or removed, the gasket reseated or replaced, the bolts and nuts reinstalled or retightened, and joints retested. Joints shall be watertight.
- D. Threaded joints shall be cleaned by wire brushing or swabbing. Teflon joint compound or Teflon tape shall be applied to pipe threads before installing threaded valves. Joints shall be watertight.

3.2 WAX TAPE COATINGS AND POLYETHYLENE WRAP

Wax tape and polyethylene wrap coating shall be per Standard Section 09952.

3.3 CONCRETE

Concrete thrust, anchor, and support blocks shall be installed as called for in the Contract Documents in accordance with the Owner's Standard Drawings. The concrete shall be placed so that valves and valve operators will be accessible for repairs or replacement. Prior to filling the pipeline with water, refer to Division 3 for minimum concrete curing time required.

3.4 GATE WELLS AND EXTENSION STEMS

Gate wells and extension stems for buried valves shall be installed in accordance with the Contract Documents and OMWD Standard Drawings.

3.5 HYDROSTATIC TESTING

Valves shall be hydrostatically tested in conjunction with the pipeline in which it is connected in accordance with Standard Section 15144.

3.6 FIELD PAINTING AND COATING

The exterior of valves installed above ground or exposed in vaults or enclosures shall be field painted in accordance with the OMWD Documents.

END OF SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

This section includes materials, testing, and installation of swing check valves as shown in the Drawings and specified herein, in accordance with the requirements of the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Submittals
- B. Section 01730 Operation and Maintenance Data
- C. Section 09961 Fusion Bonded Epoxy Coatings and Linings OMWD Standard Specifications
- D. Section 15100 Valves
- E. Section 15144 Pressure Testing of Piping OMWD Standard Specifications

1.3 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

- A. Except as otherwise indicated, the current editions of the following standards apply to the Work of this section:
 - 1. ANSI B16.42 Ductile Iron Pipe Flanges and Flanged Fittings, Class 150 only
 - 2. ASTM A193 Standard Specification for Alloy-Steel and Stainless-Steel Bolting Materials for High Temperature or High Pressure
 - ASTM A194 Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
 - 4. ASTM A536 Standard Specification for Ductile Iron Castings
 - 5. ASTM B16 Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines
 - 6. ASTM B62 Standard Specification for Composition Bronze or Ounce Metal Castings
 - 7. ASTM B148 Standard Specification for Aluminum-Bronze Sand Castings
 - 8. ASTM B584 Standard specification for Copper Alloy Sand Castings for General Applications

1.4 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300.
 - 1. Submit Shop Drawings, manufacturer's catalog data and detail construction sheets showing all valve parts and describing material of construction by material and specification (such as AISI, ASTM, SAE, or CDA). Submittal shall include valve dimensions including laying lengths and dimensions and orientation of valve operators. Submittals shall also indicate valve linings and coatings with manufacturer's and paint numbers listed. Contractor shall indicate the size, quantity and pressure rating of valves, including the class and drilling pattern of the flanges where applicable.
 - 2. Manufacturer's certification that products comply with the requirements set forth in the Contract Documents.
 - 3. Manufacturer's certification that all linings and coatings have been factory tested and comply with the indicated requirements.
 - 4. For valves requiring certified tests, submit certified test results.
 - 5. Operation and maintenance data shall be submitted in accordance with the requirements set forth in Section 01730, and shall include, but not be limited to, the following information:
 - a. Manufacturer's installation and operating instructions.
 - b. Manufacturer's maintenance procedures.
 - c. List of special tools.
 - d. Spare Parts List: A spare parts list shall be provided with information for each valve assembly.
 - e. Factory Test Data: Where indicated, signed, dated, and certified factory test data for each valve requiring certification shall be submitted before shipment of the valve. The data shall also include certification of quality and test results for factory-applied coatings.

PART 2 – MATERIALS

2.1 GENERAL

- A. Check valves shall be new and of current manufacture. Valves shall be furnished, tested, and installed by the Contractor with the type of ends, the location, and size as shown on the Drawings and as specified herein.
- B. Swing check valves shall have a minimum working pressure of 200 psi. All valves shall be certified to meet the test pressure as specified and shall have a rated working pressure that exceeds the full working pressure specified.
- C. All interior cast surfaces of the swing check valve shall be fusion bonded epoxy in accordance with Standard Section 09961. The exterior cast surfaces of the swing check valve shall be two-part epoxy, Pota-Pox, or District-approved equal.

2.2 SWING CHECK VALVES

A. Swing Check Valves 4 Inches and Larger, Class 150: Swing check valves, 4 inches and larger, shall be iron body, bronze mounted with the following materials of construction:

Description	Material	Specification	
Disc or clapper seat ring, valve body seat ring	Stainless Steel	Type CF-8M	
Body and cover (bonnet)	Ductile iron	ASTM A536, Grade 65-45-12	
Disc and hinge or arm	Ductile Iron	ASTM A536, Grade 65-45-12	
Hinge pin	Stainless steel	Type 303, 304, or 410 stainless	
Cover bolts and nuts	Type 316 Stainless steel	ASTM A193, Grade B8M; ASTM A194, Grade 8M	

- B. Ends shall be flanged, Class 150, ANSI B16.42.
- C. Check valves shall be provided with outside lever and weight, and air cushion cylinder.
- D. Valves shall be APCO Model CVS-250, or approved equal.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Flanges shall be cleaned by wire brushing before installing flanged valves. Nuts shall be tightened uniformly and progressively.
- B. If flanges leak under pressure testing, nuts and bolts shall be loosened or removed, the gasket reseated or replaced, the bolts and nuts reinstalled or retightened, and joints retested. Joints shall be watertight.
- C. Threaded joints shall be cleaned by wire brushing or swabbing. Teflon joint compound or Teflon tape shall be applied to pipe threads before installing threaded valves. Joints shall be watertight.
- D. Manufacturer's authorized representative shall be available for customer service during installation and start-up, and to train personnel in the operation, maintenance and troubleshooting of the valve.
- E. Manufacturer shall also make customer service available directly from the factory in addition to authorized representatives for assistance during installation and

SECTION 15106 - SWING CHECK VALVES

start-up, and to train personnel in the operation, maintenance and troubleshooting of the valve.

3.2 PRESSURE TESTING

All swing check valves shall be pressure tested at the same time the connecting pipelines are pressure tested. See Standard Section 15144 for pressure testing requirements.

END OF SECTION

SECTION 15132 – PRESSURE GAUGES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section includes materials and installation of pressure gauges and accessories.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 – Record Drawings and Submittals

1.3 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

- A. Except as otherwise indicated, the current edition of the following standard applies to the Work of this section:
 - 1. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

1.4 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01300.
- B. Submit manufacturer's catalog data and descriptive literature. Show materials construction by specification reference and grade.

PART 2 – MATERIALS

2.1 MANUFACTURERS

Pressure gages and tools shall be as manufactured by Ashcroft, Crosby, Marshalltown, Marsh, or District approved equal.

2.2 GAUGE DESIGN

- A. Gauges shall comply with ANSI B40.1, Grade A. Gauges shall incorporate the following features:
 - 1. Pressure tight and vibration and shock resistant.
 - 2. 270-degree arc with adjustable pointer.
 - 3. 1/4-inch threaded stem connection, unless otherwise indicated, with a Type 316 stainless steel snubber adapter and a shut-off valve.
 - 4. Dial size 4-1/2 inches, unless otherwise indicated.
 - 5. Liquid filled, silicon or glycerine.
 - 6. Gauge range shall be approximately two times the normal operating pressure or 133% of the maximum pressure, whichever is higher.

SECTION 15132 – PRESSURE GAUGES

- 7. Accuracy of gauge shall be ± 0.5 -percent.
- 8. Diaphragm seal shall be Type 316 stainless steel.
- 9. Snubber Suppliers: Cajon Company, Weksler Instruments Corp., or approved equal.

2.3 MATERIALS OF CONSTRUCTION

Materials of construction shall be as follows:

Component	Material	Specification	
Case	Stainless Steel	AISI 316	
Bourbon Tube	Stainless Steel	AISI 316	
Window	Acrylic Plastic		
Ring	Stainless Steel	AISI 316	
Stem	Stainless Steel	AISI 316	
Dial Face	Aluminum With Clear	ASTM B 209	
	Baked On Acrylic Coating	6061-T6	

2.4 PIPE NIPPLES AND FITTINGS

Nipples for connecting gauges to piping shall be Type 316 stainless steel and as shown on the Drawings.

2.5 TOOLS FOR GAUGES

Provide two-gauge tool kits, each containing a hand jack set, screwdriver, five reamers (minimum), two pin vise holders, wiggler, tweezer and carrying case.

2.6 GAUGE COCKS

Gauge cocks shall be two-way or as shown on the Drawings. Gauge cocks shall be Type 316 stainless steel. End connections shall be NPT, female.

PART 3 – EXECUTION

3.1 INSTALLATION

Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to threads before installing. Joints shall be watertight. Install gauges before conducting pressure tests. Install all gauges and appurtenances at locations shown in the Drawings and in strict accordance with the manufacturer's printed instructions.

END OF SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

The Contractor shall furnish and install all ventilating systems and equipment complete with all supports, mounting frames, factory curbs, coordination with structural and architectural elements, duct work, louvers, panels, grilles, electric drive units and controls, mechanical equipment, electrical work, appurtenances, testing, balancing, ready for operation, as shown in the Drawings and specified herein, all in accordance with the requirements of the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 15860 FRP Ductwork

1.3 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

All work and materials shall be in full accordance with the latest rules and regulations or publications of the State Energy Resources Conservation and Development commission, the State Fire Marshall, the Industrial Safety Orders, the Health and Safety Rules (Air Conditioning Systems), the local plumbing code, the local building code, and all other local codes. Nothing in the Contract Documents shall be construed to permit work in violation of the above codes, rules, and regulations. In the absence of applicable codes, the installation and workmanship shall follow the standards set by the American Society of Heating, Refrigeration, and Air Conditioning Engineers.

1.4 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300:
 - 1. Certification: Contractor shall submit for approval written calculations that the fans selected will supply the air flow required for the given system.

1.5 QUALITY ASSURANCE/WARRANTY

The fans furnished and installed by the Contractor shall carry the manufacturer's standard warranty, and all such warranties shall be furnished to the Engineer upon final acceptance of the completed systems by the Owner.

PART 2 – MATERIALS

2.1 GENERAL

A. Quality: All mechanisms or parts shall be amply proportioned for the stresses which may occur during operation or for any other stresses which may occur during fabrication and erection. Individual parts furnished that are alike in all units shall be alike in workmanship, design, and materials and shall be of the manufacturer's top line, industrial-commercial grade.

- B. Supports: Contractor shall submit shop drawings for all duct work and ventilation equipment supports, hangers, anchors, and/or restraints, noting locations and submitting calculations if necessary. Supports shall comply with ASHRAE Code, UBC, and take into account seismic conditions. Ductwork shall not hang off or be supported by other equipment.
- C. Curbs: Contractor shall provide and install all factory curbs, base flanges, neoprene boots, and all other material required to install rooftop fans in coordination with all structural and architectural elements, including but not limited to, standing seam roofing, steel decking, tile, or other roofing materials specified.
- D. Vibration Isolation: All mechanical equipment over one horsepower, and unless otherwise noted, shall be isolated from the structure by means of resilient vibration and noise isolators and supplied by a single manufacturer to the mechanical contractor. Where isolator type and required deflection are not shown or tabulated, equipment shall be isolated in accordance with the ASHRAE Guide and Date Book, Chapter 35, Table 26. The isolator manufacturer's submittal shall include: the complete design for the supplementary basis, a tabulation of the design data on the isolators including OD, and free operating heights of the neoprene or fiberglass isolators.

2.2 MISCELLANEOUS CONSTRUCTION

Bird Screens: Removable bird screens shall be provided on all outside air intake and exhaust air discharges to outside air. Screens shall be secured in frames of same metal as screens. Bird screens shall be 1/2-inch mesh by 16-gauge and shall be stainless steel.

2.3 CONTROL

- A. General: All ventilating equipment shall be provided with automatic temperature control system with manual override capability as specified. Where various items of equipment are operating in conjunction with one another, they shall be controlled by an integrated control system, located in a control panel as specified herein.
- B. Suppliers: Control system components and thermostats shall be as manufactured by Honeywell Johnson Controls Company, General Controls, or approved equal.

2.4 FANS

- A. General
 - 1. General: Fans shall include all units shown. Location shall be as shown on the drawings. Fans shall be complete with motors, adjustable drives, belt guards, flexible connections to supply and/or suction ducts, vibration isolators, and necessary accessories all provided by a single manufacturer where possible. All fans shall be suitable for continuous operation. Fabrication of fans shall conform to AMCA 99.
 - 2. Performance: Fans shall be guaranteed to deliver the quantities of standard of air against the respective static pressure without deviating by more than five percent. Every fan wheel, regardless of size, shall be

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statically and dynamically balanced, and shall be free from objectionable vibration or noises. All units shall be fully assembled, inspected and tested at the operating speed prior to shipment. Fans shall be balanced utilizing electronic balancing equipment and written certifications of the balancing shall be submitted in accordance with Section 01300. Fan performance ratings shall conform to AMCA 210 and bear the AMCA Certified Rating Seal.

- 3. Fans shall be clearly labeled, complete with flow arrows.
- 4. Sound ratings shall conform to AMCA 301; tested to AMCA 300 and bearing AMCA Certified Sound Ratings Seal.
- 5. Listing: UL-listed to the extent commercially available.
- 6. Each fan shall have a permanently affixed manufacturer's nameplate containing the model number and serial number for future identification.
- 7. Final Inspection: All fans shall receive a final inspection by a qualified inspector prior to shipment. Inspection to include: fan description and accessories, balance, welding, dimensions, bearings, duct and base connection points, paint finish and overall workmanship.
- B. Fiberglass Duct Fan
 - 1. The Contractor shall provide and install a fiberglass belt drive duct fan.
 - a. The fan shall arrive at the jobsite packaged, completely assembled and ready to install.
 - b. The resin used on fiberglass axial flow fans shall be Ashland Hetron 693, a polyester resin with 3% antimony oxide added to achieve a Class I flame spread rate of below 25 per ASTM E84 tunnel test standards and NFPA Code 91 for blower and exhaust systems. The resin shall be OSHA approved.
 - c. The propeller shall be of an airfoil design, 6 bladed, one-piece construction of solid fiberglass with an aluminum insert molded to the hub for secure attachment to the shaft.
 - d. The hub shall be assembled with Type 316 stainless bolts and mounted on fan shaft with a tapered bushing. A raised ring shall allow the bushing and locking bolts to be covered with a fiberglass and resin patch to protect them from corrosives.
 - e. Fiberglass propellers, fan housings, and components shall be capable of being used in temperatures up to 200* F.
 - f. Fan construction shall conform to ASTM Standard D4167 for fiber reinforced plastic fans and blowers.
 - g. Fan housings shall be constructed of solid fiberglass including the flanges which have drilled mounting holes.
 - h. Motor mountings shall be 316 stainless steel plate mounted on the drum exterior with glass mat, cloth, and resin. The encapsulated assembly base, 316 stainless steel riser bolts and epoxy coated

SECTION 15500 - VENTILATION

motor base provide support for the motor. Motors shall be open end protected.

- i. All other hardware shall be Type 316 stainless steel.
- j. Fan shafts shall be ground and polished Type 316 stainless steel.
- k. Bearings shall be located in a sealed drive compartment to prevent corrosive element entry. Bearings shall be heavy duty, self-aligning, and shall have extended lube tubes and be relubricable for continuous service with a minimum L10 life of 50,000 hours.
- I. Variable pitch sheaves shall be standard on fans up to and including 10 HP and belts shall be sized for continuous service.
- m. Fans shall be designed for mounting in any position from horizontal to vertical.
- n. The fan assembly shall be dynamically balanced at the factory prior to shipping. Fans shall be balanced in accordance with AMCA Standard 204-96, fan application category BV-3 (comparable to Grade G6.3).
- Fan performance shall be in accordance with AMCA Standard 210 for air performance and AMCA Standard 300 for sound. Fans shall be licensed to bear the AMCA Certified Air Performance Rating Seal.
- p. The motors shall be explosion proof.
- q. Solid fiberglass mating flanges for the fan shall be provided.
- r. Rubber-in-shear or spring type vibration isolators shall be provided.
- s. Interior airstream surfaces shall be coated with a "carbon rich" resin coat and grounding straps shall be secured from the side of the housing to the fan motor. The fan meter shall be grounded at the time of installation.
- 2. Approved Manufacturers
 - a. Series 34 belt drive duct fan as manufactured by Hartzell Fans. The size of the fans shall be as shown on the Drawings.

2.5 GRAVITY RELIEF VENTILATOR

- A. General:
 - 1. Ventilator is low silhouette for relief applications with natural gravity or negative pressure system
 - 2. Each unit shall bear a permanently affixed manufacture's nameplate containing the model number and individual serial number
 - 3. Ventilator shall be Model FGR, manufactured by Greenheck, or owner approved equal.
 - 4. Minimum Performance: 4,000 cubic feet per minute at 0.15-inch pressure drop.
- B. Hood:

SECTION 15500 – VENTILATION

- 1. Constructed of aluminum
- 2. Internal structure is constructed of galvanized steel
- 3. Hood removal by removing bolts on supports.
- 4. Powder coated per manufacturers recommendations; color shall match roof tile color.
- C. Birdscreen:
 - 1. Constructed of $\frac{1}{2}$ inch galvanized steel mesh.
 - 2. Mounted horizontally across the intake area of the hood.
- D. Options/Accessories:
 - 1. Curb Seal:
 - a. Rubber seal between fan and the roof curb
 - 2. Roof Curbs:
 - a. Type: GPI as manufactured by Greenheck or Owner approved equal
 - b. Mounted onto roof, compatible with roof tile materials
 - c. Material: Aluminum
 - d. Coating Type: Non-aluminum materials shall have a powder coating per manufacturer's recommendations. Color shall match roof tile color.
 - 3. Dampers:
 - a. Type: Motorized
 - b. Prevents outside air from entering back into the building when fan is off
 - c. Balanced for minimal resistance to flow
 - d. Galvanized frames with prepunched mounting holes
 - 4. Finishes:
 - a. Type: Non aluminum materials shall have a powder coating compatible with ammonia gas per manufacturer's recommendations.
 - 5. Hood Insulation:
 - a. Lined with 1 inch fiberglass insulation to prevent condensation and sound levels

- 6. Insect Screen:
 - a. Constructed of fine mesh aluminum
 - b. Fitted to the top of the throat and prevents entry of insects

PART 3 – EXECUTION

3.1 GENERAL

- A. Roughing-In: The Contractor shall ascertain that all inserts, chassis, shafts, and openings are correctly located; otherwise all new openings required shall be cut at the Contractor's expense. The Contractor shall be responsible to coordinate all ventilation openings with building structural and architectural elements to include roofing and factory curbs to be provided as part of equipment.
- B. Checking: The Contractor shall test and make tight all work, furnish all equipment necessary to carry out the tests, and thoroughly clean the system before starting same.
- C. System Balancing: After completion of all required work, the Contractor shall have the system, as a whole, checked and balanced. System balancing shall include the following:
 - 1. Adjusting dampers and other devices so that the quantities of air called for on the Drawings are supplied or exhausted.
 - 2. Measuring and recording current on each fan and motor, and checking for proper operation of all equipment.
 - 3. Adjusting any adjustable blade registers to the correct setting to obtain the design conditions.
- D. Electrical: The electrical section of the specifications indicates and specifies conduit, conductors, outlets, disconnect switches, starters, except as hereinafter specified, and the making of final power and control connections.

END OF SECTION

PART 1 – GENERAL

1.1 SECTION INCLUDES

This section includes materials, testing, and installation of flow meters, totalizers, indicators, and transmitters. All flow meters must be suitable for use in sewage systems.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 09900 Painting and Coating

1.3 **REFERENCE SPECIFICATIONS, CODES, AND STANDARDS**

- A. Except as otherwise indicated, the current edition of the following standard applies to the Work of this section.
 - 1. ANSI B16.5 Pipe Flanges and Flanged Fittings, Class 150 only

1.4 QUALITY CONTROL

A. Manufacturer shall provide a two-year warranty on defective workmanship or materials.

1.5 CONTRACTOR SUBMITTALS

- A. The Contractor shall furnish submittals in accordance with the requirements of Section 01300. The following submittals are required:
 - 1. Submit Shop Drawings, manufacturer's catalog data certificate of warranty, and detailed construction sheets showing all flow meter parts and describing material of construction by material and specification. Submittal shall include meter dimensions and orientation.
 - 2. Submit certified factory test results, installation instructions, and six (6) sets of operation and maintenance manuals.

PART 2 - MATERIALS

2.1 FLOW METERS

- A. Manufacturer: The meter shall be Model FM 656 Tigermag EP as manufactured by Sparling Instruments.
- B. Electrodes: Electrodes shall be constructed of fused platinum. Sensor shall be suitable for sewage applications.
- C. Sensor Cable: The sensor cable shall be a multi-conductor, abrasive resistant, polyurethane jacketed cable flexible to -40°F. The sensor cable shall be permanently bonded to the sensor.

- D. The transmitter shall be remote mounted. Transmitter Enclosure: NEMA 4X
- E. Pressure/Temperature Limits: -40 to 180°F
- F. The flow meter shall operate at pressures up to 300 psi.
- G. Power Requirements: 77 265 Vac 50/60 Hz
- H. The meter shall have flanged connections conforming to ANSI B16.5, Class 150.

2.2 PAINTING AND COATING

- A. The interior of the flow sensor shall be ceramic lined.
- B. The exterior of the flow meter shall be painted in accordance with Section 09900.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. The flow meter shall be inspected by the Construction Manager prior to installation. If in the opinion of the Construction Manager there is any damage to the flow meter including interior lining, then the flow meter shall be rejected and replaced at no cost to the Owner.
- B. Install flow meters in accordance with all manufacturer's instructions.

END OF SECTION

PART 1 – GENERAL

1.1 WORK OF THIS SECTION

A. The Work of this Section includes FRP ductwork systems including duct, bends, fittings, dampers, adapters transitions, closure pieces, supports, expansion joints, and appurtenances.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 11000 Equipment General Provisions
- C. Section 15000 Piping Components
- D. Section 15020 Pipe Supports

1.3 STANDARD SPECIFICATIONS, CODE AND STANDARDS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:
 - 1. **AMCA 500** Test Methods for Louvers, Dampers, and Shutters 2. ASTM D 2240 Test Method for Rubber Property - Durometer Hardness 3. ASTM D 2310 Classification for Machine-Made Reinforced Thermosetting Resin Pipe 4. ASTM D 2992 Practice for Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fittings 5. ASTM D 2996 Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe 6. ASTM E 84 Standard Test Method for Surface Burning **Characteristics of Building Materials**
 - 7. SMACNA Thermosetting FRP Duct and Construction Manual

1.4 SHOP DRAWINGS AND SAMPLES

- A. The following shall be submitted in compliance with Section 01300:
 - 1. Duct
 - a. Name of manufacturer
 - b. Type of resin and identification of composite layers
 - c. Pressure, vacuum, and temperature rating of duct

- d. Dimensions of sub-assemblies to be shipped
- e. Certification of compliance with reference standards
- 2. Dampers
 - a. Name of manufacturer
 - b. Type, model, materials of construction
 - c. Pressure rating
 - d. Overall dimensions, weight including operator
 - e. AMCA 500 leakage test results
- 3. Expansion Joints
 - a. Name of manufacturer
 - b. Type, model, materials of construction
 - c. Force required for expansion and contraction
- 4. Supports
 - a. Location plan with support type, details, and materials
 - b. Stamped structural design calculations for custom designed supports

1.5 FACTORY TESTING

- A. Duct shall be inspected at the factory for compliance with the defect criteria listed below.
- B. A randomly selected damper from each size classification shall be tested in accordance with AMCA 500 at an AMCA-approved testing laboratory.

PART 2 – MATERIALS

2.1 GENERAL

- A. Service Conditions: Internally, duct systems will be exposed to air saturated with water vapor containing foul odors, primarily hydrogen sulfide. Externally, duct systems will be exposed to odorous air inside the building and outside environmental conditions of sunlight, varying temperatures and humidities.
- B. Design Requirements
 - 1. Duct, adapters, transitions, expansion joints
 - a. Internal positive pressure, in. wc 25
 - b. Internal vacuum in. wc 10
 - c. Temperature, deg. F. 40 to 120
 - d. Earth Loading, FT 20
 - 2. Dampers

- a. Differential pressure, in. wc 10
- b. Temperature, deg. F. 40 to 120
- 3. Dimensions: The dimensions shown are net inside, the clear space inside the duct.
- 4. Physical Properties: Laminates shall have the following minimum properties:

		3/16 inch	1/4 inch
Property	Standard	thick	thick
Ultimate Tensile Strength, psi	ASTM D 638	9,000	12,000
Flexural Strength, psi	ASTM D 790	16,000	19,000
Flexural Modulus of Elasticity, psi (tangent)	ASTM D 790	700,000	800,000

- 5. Reinforcement: Bends, fittings and special sections shall be reinforced or shall have shell thickness increased at those locations where the combined stresses due to internal pressure and bending will exceed the maximum stress recommended by the manufacturer. The duct manufacturer shall determine and provide reinforcements or additional shell thicknesses as required to keep the combined stresses within the recommended maximum.
- 6. Structural Criteria
 - a. Round duct shall have a safety factor of 10 to 1 for pressure and 5 to 1 for vacuum service. Rectangular sections shall require special design consideration that shall be submitted to the Construction Manager for review and approval. Rectangular duct design shall be based on a maximum of 1 percent side wall deflection. Minimum wall thickness for round and rectangular duct shall be 3/16-inch.
 - b. After installation, horizontal rectangular duct shall not sag more than 2 percent of the shortest side dimension, measured from the theoretical centerline of the duct to the actual centerline at the midpoint between supports. Maximum sag of horizontal round duct shall not exceed 2 percent of diameter.
 - c. Sections of ductwork weighing more than 150 pounds shall have lifting lugs or eyes to facilitate handling and installation.
- 7. Chemical Resistance: The FRP duct shall provide chemical resistance to acids, caustic, water, hydrogen sulfide and other sulfide and disulfide compounds, mercaptans, and other materials commonly encountered in odorous air streams from wastewater treatment plants.
- 8. Flame Spread: FRP ducting and fabrications shall not exceed a flame spread index of 25 and smoke development rating of 50 when tested in accordance with ASTM E 84.
- 9. FRP Defects: FRP ductwork shall satisfy the following criteria:

Defect	Inside Surface	Outside Surface
Blister	None	Max dimension: 1/4-in dia x 1/8-in high;
		Max density: 1 per sq ft; Min separation: 2 in apart
Chips	None	Max dimension of break: 1/4-in and thickness no greater than 10 percent of wall thickness;
		Max density: 1 per sq ft
Crazing	None	Max length: 1/2 in;
		Max density: 5 per sq ft
		Min separation: 2 in
Cracks	None	None
Exposed Glass	None	None
Scratches	None	Max length: 1 in;
		Max dopth: 0.010 in
Burned Areas	None	None
Surface Porosity	None	None
Foreign Matter	None	None
Sharp Discontinuity	None	None
Pits	Max: 1/8 in dia	Max 1/8 in dia by 1/16 deep
	by 1/32 in deep;	······································
		Max: 10 per sq ft
	Max: 10 per sq ft	
Dry Spot	None	1 sq in per sq ft
Entrapped Air	None at the surface 1/16 in and 10 per sq in max within laminate	1/8 in and 4 per sq in or 1/16 in and 10 per sq in

C. Ductwork and fittings shall have the manufacturer's name printed on the exterior surface.

2.2 DUCTWORK SYSTEMS

- A. Round Duct: Filament wound, complying with NBS PS-15 (69).
- B. Rectangular Duct: Contact molded, complying with NBS PS-15 (69), with structural layer thickness determined by structural calculation. Duct may be reinforced with FRP angles or tees.

- C. Fittings and Flanges: Manufacturer's standard, shop-fabricated, compatible with duct, chemically resistant same as duct, complying with NBS PS-15 (69). Flanges shall be at least 3/4-inch thick.
- D. Manufacturers: Duct, flanges, and fittings shall be as manufactured by Heil Products, Inc., Paramount Fabricators, Delta Fiberglass, J.B. Rogers, or equal.
- E. Flange Gaskets: Full face, Hypalon, 3/16-inch min. thickness, hardness of Durometer 50 to 70 when tested according to ASTM D 2240.
- F. Bolts, Studs, Washers, Nuts: Comply with Section 15000.
- G. FRP Construction
 - 1. Resin: Resin shall be premium corrosion-resistant, fire resistant vinyl resin as recommended by the manufacturer for the intended service. Resin shall be Hetron by Ashland Chemical, Derakane by Dow Chemical, or Rigidon by Heil Products.
 - 2. Fiber Glass Reinforcement: Chopped strand fiber glass mat shall be used as reinforcement material. Alternatives such as synthetic fiber cloth, woven roving, fiber glass cloth, chopped strand fiber glass spray-up, or filament may be accepted, subject to review by the Construction Manager.
 - 3. Laminates
 - a. Inner Surface: The inner surface exposed to the exhaust air environment shall be a resin-rich liner between 0.01-inch and 0.02-inch thick obtained by using one layer of Nexus veil saturated with resin.
 - b. Interior Layer: The interior layer shall consist of chopped strand glass mat or chopped glass roving saturated with resin to achieve a minimum thickness of 0.10 inch (100 mils).
 - c. Structural Layer: The structural layer shall be fabricated using either hand layup construction per NBS PS-15 or filament wound, depending on the duct shape in cross-section.
 - d. Outside Coat: The outside coat shall be resin rich with no exposed raw fibers. For interior duct, the final coat shall be an acceptable factory applied intumescent coating to achieve the designated results for low smoke development. For exterior duct, the final coat shall be an acceptable resin coat with ultraviolet (UV) inhibitor or a suitable paint resistant to UV attack on the surface. The color shall be selected by the Construction Manager.
- H. Expansion Joints: Expansion joints shall be of a material resistant to UV light and shall be fabric-reinforced Hypalon.
 - 1. Expansion joints shall be slip-on or flanged type. The slip-on type shall be sized to fit tightly on the outside diameter of the duct and shall be secured in place by stainless steel worm screw type adjustable clamps to provide a gas-tight connection. Flange type expansion joints shall have split

stainless steel retaining rings and shall have ANSI/ASME B16.1, Class 25 diameter and drilling.

2. Expansion joints shall be capable of compressing and elongating 1-inch under a maximum force of 100 pounds or less. The joints shall also allow lateral deflections of up to 1 inch. Expansion joint material shall be stiff enough to prevent sagging or contraction due to internal vacuum.

2.3 DAMPERS

- A. Components
 - Frame Fiberglass reinforced plastic with vinyl ester resin (and UV inhibitors where dampers are located outside).
 - Blade Fiberglass reinforced plastic; stiffeners as required. If the largest dimension is 36 inches and less, thickness shall be at least 0.25 inches. If larger than 36 inches, 0.50 inches thick.
 - Axle Continuous fiberglass reinforced plastic rod; 6-inch extension beyond frame; stiffeners as required.
 - Bearings Molded PTFE.
 - Blade Stops Fiberglass reinforced plastic bar.
 - Blade Seals Neoprene.
 - Shaft Seal Neoprene.
 - Flanges Flanges shall comply with PS-15 Table 5 at a design pressure of 25 psi and shall have ANSI B16.1 Class 25 diameter and drilling.
- B. Construction: Dampers shall be of the single-blade type complete with channeltype frame, close-fitting blade, full-length axle, and bearings. The damper shall be constructed of fiberglass reinforced plastic using a vinyl ester resin similar to the duct and shall have the same dimensions as the inside of the connecting ductwork. Axles shall be not less than 1-inch in diameter and shall be continuous through the damper.
 - 1. Dampers shall have a minimum pressure rating of 10-inch water column. Dampers used for isolation service shall be furnished with a blade seal and shaft seal. Dampers used for balancing shall be furnished with a full circumference molded in blade stop. Isolation dampers shall have a maximum leakage rate of 3 cubic feet per minute per square foot of damper area, at a differential pressure of 10 inches wc. AMCA leakage tests shall be furnished as part of the submittal. Dampers shall be AMCA rated and licensed to bear the AMCA seal.
 - 2. Round dampers shall be Swartwout Model 912 or equal.

- 3. Rectangular dampers shall be the single blade type with dimensions indicated in the damper schedule.
- 4. Rectangular dampers shall be Swartwout Model 1108AF or equal.
- C. Hand Actuators: Dampers shall be provided with hand operators.
 - 1. Hand actuators for dampers 24-inch diameter and larger shall be worm geared driven, totally enclosed, weather-proof, and permanently lubricated in a die-cast aluminum housing. Housing shall be epoxy coated in the factory with a minimum dry film thickness of 8 mils. Worms shall be heat-treated carbon steel and worm wheels shall be ductile iron. Shafting shall be stainless steel. Shaft and worm wheel seals shall be Buna-N rubber. Actuator shall be bolted to the duct with stainless steel bolts. Hand wheel sizes shall be computed assuming a maximum rim effort of 40 lbs. The allowable number of turns of the hand wheel in order to rotate the blade 90 degrees shall be a minimum of 4 and maximum of 12. Actuators shall be provided with indicating arrows to clearly identify directions of rotation for opening and closing of the dampers. Arrows shall be clearly legible and of substantial durability.
 - 2. Worm gear driven hand actuators shall be Swartwout Dyna-Torque Model DT2, or equal.
 - 3. Hand actuators for dampers less than 24-inch diameter shall be heavy duty, lever type actuators. Each heavy-duty hand actuator shall be constructed of Type 316 stainless steel and shall have a locking quadrant suitable for positioning the blade at any intermediate position.
 - 4. All dampers with shaft centerlines more than 5 feet 6 inches above the floor shall be provided with chain wheels and operating chains. Each chainwheel shall be equipped with a chain guide that will permit rapid handling of the operating chain without "gagging" of the wheel and will also permit reasonable side pull on the chain. Suitable actuator extensions shall be provided, if necessary, to prevent interference of chain and adjacent piping or equipment below. Operating chains shall be hot-dip galvanized carbon steel and shall be looped to extend within 4 feet of the floor below damper.
 - 5. Galvanized tie-back hooks shall be provided on adjacent pipe supports to hold operating chains out of walkways or maintenance access areas when the damper is not being operated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Field Measurements: Duct lengths shall be determined from measurements taken at the Site. Dimensions shown on drawings are approximate, not for fabrication.

- B. Delivery, Storage, and Handling: Duct, fittings, and dampers shall be protected from damage and shall be properly supported to avoid damage due to flex strains during shipping and installation. Debris or other extraneous material shall not be allowed to enter the duct. Duct, fittings, and dampers shall not be thrown or dropped.
- C. Installation: Ducts shall be installed as indicated. All necessary provisions shall be taken into consideration during fabrication and installation of ductwork to provide for expansion and contractions. Ductwork shall be free from vibration when in operation. All necessary vibration isolation devices shall be provided.
 - 1. Anti-seize compound shall be applied to bolt threads.
 - 2. Smooth bends or internal turning vanes shall be installed at elbows, tees, and other points where air flow changes direction.
 - 3. The ductwork shall be supported per manufacturer's recommendation and as required herein.
 - 4. The inside of duct, specials, and fittings shall be smooth, clean, and free from blisters, sand, and dirt when installed.
 - 5. Ductwork shall be airtight.
- D. Joints: Joints shall be carefully and neatly made in accordance with the requirements herein and as recommended by the manufacturer.
- E. Flanges: Flange bolts shall be tightened sufficiently to slightly compress the gasket and make a good seal, but not so tightly as to distort the flanges. A flat washer shall be installed under each nut and bolt head.
- F. Dampers shall be positioned to fit in the connecting ductwork at the locations indicated on the drawings. Unless necessary for proper operation of the damper, axles shall be installed in the horizontal position.
- G. Supports and Hangers
 - 1. Supports for the FRP duct shall comply with SMACNA Standards and appropriate code requirements for aluminum duct installation. Supports and hangers shall transmit all loads into the building structural frame through a system of intermediate beams and struts as necessary to comply with these specifications. The Contractor shall submit his proposed support details plan to the Construction Manager for approval.
 - 2. Supports or hangers employing clip angles or similar devices for attachment to the duct are prohibited and all supports shall be designed to resist UBC Zone 4 seismic forces. Supports shall be as indicated in Section 15020.
- H. Alignment and Elevation: Ductwork shall be provided to the lines and elevations indicated and shall slope to facilitate water drainage where indicated. Laser beam

equipment or surveying instruments shall be used to maintain alignment and elevation. If laser beam equipment is used, periodic elevation measurements shall be made with surveying instruments to verify accuracy. If such measurements indicate thermal deflection of the laser beam due to differences between the ground temperature and the air temperature within the duct, precautions shall be taken to prevent or minimize further thermal deflections.

3.2 DUCT CLEANING

A. Duct shall be blown clean of dust and debris using compressed air. The system fans shall not be used to provide air for duct cleaning. The duct being cleaned shall be purged continuously for not less than 48 hours at a flow rate not less than the design flow rate for that duct section.

END OF SECTION

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SECTION 16010 - ELECTRICAL BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Basic requirements for electrical systems.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 1 General Requirements.
- B. Section 16120 Wire and Cable 600 Volt and Below.
- C. Section 16130 Raceways and Boxes.

1.3 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

- A. Aluminum Association (AA).
- B. American Iron and Steel Institute (AISI).
- C. ASTM International (ASTM):
 - 1. A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 2. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- D. ETL Testing Laboratories (ETL).
- E. Institute of Electrical and Electronics Engineers/American National Standards Institute (IEEE/ANSI):
 - 1. C2, National Electrical Safety Code (NESC).
- F. National Electrical Manufacturers Association (NEMA):
 - 1. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
- G. National Fire Protection Association (NFPA):
 - 1. 70, National Electrical Code (NEC).
- H. Underwriters Laboratories, Inc. (UL).
- I. Where Underwriters Laboratories, Inc. (UL) test procedures have been established for the product type, use UL or ETL Testing Laboratories (ETL) approved electrical equipment and provide with the UL or ETL label.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Division 1 for requirements for the mechanics and administration of submittal process.
 - 2. See Division 1 and individual specification sections for submittal requirements for products defined as equipment.
 - 3. General Requirements:
 - a. Provide manufacturer's technical information on products to be used, including product descriptive bulletin.
 - b. Include data sheets that include manufacturer's name and product model number.
 - 1) Clearly identify all optional accessories.
 - c. Acknowledgement that products are UL or ETL listed or are constructed utilizing UL or ETL recognized components.
 - d. Manufacturer's delivery, storage, handling and installation instructions.
 - e. Product installation details.
 - f. See individual specification sections for any additional requirements.
- B. Operation and Maintenance Manuals:
 - 1. See Division 1 for requirements for:
 - a. The mechanics and administration of the submittal process.
 - b. The content process of Operation and Maintenance Manuals.
- C. When a Specification Section includes products specified in another Specification Section, each Section shall have the required Shop Drawing transmittal form per Division 1 and all Sections shall be submitted simultaneously.

1.5 **DEFINITIONS**

- A. For the purposes of providing materials and installing electrical work the following definitions shall be used.
 - 1. <u>Outdoor Area</u>: Exterior locations where the equipment is normally exposed to the weather and including below grade structures, such as vaults, manholes, handholes and in-ground pump stations.
 - 2. <u>Architecturally Finished Interior Area</u>: Offices, laboratories, conference rooms, restrooms, corridors and other similar occupied spaces.

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- 3. <u>Non-Architecturally Finished Interior Area</u>: Pump, chemical, mechanical, electrical rooms and other similar process type rooms.
- 4. <u>Highly Corrosive and Corrosive Area</u>: Areas identified on the Drawings where there is a varying degree of spillage or splashing of corrosive materials such as water, wastewater or chemical solutions; or chronic exposure to corrosive, caustic or acidic agents, chemicals, chemical fumes or chemical mixtures.
- 5. <u>Hazardous Areas</u>: Class I, II or III areas as defined in NFPA 70 (NEC) and NFPA 820.
- 6. <u>Shop Fabricated</u>: Manufactured or assembled equipment for which a UL test procedure has not been established.

1.6 DELIVERY, STORAGE AND HANDLING

- A. See Division 1.
- B. Protect nameplates on electrical equipment to prevent defacing.

1.7 AREA DESIGNATIONS

- A. Designation of an area will determine the NEMA rating of the electrical equipment enclosures, types of conduits and installation methods to be used in that area.
 - 1. Outdoor Areas:
 - a. Wet.
 - b. Also, corrosive and/or hazardous when specifically designated on the Drawings or in the Specifications.
 - 2. Indoor Areas:
 - a. Dry.
 - b. Also, wet, corrosive and/or hazardous when specifically designated on the Drawings or in the Specifications.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Refer to specific Division 16 sections and specific material paragraphs below.
- B. Provide all components of a similar type by one (1) manufacturer.

2.2 MATERIALS

- A. Electrical Equipment Support Pedestals and/or Racks:
 - 1. Approved Manufacturers:

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- a. Modular Strut:
 - 1) Unistrut Building Systems.
 - 2) B-Line.
 - 3) OCAL.

2. Material Requirements:

- a. Modular Strut:
 - 1) Stainless steel: AISI Type 316.

2) PVC coated galvanized steel: ASTM A123 or ASTM A153 and 20 mil PVC coating.

- b. Mounting Hardware:
 - 1) Stainless steel.
 - 2) OCAL.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install and wire all equipment, including pre-purchased equipment, and perform all tests necessary to assure conformance to the Drawings and Specifications and ensure that equipment is ready and safe for energization.
- B. Install equipment in accordance with the most recent requirements of:
 - 1. NFPA 70 (NEC).
 - 2. IEEE/ANSI C2.
 - 3. The manufacturer's instructions.
- C. In general, conduit routing is not shown on the Drawings.
 - 1. The Contractor is responsible for routing all conduits including those shown on one-line and control block diagrams and home runs shown on floor plans.
 - 2. Conduit routings and stub-up locations that are shown are approximate; exact routing to be as required for equipment furnished and field conditions.
- D. When complete branch circuiting is not shown on the Drawings:
 - 1. A homerun indicating panelboard name and circuit number will be shown and the circuit number will be shown adjacent to the additional devices (e.g., light fixture and receptacles) on the same circuit.

- 2. The Contractor is to furnish and install all conduit and conductors required for proper operation of the circuit.
- 3. The indicated home run conduit and conductor size shall be used for the entire branch circuit.
- 4. See Section 16120 for combining multiple branch circuits in a common conduit.
- E. Do not use equipment that exceed dimensions or reduce clearances indicated on the Drawings or as required by the NFPA 70 (NEC).
- F. Install equipment plumb, square and true with construction features and securely fastened.
- G. Install electrical equipment, including pull and junction boxes, minimum of 6-inches from process, gas, air and water piping and equipment.
- H. Install equipment so it is readily accessible for operation and maintenance, is not blocked or concealed and does not interfere with normal operating and maintenance requirements of other equipment.
- I. Device Mounting Schedule:
 - 1. Unless indicated otherwise on the Drawings, mounting heights are as indicated below:
 - a. Light switch (to center): 48 IN.
 - b. Receptacle in architecturally finished areas (to center): 18 IN.
 - c. Receptacle on exterior wall of building (to center): 18 IN.
 - d. Receptacle in non-architecturally finished areas (to center): 48 IN.
 - e. Telephone outlet in architecturally finished areas (to center): 18 IN.
 - f. Telephone outlet for wall-mounted phone (to center): 54 IN.
 - g. Safety switch (to center of operating handle): 54 IN.
 - h. Separately mounted motor starter (to center of operating handle): 54 IN.
 - i. Pushbutton or selector switch control station (to center): 48 IN.
 - j. Panelboard (to top): 72 IN.
- J. Avoid interference of electrical equipment operation and maintenance with structural members, building features and equipment of other trades.
 - 1. When it is necessary to adjust the intended location of electrical equipment, unless specifically dimensioned or detailed, the Contractor may make adjustments in equipment locations in accordance with the following without obtaining the Engineer's approval:
 - a. 1 FT at grade, floor and roof level in any direction in the horizontal plane.
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- b. 1 FT for equipment other than lighting at ceiling level in any direction in the horizontal plane.
- c. 1 FT for lighting fixtures at ceiling level in any direction in the horizontal plane.
- d. 1 FT on walls in a horizontal direction within the vertical plane.
- e. Changes in equipment location exceeding those defined above require the Engineer's approval.
- K. Provide electrical equipment support system per the following area designations:
 - 1. All Areas:
 - a. 316 Stainless steel system consisting of stainless steel channels and fittings, nuts and hardware.
- L. Provide all necessary anchoring devices and supports rated for the equipment load based on dimensions and weights verified from approved submittals, or as recommended by the manufacturer.
 - 1. Do not cut, or weld to, building structural members.
 - 2. Do not mount safety switches or other equipment to equipment enclosures, unless enclosure mounting surface is properly braced to accept mounting of external equipment.
- M. Provide corrosion resistant spacers to maintain 1/4 IN separation between metallic equipment and/or metallic equipment supports and mounting surface in wet areas, on below grade walls and on walls of liquid containment or processing areas such as Basins, Clarifiers, Digesters, Reservoirs, etc.
- N. Do not place equipment fabricated from aluminum in direct contact with earth or concrete.
- O. Screen or seal all openings into equipment mounted outdoors to prevent the entrance of rodents and insects.
- P. Do not use materials that may cause the walls or roof of a building to discolor or rust.
- Q. Identify electrical equipment and components.

3.2 FIELD QUALITY CONTROL

- A. Verify exact rough-in location and dimensions for connection to electrified equipment, provided by others.
 - 1. See Division 1 for openings and penetrations in structures.
- B. Replace equipment and systems found inoperative or defective and re-test.

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- C. Cleaning:
 - 1. See Division 1.
- D. The protective coating integrity of support structures and equipment enclosures shall be maintained.
 - 1. Repair field damaged galvanized components utilizing a zinc rich paint.
 - 2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
 - 3. Repair PVC coated components utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the component.
 - 4. Repair surfaces which will be inaccessible after installation prior to installation.
 - 5. See Section 16130 for requirements for conduits and associated accessories.
- E. Replace nameplates damaged during installation.

3.3 **DEMONSTRATION**

A. Demonstrate equipment in accordance with Division 1.

3.4 **PROTECTIVE DEVICE COORDINATION**

- A. Provide system coordination of the protective devices furnished on this project. The protective device on the line side closest to the fault or abnormal conditions shall isolate the problem portion of the system and minimize damage in that portion. The rest of the system shall be maintained in normal service. The coordination shall be in conformance with the recommendations of latest IEEE Standard 242.
- B. Submit the analysis that shall include impedance and short circuit calculations, list of any assumptions made in the analysis, the recommended settings of the protective devices, and the system time/current characteristic curves. The submittal shall be made so as to allow time for review and resubmittal, if necessary, before the implementation of final settings and adjustments.

3.5 ARC FLASH STUDY

A. Provide a complete arc flash hazard study to help protect individuals from electrical arc flash injuries. These individuals may include any workers who inspect, maintain, or operate energized electrical equipment. Include all equipment 480 volt equipment and all panelboards.

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- B. Provide Arc Flash Hazard Warning Labels on all electrical panels. These labels are intended to assist maintenance personnel and others in the selection of proper Personal Protective Equipment when working around exposed and energized conductors.
- C. Incident Energy Study in accordance with the IEEE 1584, "IEEE Guide for Performing Arc Flash Hazard Calculations" as referenced in NFPA 70E, "Standard for Electrical Safety in the Workplace", in order to quantify the hazard for selection of personal protective equipment (PPE). Tables that assume fault current levels and clearing time for proper PPE selection are not acceptable.
- D. Installed warning labels (orange <40 cal/cm2) or danger label (red > 40 cal/cm2) in accordance with ANSI Z535.4-2002. The label must be readable in both indoor and outdoor environments for at least 3 years and contain the following information (See sample label, attached):
 - 1. Arc hazard boundary (inches).
 - 2. Working distance (inches).
 - 3. Arc flash incident energy at the working distance (calories/ cm2).
 - 4. PPE category and description including the glove rating.
 - 5. Voltage rating of the equipment.
 - 6. Limited approach distance (inches).
 - 7. Restricted approach distance (inches).
 - 8. Prohibited approach distance (inches).
 - 9. Equipment/bus name.
 - 10. Date prepared.
 - 11. Arc flash hazard study preparer name and address.
- E. Personnel performing the arc flash analysis shall be trained and experienced in accordance with NETA Training Specifications concerning the apparatus and systems being evaluated.
 - 1. LABELS: (Sample)

SECTION 16010 - ELECTRICAL BASIC REQUIREMENTS



Arc Flash and Shock Hazard Appropriate PPE Required		
40.0	cal/cm^2 Flash Hazard at 46 inches	
Class 4	Cotton Underwear + FR Shirt & Pant + Multi Layer Flash Suit + Hood	
480 VAC	Shock Hazard when cover is removed	
00	Glove Class	
42 inch	Limited Approach (Fixed Circuit)	
12 inch	Restricted Approach	
1 inch	Prohibited Approach	
Bus: CPK4	IS1A LINE Prot: F5/SUB CPK4S1A	

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. The design and installation of seismic bracing and anchorage required for electrical equipment, conduit, cable tray, and bus ducts.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 01600 Materials and Equipment
- C. Section 05120 Miscellaneous Metalwork
- D. Division 1 General Requirements.

1.3 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

- A. ASTM International (ASTM):
 - 1. A36, Standard Specification for Carbon Structural Steel.
 - 2. A307, Standard Specification Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 - 3. F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
- B. Building Code:
 - 1. International Building Code (IBC) including all State of California amendments.
 - 2. International Conference of Building Officials (ICBO) including all State of California amendments.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Division 1 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data:
 - a. Seismic control devices.
 - 3. Fabrication and/or layout drawings:

- a. Layout and mounting detail drawings showing system and proposed brace locations for all systems including pre-engineered systems.
- b. The specific detail for each type of brace or anchor must be referenced on a plan that identifies the required location.
 - 1) Supplying a book of details without referencing the proper detail to a specific location on a plan is not acceptable.
- c. Structural calculations for required lateral force level for each component.
- d. All submittals, including pre-approved systems, shall be signed and sealed by a licensed engineer, licensed in the state in which the project is located.

1.5 QUALITY ASSURANCE

A. The pre-engineered suspended bracing system manufacturer shall have a minimum of five (5) years experience in the bracing industry.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Transport bracing systems with proper equipment to protect systems from damage.
- B. Store bracing systems off ground and on firm surfaces. Protect systems from extreme temperatures and corrosion.

1.7 SYSTEM DESCRIPTION

- A. Contractor is responsible for design and installation of seismic bracing and anchorage systems.
- B. Description of Systems:
 - 1. Transverse and longitudinal bracing for seismic forces on suspended electrical systems including conduit, cable tray, bus duct, and equipment.
 - 2. Anchorage of floor and roof mounted electrical equipment.
- C. Seismic Design Requirements:
 - 1. Seismic design criteria: Provide bracing and anchoring for equipment, conduit, cable tray, bust duct, designed, constructed, and installed to resist stresses produced by lateral forces.
 - 2. Design and install seismic anchorage and bracing for all floor or roof mounted equipment weighing 400 LBS or more and all suspended or wall mounted equipment weighing 20 LBS or more.

SECTION 16012 - SEISMIC BRACING SYSTEMS

- 3. The following components are exempt from the requirements of this Section:
 - a. Electrical components in structures assigned to Seismic Design Category C provided that the importance factor (I_p) is equal to 1.0.
 - b. Electrical components in Seismic Design Categories D, E, and F where $I_p = 1.0$ and flexible connections between the components and associated ductwork, piping, and conduit are provided and that are mounted at 4 FT (1.22 m) or less above a floor level and weigh 400 LBS (1780 N) or less.
 - c. Electrical components in Seismic Design Categories D, E, and F weighing 20 LBS (95 N) or less where I_p = 1.0 and flexible connections between the components and conduit are provided, or for distribution systems, weighing 5 LBS/FT (7 N/m) or less.
- 4. Seismic forces shall be presumed to act through the center of mass of the equipment in a direction that will produce the largest single anchor force.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Pre-engineered suspended bracing systems:
 - a. International Seismic Application Technology (ISAT) "Engineered Seismic Bracing of Suspended Utilities".
 - b. Unistrut.
 - c. Tolco.
 - d. B-Line.
 - 2. Custom engineered systems designed using specified criteria and common building materials.
- B. Submit request for substitution in accordance with Specification Section 01640.

2.2 EQUIPMENT ANCHORS AND SUPPORTS

- A. Drilled-in-place concrete anchors shall have an approved ICBO Evaluation Services Report.
- B. Cast-in-place anchors shall comply with ASTM A36, ASTM A307, or ASTM F1554, 36 ksi.
- C. Anchors permanently exposed to weather or corrosive environments shall be 316 stainless steel.
- D. Structural Steel for Supports: ASTM A36.

- E. Cold formed metal and connection material: Unistrut or equal.
- F. Any details provided are based on assumed equipment and arrangement.
 - 1. Contractor shall be responsible for design and acquiring approval for support and anchorage of equipment and arrangement which varies from equipment and arrangement assumed in detail provided.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Every run which requires bracing shall have a minimum of two (2) transverse braces and one (1) longitudinal brace.
 - 1. A "run" is defined as suspended pipe, conduit, cable tray, bus duct or trapeze rack having a minimum 5 FT straight run length.
- B. Brace spacing shall not exceed the maximum allowable brace spacing as engineered by the manufacturer or custom bracing designer.
- C. Bracing may be omitted from conduit, cable tray and bus duct runs less than 5 FT in length.
- D. Bracing may be omitted from conduit, cable tray and bus duct runs where rod hung supports of less than 12 IN. (305mm) in length are required.
 - 1. All unbraced suspended utility systems having 2 IN conduit and larger or systems weighing more than 5 LBS/FT shall be installed with a minimum 6IN clearance to suspended ceiling vertical hanger wires.
 - 2. The conduit, cable tray, or bus duct shall be installed such that the lateral motion of the members will not cause damaging impact with other systems or structural members or loss of vertical support.
- E. A longitudinal brace at a 90 degree change in direction may act as a transverse brace if it is located within 2 FT of the change in direction.
- F. A transverse brace may act as a longitudinal brace if it is located within 2 FT of a change in direction and if the brace arm and anchorage have been sized to meet or exceed the requirements of the longitudinal brace.
- G. When bracing equipment or a utility system that is suspended from an overhead deck, brace back to the overhead deck or to the supporting structure supporting the deck.
 - 1. Do not brace to another element of the structure which may respond differently during a seismic event.
- H. Obtain approval from the Structural Engineer prior to attaching any brace elements to structural steel or wood framing.

- I. When utilizing cable bracing, tension the cable to remove slack without inducing uplift of the suspended element.
 - 1. Tension seismic bracing system prior to system start-up and adjust if necessary after equipment start-up.
- J. As a general rule, do not mix rigid bracing with cable bracing in the same run.
 - 1. However, once bracing has transitioned a 90 degree change in run direction, the bracing may switch from rigid to cable or vice versa if required due to a significant change in overhead deck elevation or to provide an implementable bracing scheme in a congested area.
- K. Install brace members at an angle of 45 degrees from horizontal within a tolerance of plus 2 1/2 degrees or minus 45 degrees provided the brace length is accounted for in design.
 - 1. Brace angle may be increased to 60 degrees provided the brace spacing is reduced to 1/2 that required for a 45 degree brace.
- L. Seismic bracing may not pass through a building separation joint.
 - 1. Utility systems that pass through a separation joint must be seismically restrained no greater than 5 FT from the point of connection.
 - 2. Any hardware designed to accommodate seismic movement across the span of the separation joint shall be installed per manufacturer's installation and listing instructions.
- M. With approval of the Structural Engineer, utility systems that are suspended from the overhead deck may be braced to load bearing concrete or CMU (concrete masonry) walls provided that the walls and the overhead decks will respond similarly during a seismic event.
- N. Each layer of a multiple layer trapeze rack shall be braced individually based on the weight of the individual layer.
- O. Conduit, cable tray, or bus duct constructed of non-ductile material (plastic or fiberglass), shall have brace spacing reduced to 1/2 of the spacing allowed for ductile materials.
- P. Where brace elements are through-bolted, the mounting hole in the element is to be no more than 1/16 inch in diameter larger than the bolt or threaded rod.
- Q. Seismic braces shall directly brace the system and not the hanger.

3.2 SUSPENDED ELECTRICAL SYSTEMS

A. Install seismic bracing for all conduits 2-1/2 IN trade size or greater.

SECTION 16012 - SEISMIC BRACING SYSTEMS

- B. All trapeze assemblies supporting conduits, cable trays or bus ducts shall be braced considering the total weight of the elements on the trapeze.
 - 1. For the purposes of calculating weight, all conduits are to be treated as full.
- C. Brace all trapeze racks which support conduit 2-1/2 inch in trade size or larger.
 - 1. Brace all other conduit rack, cable tray or bus duct trapezes having a minimum weight in excess of 10 LBS/LF.
 - 2. Include a minimum 10 percent additional capacity for future additions.
- D. Seismic bracing may be omitted from cable trays, conduit and bus ducts suspended by rod hung supports 12 IN or less in length from the top of the element to the bottom of the structural attachment of the hanger provided lateral motion will not cause damaging impacts to other systems or loss of system vertical support.
- E. All vertical risers involving conduit 2-1/2 inch in diameter or larger shall include lateral restraint at maximum 30 FT intervals and at the top and bottom of the riser.

3.3 FLOOR OR ROOF MOUNTED EQUIPMENT

- A. Provide one (1) anchor on each leg or corner.
 - 1. Support with a minimum of three (3) 3/8 inch diameter anchors.
- B. Friction shall be neglected when designing anchors for shear.
- C. Vertical seismic forces, when required, shall be presumed to act concurrently with horizontal seismic forces.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Material and installation requirements for grounding system(s).

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 1 General Requirements.
- B. Section 16010 Electrical: Basic Requirements.
- C. Section 16080 Acceptance Testing.
- D. Section 16120 Wire and Cable 600 Volt and Below.
- E. Section 16130 Raceways and Boxes.

1.3 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

- A. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. Standard Specification for Highway Bridges.
- B. ASTM International (ASTM):
 - 1. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
- C. Institute of Electrical and Electronics Engineers (IEEE):
 - 1. 837, Qualifying Permanent Connections Used in Substation Grounding.
- D. National Fire Protection Association (NFPA):
 - 1. 70, National Electrical Code (NEC).
- E. Underwriters Laboratories, Inc. (UL):
 - 1. 467, Standard for Safety Electrical Grounding and Bonding Equipment.
- F. Assure ground continuity is continuous throughout the entire Project.

1.4 SUBMITTALS

A. Shop Drawings

- 1. Product Technical Data
 - a. Provide submittal data for all products specified in PART 2 of this Specification except:
 - 1) Grounding clamps, terminals and connectors.
 - 2) Exothermic welding system.
 - b. See Section 16010 for additional requirements.

1.5 WORK PAYMENT

Payment for the Work in this section shall be included as part of the lump-sum or unitprice bid amount for which such Work is appurtenant thereto, including all Work and materials specified herein and as may be required to complete this portion of the Work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Ground Rods and Bars and Grounding Clamps, Connectors and Terminals:
 - a. Burndy.
 - b. Harger Lightning Protection.
 - c. Heary Brothers.
 - d. Joslyn.
 - e. Robbins Lightning Protection.
 - f. Thomas & Betts (Blackburn).
 - g. Thompson.
 - h. Or equal.
 - 2. Exothermic Weld Connections:
 - a. Erico Products Inc., Cadweld.
 - b. Harger Lightning Protection.
 - c. Thermoweld.
 - d. Or equal.
 - 3. Prefabricated Composite Test Stations:
 - a. Quazite Composolite.
 - b. Armorcast Products Company.
 - c. Or equal.

2.2 COMPONENTS

- A. Wire and Cable:
 - 1. Bare Conductors: Soft drawn stranded copper meeting ASTM B8.

SECTION 16060 - GROUNDING

- 2. Insulated Conductors: Color coded green, per Section 16120.
- B. Conduit: As specified in Section 16130.
- C. Ground Bars:
 - 1. Solid Copper:
 - a. 1/4 inch thick.
 - b. 2 or 4 inch wide.
 - c. 24 inch long minimum in main service entrance electrical rooms, 12 inch long elsewhere.
 - 2. Predrilled grounding lug mounting holes.
 - 3. Stainless steel or galvanized steel mounting brackets.
 - 4. Insulated standoffs.
- D. Ground Rods:
 - 1. 3/4 inch x 10 FT, or as indicated on the Drawings.
 - 2. Copperclad:
 - a. Heavy uniform coating of electrolytic copper molecularly bonded to a rigid steel core.
 - b. Corrosion resistant bond between the copper and steel.
 - c. Hard drawn for a scar-resistant surface.
- E. Exothermic Weld Connections:
 - 1. Copper oxide reduction by aluminum process.
 - 2. Molds properly sized for each application.
- F. Prefabricated Composite Material Test Stations:
 - 1. Fiberglass reinforced polymer concrete.
 - 2. Body and cover shall sustain a minimum vertical load test of 22,000 LBS over a 10 inch square or be H-20 rated per AASHTO.
 - 3. Size: 12 inch round or 12 inch square.
 - 4. Open bottom.
 - 5. Stackable design as required for specified depth.
 - 6. Engrave cover with the word "GROUND".

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 - 1. Install products in accordance with manufacturer's instructions.
 - 2. Size grounding conductors and bonding jumpers in accordance with NFPA 70 Article 250, except where larger sizes are indicated on the Drawings.
 - 3. Remove paint, rust, or other nonconducting material from contact surfaces before making ground connections.
 - 4. Where ground conductors pass through floor slabs or building walls provide non-metallic sleeves.
 - 5. Do not splice grounding conductors except at ground rods.
 - 6. Install ground rods and grounding conductors in undisturbed, firm soil.
 - a. Provide excavation required for installation of ground rods and ground conductors.
 - b. Use driving studs or other suitable means to prevent damage to threaded ends of sectional rods.
 - c. Unless otherwise specified, connect conductors to ground rods with exothermic weld.
 - d. Provide sufficient slack in grounding conductor to prevent conductor breakage during backfill or due to ground movement.
 - e. Backfill excavation completely, thoroughly tamping to provide good contact between backfill materials and ground rods and conductors.
 - 7. Do not use exothermic welding if it will damage the structure the grounding conductor is being welded to.
- B. Grounding Electrode System:
 - 1. Provide a grounding electrode system in accordance with NFPA 70 Article 250 and as indicated on the Drawings.
 - 2. Grounding Conductor Terminations:
 - a. Ground bars mounted on wall, use compression type terminal and bolt it to the ground bar with two bolts.
 - b. Ground bars in electrical equipment, use compression type terminal and bolt it to the ground bar.
 - c. Grounding Conductor: Bare conductor, size as indicated on the Drawings.
- C. Raceway Bonding/Grounding:
 - 1. All metallic conduit shall be installed so that it is electrically continuous.

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- 2. All conduits to contain a grounding conductor with insulation identical to the phase conductors, unless otherwise indicated on the Drawings.
- 3. NFPA 70 required grounding bushings shall be of the insulating type.
- 4. Provide Myers hubs for conduits that terminate in devices or panels that are not threaded.
- 5. Bond all conduit, at entrance and exit of equipment, to the equipment ground bus or lug.
- 6. Provide bonding jumpers if conduits are installed in concentric knockouts.
- 7. Make all metallic raceway fittings and grounding clamps tight to ensure equipment grounding system will operate continuously at ground potential to provide low impedance current path for proper operation of overcurrent devices during possible ground fault conditions.
- D. Equipment Grounding:
 - 1. All utilization equipment shall be grounded with an equipment ground conductor.

3.2 FIELD QUALITY CONTROL

- A. Leave grounding system uncovered until observed by Owner.
- B. Acceptance Testing:
 - 1. See Section 16080.

END OF SECTION

1.01 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Basic requirements for acceptance testing.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 1 General Requirements.
- B. Section 16010 Electrical: Basic Requirements.

1.3 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

- A. International Electrical Testing Association (NETA):
 - 1. ATS, Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems.
- B. National Institute for Certification in Engineering Technologies (NICET).
- C. National Institute of Standards and Technology (NIST).
- D. Nationally Recognized Testing Laboratory (NRTL).

1.4 SUBMITTALS

- A. See Division 1 for requirements for the mechanics and administration of the submittal process.
- B. Submit prior to energizing equipment:
 - 1. Photocopies of field test reports for all applicable pre-energization tests including over-potential, insulation resistance, contact resistance, ratio and excitation, protective device and continuity tests.
- C. Submit within two (2) weeks of the completion of acceptance testing:
 - 1. Final test report signed by the engineering technician including the following information:
 - a. Summary of Project.
 - b. Description of equipment/components tested.
 - 1) Identify equipment by tag numbers and circuit numbers shown on the Drawings.

- Individual units of switchgear and switchboards shall be identified by manufacturer's section number as shown on Shop Drawings.
- c. Date and time of each test.
- d. Visual inspection report.
- e. Description of tests.
- f. Test results recorded legibly or typewritten on appropriate test forms.
 - 1) Include acceptance criteria, acceptable range of values or other basis for pass/fail decision.
 - 2) Include "as found" and "as left" results and identify all adjustments or corrections made during testing.
- g. Conclusions and recommendations.

1.5 SYSTEM DESCRIPTION

- A. The purpose of field acceptance testing is to verify equipment and system integrity and operation after manufacture, shipping and installation.
 - 1. All equipment included in Division 16 shall receive all routine factory tests required by the applicable industry standards or Nationally Recognized Testing Laboratory (NRTL) and certification of these tests shall be submitted concurrent with shipment to the job site.
 - 2. However, factory testing will not be accepted in lieu of the field acceptance testing requirements specified in this Section.
 - 3. Field testing shall be by a third party.
- B. Test the following:
 - 1. Test all electrical equipment on the project.
 - 2. The following identifies the specific equipment to be tested:
 - a. Step down dry type transformers.
 - b. Low voltage cable:
 - 1) All feeders.
 - 2) All branch circuits:
 - a) Serving VFDs and/or motors.
 - b) Serving a load greater than 100 A.
 - 3) All digital communication cables (e.g., Ethernet, Device Net, Modbus, etc.).

- c. Grounding and ground fault protection.
- d. Motors and motor controls.
- e. Functional tests.
- C. Tests and inspections not specifically listed, but required to insure that the equipment is safe to energize and ready for commercial operation, shall be performed.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Scope:
 - 1. Complete visual inspection, mechanical and electrical operational tests and electrical acceptance tests shall be performed in accordance with NETA ATS.
 - 2. The following paragraphs identify the scope of testing for each item to be tested.
 - a. All required tests per NETA shall be performed.
 - b. Tests identified by NETA ATS as optional shall be performed when listed below.
 - c. Additional tests not required by NETA ATS are also listed when required.
 - 3. Perform and report all tests recommended or required by the equipment manufacturer's installation, operation and maintenance instructions, even if not included in NETA ATS or listed below.
 - 4. Repairs shall be made when test values do not meet known acceptable values.
 - a. Test report shall clearly indicate "as found" and "as left" values, the cause of the unacceptable values, and the details of the corrective action taken to obtain acceptable results.
- B. Sequencing and Scheduling:
 - 1. Testing shall be performed only after completion of installation of systems and equipment unless the nature of the test requires an exception.
 - a. Do not test partial systems unless specified.
 - 2. Schedule all tests intended to determine fitness for energizing to occur immediately prior to first energizing of equipment.

- 3. Equipment and systems shall not be energized or placed into service until testing is complete and all unacceptable results have been resolved.
 - a. Except tests that, by their nature, require the equipment in an energized or operational state, such as synchronism-check.
- C. Testing personnel shall have the following system and equipment reference data on site during all testing:
 - 1. Approved Shop Drawings for the Project to include at a minimum:
 - a. Single line diagrams.
 - b. Three-line diagrams.
 - c. Cable schedules.
 - 2. Manufacturers approved Shop Drawings for motor control centers and other major equipment items.
 - 3. Manufacturer's instruction manuals for all equipment.
 - 4. A copy of this Specification Section.
 - 5. Manufacturer's instruction manuals for all test instruments.
 - 6. NETA ATS.

3.2 ACCEPTANCE TESTING

- A. Low Voltage Molded Case Circuit Breakers:
 - 1. Perform inspections and tests per NETA ATS 7.6.1.1.
 - 2. Components:
 - a. Test all components per applicable paragraphs of this Specification and NETA ATS.
 - b. Thermal magnetic breakers: Visual and mechanical inspection per NETA ATS only.
 - c. Solid-state trip type: Visual and mechanical inspection and electrical tests per NETA ATS.
 - 3. Record as-left settings.
- B. Grounding:
 - 1. Perform inspections and tests per NETA ATS 7.13.
 - 2. Components: Test all components per applicable paragraphs of this Specification and NETA ATS.

- C. Motors:
 - 1. Perform inspections and tests per NETA ATS 7.15.1.
 - 2. Components: Test all components per applicable paragraphs of this Specification and NETA ATS.
- D. Motor Controllers:
 - 1. Perform inspections and tests per NETA ATS 7.16.
 - 2. Components: Test all components per applicable paragraphs of this Specification and NETA ATS.
- E. Control System Functional Test:
 - 1. Perform test upon completion of equipment acceptance tests.
 - 2. The test is to prove the correct interaction of all sensing, processing and action devices.
 - 3. Develop a test plan and parameters for the purpose of evaluating the performance of the system.
 - 4. Perform the following tests:
 - a. Verify the correct operation of all interlock safety devices for failsafe functions in addition to design function.
 - b. Verify the correct operation of all sensing devices, alarms and indicating devices.
 - 5. Systems to be tested: PLC's and local control system panels.

END OF SECTION

SECTION 16120 – WIRE AND CABLE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Material and installation requirements for:
 - a. Building wire.
 - b. Power cable.
 - c. Control cable.
 - d. Instrumentation cable.
 - e. Wire connectors.
 - f. Insulating tape.
 - g. Pulling lubricant.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 1 General Requirements.
- B. Section 16010 Electrical: Basic Requirements.

1.3 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

- A. National Electrical Manufacturers Association (NEMA):
 - 1. ICS 4, Industrial Control and Systems: Terminal Blocks.
- B. National Electrical Manufacturers Association/Insulated Cable Engineers Association (NEMA/ICEA):
 - 1. WC 57/S-73-532, Standard for Control Cables.
- C. National Fire Protection Association (NFPA):
 - 1. 70, National Electrical Code (NEC).
- D. Underwriters Laboratories, Inc. (UL):
 - 1. 44, Standard for Safety Thermoset-Insulated Wires and Cables.
 - 2. 83, Standard for Safety Thermoplastic-Insulated Wires and Cables.
 - 3. 467, Standard for Safety Grounding and Bonding Equipment.
 - 4. 486A, Standard for Safety Wire Connectors and Soldering Lugs for use with Copper Conductors.
 - 5. 486C, Standard for Safety Splicing Wire Connections.

SECTION 16120 - WIRE AND CABLE

- 6. 510, Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
- 7. 1581, Standard for Safety Reference Standard for Electrical Wires, Cables, and Flexible Cords.
- 8. 2250, Standard for Safety Instrumentation Tray Cable.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Product technical data:
 - a. Provide submittal data for all products specified in Part 2 of this specification except:
 - 1) Wire connectors.
 - 2) Insulating tape.
 - 3) Cable lubricant.
 - b. See Section 16010 for additional requirements.

1.5 **DEFINITIONS**

- A. Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire. All cable shall be600 volt rated.
- B. Instrumentation Cable:
 - 1. Multiple conductor, insulated, twisted or untwisted, with outer sheath.
 - 2. The following are specific types of instrumentation cables:
 - a. Analog signal cable:
 - 1) Used for the transmission of low current (e.g., 4-20mA DC) or low voltage (e.g., 0-10 Vdc) signals, using No. 16 AWG and smaller conductors.
 - 2) Commonly used types are defined in the following:
 - a) TSP: Twisted shielded pair. #18 AWG minimum size.
 - b) TST: Twisted shielded triad. #18 AWG minimum size.
 - b. Digital signal cable: Used for the transmission of digital signals between computers, PLC's, RTU's, etc.

SECTION 16120 – WIRE AND CABLE

B. Building Wire: Single conductor, insulated, with or without outer jacket depending upon type.

1.6 DELIVERY, STORAGE AND HANDLING

A. See Section 16010.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Building wire, power and control cable and multiplex cable:
 - a. American Insulated Wire Corporation.
 - b. General Cable.
 - c. Southwire Company.
 - 2. Instrumentation cable:
 - a. Analog cable:
 - 1) Alpha Wire Corporation.
 - 2) American Insulated Wire Corporation.
 - 3) Belden CDT Inc.
 - 3. Wire connectors:
 - a. Burndy Corporation.
 - b. Buchanan.
 - c. Thomas and Betts.
 - 4. Insulating and color coding tape:
 - a. 3M Co.
 - b. Plymouth Bishop Tapes.
 - c. Red Seal Electric Co.
- B. Submit request for substitution in accordance with Division 1.

2.2 MANUFACTURED UNITS

- A. Building Wire:
 - 1. Conductor shall be copper with 600 V rated insulation.
 - 2. Conductors shall be stranded, except for conductors used in lighting and receptacle circuits which may be stranded or solid.

SECTION 16120 – WIRE AND CABLE

- 3. Surface mark with manufacturers name or trademark, conductor size, insulation type and UL label.
- 4. Conform to NEMA/ICEA WC 70/S-95-658 and UL 44 for type XHHW-2 insulation.
- B. Power Cable:
 - 1. Conductor shall be copper with 600 V rated insulation.
 - 2. Surface mark with manufacturers name or trademark, conductor size, insulation type and UL label.
 - 3. Conform to NEMA/ICEA WC 70/S-95-658 and UL 83 and UL 1277 for type XHHW-2 insulation with an overall PVC jacket.
 - 4. Number of conductors as required, including a bare ground conductor.
 - 5. Individual conductor color coding:
 - a. ICEA Method 4.
 - b. See Part 3 of this specification for additional requirements.
 - 5. Conform to NFPA 70 Type TC {and IEEE/ANSI 1202 or CSA FT-4}.
- C. Control Cable:
 - 1. Conductor shall be copper with 600 V rated insulation.
 - 2. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
 - 3. Conform to NEMA/ICEA WC 57/S-73-532 and UL 83 and UL 1277 for type THHN/THWN insulation with an overall PVC jacket.
 - 4. Number of conductors as required, provided with insulated ground conductor of the same AWG size.
 - 5. Individual conductor color coding:
 - a. NEMA/ICEA Method 1, Table E-2.
 - b. See Part 3 of this Specification for additional requirements.
 - 6. Conform to NFPA 70 Type TC.
- D. Electrical Equipment Control Wire:
 - 1. Conductor shall be copper with 600 V rated insulation.
 - 2. Conductors shall be stranded

SECTION 16120 - WIRE AND CABLE

- 3. Surface mark with manufacturers name or trademark, conductor size, insulation type and UL label.
- 4. Conform to UL 44 for Type SIS insulation.
- 5. Conform to UL 83 for Type MTW insulation.
- E. Instrumentation Cable:
 - 1. Surface mark with manufacturers name or trademark, conductor size, insulation type and UL label.
 - 2. Analog cable:
 - a. Tinned copper conductors, #18 AWG minimum.
 - b. 300 V or 600 V PVC insulation with PVC jacket.
 - c. Twisted with 100 percent foil shield coverage with drain wire.
 - d. Six (6) twists per foot minimum.
 - e. Individual conductor color coding: ICEA Method 1, Table K-2.
 - f. Conform to UL 2250, UL 1581 and NFPA 70 Type ITC.
 - 3. Digital cable:
 - a. As recommended by equipment (e.g., PLC, RTU) manufacturer.
 - b. Conform to UL 910 and NFPA 70 Type ITC.
- F. Wire Connectors:
 - 1. Twist/screw on type:
 - a. Insulated pressure or spring type solderless connector.
 - b. 600 V rated.
 - c. Ground conductors: Conform to UL 486C and/or UL 467 when required by local codes.
 - d. Phase and neutral conductors: Conform to UL 486C.
 - 2. Compression and mechanical screw type:
 - a. 600 V rated.
 - b. Ground conductors: Conform to UL 467.
 - c. Phase and neutral conductors: Conform to UL 486A.
 - 3. Terminal block type:
 - a. High density, screw-post barrier-type with white center marker strip.
 - b. 600 V and ampere rating as required, for power circuits.
 - c. 600 V, 20 ampere rated for control circuits.
 - d. 300 V, 15 ampere rated for instrumentation circuits.
 - e. Conform to NEMA ICS 4 and UL 486A.

SECTION 16120 - WIRE AND CABLE

- G. Insulating and Color Coding Tape:
 - 1. Pressure sensitive vinyl.
 - 2. Premium grade.
 - 3. Heat, cold, moisture, and sunlight resistant.
 - 4. Thickness, depending on use conditions: 7, 8.5, or 10 mil.
 - 5. For cold weather or outdoor location, tape must also be all-weather.
 - 6. Color:
 - a. Insulating tape: Black.
 - b. Color coding tape: Fade-resistant color as specified herein.
 - 7. Comply with UL 510.
- H. Pulling Lubricant: Cable manufacturer's standard containing no petroleum or other products which will deteriorate insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Permitted Usage of Insulation Types:
 - 1. Type XHHW-2:
 - a. Building wire and power and control cable in architectural and nonarchitectural finished areas.
 - b. Building wire and power and control cable in conduit below grade.
 - 2. Type SIS and MTW:
 - a. For the wiring of control equipment within control panels and field wiring of control equipment within switchgear, switchboards, motor control centers.
- B. Conductor Size Limitations:
 - 1. Feeder and branch power conductors shall not be smaller than No. 12 AWG unless otherwise indicated on the Drawings.
 - 2. Control conductors shall not be smaller than No. 14 AWG unless otherwise indicated on the Drawings.
 - 3. Instrumentation conductors shall not be smaller than No. 18 AWG unless otherwise indicated on the Drawings.

- C. Color Code All Wiring as Follows:
 - 1. Building wire:

	240 V, 208 V, 240/120 V, 208/120 V	480 V, 480/277 V	
Phase 1	Black	Brown	
Phase 2	Red [*]	Orange	
Phase 3	Blue	Yellow	
Neutral	White	Grey	
Ground	Green	Green	
* Orange when it is a high leg of a 120/240 V Delta system.			

- a. Conductors No. 6 AWG and smaller: Insulated phase, neutral and ground conductors shall be identified by a continuous colored outer finish along its entire length.
- b. Conductors larger than No. 6 AWG:
 - 1) Insulated phase and neutral conductors shall be identified by one (1) of the following methods:
 - a) Continuous colored outer finish along its entire length.
 - b) 3 IN of colored tape applied at the termination.
 - 2) Insulated grounding conductor shall be identified by the following method:
 - a) Continuous green outer finish along its entire length.
 - 3) The color coding shall be applied at all accessible locations, including but not limited to: Junction and pull boxes, wireways, manholes and handholes.
- 2. Power cables ICEA Method 4 with:
 - a. Phase and neutral conductors identified with 3 IN of colored tape, per the Table herein, applied at the terminations.
 - b. Ground conductor: Green insulation the entire length.
- 3. Control cables NEMA/ICEA Method 1, Table E-2:
 - When used in power applications the colored insulated conductors used as phase and neutral conductors may have to be re-identified with 3 IN of colored tape, per the Table herein, applied at the terminations.

- D. Install all wiring in raceway unless otherwise indicated on the Drawings.
- E. Feeder, branch, control and instrumentation circuits shall not be combined in a raceway, cable tray, junction or pull box, except as permitted in the following:
 - 1. Where specifically indicated on the Drawings.
 - 2. Where field conditions dictate and written permission is obtained from the Engineer.
 - 3. Control circuits shall be isolated from feeder and branch power and instrumentation circuits but combining of control circuits is permitted.
 - a. The combinations shall comply with the following:
 - 1) 12 Vdc, 24 Vdc and 48 Vdc may be combined.
 - 2) 125 Vdc shall be isolated from all other AC and DC circuits.
 - 3) AC control circuits shall be isolated from all DC circuits.
 - 4. Instrumentation circuits shall be isolated from feeder and branch power and control circuits but combining of instrumentation circuits is permitted.
 - a. The combinations shall comply with the following:
 - 1) Analog signal circuits may be combined.
 - 2) Digital signal circuits may be combined but isolated from analog signal circuits.
 - 5. Multiple branch circuits for lighting, receptacle and other 120 Vac circuits are allowed to be combined into a common raceway.
 - a. Contractor is responsible for making the required adjustments in conductor and raceway size, in accordance with all requirements of the NEC, including but not limited to:
 - 1) Up sizing conductor size for required ampacity de-ratings for the number of current carrying conductors in the raceway.
 - 2) The neutral conductor may be shared on sequential circuits (e.g., circuit numbers 1, 3, 5).
 - 3) Up sizing raceway size for the size and quantity of conductors.
- F. Ground the drain wire of shielded instrumentation cables at one (1) end only.
 - 1. The preferred grounding location is at the load (e.g., control panel), not at the source (e.g., field mounted instrument).
- G. Splices and terminations for the following circuit types shall be made in the indicated enclosure type using the indicated method.
 - 1. Feeder and branch power circuits:

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- a. Device outlet boxes:
 - 1) Twist/screw on type connectors.
- b. Junction and pull boxes and wireways:
 - 1) Twist/screw on type connectors for use on No. 8 and smaller wire.
 - Compression, mechanical screw or terminal block or terminal strip type connectors for use on No. 6 AWG and larger wire.
- c. Motor terminal boxes:
 - 1) Compression lugs taped first with 3M Cambric tape, or equal, followed by rubber splicing tape, followed by vinyl electric tape, or by means approved by the motor manufacturer.
- d. Manholes or handholes:
 - 1) Twist/screw on type connectors pre-filled with epoxy for use on No. 8 AWG and smaller wire.
 - 2) Watertight compression or mechanical screw type connectors for use on No. 6 AWG and larger wire. All splices shall be submersible.
- 2. Control Circuits:
 - a. Junction and pull boxes: Terminal block type connector.
 - b. Manholes or handholes: Twist/screw on type connectors pre-filled with epoxy.
 - c. Control panels and motor control centers: Terminal block or strips provided within the equipment or field installed within the equipment by the Contractor.
- 3. Instrumentation circuits can be spliced where field conditions dictate and written permission is obtained from the Engineer.
 - a. Maintain electrical continuity of the shield when splicing twisted shielded conductors.
 - b. Junction and pull boxes: Terminal block type connector.
 - c. Control panels and motor control centers: Terminal block or strip provided within the equipment or field installed within the equipment by the Contractor.
- 4. Non-insulated compression and mechanical screw type connectors shall be insulated with tape or hot or cold shrink type insulation to the insulation level of the conductors.
- H. Insulating Tape Usage:

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- 1. For insulating connections of No. 8 AWG wire and smaller: 7 mil vinyl tape.
- 2. For insulating splices and taps of No. 6 AWG wire or larger: 10 mil vinyl tape.
- 3. For insulating connections made in cold weather or in outdoor locations: 8.5 mil, all weather vinyl tape.
- I. Color Coding Tape Usage: For color coding of conductors.

3.2 FIELD QUALITY CONTROL

- A. Acceptance Testing:
 - 1. See Section 16080.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Material and installation requirements for:
 - a. Conduits.
 - b. Conduit fittings.
 - c. Conduit supports.
 - d. Wireways.
 - e. Outlet boxes.
 - f. Pull and junction boxes.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 1 General Requirements.
- B. Section 16010 Basic Electrical Requirements.
- C. Section 16135 Electrical: Exterior Underground.
- D. Section 16140 Wiring Devices.

1.3 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

- A. American Iron and Steel Institute (AISI).
- B. ASTM International (ASTM):
 - 1. D2564, Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
- C. National Electrical Manufacturers Association (NEMA):
 - 1. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. RN 1, Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - 3. TC 3, PVC Fittings for Use with Rigid PVC Conduit and Tubing.
- D. National Fire Protection Association (NFPA):
 - 1. 70, National Electrical Code (NEC).
- E. Underwriters Laboratories, Inc. (UL):
 - 1. 1, Standard for Safety Flexible Metal Conduit.

- 2. 6, Standard for Safety Rigid Metal Conduit.
- 3. 50, Standard for Safety Enclosures for Electrical Equipment.
- 4. 360, Standard for Safety Liquid-Tight Flexible Steel Conduit.
- 5. 467, Standard for Safety Grounding and Bonding Equipment.
- 6. 514A, Standard for Safety Metallic Outlet Boxes.
- 7. 514B, Standard for Safety Fittings for Cable and Conduit.
- 8. 651, Standard for Safety Schedule 40 and 80 Rigid PVC Conduit.
- 9. 870, Standard for Safety Wireways, Auxiliary Gutters, and Associated Fittings.
- 10. 886, Standard for Safety Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Product technical data:
 - a. Provide submittal data for all products specified in PART 2 of this Specification except:
 - 1) Conduit fittings.
 - 2) Support systems.
 - b. See Section 16010 for additional requirements.
 - 2. Fabrication and/or layout drawings:
 - a. Identify dimensional size of pull and junction boxes to be used.

1.5 DELIVERY, STORAGE AND HANDLING

A. See Section 16010.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. PVC coated rigid metallic conduits and repair kits:

- a. Occidental Coating Company.
- b. Rob-Roy Ind.
- c. OCAL
- 2. Rigid non-metallic conduit:
 - a. Carlon.
 - b. Cantex.
- 3. Flexible conduit:
 - a. AFC Cable Systems.
 - b. Anamet, Inc.
 - c. Electri-Flex.
- 4. Wireway:
 - a. Hoffman Engineering Company.
- 5. Conduit fittings and accessories:
 - a. OCAL.
- 6. Support systems:
 - a. Unistrut Building Systems (316 stainless steel).
 - b. OCAL.
- 7. Outlet, pull and junction boxes:
 - a. OCAL.

2.2 RIGID METALLIC CONDUITS

- A. PVC-Coated Rigid Steel Conduit (PVC-RGS):
 - 1. Nominal 40 mil Polyvinyl Chloride Exterior Coating:
 - a. Coating: Bonded to hot-dipped galvanized rigid steel conduit conforming to NEMA/ANSI C80.1.
 - b. The bond between the PVC coating and the conduit surface: Greater than the tensile strength of the coating.
 - 2. Nominal 2 mil, minimum, urethane interior coating.
 - 3. Urethane coating on threads.
 - 4. Conduit: Epoxy prime coated prior to application of PVC and urethane coatings.

- 5. Female Ends:
 - a. Have a plastic sleeve extending a minimum of 1 pipe diameter or 2 IN, whichever is less beyond the opening.
 - b. The inside diameter of the sleeve shall be the same as the outside diameter of the conduit to be used with it.
- 6. Standards: NEMA/ANSI C80.1, UL 6, NEMA RN 1.

2.3 RIGID NON-METALLIC CONDUIT

- A. Schedules 80 (PVC-80):
 - 1. Polyvinyl-chloride (PVC) plastic compound which includes inert modifiers to improve weatherability and heat distribution.
 - 2. Rated for direct sunlight exposure.
 - 3. Fire retardant and low smoke emission.
 - 4. Shall be suitable for use with 90 DegC wire and shall be marked "maximum 90 Deg C".
 - 5. Standards: NEMA TC 2, UL 651.

2.4 FLEXIBLE CONDUIT

- A. PVC-Coated Flexible Galvanized Steel (liquid-tight) Conduit (FLEX-LT):
 - 1. Core formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked. ³/₄-inch minimum size.
 - 2. Extruded PVC outer jacket positively locked to the steel core.
 - 3. Liquid and vaportight.
 - 4. Standard: UL 360.

2.5 WIREWAY

- A. Watertight (NEMA 4X rated) Wireway:
 - 1. 14 GA Type 316 stainless steel bodies and covers without knockouts and 10 GA stainless steel flanges.
 - 2. Cover: Fully gasketed and held in place with captive clamp type latches.
 - 3. Flanges: Fully gasketed and bolted.

2.6 CONDUIT FITTINGS AND ACCESSORIES

- A. Fittings for Use with PVC-RGS:
 - 1. General:
 - a. In hazardous locations listed for use in Class I, Division 2, Groups C and D locations.
 - 2. Hubs: Threaded, insulated and gasketed metallic for raintight connection. 316 Stainless steel or PVC coated.
 - 3. Unions: Threaded PVC coated, galvanized steel or zinc plated malleable iron.
 - 4. Conduit bodies (ells and tees):
 - a. Body: PVC coated with threaded hubs.
 - b. Standard and mogul size.
 - c. Cover:
 - 1) PVC coated, clip-on type with 316 stainless steel screws.
 - 5. Conduit bodies (round):
 - a. Body: PVC coated with threaded hubs.
 - b. Cover: Threaded screw on type, PVC coated.
 - 6. Sealing fittings:
 - a. Body: PVC coated.
 - b. Standard and mogul size.
 - c. With or without drain and breather.
 - d. Fiber and sealing compound: UL listed for use with the sealing fitting.
- B. Fittings for Use with FLEX-LT:
 - 1. Connector:
 - a. Straight or angle type.
 - b. PVC coated, insulated and gasketed.
 - c. Composed of locknut, grounding ferrule and gland compression nut.
 - d. Liquid tight.
 - 2. Standards: UL 467, UL 514B.
- C. Fittings for Use with Rigid Non-Metallic PVC Conduit:

- 1. Coupling, adapters and conduit bodies:
 - a. Same material, thickness, and construction as the conduits with which they are used.
 - b. Homogeneous plastic free from visible cracks, holes or foreign inclusions.
 - c. Bore smooth and free of blisters, nicks or other imperfections which could damage the conductor.
- 2. Solvent cement for welding fittings shall be supplied by the same manufacturer as the conduit and fittings.
- 3. Standards: ASTM D2564, NEMA TC 3, UL 651, UL 514B.
- D. Weather and Corrosion Protection Tape:
 - 1. PVC based tape, 10 mils thick.
 - 2. Protection against moisture, acids, alkalis, salts and sewage and suitable for direct bury.
 - 3. Used with appropriate pipe primer.

2.7 ALL RACEWAY AND FITTINGS

- A. Mark Products:
 - 1. Identify the nominal trade size on the product.
 - 2. Stamp with the name or trademark of the manufacturer.

2.8 OUTLET BOXES

- A. Cast Outlet Boxes:
 - 1. Threaded hubs and grounding screw.
 - 2. Styles:
 - a. "FS" or "FD".
 - b. "Bell".
 - c. Single or multiple gang and tandem.
 - d. "EDS" or "EFS" for hazardous locations.
 - 3. Accessories: 40 mil PVC exterior coating and 2 mil urethane interior coating.
 - 4. Standards: UL 514A, UL 886.
- B. See Section 16140 for wiring devices, wallplates and coverplates.
2.9 PULL AND JUNCTION BOXES

A. NEMA 4X Rated (metallic):

Body and cover: 14 GA Type 316 stainless steel.

Seams continuously welded and ground smooth.

No knockouts.

External mounting flanges.

Hinged door and 316 stainless steel screws and clamps.

Door with oil-resistant gasket.

- B. NEMA 7 and 9 Rated:
 - 1. Cast gray iron alloy or copper-free aluminum with manufacturers standard finish.
 - 2. Drilled and tapped openings or tapered threaded hub.
 - 3. Cover bolted-down with 316 stainless steel bolts or threaded cover with neoprene gasket.
 - 4. External mounting flanges.
 - 5. Grounding lug.
 - 6. Accessories: 40 mil PVC exterior coating and 2 mil urethane interior coating.
- E. Miscellaneous Accessories:
 - 1. Rigid handles for covers larger than 9 SF or heavier than 25 LBS.
 - 2. Split covers when heavier than 25 LBS.
 - 3. Weldnuts for mounting optional panels and terminal kits.
 - 4. Terminal blocks: Screw-post barrier-type, rated 600 volt and 20 ampere minimum.
- F. Standards: NEMA 250, UL 50.

2.10 SUPPORT SYSTEMS

A. Multi-conduit Surface or Trapeze Type Support and Pull or Junction Box Supports:

- 1. Material requirements.
 - a. Stainless steel: AISI Type 316.
- B. Single Conduit and Outlet Box Support Fasteners:
 - 1. Material requirements:
 - a. 316 Stainless steel.
 - b. PVC coat malleable iron or steel: 20 mil PVC coating.

PART 3 - EXECUTION

3.1 RACEWAY INSTALLATION – GENERAL

- A. Shall be in accordance with the requirements of:
 - 1. NFPA 70.
 - 2. Manufacturer instructions.
- B. Size of Raceways:
 - 1. Raceway sizes are shown on the Drawings, if not shown on the Drawings, then size in accordance with NFPA 70.
 - 2. Unless specifically indicated otherwise, the minimum raceway size shall be:
 - a. Conduit: 3/4 IN (exposed) and 1 IN (buried).
 - b. Wireway: 2-1/2 IN x 2-1/2 IN.
- C. Field Bending and Cutting of Conduits:
 - 1. Utilize tools and equipment recommended by the manufacturer of the conduit, designed for the purpose and the conduit material to make all field bends and cuts.
 - 2. Do not reduce the internal diameter of the conduit when making conduit bends.
 - 3. Prepare tools and equipment to prevent damage to the PVC coating.
 - 4. Degrease threads after threading and apply a zinc rich paint.
 - 5. Debur interior and exterior after cutting.
- D. Male threads of conduit systems shall be coated with an electrically conductive anti-seize compound.

- E. The protective coating integrity of conduits, fittings, outlet, pull and junction boxes and accessories shall be maintained.
 - 1. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
 - 2. Repair PVC coated components utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the conduit; or a self-adhesive, highly conformable, cross-linked silicone composition strip, followed by a protective coating of vinyl tape.
 - a. Total nominal thickness: 40 mil.
 - 3. Repair surfaces which will be inaccessible after installation prior to installation.
- F. Remove moisture and debris from conduit before wire is pulled into place.
 - 1. Pull mandrel with diameter nominally 1/4 IN smaller than the interior of the conduit, to remove obstructions.
 - 2. Swab conduit by pulling a clean, tight-fitting rag through the conduit.
 - 3. Tightly plug ends of conduit with tapered wood plugs or plastic inserts until wire is pulled.
- G. Only nylon or polyethylene rope shall be used to pull wire and cable in conduit systems.
- H. Where portions of a raceway are subject to different temperatures and where condensation is known to be a problem, as in cold storage areas of buildings or where passing from the interior to the exterior of a building, the raceway shall be sealed to prevent circulation of warm air to colder section of the raceway.
- I. Fill openings in walls, floors, and ceilings and finish flush with surface.
 - 1. See Division 1.

3.2 RACEWAY ROUTING

- A. Raceways shall be routed in the field unless otherwise indicated.
 - 1. Conduit and fittings shall be installed, as required, for a complete system that has a neat appearance and is in compliance with all applicable codes.
 - 2. Run in straight lines parallel to or at right angles to building lines.
 - 3. Do not route conduits:
 - a. Through areas of high ambient temperature or radiant heat.
 - b. In suspended concrete slabs.

- 4. Conduit shall not interfere with, or prevent access to, piping, valves, ductwork, or other equipment for operation, maintenance and repair.
- 5. Provide pull boxes or conduit bodies as needed so that there is a maximum of 360 degrees of bends in the conduit run or in long straight runs to limit pulling tensions.
- B. Maintain minimum spacing between parallel conduit and piping runs in accordance with the following when the runs are greater than 30 FT:
 - 1. Between instrumentation and telecommunication: 1 IN.
 - 2. Between instrumentation and 125 V, 48 V and 24 Vdc, 2 IN.
 - 3. Between instrumentation and 600 V and less AC power or control: 6 IN.
 - 4. Between instrumentation and greater than 600 Vac power: 12 IN.
 - 5. Between telecommunication and 125 V, 48 V and 24 Vdc, 2 IN.
 - 6. Between telecommunication and 600 V and less AC power or control: 6 IN.
 - 7. Between telecommunication and greater than 600 Vac power: 12 IN.
 - 8. Between 125 V, 48 V and 24 Vdc and 600 V and less AC power or control: 2 IN.
 - 9. Between 125 V, 48 V and 24 Vdc and greater than 600 Vac power: 2 IN.
 - 10. Between 600 V and less AC and greater than 600 Vac: 2 IN.
 - 11. Between process, gas, air and water pipes: 6 IN.
- C. Conduits shall be installed to eliminate moisture pockets.
 - 1. Where water cannot drain to openings, provide drain fittings in the low spots of the conduit run.
- D. Provide all required openings in walls, floors, and ceilings for conduit penetration.
 - 1. See Division 1.

3.3 RACEWAY APPLICATIONS

- A. Permitted Raceway Types per Wire or Cable Types:
 - 1. Power wire or cables: All raceway types.

- 2. Control wire or cables: All raceway types.
- 3. Instrumentation cables: Metallic raceway except non-metallic may be used underground.
- 4. Motor leads from a VFD: RGS, RAC or shielded VFD cables in all other raceways.
- 5. Telecommunication cables: All raceway types.
- B. Permitted Raceway Types Per Area Designations:
 - 1. All exposed areas:
 - a. PVC-RGS.
- C. Permitted Raceway Types Per Routing Locations:
 - 1. Direct buried conduits and ductbanks:
 - a. PVC-80.
 - b. 90 degree elbows for transitions to above grade:
 - 1) PVC-RGS.
 - c. Long sweeping bends greater than 15 degrees:
 - 1) PVC-RGS.
 - 2. Red concrete encased ductbanks:
 - a. PVC-80.
 - b. 90 degree elbows for transitions to above grade:
 - 1) PVC-RGS.
 - c. Long sweeping bends greater than 15 degrees:
 - 1) RGS for sizes 2 IN and larger.
- D. FLEX-LT conduits shall be install as the final conduit connection to light fixtures, dry type transformers, motors, electrically operated valves, instrumentation primary elements, and other electrical equipment that is liable to vibrate.
 - 1. The maximum length shall not exceed:
 - a. 3 FT to motors.
 - b. 3 FT to all other equipment.

3.4 CONDUIT FITTINGS AND ACCESSORIES

- A. Conduit Seals:
 - 1. Installed in conduit systems located in hazardous areas as required by the NFPA 70.
- B. Rigid non-metallic conduit and fittings shall be joined utilizing solvent cement.
 - 1. Immediately after installation of conduit and fitting, the fitting or conduit shall be rotated 1/4 turn to provide uniform contact.
- C. Install Expansion Fittings:
 - 1. Where conduits are exposed to the sun and conduit run is greater than 200 FT.
 - 2. Elsewhere as identified on the Drawings.
- D. Install Expansion/Deflection Fittings:
 - 1. Where conduits enter a structure.
 - a. Except electrical manholes and handholes.
 - b. Except where the ductbank is tied to the structure with rebar.
 - 2. Where conduits span structural expansions joints.
 - 3. Elsewhere as identified on the Drawings.
- E. Threaded connections shall be made wrench-tight.
- F. Conduit joints shall be watertight:
 - 1. Where subjected to possible submersion.
 - 2. In areas classified as wet.
 - 3. Underground.
- G. Terminate Conduits:
 - 1. In NEMA 4 and 4X rated enclosures:
 - a. Watertight, insulated and gasketed hub and locknut.
 - 2. In NEMA 7 and 9 rated enclosures:
 - a. Into an integral threaded hub.

- 3. When stubbed up through the floor into floor mount equipment:
 - a. With an insulated grounding bushing on metallic conduits.
 - b. With end bells on non-metallic conduits.

3.5 CONDUIT SUPPORT

- A. Permitted multi-conduit surface or trapeze type support system per area designations and conduit types:
 - 4. All areas:
 - a. 316 Stainless steel system consisting of: 316 Stainless steel channels and fittings, nuts and hardware and conduit clamps.
- B. Permitted single conduit support fasteners per area designations and conduit types:
 - 1. All areas:
 - a. Material: 316 Stainless steel and PVC coat malleable iron or steel.
 - b. Types of fasteners: Straps, hangers with bolts, clamps with bolts and bolt on beam clamps.
- C. Conduit Support General Requirements:
 - 1. Maximum spacing between conduit supports per NFPA 70.
 - 2. Support conduit from the building structure.
 - 3. Do not support conduit from process, gas, air or water piping; or from other conduits.
 - 4. Provide hangers and brackets to limit the maximum uniform load on a single support to 25 LBS or to the maximum uniform load recommended by the manufacturer if the support is rated less than 25 LBS.
 - a. Do not exceed maximum concentrated load recommended by the manufacturer on any support.
 - b. Conduit hangers: Continuous threaded rods combined with struts or conduit clamps: Do not use perforated strap hangers and iron bailing wire.
 - 5. Conduit support system fasteners:
 - a. Use sleeve-type expansion anchors as fasteners in masonry wall construction.
 - b. Do not use concrete nails and powder-driven fasteners.

3.6 OUTLET, PULL AND JUNCTION BOX INSTALLATION

- A. General:
 - 1. Install products in accordance with manufacturer's instructions.
 - 2. See Section 16010 and the Drawings for area classifications.
 - 3. Size boxes to accommodate quantity of conductors enclosed and quantity of conduits connected to the box.
- B. Outlet Boxes:
 - 1. Permitted uses of cast outlet boxes:
 - a. Housing of wiring devices surface mounted in non-architecturally finished dry, wet corrosive, highly corrosive and hazardous areas.
 - b. Pull and junction box surface mounted in non-architecturally finished dry, wet corrosive and highly corrosive areas.
 - 2. Mount device outlet boxes where indicated on the Drawings and at heights as scheduled in Section 16010.
 - 3. Set device outlet boxes plumb and vertical to the floor.
 - 4. When an outlet box is connected to a PVC coated conduit, the box shall also be PVC coated.
- C. Pull and Junction Boxes:
 - 1. Install pull or junction boxes in conduit runs where indicated or required to facilitate pulling of wires or making connections.
 - a. Make covers of boxes accessible.
 - 2. Permitted uses of NEMA 4X metallic enclosure:
 - a. Pull or junction box surface mounted in areas designated as wet and/or corrosive.
 - 3. Permitted uses of NEMA 7 enclosure:
 - a. Pull or junction box surface mounted in areas designated as Class I hazardous.
 - 1) Provide PVC coating in corrosive and highly corrosive areas when PVC coated conduit is used.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Material and installation requirements for:
 - a. Handhole.
 - b. Underground conduits and ductbanks.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 1 General Requirements.
- B. Section 16060 Grounding.
- C. Section 16130 Raceways and Boxes.

1.3 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

- A. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. Standard Specifications for Highway Bridges.
- B. ASTM International (ASTM):
 - 1. A536, Standard Specification for Ductile Iron Castings.
- C. National Electrical Manufacturers Association (NEMA):
 - 1. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. National Fire Protection Association (NFPA):
 - 1. 70, National Electrical Code (NEC).
- E. Society of Cable Telecommunications Engineers (SCTE):
 - 1. 77, Specification for Underground Enclosure Integrity.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Division 1 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data:

- a. Provide submittal data for all products specified in PART 2 of this Specification.
- 3. Fabrication and/or layout drawings:
 - a. Provide dimensional drawings of each manhole indicating all specified accessories and conduit entry locations.

1.5 **DEFINITIONS**

- A. Direct-buried conduit(s):
 - 1. Individual (single) underground conduit.
 - 2. Multiple underground conduits, arranged in one or more planes, in a common trench.
 - B. Concrete encased ductbank: An individual (single) or multiple conduit(s), arranged in one or more planes, encased in a common concrete envelope.

1.6 WORK PAYMENT

A. Payment for the Work in this section shall be included as part of the lump-sum or unit-price bid amount for which such Work is appurtenant thereto, including all Work and materials specified herein and as may be required to complete this portion of the Work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Precast handholes:
 - a. Utility Vault Co.
 - b. Oldcastle Precast, Inc.
 - c. Or equal.

2.2 HANDHOLES

- A. Precast Handholes:
 - 1. Fiberglass reinforced polymer concrete or steel reinforced cement concrete structures:
 - 2. Shall have an AASHTO live load rating of H-20 for full deliberate vehicle traffic.
 - 3. Mating edges shall be tongue and groove type.

OLIVENHAIN MWD 4S RANCH NBHD1 SPS REPLACEMENT PROJECT

- 4. Solid bottom with a 12 inch x 12 inch or 12 inch diameter French drain in the bottom of each manhole.
- 5. Gasketed removable top slab with lifting eyes and cast in frame for cover. Cover extension rings as required.

2.3 UNDERGROUND CONDUIT AND ACCESSORIES

- A. Concrete: Comply with Division 3.
- B. Conduit: See Section 16130.
- C. Duct Spacers/Supports:
 - 1. High density polyethylene or high impact polystyrene.
 - 2. Interlocking.
 - 3. Provide 3 inch minimum spacing between conduits.
 - 4. Accessories, as required:
 - a. Hold down bars.
 - b. Ductbank strapping.

PART 3 - EXECUTION

3.1 GENERAL

- A. Drawings indicate the intended location of handholes and routing of ductbanks and direct buried conduit.
 - 1. Field conditions may affect actual routing.
- B. Handhole Locations:
 - 1. Approximately where shown on the Drawings.
 - 2. As required for pulling distances.
 - 3. As required to keep pulling tensions under allowable cable tensions.
 - 4. As required for number of bends in ductbank routing.
 - 5. Shall not be installed in a swale or ditch.
 - 6. Determine the exact locations after careful consideration has been given to the location of other utilities, grading, and paving.

- 7. Locations are to be approved by the Engineer prior to excavation and placement or construction of manholes and handholes.
- C. Install products in accordance with manufacturer's instructions.
- D. Install handholes in conduit runs where indicated or as required to facilitate pulling of wires or making connections.
- E. Comply with Division 2 for trenching, backfilling and compacting.

3.2 HANDHOLES

- A. Precast Handholes:
 - 1. For use in vehicular and non-vehicular traffic areas.
 - 2. Construction:
 - a. Grout or seal all joints, per manufacturer's instructions.
 - 3. Place manhole or handhole on a foundation of compacted 1/4 to 1/2 inch crushed rock or gravel a minimum of 8 inch thick and 6 inch larger than manholes or handholes footprint on all sides.
 - 4. Install so that the top of cover is 1 inch above finished grade.
 - a. Where existing grades are higher than finished grades, install sufficient number of courses of curved segmented concrete block between top of handhole frame to temporarily elevate manhole cover to existing grade level.
 - 5. After installation is complete, backfill and compact soil around handholes.
 - 6. Handhole size:
 - a. As indicated on the Drawings or as required for the number and size of conduits entering or as indicated on the Drawings.

3.3 UNDERGROUND CONDUITS

- A. General Installation Requirements:
 - 1. Ductbank types per location:
 - a. Concrete encased ductbank:
 - 1) Under all traffic areas.
 - 2) Conduits containing medium voltage cables.
 - b. Direct-buried conduit(s):

- 1) All other locations.
- 2. Do not place concrete or soil until conduits have been observed by the Owners Representative.
- 3. Ductbanks shall be sloped a minimum of 4 inch per 100-foot or as detailed on the Drawings.
 - a. Low points shall be at handholes.
- 4. During construction and after conduit installation is complete, plug the ends of all conduits.
- 5. Provide conduit supports and spacers.
 - a. Place supports and spacers for rigid nonmetallic conduit on maximum centers as indicated for the following trade sizes:
 - 1) 1 inch and less: 3 FT.
 - 2) 1-1/4 to 3 IN: 5 FT.
 - 3) 3-1/2 to 6 IN: 7 FT.
 - b. Place supports and spacers for rigid steel conduit on maximum centers as indicated for the following trade sizes:
 - 1) 1 inch and less: 10 FT.
 - 2) 1-1/4 to 2-1/2 IN: 14 FT.
 - 3) 3 inch and larger: 20 FT.
 - c. Securely anchor conduits to supports and spacers to prevent movement during placement of concrete or soil.
- 6. Stagger conduit joints at intervals of 6 inch vertically.
- 7. Make conduit joints watertight and in accordance with manufacturer's recommendations.
- 8. Accomplish changes in direction of runs exceeding a total of 15 degrees by long sweep bends having a minimum radius of 25 FT.
 - a. Sweep bends may be made up of one or more curved or straight sections or combinations thereof.
- 9. Furnish manufactured bends at end of runs.
 - a. Minimum radius of 18 inch for conduits less than 3 inch trade size and 36 inch for conduits 3 inch trade size and larger.
- 10. Field cuts requiring tapers shall be made with the proper tools and shall match factory tapers.

- 11. After the conduit run has been completed, pull a standard flexible mandrel having a length of not less than 12 inch and a diameter approximately 1/4 inch less than the inside diameter of the conduit through each conduit.
 - a. Then pull a brush with stiff bristles through each conduit to remove any foreign material left in conduit.
- 12. Pneumatic rodding may be used to draw in lead wire.
 - a. Install a heavy nylon cord free of kinks and splices in all unused new ducts.
 - b. Extend cord 3-foot beyond ends of conduit.
- 13. Transition from rigid non-metallic conduit to rigid metallic conduit, per Section 16130, prior to entering a structure or going above ground.
 - a. Except rigid non-metallic conduit may be extended directly to manholes, handholes, pad mounted transformer boxes and other exterior pad mounted electrical equipment where the conduit is concealed within the enclosure.
 - b. Terminate rigid PVC conduits with end bells.
 - c. Terminate steel conduits with insulated bushings.
- 14. Place warning tape in trench 12-inches above ductbanks, direct-buried conduit, and direct-buried wire and cable.
- 15. Placement of conduits stubbing into handholes shall be located to allow for proper bending radiuses of the cables.
- B. Concrete Encased Ductbank:
 - 1. Ductbank system consists of conduits completely encased in minimum 2 inch of <u>red</u> concrete and with separations between different cabling types as required in Section 16130 or as detailed on the Drawings.
 - 2. Install so that top of concrete encased duct, at any point:
 - a. Is not less than 24 inch below grade.
 - b. Is below pavement sub-grading.
 - 3. Where identified and for a distance 10-foot either side of the area, the concrete shall be reinforced.
 - a. The reinforcement shall consist of #4 bars and #4 ties placed 12 inch on center, in accordance with Division 3 or as detailed on the Drawings.
 - 4. Conduit supports shall provide a uniform minimum clearance of 2 inch between the bottom of the trench and the bottom row of conduit.

- 5. Conduit separators shall provide a uniform minimum clearance of 2 inch between conduits or as required in Section 16130 for different cabling types.
- C. Direct-Buried Conduit(s):
 - 1. Install so that the top of the uppermost conduit, at any point:
 - a. Is not less than 30 inch below grade.
 - b. Is below pavement sub-grading.
 - 2. Provide a uniform minimum clearance of 2 inch between conduits or as required in Section 16130 for different cabling types.
 - a. Maintain the separation of multiple planes of conduits by one of the following methods:
 - Install multilevel conduits with the use of conduit supports and separators to maintain the required separations, and backfill with flowable fill (100 PSI) or concrete per Division 2.
 - 2) Install the multilevel conduits one level at a time.
 - 3. Each level is backfilled with the appropriate amount of soil and compaction, per Division 2, to maintain the required separations.
- D. Conduits embedded in concrete structure (e.g., sidewalks, bridge decks) where shown on the Contract Drawings:
 - 1. Shall not be considered to replace structurally the displaced concrete except as indicated in the following:
 - 2. Shall not be larger in outside diameter than one-third the thickness of concrete.
 - 3. Shall have a minimum spacing of 3 diameter OC.
 - 4. In reinforced concrete construction:
 - a. Place conduit after reinforcing steel has been laid.
 - b. The reinforcement steel shall not be displaced by the conduit.
 - c. Provide a minimum of 1-1/2 inch of cover over conduit.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Material and installation requirements for:
 - a. Light switches.
 - b. Receptacles.
 - c. Device wallplates and coverplates.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 1 General Requirements.
- B. Section 16010 Electrical Basic Requirements.
- C. Section 16130 Raceways and Boxes.
- D. Section 16920 Motor Control Equipment.

1.3 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

- A. National Electrical Manufacturers Association (NEMA):
 - 1. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. WD 1, General Color Requirements for Wiring Devices.
 - 3. WD 6, Wiring Devices Dimensional Requirements.
- B. Underwriters Laboratories, Inc. (UL):
 - 1. 20, Standard for Safety General Use Snap Switches.
 - 2. 498, Standard for Safety Attachment Plugs and Receptacles.
 - 3. 514A, Standard for Safety Metallic Outlet Boxes.
 - 4. 894, Standard for Safety Switches for Use in Hazardous (Classified) Locations.
 - 5. 943, Standard for Safety Ground-Fault Circuit-Interrupters.
 - 6. 1010, Standard for Safety Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations.

1.4 SUBMITTALS

A. Shop Drawings:

- 1. See Section 01340 for requirement for the mechanics and administration of the submittal process.
- 2. Product technical data:
 - a. Provide submittal data for all products specified in PART 2 of this Specification.
 - b. See Division 1 for additional requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Light switches and receptacles:
 - a. Bryant.
 - b. Cooper Wiring Devices.
 - c. Hubbell.
 - d. Leviton.
 - e. Pass & Seymour.
 - f. Crouse-Hinds.
 - g. Appleton Electric Co.
 - h. Killark.
- B. Submit request for substitution in accordance with Division 1.

2.2 LIGHT SWITCHES

- A. General requirements unless modified in specific requirements paragraph of switches per designated areas or types:
 - 1. Toggle type, quiet action, Industrial Specification Grade.
 - 2. Self grounding with grounding terminal.
 - 3. Back and side wired.
 - 4. Solid silver cadmium oxide contacts.
 - 5. Rugged urea housing and one-piece switch arm.
 - 6. Rated 20 A, 120/277 Vac.
 - 7. Switch handle color: lvory.
 - 8. Types as indicated on the Drawings:
 - a. Single pole.

- b. Double pole.
- c. 3-way.
- d. 4-way.
- 9. Standards: UL 20, UL 514A, NEMA WD 6.
- B. Architecturally Finished Areas:
 - 1. Wallplate:
 - a. Ivory colored high impact thermoplastic or nylon.
 - b. Single or multiple gang as required.
- C. Dry Non-architecturally Finished Areas:
 - 1. Coverplate:
 - a. Zinc plated malleable iron or galvanized steel.
 - b. Single or multiple gang as required.
- D. Wet Non-architecturally Finished Areas:
 - 1. Coverplate:
 - a. Gasketed zinc plated malleable iron or aluminum with stainless steel screws utilizing rocker, front mounted toggle or pull type switch.
 - b. Single or multiple gang as required.
- E. Corrosive Areas:
 - 1. Corrosion resistant nickel plated metal parts.
 - 2. Coverplate:
 - a. Gasketed zinc plated malleable iron or copper free aluminum with stainless steel screws utilizing rocker, front mounted toggle or pull type switch.
 - b. Single or multiple gang as required.
- F. Highly Corrosive Areas:
 - 1. Corrosion resistant nickel plated metal parts.
 - 2. Coverplate:
 - a. PVC-RGS conduit system:
 - PVC coated zinc plated malleable iron or copper free aluminum with stainless steel screws utilizing rocker, front mounted toggle or pull type switch.

- 2) Single or multiple gang as required.
- b. PVC conduit system:
 - 1) Gray colored high impact thermoplastic.
 - 2) Single or multiple gang as required.

G. Hazardous Areas:

- 1. Rated for Class I, Division 1 and 2, Groups B, C, and D and Class II, Division 1 and 2 areas, Groups E, F, and G.
- 2. Switch enclosed in separate sealing chamber.
 - a. Sealing chamber has prewired factory sealed pigtail leads.
- 3. Coverplate:
 - a. Zinc plated malleable iron or copper free aluminum with stainless steel screws utilizing rocker or front mounted toggle type switch.
 - b. Single or multiple gang as required.
- 4. Standards: UL 894.

2.3 RECEPTACLES

- A. General requirements unless modified in specific requirements paragraph of receptacles per designated areas:
 - 1. Straight blade, Industrial Specification Grade.
 - 2. Brass triple wipe line contacts.
 - 3. One-piece grounding system with double wipe brass grounding contacts and self grounding strap.
 - 4. Back and side wired.
 - 5. Rated 20 A, 125 Vac.
 - 6. High impact nylon body.
 - 7. Receptacle body color:
 - a. Normal power: lvory.
 - 8. Types as indicated on the Drawings:
 - a. Normal: Self grounding with grounding terminal.
 - b. Ground fault circuit interrupter: Feed-through type with test and reset buttons.

- 9. Duplex or simplex as indicated on the Drawings.
- 10. Configuration: NEMA 5-20R.
- 11. Standards: UL 498, UL 514A, UL 943, NEMA WD 1, NEMA WD 6.
- B. Architecturally Finished Areas:
 - 1. Wallplate: Ivory colored high impact thermoplastic or nylon.
- C. Dry Non-architecturally Finished Areas:
 - 1. Coverplate:
 - a. Zinc plated malleable iron or galvanized steel.
 - b. Single or multiple gang as required.
- D. Wet Non-architecturally Finished Areas:
 - 1. Coverplate: Weatherproof (NEMA 3R) while in use, gasketed, copperfree aluminum, 2.5 IN minimum cover depth.
- E. Exterior Locations:
 - 1. Coverplate: Weatherproof (NEMA 3R) while in use, gasketed, copperfree aluminum, 2.5 IN minimum cover depth.
- F. Corrosive Areas:
 - 1. Corrosion resistant nickel plated metal parts.
 - 2. Receptacle body color: Yellow.
 - 3. Coverplate:
 - a. Zinc plated malleable iron or galvanized steel.
 - b. Single or multiple gang as required.
- G. Highly Corrosive Areas:
 - 1. Corrosion resistant nickel plated metal parts.
 - 2. Receptacle body color: Yellow.
 - 3. Coverplate:
 - a. PVC-RGS conduit system:
 - 1) PVC coated zinc plated malleable iron or copper free aluminum.
 - 2) Single or multiple gang as required.

- b. PVC conduit system:
 - 1) Gray colored high impact thermoplastic.
 - 2) Single or multiple gang as required.
- H. Hazardous Areas:
 - 1. Rated for Class I, Division 1 and 2, Groups B, C, and D; and Class II, Division 1 and 2, Groups F and G.
 - 2. Factory-sealed receptacle/switch/coverplate.
 - a. Zinc plated malleable iron or copper free aluminum with stainless steel screws and gasketed spring-loaded cover.
 - 3. "Dead-front" construction requiring plug to be inserted and rotated to activate receptacle.
 - a. Ordinary non-hazardous plug shall not activate the receptacle.
 - 4. Standard: UL 1010.
- I. Special Purpose Receptacles:
 - 1. NEMA configuration as indicated on the Drawings.
 - 2. Coverplate: See requirements per area designations herein.

2.4 MISCELLANEOUS WIRING DEVICES

A. Manual Motor Starters: Horsepower rated with or without thermal overloads, see Section 16955.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Mount devices where indicated on the Drawings and as scheduled in Section 16010.
- C. See Section 16130 for device outlet box requirements.
- D. Where more than one (1) receptacle is installed in a room, they shall be symmetrically arranged.
- E. Provide blank plates for empty outlets.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Nameplates and labels.
- B. Wire and cable markers.
- C. Conduit markers

1.2 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

A. ANSI/NFPA 70 - National Electrical Code.

1.3 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.4 SUBMITTALS

- A. Submit under provisions of the General Requirements.
- B. Product Data: Provide catalog data for nameplates, labels, and markers.

PART 2 - PRODUCTS

2.1 NAMEPLATES AND LABELS

- A. Nameplates: Engraved three-layer laminated plastic, black letters on white background. Provide 316 stainless steel screws for mounting (adhesives not allowed). Seton Identifications Products or approved equal.
- B. Locations:
 - 1. Each electrical distribution and control equipment enclosure.
- C. Letter Size:
 - 1. Use 1/8 inch letters for identifying individual equipment and loads.
 - 2. Use 1/4 inch letters for identifying grouped equipment and loads.
- D. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background. Use only for identification of individual wall switches and receptacles, and control device stations.

2.2 WIRE MARKERS

- A. Description: Slip-on PVC sleeve type as manufactured by Brady or approved equal.
- B. Locations: Each conductor at terminal boards and at each termination.
- C. Wire Labeling Standard: The intent of this standard is to provide for a wire marking system that clearly identifies the termination point at either end of any given conductor. Implementing this system would facilitate quicker troubleshooting due to the immediate recognition of a wires origination and destination without the need of contract drawings.
 - 1. Method: The most powerful controller would take precedence as the first termination point called out on the label. The second half of the label would be the termination point at the other end. The wire label would remain the same at both ends of the wire. For example:
 - a. If a wire ran from the RTU, Terminal Block number 4, Point 25 to the Motor Control Center, Pump 1 bucket, Field Terminal Block, Point 3, the tag would read; RTU-TB4-25/MCC-P1-FTB-3.
 - b. A wire that runs from the Motor Control Center, Pump 1 bucket, Field Terminal Block, Point 22 to the common of High Pressure Switch PSH-101, would read; MCC-P1-FTB-22/PSH-101-C.
 - c. An analog signal conductor from the positive connection of Pressure Transmitter PIT-111 to the RTU, Terminal Block number 6, Point 6, would read; RTU-TB6-6/PIT-111-+.
 - d. A circuit conductor originating from panel "LP" circuit breaker number 5 and feeding exhaust fan EF1 would read, LP-5/EF1.
 - e. Any conductor going to a relay would include the actual relay base pin number. For example, a conductor from the RTU Terminal Block 2 point 12 to relay CR1 pin 7 would read, RTU-TB2-12/CR1-7.
 - f. Motor feeders are not required to be marked with anything other than phase colors.

2.3 CONDUIT TAGS

A. Conduit tags shall be provided for exposed conduits stub ups and shall be 316 stainless steel and labeled per the Drawing conduit schedule. Provide Seaton or equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.2 APPLICATION

- A. Install nameplate and label parallel to equipment lines.
- B. Secure nameplate to equipment surface using 316 stainless steel machine screws. Sheet metal screws shall not be used. Adhesives are not allowed.
- C. Wire numbers shall be precisely located on each conductor, 3/8" from end of insulation. Where solderless type terminals are used, the number shall be applied to the wire not the terminal insulator.

END OF SECTION

PART 1 – GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Induction motors. Refer to other Divisions for dry pit submersible motors.
- B. When motors are furnished with driven equipment, the driven equipment supplier shall be responsible for assembling the motor and driven equipment as a complete unit, correctly aligned and coupled with the coupling or sheave specified on the driven equipment data sheet, and designing for vibration, special, or unbalanced forces resulting from equipment operation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 1 General Requirements.
- B. Division 13 Special Construction.
- C. Division 16 Electrical.

1.3 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

- A. Institute of Electrical and Electronic Engineers/American National Standards Institute (IEEE/ANSI):
 - 1. 43, Recommended Practice for Testing Resistance of Rotating Machinery.
- B. National Electrical Manufacturers Association (NEMA):
 - 1. MG 1, Motors and Generators.
- C. National Fire Protection Association (NFPA):
 - 1. 70, National Electrical Code (NEC).
- D. Underwriters Laboratories (UL):
 - 1. 674, Standard for Safety Electric Motors and Generators for Use in Division 1 Hazardous Locations.
 - 2. 1836, Outline of Investigation: Electric Motors and Generators for Use in Class I, Division 2 and Class II, Division 2 Hazardous (Classified) Locations.

1.4 SUBMITTALS

A. Shop Drawings:

- 1. See Division 1 for requirements for the mechanics and administration of the submittal process.
- 2. Product technical data:
 - a. Identify each motor by driven machine identification.
 - b. Motor manufacturer and model number.
 - c. Complete motor nameplate data.
 - d. Weight.
 - e. NEMA design type.
 - f. Enclosure type.
 - g. Frame size.
 - h. Winding insulation class and temperature rise.
 - i. Starts per hour.
 - j. Performance data:
 - 1) Guaranteed minimum efficiencies at 100 percent, 75 percent and 50 percent of full load.
 - 2) Guaranteed minimum power factor at 100 percent, 75 percent and 50 percent of full load.
 - 3) Locked rotor and full load current at rated terminal voltage and minimum permissible or specified terminal voltage.
 - 4) Starting, full load and breakdown torque at rated terminal voltage and minimum permissible or specified terminal voltage.
 - k. Bearing data and lubrication system.
 - I. Thermal protection system including recommended alarm and trip settings for winding and bearing RTDs.
- 3. Fabrication and/or layout drawings:
 - a. Dimensioned outline Drawing.
 - b. Connection diagrams including accessories (strip heaters, thermal protection, etc.).
- 4. Certifications:
 - a. When utilized with a reduced voltage starter, certify that motor and driven equipment are compatible.
 - b. When utilized with a variable frequency controller, certify motor is inverter duty and the controller and motor are compatible.
 - 1) Include minimum speed at which the motor may be operated for the driven machinery.
- 5. Test reports:
 - a. Motor test reports for all testing required in this Section.
- B. Operation and Maintenance Manuals:

- 1. See Division 1 for requirements for:
 - a. The mechanics and administration of the submittal process.
 - b. The content of Operation and Maintenance Manuals.
- 2. Installation instructions.
- 3. Operation and maintenance instructions.
- 4. Recommended spare parts list.

1.5 **DEFINITIONS**

- A. Inverter Duty Motor: An AC induction motor complying with all requirements of NEMA MG 1 Part 31 for definite-purpose inverter-fed motors.
- B. Abbreviations:
 - 1. DPFG Dripproof Fully Guarded.
 - 2. ODP Open Dripproof.
 - 3. RTD Resistance Temperature Detector.
 - 4. TEFC Totally Enclosed Fan Cooled.
 - 5. TENV Totally Enclosed Non-ventilated.
 - 6. WP-I Weather Protected Type I.
 - 7. WP-II Weather Protected Type II.
 - 8. Motor Controllers:
 - a. FVNR Full Voltage Non-Reversing.
 - b. RVAT Reduced Voltage Autotransformer.
 - c. RVPR Reduced Voltage Primary Reactor.
 - d. RVSS Reduced Voltage Solid State.
 - e. VFD Variable Frequency Drive.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. See Division 1.
- B. Protect equipment during shipment, handling, and storage by suitable boxes, crates, or other complete enclosures.
 - 1. Protect equipment from exposure to elements and keep thoroughly dry.
- C. Protect painted surfaces against impact, abrasion, discoloration, and other damage.

- 1. Repaint damaged painted surfaces to satisfaction of Engineer.
- D. Store all motors in a clean and dry indoor location until final installation.
- E. Where space heaters are provided in motors, provide temporary electrical power and operate heaters during storage and after motors are installed in permanent location until equipment is placed in service.
- F. For storage longer than one (1) month, see manufacturer's storage instructions.

1.7 SITE CONDITIONS

- A. Ambient air temperature: 40-110 Deg F.
- B. Altitude: 1000 FT above sea level.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
 - 1. Baldor.
 - 2. General Electric.
 - 3. Toshiba U.S.
 - 4. U.S. Electrical Motors.
 - 5. WEG.
- B. Submit request for substitution in accordance with Division 1.

2.2 EQUIPMENT

- A. General Requirements:
 - 1. Standards: NEMA MG 1.
 - 2. Identify each motor by the driven machine identification.
 - 3. An embossed or engraved stainless steel nameplate, with the required NEC and NEMA data, to be permanently attached to the motor.
 - 4. Maximum motor loading shall not exceed motor nameplate horsepower rating, exclusive of service factor.
 - 5. All motors shall be sized to carry continuously all loads, which may be imposed through their full range of operation.
 - 6. Altitude: For applications above 3300 FT, motors to be specifically designed and certified for operation at the specified altitude.

- 7. NEMA MG 1, Design B (unless otherwise required), constant speed squirrel-cage induction type having normal starting torque with low starting current.
- 8. Suitable for the starting method indicated (e.g., full voltage, autotransformer, solid state reduced voltage, VFD, etc.).
- 9. Where frequent starting occurs, design for frequent starting duty equivalent to duty service required by driven equipment.
- 10. Lifting devices: Motors weighing 265 LBS or more shall have suitable lifting eyes for installation and removal.
- 11. Grounding:
 - a. Lug suitable to terminate ground wire in terminal box, sized as indicated on the Drawings.
 - b. Frame ground pad on medium voltage induction motors.
- 12. Stator windings: Copper.
- 13. Rotor cage: Aluminum or copper.
- 14. Motor leads shall be non-wicking with permanent identifiers.
- 15. Totally enclosed motor to have one-way breather drains.
- 16. Efficiency:
 - a. Meet NEMA MG 1 (NEMA Premium) efficiencies.
 - b. If motor type, horsepower or speed is not included in the NEMA requirements for NEMA Premium, provide manufacturers "premium energy efficient" design.
- 17. Power factor:
 - a. Minimum of 80 percent lagging at full load, except on motors with speed slower than 900 RPM.
 - b. Power factor correction capacitors to be utilized when indicated on the Drawings.
- 18. Service factor: 1.15
- 19. Standards: NEMA MG 1, UL 674, UL 1836.
- 20. Duty: All small motors shall be wash down duty. All chemical pump motors shall be severe duty.

2.3 FRACTIONAL INDUCTION MOTORS

A. Electrical Ratings:

- 1. Appropriate for the voltage system indicated, single phase, 60 Hz.
- 2. Dual voltage rated motors (e.g., 115/230 V) are acceptable, provided all leads are brought out to the terminal box and permanently marked.
- B. Enclosure: TENV or TEFC, rolled steel enclosure permitted.
- C. Bearings: Lubricated-for-Life ball bearings
- D. Insulation: Class F insulation with temperature rise not to exceed the insulation class.
- E. Thermal Protection: Integral manual or automatic reset thermal protector.

2.4 INDUCTION MOTORS, 600 VOLT AND LESS

- A. Horizontal Shaft:
 - 1. Electrical rating:
 - a. Appropriate for the voltage system indicated, 3 PH, 60 Hz.
 - b. Dual voltage rated motors (e.g., 230/460 V) are acceptable, provided all leads are brought out to the terminal box and permanently marked.
 - 2. Enclosure:
 - a. Cast iron (exception: fan covers can be steel).
 - b. Type: DPFG, TEFC, WP-I or WP-II as indicated in the schedule.
 - 3. Terminal box:
 - a. Gasketed.
 - b. Diagonally split.
 - c. Field adjustable in 90-degree increments.
 - d. Oversized to accept the required conductors and conduits.
 - e. Located on "F1" side unless specifically indicated to be on the "F2" side.
 - f. Separate terminal box with terminal blocks for winding thermal protection devices (RTD and thermocouples).
 - 4. Bearings:
 - a. 5 HP and less: Lubricated-for-Life ball bearings.
 - b. Greater than 5 HP:
 - 1) Relubricatable.
 - 2) Antifriction.
 - 3) Minimum rated ABMA L-10 life of 10 years or 100,000 hours.

- 5. Insulation:
 - a. Class F insulation with Class B temperature rise.
 - b. Dipped and baked with non-hydroscopic varnish or epoxy.
- 6. Accessories: See Accessories article in PART 2 and Schedules article in PART 3.
- B. Vertical Solid or Hollow Shaft:
 - 1. Electrical rating:
 - a. Appropriate for the voltage system indicated, 3 PH, 60 Hz.
 - b. Dual voltage rated motors (e.g., 230/460 V) are acceptable, provided all leads are brought out to the terminal box and permanently marked.
 - 2. Enclosure:
 - a. Cast iron.
 - b. Type: DPFG, TEFC, WP-I or WP-II as indicated in the schedule.
 - 3. Terminal box:
 - a. Gasketed.
 - b. Diagonally split.
 - c. Oversized to accept the required conductors and conduits.
 - d. Separate terminal box with terminal blocks for winding thermal protection devices (RTD and thermocouples).
 - 4. Bearings (Solid Shaft):
 - a. Relubricatable.
 - b. Antifriction.
 - c. Minimum rated AMBA L-10 life of 10 years or 100,000 HRS.
 - 5. Bearings (Hollow Shaft):
 - a. Relubricatable.
 - b. Antifriction.
 - c. Oil or grease lubricated thrust bearings.
 - d. Grease lubricated guide bearings.
 - e. Minimum rated ABMA L-10 life of 10 years or 100,000 HRS.
 - 6. Non-reverse ratchets.
 - 7. Insulation:
 - a. Class F insulation with Class B temperature rise.
 - b. Dipped and baked with non-hydroscopic varnish or epoxy.

- 8. Accessories: See Accessories article in PART 2 and Schedules article in PART 3.
- 9. Modifications:
 - a. Inverter duty:
 - 1) At a minimum, applied to motors connected to a VFD.
 - 2) Windings insulated for 1600 peak volts and voltage rise times of 0.1 microseconds.
 - 3) Nameplate identification of meeting NEMA MG 1 Part 31 requirements.
 - 4) Have the following minimum turndown ratio without the use of a blower to provide continuous supply of cooling air over the motor.
 - a) Variable torque: 10:1.
 - b) Constant torque: 6:1.
 - 5) For motors 250 HP and larger, both bearings shall be of the insulated type.

2.5 ACCESSORIES

- A. Thermal Protection:
 - 1. Thermostats:
 - a. One (1) winding thermostat per phase for shutdown.
 - b. Snap action, bi-metallic, temperature-actuated switch type.
 - c. Normally closed, wired in series.
 - d. Automatic reset.
 - e. Switch point shall be pre-calibrated by the manufacturer.
 - 2. RTD's (where indicated):
 - a. One (1) winding thermostat per phase (minimum) for shutdown mounted in end turns.
 - b. Platinum 100 ohm positive temperature coefficient type.
- B. Space Heaters:
 - 1. Silicone rubber strip type, 120 V rated.
 - 2. Provided on:
 - a. All motors 10 HP and larger.
 - b. Indoor motors in humid environments as indicated.

2.6 SOURCE QUALITY CONTROL

- A. Test motors in accordance with NEMA, IEEE and manufacturer procedures.
 - 1. The test shall include but not necessarily be limited to the following:
 - a. Routine test:
 - 1) No-load current and speed at rated voltage and frequency.
 - 2) Locked rotor current.
 - 3) Winding resistance.
 - 4) Vibration check.
 - 5) High potential.
 - b. Complete test (in addition to the routine tests):
 - 1) Rated load temperature rise.
 - 2) Winding resistance.
 - 3) Slip test, measured in percent slip.
 - 4) Locked rotor amperes (3 PH, full voltage).
 - 6) Locked rotor torque.
 - 7) Breakdown torque.
 - 8) Efficiencies tabulated at 100, 75, and 50 percent of full load.
 - 9) Power factor tabulated at 100, 75, and 50 percent of full load.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Ground all motors in accordance with Section 16060 Grounding.

3.2 FIELD QUALITY CONTROL

- A. Check motor installation for adequate mounting method, shaft alignment, adjustment, cleanliness, and lubrication.
- C. Inspect each motor installation for any deviation from rated voltage, phase or frequency; or improper installation.
- D. Visually check for proper phase and ground connections.
 - 1. Verify that multi-voltage motors are connected for proper voltage.
- E. Check thermal protection devices and space heaters for functional operation.
- F. Test insulation resistance of all new in accordance with IEEE/ANSI 43 and NEMA MG 1.
 - 1. Test voltage per manufacturer.

- 2. Test values shall be temperature corrected if not measured when motor is at ambient conditions.
- 3. Report insulation resistance and dielectric absorption ratio for medium sized motors or polarization index for large motors.
- G. Test for proper rotation prior to connection to the driven equipment.

END OF SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section includes materials of automatic transfer switches. The transfer switches shall be provided and factory installed in the motor control centers.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 16010: General Electrical Requirements.
- B. Section 16920: Motor Control Centers.

1.3 SUBMITTALS

- A. Submit shop drawings in accordance with the General Conditions.
- B. Submit manufacturer's descriptive data including ratings, circuit diagrams, dimensional data, conduit entry restrictions, and a list of accessories.

1.4 MANUFACTURER'S SERVICES

- A. Provide manufacturer's services at the jobsite for the minimum man-days listed below, travel time excluded:
 - 1. Two man-days to check the installation, supervise start-up, and supervise testing and adjustments of the transfer switches.

PART 2 – MATERIALS

2.1 TRANSFER SWITCH

- A. Transfer switch shall be open type and installed as shown in the drawings. Transfer switch shall have three poles, three positions, with amperage and voltage ratings as shown in the drawings. Withstand current rating shall not be less than 65,000-ampere rms symmetrical.
- B. Switch shall be listed per UL-1008 as a recognized component for emergency systems and rated for all classes of loads.
- C. Transfer switch shall be electrically operated and mechanically held in each direction by an operating mechanism momentarily energized from the source to which the load shall be transferred. Accomplish mechanical locking in each direction without the aid of latching solenoids, toggle mechanisms, or gear arrangements. Total operating transfer time shall not exceed one-sixth of a second.
- D. Electrical spacings must not be less than those listed in Table 15.1 of UL-1008. Provide a handle to permit no-load manual operation.

2.2 ACCESSORIES

- A. Provide a solid-state sensing and control logic panel. Include the following operational characteristics:
 - 1. Adjustable (0.5 to 6.0 seconds) time delay on engine starting to override momentary dips in normal source, set at 1 second.
 - 2. Full phase voltage relay supervision of the normal source with at least one close differential relay to detect "brownout" condition, set at 70% dropout and 90% pickup.
 - 3. Voltage/frequency lockout relay to prevent premature transfer, set at 90% voltage and 90% frequency.
 - 4. Engine starting control contacts (one normally open and one normally closed).
 - 5. Adjustable (2 to 25 minutes) time delay on retransfer to normal, set at 20 minutes.
 - 6. Unloaded running time delay for generator cool down (adjustable 0.1 to 10 minutes), set at 5 minutes.
 - 7. Transfer to emergency time delay (adjustable 1 to 300 seconds), set at 1 second.
 - 8. Provide a delayed neutral position transfer.
- B. Provide a maintained system test switch on the front of the enclosure that simulates loss of normal power source. Provisions for a remote dry contact shall simulate loss of normal power source and prevent transfer back to the normal source.
- C. Manual push button to bypass the time delay on re-transfer.
- D. Pilot lights or display to indicate source to which the load is connected.
- E. Pilot light or display to indicate presence of normal power source.
- F. Auxiliary contacts for remote indication of switch position, two normally open and two normally closed contacts for normal and emergency position.
- G. Provide engine exercising feature.
- H. Provide a door mounted power monitor with display and Ethernet TCP/IP output.
- I. Provide an external manual mechanism as an alternate means to operate the transfer switch
SECTION 16250 – TRANSFER SWITCH

2.3 MANUFACTURERS

The transfer switch shall be ASCO 7000 series or approved equal.

PART 3 – EXECUTION

3.1 FIELD TESTING

A. Contractor shall field test and calibrate timing and monitoring logic. All adjustments shall be within 5% of the previously specified set points.

END OF SECTION

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SECTION 16280 – ACTIVE LINE CONDITIONER

PART 1 - GENERAL

1.1 SUMMARY

This specification defines the requirements for active line conditioner systems in order to meet IEEE-519-2014 electrical system requirements for harmonic current limits. The Active Line Conditioner (ALC) shall maintain power factor to .98 lagging. The ALC is mounted in the Motor Control Center.

1.2 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

- A. The active line conditioner system shall be designed in accordance with the applicable sections of the following documents.
- B. ANSI IEEE STD 519-2014
- C. UL 508
- D. The products shall include third party approvals by cULus.

1.3 SYSTEM DESCRIPTION

- A. System Description
 - 1. Voltage: 480 Volts, 60 Hz, 3 phase, 3 wire plus ground.
 - 2. Current Rating: Provide the rated current as indicated on the drawings
 - 3. Current Transformers:
 - a. Two current transformers are required and mounted on phases A & C.
 - b. Current transformers are an integral part of the Active Line Conditioner. When current transformers installed external to the Active Line Conditioner equipment, the contractor shall be responsible for the installation of manufacturer provided current transformers.
 - c. Current ratings of the current transformers shall be according to full load current of the circuit on which installed, 500, 1000, 3000, or 5000A to 5A secondary acceptable.
 - d. Current transformers rated for 400 hertz shall be used.
 - e. The current transformers shall be placed as close to the non-linear load to be conditioned within manufacturer guidelines.
- B. Philosophy of Operation
 - 1. The active line conditioner shall be designed to electronically supply nonfundamental current of magnitudes and phase relationships to satisfy the non-linear load current demand that results in a near sinusoidal current being drawn from the supply.

- C. Performance Requirements
 - 1. Response Time:
 - a. In a steady state condition, the active line conditioner shall have a response time of less than one (1) line cycle.
 - b. In the event of a load change or transient condition, the response time shall be within three (3) line cycles.
 - 2. Input Power:
 - a. Voltage: 208 Volt through 480 Volt, 3 phase, 3 wire, plus ground
 - b. Voltage Tolerance: +/- 10% of nominal
 - c. Frequency: automatically adapted to from 45 to 70 Hz, +/- 3 Hz
 - d. Input Circuit Breaker 100k AIC Rated
 - 3. Output Performance
 - a. Performance of the active line conditioner shall be independent of the impedance of the power source. All performance levels shall be attained whether on the AC lines, backup generator, or output of UPS.
 - b. Harmonic Correction:
 - Limit the 2nd through 50th order harmonic current to <5% TDD at each installed location indicated herein. Harmonic levels for individual harmonic orders shall comply with respective levels established in ANSI/IEEE std 519-1992, Table 10.3.
 - Limit the THD(V) added to the electrical system immediately upstream of the active line conditioner location(s) to less than or equal to 5%. The active line conditioner shall not correct for utility supplied voltage distortion levels.
 - c. Reactive Current Compensation shall be to .98 lagging displacement power factor. Leading power factor is not permitted.

1.4 ENVIRONMENTAL CONDITIONS

- A. The active line conditioner shall be able to withstand the following environmental conditions without damage or degradation of operating characteristics or life.
 - 1. Operating Ambient Temperature: -20°C to 40°C.
 - 2. Storage Temperature: -40°C to 65°C.
 - 3. Relative Humidity: 0 to 95%, non-condensing.
 - 4. Altitude: Operating to 1000 meters (3300 ft). De-rated for higher elevations.

PART 2 - PRODUCT

2.1 ENCLOSURE

- A. Each power correction unit shall be provided within the MCC.
- B. All UL Type 1 enclosed units shall include a door-interlocked circuit breaker that provides power interruption when the door is opened. The circuit breaker shall be lockable in the power-off position. Units shall be disconnected from the power source by a disconnect device or circuit breaker contained in the power distribution center as defined by local and national codes for branch circuit protection.
- C. Freestanding units shall include lifting provisions by forklift truck and lifting lugs. Wall mount units weighing more than 80 pounds shall be equipped with a means of lifting such as lifting lugs.
- D. Door Mounted Digital HMI Operator Interface.
- E. All units shall be provided with a grounding lug. Grounding by the contractor is to be performed according to local and national standards.
- F. The paint shall be the manufacturer's standard type and color.
- G. All units shall have a door-interlocked disconnect for power interruption when the door is opened.

2.2 OPERATOR CONTROLS AND INTERFACE

- A. The unit supplied shall not require field programming.
- B. Digital keypads shall be required for operation of the Active Line Conditioner. The ALC shall have Ethernet IP communication module to interface with the MCC Ethernet switch.
- C. The unit should automatically begin to correct harmonic currents after power up without the need for an operator command.
- D. Contacts shall be provided for operator information for run and fault. Each contact shall be rated for .4 Amperes at 125 volts. One form C contact shall be provided for each relay.

2.3 DESIGN

A. All active line conditioners shall be defined as power electronic devices which consist of power semiconductors that inject current into the AC line that will cancel undesirable harmonic currents. A DC bus shall store power for power semiconductor switching. A digital microcontroller shall control the operation of the power converter.

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- B. Each unit shall be designed with over-current and current limiting self protection. Operation shall continue indefinitely at manufacturer defined safe operating levels without trip off or destruction of the active line conditioner.
- C. Two distinct levels of faults shall be employed. Non-critical level faults will provide automatic restart and a return to normal operation upon automatic fault clearance. Critical level faults stop the function of the unit and await operator action and restart.
 - 1. Faults such as AC line power loss shall be automatically restarted upon power restoration. Upon removal of these fault conditions, the active line conditioner shall restart without user action.
 - 2. All other types of faults shall be considered critical and stop the active line conditioner. The run relay shall be disabled and the fault relay enabled. User shall be required to initiate a power reset (cycle power off and on) to restart the active line conditioner.
- D. The logic of the active line conditioner shall monitor the load current by utilizing two (2) current transformers (CTs) mounted on phases A and C to direct the function of the power electronic converter.
- E. Multiple active line conditioners may be installed in parallel to inject current. The units will function independently. If one unit is stopped or faulted, the remaining units will adjust accordingly to maintain optimum harmonic cancellation levels up to the capacity of the remaining units.
- F. Individual unit characteristics, including sample drawings, weight, and watts loss, can be found in the H5 Installation, Operation, and Maintenance Manual.
- G. Approved Manufacturers; TCI Harmonic Guard, no Equal

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall furnish and install, where indicated, a free-standing, frontaccess only, dead front type low voltage distribution switchboard, utilizing group mounted circuit protective devices as specified herein, and as shown on the contract drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 16010 Basic Electrical Requirements.
- B. Section 16443 Surge Suppression Device

1.3 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

- A. The low voltage distribution switchboards and all components shall be designed, manufactured and tested in accordance with the latest applicable following standards:
- B. NEMA PB-2
- C. UL Standard 891

1.4 SUBMITTALS – FOR REVIEW/APPROVAL

- A. The following information shall be submitted to the Engineer:
 - 1. Master drawing index
 - 2. Front view elevation
 - 3. Floor plan
 - 4. Top view
 - 5. Single line
 - 6. Schematic diagram
 - 7. Nameplate schedule
 - 8. Component list
 - 9. Conduit entry/exit locations
 - 10. Assembly ratings including:

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- a. Short-circuit rating
- b. Voltage
- c. Continuous current
- 11. Major component ratings including:
 - a. Voltage
 - b. Continuous current
 - c. Interrupting ratings
- 12. Cable terminal sizes
- 13. Product data sheets.
- B. Where applicable, the following additional information shall be submitted to the Engineer:
 - 14. Connection details between close-coupled assemblies
 - 15. Composite floor plan of close-coupled assemblies

1.5 SUBMITTALS – FOR CONSTRUCTION

- A. The following information shall be submitted for record purposes:
 - 1. Final as-built drawings and information for items listed in paragraph 1.04.
 - 2. Wiring diagrams
 - 3. Certified production test reports
 - 4. Installation information
 - 5. Seismic certification and equipment anchorage details.
- B. The final (as-built) drawings shall include the same drawings as the original construction drawings and shall incorporate all changes made during the manufacturing process.

1.6 QUALIFICATIONS

- A. The manufacturer of the assembly shall be the manufacturer of the circuit protective devices within the assembly.
- B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement. The equipment and major components shall be suitable for and certified to meet all applicable seismic

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requirements of the California Building Code (CBC) through zone 4 application. Guidelines for the installation consistent with these requirements shall be provided by the switchgear manufacturer and be based upon testing of representative equipment. The test response spectrum shall be based upon a 5% minimum damping factor, CBC: a peak of 2.15g's and a ZPA of 0.86g's applied at the base of the equipment. The tests shall fully envelop this response spectrum for all equipment natural frequencies up to at least 35 Hz. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.

- 1. The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision, prepared and stamped by a licensed civil engineer in the state. Mounting recommendations shall be provided by the manufacturer based upon approved shake table tests used to verify the seismic design of the equipment.
- 2. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.
- 3. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.

1.7 REGULATORY REQUIREMENTS

A. The low-voltage switchboard shall be UL labeled.

1.8 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment

1.9 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Cutler-Hammer
- B. General Electric
- C. Square D

D. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Owner ten (10) days prior to bid date.

2.2 RATINGS

- A. The assembly shall be rated to withstand mechanical forces exerted during shortcircuit conditions when connected directly to a power source having available fault current of 65,000 amperes symmetrical at rated voltage.
- B. Voltage and ampere rating to be as indicated on the drawings.

2.3 CONSTRUCTION

- A. Indoor NEMA 1G switchboard shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides and rear shall be covered with removable bolt-on covers. All edges of front covers or hinged front panels shall be formed. Provide adequate ventilation within the enclosure.
- B. All sections of the switchboard shall be rear aligned with depth as shown on the drawings. All protective devices shall be group mounted. Devices shall be front removable and load connections front accessible enabling switchboard to be mounted against a wall.
- C. The assembly shall be provided with adequate lifting means.
- D. The switchboard shall utilize the components herein specified and as shown on the drawings.
- E. The service meter switchboard shall be suitable for use as service entrance equipment and be labeled in accordance with UL requirements.

2.4 BUS

- A. All bus bars shall be silver-plated copper. Main horizontal bus bars shall be mounted with all three phases arranged in the same vertical plane. Bus sizing shall be based on NEMA standard temperature rise criteria of 65 degrees C over a 40 degrees C ambient (outside the enclosure).
- B. A copper ground bus (minimum 1/4 x 2 inches), shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchboard.
- C. All hardware used on conductors shall be high-tensile strength and zinc-plated. All bus joints shall be provided with conical spring-type washers.

2.5 WIRING/TERMINATIONS

- A. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished as required. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.
- B. Mechanical-type terminals shall be provided for all line and load terminations suitable for copper or aluminum cable rated for 75 degrees C of the size as indicated on the drawings.
- C. Lugs shall be provided in the incoming line section for connection of the main grounding conductor. Additional lugs for connection of other grounding conductors shall be provided as indicated on the drawings.
- D. All control wire shall be type SIS, bundled and secured with nylon ties. Insulated locking spade terminals shall be provided for all control connections, except where saddle type terminals are provided integral to a device. All current transformer secondary leads shall first be connected to conveniently accessible short-circuit terminal blocks before connecting to any other device. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips. Provide wire markers at each end of all control wiring.

2.6 MOLDED CASE CIRCUIT BREAKERS

- A. Protective devices shall be molded case circuit breakers with inverse time and instantaneous tripping characteristics.
- B. Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be non-welding silver alloy and arc extinction shall be accomplished by means of DE-ION arc chutes. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.
- C. Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the drawings.
- D. Circuit breakers 250 ampere frame and below shall be thermal-magnetic trip units and inverse time-current characteristics.
- E. Circuit breakers 400 ampere and larger frame shall have microprocessor-based RMS sensing trip units. Provide ALSIG feature, where indicated. Provide arc flash maintenance switches to reduce arc flash for downstream equipment when selected.
- F. Ground fault protection shall be provided where indicated.
- G. Where indicated, provide UL listed circuit breakers, where indicated, for applications at 100% of their continuous ampere rating in their intended enclosure.

H. Circuit breakers shall be padlockable in the open position.

2.7 TRIP UNIT

- A. Each molded case circuit breaker microprocessor-based tripping system shall consist of three (3) current sensors, a trip unit and a flux-transfer shunt trip. The trip unit shall use microprocessor-based technology to provide the adjustable time-current protection functions. True RMS sensing circuit protection shall be achieved by analyzing the secondary current signals received from the circuit breaker current sensors, and initiating trip signals to the circuit breaker trip actuators when predetermined trip levels and time-delay settings are reached.
- B. An adjustable trip setting dial mounted on the front of the trip unit, or interchangeable ratings plugs shall establish the continuous trip ratings of each circuit breaker. Rating plugs shall be fixed or adjustable as indicated. Rating plugs shall be interlocked so they are not interchangeable between frames, and interlocked such that a breaker cannot be closed and latched with the rating plug removed.
- C. System coordination shall be provided by the following microprocessor-based time-current curve shaping adjustments:
 - 1. Adjustable long-time setting (set by adjusting the trip setting dial or rating plug)
 - 2. Adjustable short-time setting and delay with selective curve shaping
 - 3. Adjustable instantaneous setting
 - 4. Arc Flash feature
- D. The microprocessor-based trip unit shall have both powered and un powered thermal memory to provide protection against cumulative overheating should a number of overload conditions occur in quick succession.
- E. When the adjustable instantaneous setting is omitted, the trip unit shall be provided with an instantaneous override.
- F. Breakers shall have built-in test points for testing the long-time delay, instantaneous, and ground fault functions of the breaker by means of a test set.

2.8 UTILITY METERING

- A. Where indicated on the drawings, furnish a separate barriered utility metering compartment complete with hinged sealable door. Bus work shall include provisions for mounting utility company current transformers and potential transformers or potential taps as required by the utility company.
- B. Provide service entrance label and provide necessary applicable service entrance features per NEC and local code requirements. The switchboard shall meet the

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requirements of San Diego Gas and Electric (SDG&E) and be approved by SDG&E.

2.9 ENCLOSURES

- A. Indoor NEMA 1G Enclosure.
 - 1. Section lineup and configuration shall be as indicated on the drawings.
 - 2. Finish: Manufacturer's standard gray enamel.

2.10 NAMEPLATES

- A. Engraved nameplates, mounted on the face of the assembly, shall be furnished for all main and feeder circuits as indicated on the drawings. Nameplates shall be laminated plastic, black characters on white background. Characters shall be 3/16-inch high, minimum. Nameplates shall give item designation and circuit number as well as frame ampere size and appropriate trip rating. Furnish master nameplate giving switchboard designation, voltage ampere rating, short-circuit rating, manufacturer's name, general order number, and item number.
- B. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.
- C. Provide a warning sign near the breakers warning emergency generator operation per NEC article 702.7(A).

2.11 FINISH

A. All exterior and interior steel surfaces of the switchboard shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the switchboard shall be ANSI 61 light gray.

2.12 SURGE SUPPRESSION DEVICE

A. Provide a surge suppression in service entrance switchboard as specified in Section 16443.

PART 3 - EXECUTION

3.1 FACTORY TESTING

- A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.
 - 1. The switchboard shall be completely assembled, wired, adjusted, and tested at the factory. After assembly, the complete switchboard will be tested for operation under simulated service conditions to assure the accuracy of the wiring and the functioning of all equipment. The main

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circuits shall be given a dielectric test of 2200 volts for one (1) minute between live parts and ground, and between opposite polarities. The wiring and control circuits shall be given a dielectric test of 1500 volts for one (1) minute between live parts and ground.

B. The manufacturer shall provide three (3) certified copies of factory test reports.

3.2 MANUFACTURER'S CERTIFICATION

A. A certified test report of all standard production tests shall be available to the engineer upon request.

3.3 TRAINING

- A. The Contractor shall provide a training session for up to six (6) owner's representatives for one normal workday at a jobsite location determined by the Owner.
- B. The training session shall be conducted by a manufacturer's qualified representative, not the Contractor. The training program shall consist of instruction on operation of the assembly, circuit breakers, fused switches, and major components within the assembly.

3.4 INSTALLATION

- A. The contractors shall install all equipment per the manufacturer's instructions, contract drawings and national electrical code.
- B. The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to the floor without the use of floor sills provided the floor is level to 1/8 inch per 3-foot distance in any direction. All necessary hardware to secure the assembly in place shall be provided by the Contractor.

3.5 FIELD ADJUSTMENTS

- A. The Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short circuit study, protective device evaluation study and protective device coordination study.
- B. Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with an approved short circuit and protective device coordination study shall be carried out by the Contractor at no additional cost to the owner.

END OF SECTION

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SECTION 16421 - UTILITY SERVICE ENTRANCE

PART 1 - GENERAL

1.1 SUMMARY

- A. Arrangement with Utility Company for permanent electric service.
- B. Underground service entrance.
- C. Metering equipment.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 Record Drawings and Submittals
- B. Section 01600 Materials and Equipment
- C. Section 16130 Raceways and Boxes
- D. Section 16170 Grounding and Bonding
- E. Section 16400 Switchboards

1.3 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

- A. ANSI/NFPA 70 National Electrical Code.
- B. SDG&E Guide.

1.4 SUBMITTALS

A. Submit under provisions of the General Requirements.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with Utility Company written requirements.
- B. Maintain one copy of each document on site.

1.6 SYSTEM DESCRIPTION

A. System Characteristics: 480/277, three phase, four-wire, 60 Hertz.

1.7 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

SECTION 16421 - UTILITY SERVICE ENTRANCE

1.8 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on Utility Company drawings.

PART 2 - PRODUCTS

2.1 UTILITY METERS

A. Meters will be furnished by Utility Company.

2.2 UTILITY METER BASE

A. Description: Meter base shall meet SDG&E service guide requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that service equipment is ready to be connected and energized.

3.2 **PREPARATION**

- A. Make arrangements with Utility Company to obtain permanent electric service to the Project.
- B. Coordinate location of Utility Company's facilities to ensure proper access is available.
- C. Obtain the Utility Company's approval of the Service Distribution Switchboard submittal prior to fabrication.

3.3 INSTALLATION

- A. Install service entrance conduits from Utility Company's indicated point of connection to building service entrance equipment per utility company drawings. Connect service lateral conductors to service entrance conductors.
- B. The transformer pad and transformer is existing to remain.

END OF SECTION

PART 1 - GENERAL

1.1 REQUIREMENT

- A. The Contractor shall prepare a short circuit and protective device coordination study for the electrical power system in accordance with the requirements of these Specifications and as shown. The coordination study shall be completed after preliminary approval of the switchgear. The switchgear shall not be shipped until approval of the coordination study.
- B. The study shall include all portions of the 480V electrical distribution system for normal and standby power sources.
- C. The work to be provided by the Contractor shall include protection studies for motors supplied with solid state overload and overcurrent protection devices.
- D. It is the responsibility of the Contractor to obtain from the serving utility and vendors the information required for the work.
- E. Provide a complete arc flash hazard study to help protect individuals from electrical arc flash injuries. These individuals may include any workers who inspect, maintain, or operate energized electrical equipment. Include all equipment 480 volts and 240 panelboards.
- F. Provide Arc Flash Hazard Warning Labels. These labels are intended to assist operators and others in the selection of proper Personal Protective Equipment when working around exposed and energized conductors.

1.2 ORGANIZATION'S QUALIFICATIONS

A. Short circuit studies, protective device evaluation studies, and protective device coordination studies shall be performed by a third party testing agency who has been regularly engaged in short circuit and protective device coordination services for a period of at least 15 years. The study shall utilize proven computer programs for making three-phase fault duty calculations. The studies shall be signed by the professional electrical Engineer, registered in the State of California, responsible for the studies.

1.3 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

- A. Short Circuit Study in accordance with ANSI standard C37 and IEEE standard 141 (Red Book).
- B. Coordination Study in accordance with IEEE 242 "Buff" to determine the proper overcurrent device settings that will balance system reliability through selective coordination while minimizing the magnitude of an electrical arc flash hazard incident.
- C. Incident Energy Study in accordance with the IEEE 1584, "IEEE Guide for

Performing Arc Flash Hazard Calculations" as referenced in NFPA 70, "Standard for Electrical Safety in the Workplace", in order to quantify the hazard for selection of personal protective equipment (PPE). Tables that assume fault current levels and clearing time for proper PPE selection are not acceptable.

1.4 SUBMITTALS

- A. The short circuit protective device coordination report shall conform to the requirements of this Section.
- B. Studies related to distribution system protection, and coordination shall be submitted to the Engineer 30 days prior to receiving final approval of the distribution equipment shop drawings and release of equipment for manufacture. Approval from the Engineer shall be obtained for a preliminary submittal of sufficient detail to ensure that device selection will be adequate. Preliminary submittal shall indicate the computer program for use in performing the WORK of this Section.
- C. Protective device and coordination evaluation studies shall be approved by the Engineer prior to releasing all distribution equipment for manufacturer, and project acceptance.
- D. The Contractor shall indicate in the submittal changes to the protection scheme or equipment selection that will result in improved system reliability, and safety.
- E. The submittal shall provide information concerning the program used for the work of this Section, and it shall include a general discussion of the procedure, items, and data considered in preparing the WORK.

PART 2 - PRODUCTS

2.1 GENERAL

A. The study organization shall include a single-line, and an impedance diagram of the power system. This diagram shall identify all components considered in the study and the ratings of all power devices. This includes, but is not limited to: transformers, circuit breakers, relays, fuses, busses, and cables. The resistances and reactances of all cables shall be identified in the impedance diagram. The study shall contain, from the serving utility company, all written data regarding maximum available short circuit current, voltage, and X/R ratio of the utilities' power system.

2.2 SHORT CIRCUIT STUDY

A. The short circuit study shall be performed with the aid of a digital computer program, and shall be in accordance with ANSI/IEEE C 37.010, ANSI/IEEE C 37.13, ANSI/IEEE Standard 242, and ANSI/IEEE Standard 141.

2.3 PROTECTIVE DEVICE EVALUATION STUDY

A. A protective device evaluation study shall be performed to determine the adequacy of circuit breakers, molded case switches, automatic transfer switches, and fuses. Any problem areas or inadequacies in the equipment due to prospective short-circuit currents shall be promptly brought to the Engineer's attention.

2.4 PROTECTIVE DEVICE COORDINATION STUDY

A. A protective device coordination study shall be performed to provide the necessary calculations required to select or check the selection of power fuse ratings, protective relay characteristics, and settings ratios, and characteristics of associated current transformers, and low-voltage breaker trip characteristics, and settings.

2.5 TIME/CURRENT COORDINATION CURVES

- A. As a minimum, the time/current coordination curves for the power distribution system shall include the following on log-log graph paper:
 - 1. Time/current curves for each protective relay, circuit breaker, or fuse showing graphically that the settings will provide protection and selectivity within industry standards. Each curve shall be identified, and tap and time dial settings shall be specified. Provide individual curves for each feeder unless identical to others shown.
 - 2. Time/current curves for each device shall be positioned to provide the maximum selectivity to minimize system disturbances during fault clearing. Where selectivity cannot be achieved, the Engineer shall be notified as to the cause. Recommendations shall be included for alternate designs that would improve selectivity.
 - 3. Time/current curves and points for cable and equipment damage.
 - 4. Circuit interrupting device operating and interrupting times.
 - 5. Indicate maximum fault values on the graph.
 - 6. Sketch of bus and breaker arrangement.
 - 7. Magnetizing inrush points of transformers.
 - 8 All restrictions of the ANSI and National Electrical Code shall be adhered shall be maintained.
 - 9. Thermal limits of motors 250 hp and above.
 - 10. Thermal limits of dry type and liquid insulated transformers. (ANSI damage curve).

2.6 LABELS

- A. Installed warning labels (orange <40 cal/cm2) or danger label (red > 40 cal/cm2) in accordance with ANSI Z535.4-2002. The label must be readable in both indoor and outdoor environments for at least 3 years and contain the following information (See sample label, attached):
 - 1. Arc hazard boundary (inches)
 - 2. Working distance (inches)
 - 3. Arc flash incident energy at the working distance (calories/ cm2)
 - 4. PPE category and description including the glove rating
 - 5. Voltage rating of the equipment
 - 6. Limited approach distance (inches)
 - 7. Restricted approach distance (inches)
 - 8. Prohibited approach distance (inches)
 - 9. Equipment/bus name
 - 10. Date prepared
 - 11. Arc flash hazard study preparer name and address
 - 12. Protective device and rating

PART 3 - EXECUTION

3.1 PROTECTIVE DEVICE TESTING, CALIBRATION, AND ADJUSTMENT

- A. The Contractor shall provide the services of a qualified field Engineer and necessary tools and equipment to test, calibrate, and adjust the protective relays and circuit breaker trip devices as recommended in the power system coordination study.
- B. The motor control center manufacturer shall provide the services of a qualified field Engineer to calibrate all MCPs as recommended in the power system study.

3.2 STUDY REPORTS

A. The results of the power system study shall be summarized in a final report. Eight bound copies of the final report shall be submitted. The report shall include the following:

- 1. Single-line diagram
- 2. Impedance diagram
- 3. Tabulation of all protective devices, which shall be identified on the single line diagram
- 4. Time/current coordination curves
- 5. Computerized fault current calculations
- 6. Specific recommendations, if any
- 7. Test instrumentation, condition, and connections, as applicable, for each study.

3.3 ARC FLASH ANALYSIS

- A. Personnel performing the arc flash analysis shall be trained and experienced in accordance with NETA Training Specifications concerning the apparatus and systems being evaluated.
- B. LABELS: (Sample)

	WARNING
Arc Flash and Shock Hazard Appropriate PPE Required	
40.0	cal/cm^2 Flash Hazard at 45 inches
Class 4	Cotton Underwear + FR Shirt & Pant + Multi Layer Flash Suit + Hood
480 VAC	Shock Hazard when cover is removed
00	Glove Class
42 inch	Limited Approach (Fixed Circuit)
12 inch	Restricted Approach
1 inch	Prohibited Approach
Bus: CPK4	S1A LINE Prot: F5/SUB CPK4S1A

END OF SECTION

PART 1 – GENERAL

1.1 SCOPE

A. The Contractor shall furnish and install the Surge Suppression Device (SPD) equipment having the electrical characteristics, ratings and modifications as specified herein and as shown on the contract drawings. To maximize performance and reliability, the AC surge protection shall be integrated into the main switchboard as indicated.

1.2 RELATED WORK SPECIFIED ELSEWHERE (NOT USED)

1.3 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

A. SPD units and all components shall be designed, manufactured and tested in accordance with the latest applicable UL Listed standards (UL 1449, 3rd Edition), UL 1283 and CSA certified per CSA 22.2

1.4 SUBMITTALS

- A. The following information shall be submitted to the Engineer:
 - 1. Provide verification that the SPD device complies with the required UL 1449 3rd Edition and CSA approvals.
 - 2. For retrofit mounting applications, electrical and mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.
- B. The following additional information shall be submitted to the engineer:
 - 1. Descriptive bulletins.
 - 2. Product sheets.

1.5 QUALIFICATIONS

- A. For the specified herein, the manufacturer shall be ISO 9000 certified.
- B. The manufacturer must have a 24-hour response capability with nationwide field engineering personnel. The field service organization must have fully accredited, Power System Engineers located across North America who are capable of performing complete grounding, Power Quality analysis, and coordination studies. Factory trained SPD sales personnel do not qualify as Power System Engineers.
- C. The manufacturer of the transient voltage surge suppression equipment shall be the same manufacturer as the manufacturer of the low voltage distribution equipment in which the SPD units are installed.
- D. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.

- 1. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.
- 2. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.

1.6 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of manufacturer's instructions shall be included with the equipment at time of shipment.

1.7 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

PART 2 - MATERIALS

2.1 MANUFACTURERS

A. Eaton/Cutler-Hammer: Visor Series, or equal.

2.2 VOLTAGE SURGE SUPPRESSION - GENERAL

- A. Electrical Requirements
 - 1. Unit Operating Voltage Refer to drawings for operating voltage and unit configuration.
 - 2. Maximum Continuous Operating Voltage (MCOV) The MCOV shall be greater than 115% of the nominal system operating voltage.
 - 3. The suppression system shall incorporate a hybrid designed Metal-Oxide Varistors (MOV) surge suppressor for the service entrance and other distribution level. The system shall not utilize silicon avalanche diodes, selenium cell, air gaps or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
 - Protection Modes For a wye configured system, the device must have directly connected suppression elements between line-neutral (L-N), lineground (L-G), and neutral-ground (N-G). For a delta-configured system, the device must have suppression elements between line to line (L-L) and line to ground (L-G).

- 5. UL 1449 3rd Edition Suppressed Voltage Rating (SVR) The maximum UL 1449 2nd Edition SVR for the device must not exceed the following:
 - a. Modes 208Y/120 480Y/277 600Y/347
 - b. L-N; L-G; N-G 400V 800V 1200V
 - c. L-L 800V 1800V 1800V
- 6. ANSI/IEEE Cat. C3 Let Through Voltage The let through voltage based on IEEE C62.41 and C62.45 recommended procedures for Category C3 surges (20 kV, 10 kA) shall be less than:
 - a. Modes 208Y/120 480Y/277 600Y/347
 - b. L-N 560V 960V 1840V
- ANSI/IEEE Cat. B3 Let Through Voltage Let through voltage based on IEEE C62.41 and C62.45 recommended procedures for the ANSI/IEEE Cat. B3 ring wave (6 kV, 500 amps) shall be less than:
 - a. Modes 208Y/120 480Y/277 600Y/347
 - b. L-N 160V 165V 168V
- B. SPD Design
 - 1. Balanced Suppression Platform The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating SPD modules shall not be acceptable.
 - 2. Electrical Noise Filter Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be 50 dB at 100 kHz using the MIL-STD-220A insertion loss test method. Products not able to demonstrate noise attenuation of 50 dB @ 100 kHz shall be rejected.
 - 3. Extended Range Filter –The Surge Protective Device shall have a High Frequency Extended Range Tracking Filter in each Line to Neutral mode with compliance to UL 1283 and NEMA LS1. The filter shall have published high frequency attenuation rating in the attenuation frequencies.
 - a. Attenuation Frequency 50kHz 100kHz 500kHz 1MHz 10MHz 100HHz
 - b. Insertion Loss (ratio) 40 316 89 200 79
 - c. Insertion Loss (dB) 32 50 39 46 38
 - 4. Internal Connections No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be hardwired with connections utilizing low impedance conductors and compression fittings.

SECTION 16443 - SURGE SUPPRESSION DEVICE (SPD)

- 5. Standard Monitoring Diagnostics Each SPD shall provide integral monitoring options:
 - a. Each unit shall provide a green / red solid state indicator light shall be provided on each phase. The absence of a green light and the presence of a red light shall indicate which phase(s) have been damaged.
 - b. Remote Status Monitor The SPD device must include form C dry contacts (one NO and one NC) for remote annunciation of unit status. The remote alarm shall change state if any of the three phases detect a fault condition.
 - c. Event Counter The SPD shall be equipped with an LCD display system designed to indicate to the user how many surges, sags, swells and outages have occurred at the location. The event counter triggers each time under each respective category after significant event occurs. A reset pushbutton shall also be standard allowing all counters to be zeroed.
 - d. Push to Test The SPD shall be equipped with push-to-test feature, designed to provide users with real time testing of the suppressor's monitoring and diagnostic system. By depressing the test button, the diagnostic system initiates a self test procedure. If the system is fully operational, the self test will activate all indicator lights.
- 6. Optional Monitoring Diagnostics:
 - a. Non Volatile Memory The SPD shall at least be able to save the last 1000 events.
- 7. Overcurrent Protection Fusing: In order to isolate the SPD under any fault condition, the manufacturer shall provide:
 - a. Individual Fusing: MOV's shall be individually fused via Copper Fuse Trace. The Copper Fuse shall allow protection during high surge (kA) events.
 - b. Thermal Protection: MOV's shall be equipped with Thermal Fuse Spring (TFS) technology which allows disconnection of the suppression component at the overheated stage common during temporary over voltage condition. For small fault currents between 100mA to 30Amp, or if the occurrence is over a longer period of time, the TFS will disconnect first. Manufacturers that utilize fuse trace only shall not be approved since there is no fault current protection between 100mA to 30A.
 - c. All overcurrent protection components shall be tested in compliance with UL 1449-Limited Current Test and AIC rating test.
- C. Minimum Repetitive Surge Current Capability as per ANSI/IEEE C62.41 and ANSI/IEEE C62.45 1992. The suppression filter system shall be repetitive surge tested in every mode utilizing a 1.2 x 50µsec, 20kV open circuit voltage. 8 x 20µsec, 10kA short circuit current Category C3 bi-wave at one minute intervals without suffering either performance degradation or more than 10% deviation of clamping voltage at a specified surge current. The minimum repetitive surge

SECTION 16443 - SURGE SUPPRESSION DEVICE (SPD)

current capability as per ANSI/IEEE C62.41 and ANSI/IEEE C62.45 – 1992 shall 12000 impulse per mode

2.3 SYSTEM APPLICATION

- A. The SPD applications covered under this section include distribution and branch panel locations, bus plugs, motor control centers (MCC), switchgear, and switchboard assemblies. The branch panel located SPD shall be tested and demonstrate to be suitable for ANSI/IEEE C62.41 Category C1 environments.
- B. Surge Current Capacity -- The minimum total surge current 8 x 20 microsecond waveform that the device is capable of withstanding shall be as follows:
 - 1. Minimum total Surge Current and Withstand Capability with compliance to ANSI/IEEE C62.41 AND NEMA LS1, Application Per Phase, Per Mode Surge Withstand Capabilities ANSI/IEEE C3 Wave (10kA).
 - 2. Service Entrance Locations (Switchboards): 250kA, 125kA, 12000 hits.
- C. Switchboard Requirements
 - 1. The SPD application covered under this section is for switchboard locations. Service entrance located SPD shall be tested and suitable for ANSI/IEEE C62.41 Category C3 environments.
 - 2. The SPD shall be of the same manufacturer as the switchboard where possible.
 - 3. Locate suppressor on load side of main disconnect device, as close as possible to the phase conductors and ground/neutral bar.
 - 4. Provide a 30-amp disconnect. The disconnect shall be directly integrated to the suppressor and assembly bus using bolted bus bar connections.
 - 5. All monitoring diagnostics features shall be visible from the front of the equipment.

PART 3 – EXECUTION

3.1 FACTORY TESTING

A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

3.2 INSTALLATION

A. The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.

3.3 WARRANTY

A. The manufacturer shall provide a full ten (10) year warranty from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable national or local code.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Provide all labor, materials, equipment, and incidentals required, and install, place in operation and field test the variable frequency drives (VFD's). The VFD's shall be installed in the motor control center (MCC).
- B. The drive manufacturer shall furnish, field test, adjust and certify all installed drives for satisfactory operation.

1.2 RELATED WORK SPECIFIED ELSEWHERE (NOT USED)

1.3 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

- A. ANSI/NFPA 70 National Electrical Code.
- B. ANSI C84.1 Voltages Tolerances for North America
- C. CSA C22.2 No. 14-M91 Industrial Control Equipment
- D. IEC 68 Part 2-3 Basic Environmental Testing Procedures Part 2: tests Test Ca: Damp Heat
- E. IEC 146.1 Semiconductor Converters-General Requirements and Line Commutated Converters Part 1-1: Specifications of Basic Requirements
- F. IEC 664 Insulation Coordination for Equipment within Low-Voltage Systems
- G. IEC 447 Man-Machine Interface Actuating Principles
- I. IEC 439 Part 1 Low Voltage Switchgear and Controlgear Assemblies
- J. IEC 947 Low Voltage Switchgear and Controlgear Components
- K. IEC 364 Electrical Installation of Buildings
- L. IEC 204/NFPA 79 Electrical Equipment of Industrial Machines/Industrial Machinery
- M. IEC 106 Guide for Specifying Environmental Conditions for Equipment Performance Rating
- N. IEC 529 Degrees of Protection Provided by Enclosure
- O. IEC 1000 Electromagnetic Compatibility
- P. IEC 721 Classification of Environmental Conditions
- Q. IEC 255 8 Overload Relays

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- R. IEC 801-2, -3,-4,-5 Immunity Tests
- S. NEMA ICS 6 Industrial Control and Systems Enclosures
- T. NEMA ICS, Part 4 Overload Relays
- U. NEMA 250 Enclosures for Electrical Equipment
- V. NEMA ICS 2-321 Electrical Interlocks
- W. NEMA ICS7 Industrial Control and Systems Adjustable Speed Drives
- X. NEMA ICS 7.1 Safety Standards for Construction and Guide for Selection Installation and Operation of Adjustable Speed Drives
- Y. UL 50 UL Standard for Safety Enclosures for Electrical Equipment
- Z. UL 98 UL Standard for Disconnect Switches
- AA. UL 507 UL Standard for Safety Electric Fans
- BB. UL 508 UL Standard for Safety Industrial Control Equipment
- CC. UL 508C UL Standard for Safety Power Conversion Equipment
- DD. UL 991 UL Standard for Safety Tests for Safety Related Controls employing Solid State Devices
- EE. OSHA 1910.95 AC Drive Controller Acoustical Noise
- FF. National Safe Transmit Association and International Safe Transmit Association Test for Packages Weighing 100 lbs. or Over

1.4 SUBMITTALS

- A. Submittals shall be in accordance with Section 01300-Submittals. Provide elementary power and control wiring diagrams and enclosure outline drawings. The enclosure drawings shall include front and side views of the enclosures with overall dimensions and weights shown, conduit entrance locations and nameplate legends.
- B. Furnish standard catalog sheets showing voltage, horsepower, maximum current ratings and recommended replacement parts with part numbers for each different horsepower rated AC drive.

1.5 QUALITY ASSURANCE

A. The AC Drive and all associated optional equipment shall be UL listed according to Power Conversion Equipment UL 508C. A UL label shall be attached inside each enclosure as verification.

SECTION 16483 – VARIABLE FREQUENCY DRIVES

- B. The AC Drive shall be designed, constructed and tested in accordance with NEMA, NEC, VDE, IEC standards and CSA certified.
- C. Test every power converter with an actual AC Induction Motor 100% loaded and temperature cycled within an environment chamber at 104 F degrees. Furnish documentation to verify successful completion at the request of the Engineer.
- D. Test all drive door-mounted pilot devices to verify successful operation. Furnish documentation upon the request of the Engineer.
- E. Submit the AC drive to a Hi-Pot test with all enclosed devices mounted and wired, prior to shipment.

1.6 WARRANTY

The manufacturer shall provide to OWNER a certificate of warranty which states: "The complete VFD unit was installed properly. It shall receive a full warranty for all material and workmanship. The material and workmanship warranty is for a period of 1 year starting on the day of final approval from the OWNER." The manufacturer shall provide field response to the OWNER's request regarding any defects in the pumping unit. The manufacturer shall repair or replace any parts, which fails to meet the requirements of this Section at no cost to the OWNER.

PART 2 - PRODUCT

2.1 MANUFACTURER

Mitsubishi FR-F800-E Series. No other equals allowed.

2.2 GENERAL DESCRIPTION

- A. The AC Drive shall convert the input AC mains power to an adjustable frequency and voltage as defined in the following sections.
- B. The input power section shall utilize a full wave bridge design incorporating diode rectifiers. The diode rectifiers shall convert fixed voltage and frequency, AC line power to fixed DC voltage. This power section shall be insensitive to phase rotation of the AC line.
- C. The output power section shall change fixed DC voltage to adjustable frequency AC voltage. This section shall utilize insulated gate bipolar transistors (IGBTs).

2.3 CONSTRUCTION

- A. Provide an incoming line HMCP rated 65kaic with mechanical interlock to prevent an operator from opening the AC Drive door when the disconnect is in the *on* position. Another mechanical interlock shall prevent an operator from placing the disconnect in the *on* position while the AC Drive door is open. It shall be possible for authorized personnel to defeat these interlocks.
- B. Provide mechanism to lock all disconnects in the off position with up to three

padlocks.

- C. Provide optional ventilation fans.
- D. Provide a 3% input line reactor.
- E. Provide Ethernet interface.

2.4 APPLICATION DATA

- A. Size the AC Drive to operate a variable torque load.
- B. The speed range shall be from a minimum speed of 0.5 Hertz to a maximum speed of 60 Hertz.

2.5 ENVIRONMENTAL RATINGS

- A. Design the AC Drive to operate in an ambient temperature from 0 to + 40 degrees C (+32 to 104 degrees F).
- B. The storage temperature range shall be -25 to + 70 degrees C.
- C. The maximum relative humidity shall be 95% at 40 degrees C, non-condensing.
- D. The AC Drive shall be rated to operate at altitudes less than or equal to 3,300 ft (1000m). For altitudes above 3,300 ft, de-rate the AC Drive by 1.2% for every 300 ft (100m).
- E. The AC Drive shall meet the IEC 68-2 Operational vibration specification.

2.6 RATINGS

- A. The AC Drive shall operate from an input voltage frequency range from 47.5 to 63 Hertz.
- B. The displacement power factor shall not be less than .95 lagging under any speed or load condition.
- C. The efficiency of the AC Drive at 100% speed and load shall not be less than 95%.
- D. The variable torque rated AC Drive overcurrent capacity shall be 110% for 1 minute.
- E. The output carrier frequency of the AC Drive shall be randomly modulated and selectable at multiple frequencies depending on Drive rating for low noise operation.
- F. The AC Drive shall be able to develop rated motor torque at 0.5 Hertz (60 Hz base) in a sensorless flux vector mode using a standard induction motor without an encoder feedback signal.

2.7 PROTECTION

- A. Upon power-up the AC Drive shall automatically test for valid operation of memory, option module, loss of analog reference input, loss of communication, dynamic brake failure, DC to DC power supply, control power and the pre-charge circuit.
- B. The AC Drive shall be UL 508C listed for use on distribution systems with 30,000A RMS available fault current. The drive shall meet short circuit withstandability of 30,000 RMS symmetrical amperes as defined by NEMA ICS 7.1.09 and have the value listed on the AC Drive nameplate. Provide current limiting fuses if required.
- C. The power converter shall be protected against short circuits, between output phases and ground and the logic and analog outputs.
- D. The AC drive shall have a minimum AC undervoltage power loss ride-through of 200 milliseconds. The AC Drive shall have the user defined option of frequency fold-back to allow motor torque production to continue to increase the duration of the power loss ride-through.
- E. The AC drive shall have a selectable ride through function which will allow the logic to maintain control for a minimum of one second without faulting.
- F. For a fault condition other than a ground fault, short circuit or internal fault, an auto restart function will provide up to 5 programmable restart attempts. The programmable time delay before restart attempts will range from 1 second to 600 seconds.
- G. The deceleration mode of the AC drive shall be programmable for normal and fault conditions. The stop modes shall include free-wheel stop, fast stop and DC injection braking.
- H. Upon loss of the analog process follower reference signal, the AC drive shall fault and/or operate at a user defined speed set between software programmed low speed and high speed settings.
- I. The AC drive shall have solid state I²t protection that is UL listed and meets UL 508 C as a Class 10 overload protection and meets IEC 947. The minimum adjustment range shall be from .45 to 1.05 percent of the current output of the AC Drive.
- J. The AC Drive shall have a thermal switch with a user selectable pre-alarm that will provide a minimum of 60 seconds delay before over-temperature fault.
- K. The AC Drive shall utilize bonded fin heatsink construction for maximum heat transfer.
- L. The AC drive shall have a programmable fold-back function that will anticipate a controller overload condition and fold back the frequency to avoid a fault condition.
- M. The output frequency shall be software enabled to fold back when the motor is overloaded.

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- N. There shall be 3 skip frequency ranges that can each be programmed with a selectable bandwidth of 2 or 5 Hz. The skip frequencies shall be programmed independently, back to back or overlapping.
- O. The AC Drive shall include metal oxide varistors (MOVs) wired to the incoming AC Mains.

2.8 ADJUSTMENTS AND CONFIGURATION

- A. The AC drive shall self-configure to the main operating supply voltage and frequency. No operator adjustments shall be required.
- B. Upon power-up, the AC drive shall automatically send a signal to the connected motor and store the resulting resistance data into memory. The inductance data shall be measured during no-load operation when operating at a frequency between 20-60 Hz. The AC Drive shall automatically optimize the operating characteristics according to the stored data.
- C. The AC drive shall be factory pre-set to operate most common applications.
- D. A choice of three types of acceleration and deceleration ramps shall be available in the AC Drive software; linear, S curve and U curve.
- E. The acceleration and deceleration ramp times shall be adjustable from 0.1 to 999.9 seconds.
- F. The volts per frequency ratios shall be user selectable to meet variable torque loads, normal and high torque machine applications.
- G. The memory shall retain and record run status and fault type of the past 8 faults.
- H. Slip compensation shall be a software enabled function.
- I. The software shall have a NOLD (no load) function that will reduce the voltage to the motor when selected for variable torque loads. A constant volts/Hz ratio shall be maintained during acceleration. The output voltage will then automatically adjust to meet the torque requirement of the load.

2.9 OPERATOR INTERFACE

- A. The MCC door mounted operator interface terminal shall offer the modification of AC drive adjustments via a touch keypad. All electrical values, configuration parameters, I/O assignments, application and activity function access, faults, local control, adjustment storage, self-test and diagnostics shall be in plain English. Provide Mitsubishi Type FR-P007-01.
- B. The display will be a high resolution, LCD backlighted screen capable of displaying graphics such as bar graphs as well as six lines of twenty-one alphanumeric characters.

SECTION 16483 – VARIABLE FREQUENCY DRIVES

- C. The AC drive model number, torque type, software revision number, horsepower, output current, motor frequency and motor voltage shall all be listed on the drive identification display as viewed on the LCD display.
- D. A user defined label function shall be available. As a minimum the selectable outputs shall consist of speed reference, output frequency, output current, motor torque, output power, output voltage, line voltage, DC voltage, motor thermal state, drive thermal state, elapsed time, motor speed, machine speed reference and machine speed.
- E. A single keystroke scrolling function shall allow dynamic switching between display variables.
- F. The terminal keypad shall consist of programmable function keys. The functions shall allow both operating commands and programming options to be preset by the operator. A hardware selector switch shall allow the terminal keypad to be locked out from unauthorized personnel.
- G. The operator terminal shall offer a general menu consisting of parameter setting, I/O map, fault history, and drive configuration. A software lock shall limit access to the main menu. The main menu shall consist of keypad configuration, drive configuration, general configuration, diagnostic mode and drive initialization screens.
- H. There shall be arrow keys that will provide the ability to scroll through menus and screens, select or activate functions or increase the value of a selected parameter.
- I. A data entry key shall allow the user to confirm a selected menu, numeric value or allow selection between multiple choices.
- J. An escape key shall allow a parameter to return the existing value if adjustment is not required and the value is displayed. The escape function shall also return to a previous menu display.
- K. A RUN key and a STOP key shall command a normal starting and stopping as programmed when the AC drive is in keypad control mode. The STOP key shall be active in all control modes.
- L. A user interface shall be available that is a Windows based personal computer, serial communication link or detachable operator interface.

2.10 CONTROL

- A. External pilot devices shall be able to be connected to a terminal strip for starting/stopping the AC Drive, speed control and displaying operating status. All control inputs and outputs shall be software assignable.
- B. 2-wire or 3-wire control strategy shall be defined within the software.
 - 1. 2-wire control shall allow automatic restart of the AC Drive without operator intervention after a fault or loss of power.

- 2. 3-wire control shall require operator intervention to restart the AC Drive after a fault or loss of power.
- C. The internal power supply shall incorporate an automatic current fold-back that protects the internal power supply if incorrectly connected or shorted. The transistor logic outputs shall be current limited and not be damaged if shorted or excess current is pulled.
- D. All logic connections shall be furnished on pull-apart terminal strips.
- E. There shall be (1) one software assignable, optically isolated analog inputs. The analog input shall be software selectable and consist of the following configurations: 0-20 ma, 4-20 ma, 20-4 ma, x-20 ma (where x is user defined) 0-5 v, 1-5 v or 0-10 v.
- F. There shall be a minimum of 4 software assignable, optically isolated logic inputs that will be selected and assigned in the software. The selection of assignments shall consist of enable, jog, plus/minus speed (2 inputs required), setpoint memory, preset speeds (up to 2 inputs), auto/manual control, start/stop, terminal or keypad control, external fault, and fault reset.
- G. There shall be two software assignable optically isolated analog outputs that can be selected and assigned in the software. The analog output assignments shall be proportional to the following motor characteristics: frequency, current, power, torque, voltage and thermal state. The output signal shall be selectable from 0-20 ma or 4-20 ma.
- H. Two voltage-free Form C relay output contacts shall be provided. One of the contacts shall indicate AC drive fault status. The other contact shall be user assignable as a run status.
- I. Provide additional expansion module for I/O logic functions to interface with remote field devices. Provide for four programmable inputs and two programmable outputs for user use. The logic shall have timer functions that will interface with field devices such as limit and pressure switches. Allow for up to four door mounted indicator lights to be connected to the logic output terminal. Indicator lights shall be push-to-test LED type.
- J. The AC Drive door mounted control island shall include a power ON, Drive RUN, Drive Fault Light and Auto-Manual selector switch with manual speed control in the manual mode. Provide door mounted 1-turn speed pot
- K. Provide hard logic as indicated in the control diagrams.
- L. Provide Ethernet communication card for future communication with remote Allen Bradley Contrologix PLC.
- M. Provide a three-contactor isolation and bypass feature for manual bypass. Provide VFD/Bypass selector switch and features shown in the control diagrams. Adjust logic, as required, to meet manufacturer standard control scheme.
2.11 CONTROL WIRING

- A. Wiring: 600 volt, stranded copper, 90 degrees C color coded insulation, minimum size No. 16 AWG (120VAC control power only).
- B. Identification and termination: Crimp type wire lugs with sleeve type markers at each termination point. Provide numbered terminal blocks for external connections.
- C. Control power: Provide a 120VAC, fused, control power transformer for cooling fans, coils, indicators, and external control circuits when required. All control circuits shall be isolated from power circuits.

2.12 IDENTIFICATION

Conductor and equipment identification devices shall be either imprinted plastic coated cloth marking devices such as manufactured by Brady, Thomas & Betts, or approved equal, or shall be heat-shrink plastic tubing, imprinted split-sleeve markers cemented in place. Equipment nameplate shall be engraved.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. Provide the services of a qualified factory-trained and authorized factory representative to assist the Contractor in installation and start-up of the equipment specified under this section. The manufacturer's representative shall provide technical direction and assistance to the Contractor in general assembly of the equipment, connections and adjustments, and testing of the assembly and components contained herein.
- B. The following minimum work shall be performed by the authorized factory representative.
 - 1. Inspection and final adjustments.
 - 2. Operational and functional checks of VFD and spare parts.

3.2 FIELD ADJUSTMENTS

Perform all adjustments in OWNER presence.

3.3 FIELD TESTING

Demonstrate that the drive works in all local and remote modes of operation to OWNER satisfaction.

3.4 MANUFACTURER'S CERTIFICATION

A. A qualified factory-trained manufacturer's representative shall certify in writing that

SECTION 16483 – VARIABLE FREQUENCY DRIVES

the equipment has been installed, adjusted, and tested in accordance with the manufacturer's recommendations.

B. Provide three (3) copies of the manufacturer's representative's certification before final payment is made.

3.5 TRAINING

- A. The manufacturer's representative shall provide a training session for up to three OWNER staff for one normal workday at a jobsite location determined by OWNER.
- B. The training program shall consist of the following:
 - 1. Instructions on the proper maintenance and operation of the equipment.
 - 2. Demonstration on how to adjust settings.

3.6 SPARE PARTS

- A. Furnish the following spare parts:
 - 1. Three of each type of fuse rated 460V or less.
 - 2. Five of each type of panel lamp.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

It is the intent of these specifications to secure for the purchaser a generator set of the latest commercial design, together with all accessories necessary for a complete installation as shown on the plans and drawings and specified herein. The equipment supplied and the installation shall meet the applicable requirements of the following codes and regulations:

A. California Administration Code (CAC)

CAC Title 24 State of California Admisintration Code, Title 24, Building Standards

CAC Title 19 State of California Administration Code, Title 19, Public Safety

B. Code of Federal Regulations (CFR)

CFR 1910 Occupational Safety and Health Standards

1. <u>Electrical Generating Systems Association (EGSA)</u>

EGSA 100B	Performance Standard for Engine Cranking
	Batteries Used with Engine Generator Sets
EGSA 100C	Performance Standard for Battery Chargers for
	Engine Starting Batteries and Control Batteries
EGSA 100D	Performance Standard for Generator Overcurrent
	Protection 600 Volts and Below
EGSA 100E	Performance Standard for Governors on Engine
	Generator Sets
EGSA 100F	Performance Standard for Engine Protection
	Systems
EGSA 100G	Performance Standard for Generator Set
	Instrumentation, Control and Auxiliary Equipment
EGSA 100M	Performance Standard for MultipleEngine
	Generator Set Control Systems
EGSA 100S	Performance Standard for Transfer Switches for
	Use with Engine Generator Sets
EGSA 1001	Diesel Fuel Systems for Engine Generator Sets
	with Above Ground Steel Tanks

2. <u>International Conference of Building Officials (ICBO)</u> ICBO UBC Uniform Building Code

3.	cal and Electronics Engineers, Inc. (IEEE)	
	IEEE 115	Sychronous Machines
	IEEE 126	Speed Governing of Internal Combustion Engine- Generator Units
	IEEE 421.1	Definitions for Excitation Systems for Synchronous Machines
	IEEE C37.2	Electrical Power System Device

4. National Electrical Manufacturers Association (NEMA)

NEMA 250	Enclosures for Electrical Equipment (1000 volts Maximum)
NEMA AB 1	Molded Case Circuit Breakers and Molded Case Switches
NEMA MG 1	Motors and Generators
NEMA PB 2	Deadfront Distribution Switchboards
NEMA/ICS 1	Industrial Control and Systems
NEMA/ICS 2	Controllers, Contactors and Overload Relays, Rated not more than 2000 Volts AC or 750 Volts DC
NEMA/ICS 2-447	Standard for Automatic Transfer Switches
NEMA/ICS 6	Industrial Control and Sytstems Enclosures

5. <u>National Fire Protection Association (NFPA)</u>

NFPA 20	Centrifugal Fire Pumps
NFPA 30	Flammable and Combustible Liquids Code
NFPA 37	Installation and Use of Stationary Engines and Gas
	Turbines
NFPA 70	National Electrical Code
NFPA 70B	Electrical Equipment Maintenance
NFPA 99	Health Care Facilities
NFPA 101	Life Safety Code
NFPA 110	Emergency and Stanby Power Systems

6. <u>Underwriters Laboratories Inc. (UL)</u>

UL 142	Steel Above Ground Tanks	
UL 429	Electrically Operated Valves	
UL 489	Molded-Case Circuit Breakers and Circuit-Breaker	
UL 1008	Automatic Transfer Switches	
UL 1236	Battery Chargers for Charging Engine-Starter	
	Dallenes	
UL 2200	Standard for Stationary Engine Generator Assemblies	

- Regional Codes and Regulations
 County Noise Ordinance as determined by site location
 Air Pollution Control City Rules and Regulations for San Diego Air
 Pollution Control District at time of permitting.
- C. All equipment shall be new, of current domestic production of a national firm which manufacturers the engine-generator set as a matched unit, and whose quality control program complies with ISO Standards and that is certified to ISO-9001. The manufacturer together with its authorized local representative, shall have full responsibility for the performance of the generator set and its accessories. Unit shall be designed for outdoor installation.
- D. Supplier shall maintain a parts and service facility within 50 miles of the installation site, employ factory trained technicians, and offer 24-hour emergency

service. Supplier shall be the authorized dealer of a manufacturer offering standard production equipment built and prototype tested in accordance with NFPA 110, and shall be authorized to administer the warranty for all components of the emergency generator system specified herein.

- E. The engine generator shall be equipped with the necessary devices to meet current SDAPCD regulations for the operation of the submitted diesel generator. Documentation shall list current tier requirements and particulate filter. Contractor shall obtain a general permit registration number to submit application, pay for, and obtain a San Diego Air Pollution Control District (APCD) permit to contruct and operate the standby generator for the first year of operation. The generator fuel fill system shall meet the requirements of the local fire department. The fuel tank vent shall be routed outside of the enclosure 12' above the generator pad.
 - 1. Emissions:
 - a. Air Emissions:

The Contractor shall be solely responsible for providing a system that complies with the latest BACT standards at the time of equipment purchase. At a minimum, the engines shall be a minimum Tier 2 Certified. Documentation shall list current Tier requirements and particulate filters (if required). Particulate filters shall be active type.

1.2 SUBMITTALS

- A. Submittals shall be provided in sufficient detail to demonstrate compliance with these specifications. As a minimum, the submittal shall be bound, provided with an index to cross-reference the submittal item and page location, marked to indicate the specific item to be provided, and include the following data.
 - 1. Bill of Material, covering all equipment submitted.
 - 2. Qualifications of the engine-generator manufacturer and of the authorized distributor. ISO-9001 certification. 24-Hour emergency service capability.
 - 3. Manufacturer's published rating sheet. NFPA-110 prototype test verification. Altitude and temperature derating procedures. Frequency and voltage regulation. Cooling system capability. Full rated load pickup capability.
 - 4. Installation requirements: radiator airflow and backpressure capacity, combustion air requirement, fuel consumption, fuel circulation, heat rejection, exhaust flow, exhaust back-pressure calculations, battery requirements. Floor layout dimensional data with provision for cable entry and termination.

- 5. Engine performance data. Configuration, cubic inch displacement, rated RPM, type of aspiration, voltage of electrical system, oil and coolant, exhaust volume and temperature.
- 6. Exhaust emission data provided on the current application form for the air quality agency having jurisdiction. Exhaust and crankcase emission control equipment devices. Provide completed APCD forms.
- 7. Battery set and battery charger.
- 8. Generator performance data. Motor and load starting capability verification. Temperature rise and insulation classification. Short circuit sustaining capability. Over-voltage safety shutdown. Decrement curve specific voltage specified.
- 9. Output circuit breaker size, manufacturer, model, and trip curve for 10 second short-circuit capability.
- 10. Control panel features and performance. Meters and gauges. Safety alarm and shutdown devices. Cranking control. Indicator lamps and horn. Control switches. Rodent protection.
- 11. Exhaust silencer attenuation rating.
- 12. Jacket water heater system.
- 13. Fuel system. Alarm and indicator devices. Dimensional data. Shutoff valves, fuel strainer, and flexible hose. Fuel purifier.
- 14. Fuel storage system. Compliance with UL-142. Alarm and indicator devices. Dimensional data. Fuel capacity and hours of operation possible. Seismic restraint devices and calculations for fuel tank.
- 15. Generator sizing report showing steps and voltage drops.
- 16. Seismic restraint devices. Agency pre-qualification. Dimensional data. Seismic restraint calculations.
- 17. Generator set enclosure. Material and construction details. Dimensional data. Sound attenuation data when specified. Compatibility with requirements of generator set at rated load and specified ambient conditions.
- 18. Completed APCD applications with emissions data. Applications shall include the Authority to Construct application and the Permission To Operate application as well as any other applications required for full approval from APCD.
- 19. Dimensional data.

- 20. Schematic and wiring diagrams for all major componentsInterconnection diagram for all major components.
- 21. Testing procedure.
- 22. Warranty certificate and administration authorization.
- 23. Preventative maintenance contract. Pollution liability insurance and certificate.
- 24. Operations and Maintenance Manual per Section 01730.

PART 2 - PRODUCTS

2.1 MANUFACTURE

A. Provide Caterpillar, Kohler, Onan, Generac, or approved equal.

2.2 RATING

- A. Unit shall be minimally rated at 300 KW, .8 PF, 375 KVA for continuous standby operation during any utility power failure. Rating shall be verified by published specification sheets of its nationally recognized manufacturer. Generator set shall be capable of accepting rated load in one step in accordance with NFPA-110 Para. 3-5.3.1.
- B. System voltage shall be 277 / 480, 3 phase, 4 wire, 60 Hertz, with full load current capacity of 903 amps.
- C. The maximum step voltage drop shall not exceed 20% (VFD mode) or 25% (FVNR mode) and frequency drop shall not exceed 10% with loads and starting steps indicated below. Provide generator sizing report.
 - 1. Step 1: miscellaneous load 15 kw, 18kva, .90 pf,single phase: (2) 1 hp fans, (1) 10 hp fan, and (1) 5 hp air compressor (FVNR)
 - 2. Step 2: (2) 60 hp variable frequency drive (125% current limit) pump.
 - 3. Step 3: (2) 60 hp variable frequency drive (125% current limit) pump
 - 4. Step 2 and 3 shall also be modeled as FVNR starters.
 - 5. Pumps and fans are variable torque and start unloaded.

2.2 ENGINE

A. The engine shall be 4-cycle, direct connected to the generator by a semi-flexible coupling, and both shall be mounted on a common sub-base. The engine shall have sufficient power to produce the specified rating when operating at generator synchronous speed with all accessories required for normal operation including exhaust, fuel, cooling, and battery charging systems. Maximum engine speed

shall be 1800 RPM. The engine shall have a pressure lubrication system and replaceable element oil filter. The engine oil drain shall be piped to the outside of the skid base and provided with a stainless steel ball-valve to facilitate draining.

- B. The engine shall be equipped with a fuel system suitable for operation on DF-2 diesel fuel with a sulfur content not to exceed 0.05 percent by weight. Fuel system shall include an engine driven transfer pump, replaceable filter, fuel purifier, and flexible fuel lines. Fuel system shall comply with the requirements of NFPA-37 and NFPA-110 Paragraph 5-9.
 - 1. Diesel fuel purifier system shall be the heavy-duty centrifugally driven type and shall be furnished in addition to the filtration system furnished by the engine manufacturer. Ther purifier system shall be designed to help prevent the formation of rust in the fuel. The unit shall be rated to remove particles of (7) microns and be capable of removing a minimum of 99.5 percent of all water and 95 percent of solid type contanimants in the fuel. The unit furnished shall be located in the fuel system as the first protective device after the fuel leaves the fuel tank. Unit furnished shall have an electric heater element to help prevent diesel fuel gelling in winter operation. The heater shall be rated at a maximum of 100 watts and be the 12-volt DC type to operate only when the engine is running. Power source for the heater shall be the engine's 24-volt system. The system furnished shall not require the replacement of any tipe of filter element or any other internal parts. System shall be RCI diesel fuel purifier, or equal.
 - 2. Provide flexible fuel lines rated for duty at 300 degrees Fahrenheit and 100 psi.
- C. The engine cooling system shall be designed to provide adequate cooling at rated load, within the specified enclosure, in ambient temperatures up to 104 degrees Fahrenheit. The system shall include a unit mounted radiator, blower fan, water pump, and thermostat. Cooling system shall meet the performance requirements of NFPA-110 Para. 5-8.1. Provide a low water level shutdown device.
- D. The engine governor shall maintain frequency within a .25 percent band under steady state conditions and isochronous from no-load to full load. Regulation shall be as defined by IEEE Std 126-1959/83. Governor performance shall comply with EGSA 100E.
- E. Starting shall be by means of a solenoid operated positive engagement gear driven electric starter for operation on 12 or 24 volt D.C. Note the cycle-crank requirement specified within the generator control panel. Provide a primary and a secondary means of cranking termination in accordance with NFPA-110 Para. 3-5.4.2.
- F. Engine protective devices shall meet the performance requirements of EGSA 100F and shall include the following:
 - 1. Overcrank lockout

- 2. Low oil pressure preliminary alarm
- 3. Low oil pressure shutdown
- 4. High water temperature preliminary alarm
- 5. High water temperature shutdown
- 6. Low water temperature alarm
- 7. Low water level shutdown
- 8. Overspeed shutdown
- 9. Low fuel level alarm
- G. Provide vibration isolators installed between the engine generator and base assembly, or between the base assembly and the foundation.
- H. Engine crankcase emissions shall be filtered to prevent oil mist from contaminating the engine space and to comply with Air Pollution Control District requirements for visible emissions. Filters shall be of the closed cycle type. 2-cycle engines shall also filter the air box drain lines. Filter device shall consist of a replaceable filter element and a removable reservoir for collected fluids. Filter shall be sized for the allowable crankcase backpressure established by the engine manufacturer.

2.3 BATTERY SET

A. A lead acid battery set shall be provided and installed on the generator base with seismic restraints. System voltage shall match that of the starter. Cold-cranking amperage capacity shall conform with the requirements of SAE Standard J-537 for zero degrees Fahrenheit. Performance of the battery system shall comply with EGSA 100B.

2.4 BATTERY CHARGER

- A. An automatic float/equalize type battery charger shall be provided, installed with vibration isolators, and wired on the generator set. Connections to the battery shall be solid wired (clip-on type clamps not acceptable). Input voltage shall be 120 volts AC. Charger shall be UL listed. Output capacity shall be a minimum of 10 amps. Battery charger shall meet the performance requirements of EGSA 100C, and shall include the characteristics required by NFPA-110 Para. 3-5.4.6. DC voltage regulation shall be within +/-1 percent from no load to full load and over an AC input line voltage variation of +/-10 percent.
- B. Features shall include the following:
 - 1. Automatic "float-to-equalize" operation, with individual potentiometer adjustments.
 - 2. "Power on" lamp to indicate when charger is operating.
 - 3. DC voltmeter and DC ammeter, 5 percent full scale accuracy.
 - 4. Reverse polarity protection.
 - 5. AC input and DC output fuse protection.

- 6. Automatic current limiting protection.
- 7. Battery charger failure alarm contacts, set to close if AC power is lost to charger.
- 8. Low and high battery voltage alarm contacts, set to close if battery voltage drops below 90 percent or rises above 110 percent of rated.
- C. Battery charger enclosure shall be Nema I Construction and arranged for convection cooling.

2.5 GENERATOR

- A. The generator shall be 4-pole, revolving field, with rotating brushless or static exciter. It shall have a solid state voltage regulator capable of maintaining voltage within <u>+</u> 2 percent at constant load from 0-100 percent of rating. Voltage regulator shall be of the volts-per-hertz type and NFPA-110 requirement for 100% load pickup shall be met. The regulator shall be sealed from the environment and isolated from the load to prevent tracking when connected to SCR loads. Voltage regulator shall meet the performance standards of EGSA 100R. Maximum alternator subtranscient reactance shall not exceed 12% p.u. based on full generator rating. Provide oversized alternator to meet maximum voltage drop requirements.
- B. Generator shall be self-ventilated of drip-proof construction with amortisseur rotor winding and skewed for smooth voltage waveform. The insulation material shall meet the NEMA standard (MGI-22.40 and 16.40) for Class H and be vacuum impregnated with epoxy varnish to be fungus resistant per MIL I-24092. Temperature rise of the rotor and stator shall be limited to NEMA standard (MG1-22.40 and 22.85).
- C. On application of any load up to 100 percent of the rated load, the instantaneous voltage dip shall not exceed 20 percent and shall recover to \pm 2 percent rated voltage within one second. The generator shall be capable of sustaining at least 300% of rated current for at least 10 seconds under a 3 phase symmetrical short by inherent design or by the addition of an optional current boost system. The generator, having a single maintenance free bearing, shall be directly connected to the flywheel housing with a semiflexible coupling between the rotor and the flywheel.
- D. A resettable, line current sensing circuit breakers with inverse time versus current response shall be furnished and shall not automatically reset preventing restoration of voltage if maintenance is being performed. This breaker shall protect the generator from damage due to its own high current capability and shall not trip within the 10 seconds specified above to allow selective tripping of down-stream fuses or circuit breakers under a fault condition. Circuit breakers shall be installed in the generator terminal box and be easily operable when the operator is at the control panel. Circuit breakers shall include provision for a lock out device in the de-energized position to comply with NFPA 70E. Provide

quantity of breakers indicated for multiple loads. Provide 100% rated breakers where indicated. Provide a second circuit breaker for full load bank testing.

E. Provide generator over-voltage protection for sensitive loads that will shut the unit down when voltage exceeds 115 percent of rated for longer than 1 second.

2.6 GENERATOR CONTROLLER

- A. A solid State Controller shall be vibration isolated above the generator. The microprocessor control board shall be moisture proof and capable of operation from -40c to 85c. Relays will only be acceptable in high current circuits. Generator set instrumentation; control and auxiliary equipment shall meet the performance standards of EGSA 100G. Provide a Ethernet communications adapter for the control panel (Monico or equal). The module shall communicate all status and alarms including analog fuel level, low fuel level, fuel leak, low battery voltage. Provide an input and output expansion module on the generator control panel.
- B. Circuitry shall be of plug-in design for quick replacement. Controller shall be equipped to accept a plug-in device capable of allowing maintenance personnel to test controller performance without operating the engine. The controller shall include:
 - 1. Fused DC circuits.
 - 2. Complete two-wire start/stop control which shall operate on closure of a remote contact.
 - 3. Speed sensing and a second independent starter motor disengagement systems shall protect against the starter engaging with a moving flywheel. Battery charging alternator voltage will not be acceptable for this purpose.
 - 4. The starting system shall be designed for restarting in the event of a false engine start, by permitting the engine to completely stop and then re-engage the starter.
 - 5. Cranking cycler with 15-second ON and OFF cranking periods.
 - 6. Overcrank protection designed to open the cranking circuit after 75 seconds if the engine fails to start.
 - 7. Engine cool down timer factory set at five minutes to permit unloaded running of the standby set after transfer of the load to normal.
 - 8. Three-position (Automatic OFF TEST) selector switch. In the test position, the engine shall start and run regardless of the position of the remote starting contacts. In the automatic position, the engine shall start when contacts in the remote control circuit close and stop five minutes after those contacts open. In the off position, the engine shall not start even though the remote start contacts close. This position shall also provide for immediate shutdown in case of an emergency. Reset of any

fault lamp shall also be accomplished by putting the switch to the off position.

C. An engine and generator instrument panel shall be installed on the unit with vibration isolators, and include the following:

Instruments AC Voltmeter, 3.5 inch, 2% accuracy AC Ammeter, 3.5 inch, 2% accuracy VM/AM phase selector switch Frequency meter, 3.5 inch, 0.5% accuracy, dial type DC Voltmeter, 2 inch, 2% accuracy Engine water temperature, 2 inch, 2% accuracy Engine oil pressure, 2 inch, 2% accuracy Running time meter Indicator Lamps And Alarm Contacts (Provide LED type lamps) Overcrank (red) High water temperature (red) Low oil pressure (red) Overspeed (red) Anticipatory low oil pressure (yellow) Anticipatory high water temperature (yellow) Low water temperature (yellow)

Emergency stop (red) "Not in auto" (flashing red) System ready (green) Battery charger fault (red) Low battery volts (red) Low fuel level (red) <u>Controls</u> Lamp test switch Voltage adjusting rheostat, + or - 5 percent range Panel lamps (2) <u>Alarm horn</u>, with silence switch, to meet the requirements of NFPA 110. Note: Silencing this horn after one fault, <u>i.e.</u> low fuel, shall not prevent it from sounding again should a different fault condition occur.

D. Complete control panel shall be "rodent proofed" to prevent damage to components by small rodents.

2.7 EXHAUST SYSTEM

A. A critical degree silencer shall be provided and installed inside the generator set enclosure. Supplier shall furnish back pressure calculations for the installation verifying that engine limitation is not exceeded. Silencer shall be arranged for horizontal mounting with bottom (side) inlet and end outlet. Provide a stainless steel bellows type flexible exhaust connector at the engine exhaust outlet. Provide a long radius type elbow to discharge exhaust gases vertically Provide suitable raincap. A "Critical Degree" silencer is considered to be one capable of

attenuating engine exhaust noise component to 85 dba at 10 feet in a free-field environment. Provide thermal protective wrapping.

2.8 JACKET WATER HEATER

A. A jacket water heater, thermostatically controlled, shall be installed on the engine. Heater shall be 240 VAC input. Heater shall be mounted on the generator base rails and provided with flexible hoses to the engine. Flexible hoses shall be rated at 300 degrees F. and 100 PSI. Provision shall be made for isolation of the jacket water heater with 3/4 inch NPT ball-valves installed at the engine side of the flexible hoses. Provide a disconnect safety switch, or disconnect plug, to isolate the heating element from the electrical source for maintenance purposes.

2.9 FUEL STORAGE SYSTEM

- A. Provide a sub-base mounted fuel storage tank capable of supporting the generator set at rated load for 8 hours. Provide access for electrical conduit from below. Tank height shall not exceed 12-inches. Tank shall be built and labeled in accordance with UL-142. Mounting feet shall provide 1 inch clearance between bottom of tank and foundation.
- B. Tank features shall include:
 - 1. 2 inch filler neck and locking cap
 - 2. Engine supply and return openings and draw tubes
 - 3. 12 foot normal vents
 - 4. Emergency vents per UL for both primary and secondary containment with approved caps.
 - 5. Tank leak port
 - 6. Fuel level indicator gauge, direct reading type
 - 7. Low fuel level alarm switch, set at 4 remaining hours capacity
 - 8. Secondary containment, totally closed design, by double wall construction. Provide alarm contact for "liquid in containment basin." Wire contact to alarm light in the generator control panel.
 - 9. Provide 4-20 ma analog fuel level transmitter.

2.10 WEATHER PROTECTIVE ENCLOSURE

 Provide an aluminum, weather-protective and sound attenuated enclosure. Enclosure material shall be a minimum thickness of 14 gauge. Lockable latches shall be of stainless steel. Doors shall have a common keyed latch. Provide two (2) sets of keys. Enclosure and engine exhaust system shall be sound

attenuated to limit noise level when operating at full load to a maximum of 75 dBA at 23 feet in any horizontal direction from the center of the unit. Attenuation shall include exhaust manifold and silencer blankets of the removable/reusable type. Intake and discharge of cooling air shall be through openings that are covered for weather protection. Provide acoustical material on internal walls and surfaces of the enclosure. Enternal holes and openings in the enclosure shall be covered with galvanized or coated mesh to prevent entry of birds and rodents.

2.11 SEISMIC RESTRAINT

- A. The generator set shall be anchored directly to the concrete foundation by means of approved anchor bolts. A minimum of four (4) anchors shall be provided by the generator set supplier.
- B. Provide calculations signed by an engineer registered in the State of California verifying compliance with California Administrative Code Title 24 and ASCE/SEI 7-05 for Zone 4. These calculations shall be a part of the submittal data provided.

2.12 GENERATOR SET MOUNTING

- A. Provide the equipment concrete foundations as shown on the Drawings, and as required. Each electric generating plant shall be equipped with vibration isolators as required and mounted on a welded structural steel base. Cross framing shall be used for additional stiffening. The entire welded steel base shall be mounted on concrete base with steel spring isolators that meet the following requirements:
 - 1. Minimum steel spring static deflection shall be 0.375-inches with a ratio of horizontal spring constant to vertical spring constant of at least 1:1.
 - 2. The spring diameter shall be no less than 0.8 times the compressed spring height at rated load. The difference between compressed spring height and solid spring height shall be at least 0.5 times the rated static deflection.
 - 3. The spring isolator shall include an adjusting bolt for leveling and attachment to the mounting base, and shall be mounted on 1/4-inch thick ribbed or waffle-pattern neoprene acoustical pad. The spring isolator shall be contained within a rigid housing that includes vertical stabilizers that shall restrain motion from seismic forces equal to 1/2 g in the lateral direction and 1 g in the vertical direction.
 - 4. The spring isolator shall The spring isolators shall be selected for uniform static deflections according to the weight distribution of the electric generating plant and disturbing starting forces.
 - 5. Furnish submittals of the spring diameters, static deflections, compressed spring height, and solid spring height.

6. Submit design calculations for structural and seismic design for number, size and embedment of anchor bolts signed and stamped by a structural or civil engineer in the State of California. The minimum design seismic forces shall be those prescribed for Zone 4 for Essential Facilities of the latest edition of the Uniform Building Code.

2.13 LOAD BANK

- A. The generator skid set shall have an integral resistive load bank, which will operate only under exercising function of the generator. The rating of the load resistors shall be not less than 50 percent of the full load kW rating of the generator to which it is connected, or larger, as required by engine generator manufacturer to maintain by unit warranty. The load shall be provided with a minimum of four load steps.
- B. The load bank shall be housed in a NEMA 1 enclosure, mounted integrally to the engine on the front radiator within the outdoor enclosure. The load bank's load chamber shall have the physical dimensions coordinated with the radiators duct flange. The radiator fans cooling capacity shall be increased as necessary to prevent excessive static pressure build-up caused by the load bank.
- C. Resisters shall be constructed of high temperature alloy capable of continuous operation at 1920 deg F, and designed to operate at an average of 750 deg F. The resisters shall be assembled in a three-phase array with the phase-to-phase resister current balanced within 2%, and an overall Kw tolerance within 5% of its normal rating.
- D. A circuit breaker shall be provided in the engine generator supplying the load bank, sized at 125% of the full load bank. Provide fuse protection for the individual load bank section.
- E. Provide automatic electric contactors, as required, to activate load bank, in the exercising mode. Provide all control interlocks with the automatic transfer switch for the unit, as required, to provide the following functions:
 - 1. Transfer switch exercising time lock starts generator and brings load bank on-line.
 - 2. Exercising function operates for pre-selected period of time with the load bank connected at 100% of load bank capacity.
 - 3. At end of exercise period, load bank shall be automatically taken off line.
 - 4. If utility power outage occurs during the exercise period, the load bank shall immediately be de-energized before the emergency load automatic transfer switches change position; generator shall continue to run during the disconnect of the load bank,
- F. Load bank systems shall be as manufactured by Load Technology, Inc., Las Vegas, Nevada, AVTRON, Simplex or equal.

PART 3 - EXECUTION

3.1 SAN DIEGO APCD PERMIT APPLICATIONS

- A. Authority to Construct (ATC) Permit: Contractor shall prepare a complete application for submittal to the San Diego Air Pollution Control District (APCD) requesting an ATC Permit. Such application shall be submitted to the District for review and approval in accordance with Section 1.2 SUBMITTALS of this specification prior to submittal to APCD. District shall review and provide comments or approval to submit within fifteen (15) days from receipt of the completed application. An approved ATC permit from APCD shall be received prior to the start of installation of the new generator. All costs and fees for submittal and review of the ATC application by APCD shall be included in the Contractor's bid and paid by the Contractor.
- B. Permission to Operate (PTO) Permit: Contractor shall prepare a complete application for submittal to the San Diego Air Pollution Control District (APCD) requesting a PTO Permit. Such application shall be submitted to the District for review and approval in accordance with Section 1.2 SUBMITTALS of this specification prior to submittal to APCD. District shall review and provide comments or approval to submit within thirty (30) days from receipt of the completed application. An approved PTO permit from APCD shall be required before a Notice of Completion is issued by the District. All costs and fees for submittal and review of the PTO application by APCD shall be included in the Contractor's bid and paid by the Contractor.

3.2 TESTING

- A. Design prototype test: Components of the emergency system, such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype test since the tests are potentially damaging. Rather, similar design prototypes and reliability preproduction models, which will not be sold, shall be used for these tests. Upon request, the following certified test records shall be made available:
 - 1. Maximum power (kW).
 - 2. Maximum starting (kVA) at 30% instantaneous voltage dip.
 - 3. Alternator temperature rise by embedded thermocouple and by resistance method per NEMA MG1-22.40 and 16.40.
 - 4. Governor speed regulation under steady-state and transient conditions.
 - 5. Voltage regulation and generator transient response.
 - 6. Fuel consumption at no load, 1/4, 1/2, 3/4, and full load.

- 7. Harmonic analysis, voltage waveform deviation, and telephone influence factor.
- 8. Three-phase line-to-line short circuit test.
- 9. Alternator cooling air flow.
- 10. Torsional analysis testing to verify that the generator set is free of harmful torsional stresses.
- 11. Endurance testing.
- B. Final production tests: Each generator set shall be factory tested under varying loads with guards and exhaust system in place. Upon request, arrangements to witness this test will be made or a certified test record will be sent prior to shipment. Tests shall include:
 - 1. Single-step load pickup.
 - 2. Transient and steady-state governing.
 - 3. Safety shutdown.
 - 4. Voltage regulation.
 - 5. Rated power.
 - 6. Maximum power.
- C. Site tests: An installation check, start-up and rated load test shall be performed by the manufacturer's local representative. The engineer, APCD, regular operators, and the maintenance staff shall be notified of the time and date of the site test. Coordinate test date with APCD inspection to allow APCD observation of full test load. The test shall include:
 - 1. The initial startup of the engine-generator set shall be performed by a factory trained representative of the engine generator set manufacturer. He shall furnish and install the recommended engine lubricants and fill the cooling system with a 50% solution of ethylene glycol antifreeze in accordance with the engine manufacturer's recommendations. He shall be present during the load test specified, and at the conclusion of the test shall supply the owner's representative with five complete sets(s) of operation, maintenance, and parts manuals for all equipment. Under this section of the specification, he shall instruct the owner's personnel in the proper operating and maintenance procedures for all components of the standby power system.
 - 2. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. This shall include: engine heaters, battery charger, etc.

- 3. Start-up under test mode to check for exhaust leaks, path of exhaust gases, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage and phase rotation.
- 4. Automatic start-up by means of simulated power outage to test remote automatic starting, transfer of load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper systems coordination. Engine temperature, oil pressure and battery charger level along with generator voltage, amperes, and frequency shall be monitored throughout the test.
- 5. Load test system, utilizing contractor furnished resistive load bank, as follows:

a.	1/2 hour	@	1/2 load
b.	1/2 hour	<u>@</u>	3/4 load
c.	2 hours	@	rated load

- 6. Measure and record the transient frequency and voltage dip, and recovery time to steady state conditions, for the single step application of rated load. Verify compliance with the governor and voltage regulator performance specified in paragraph 4.4 and 7.3. Recording instrument to be of the light beam or direct thermal array type (ink chart type not permitted).
- 7. Provide a certified copy of site test report showing compliance with specifications and approval of the installation for warranty purposes.

3.3 WARRANTY

A. The equipment supplied under this section shall be covered by a single warranty against defects in material and workmanship for a period of five (5) years or 3000 hours of operation. Warranty shall provide for free replacement or repair of parts for the 5 year (3000 hour) period, and free labor for the first two years. A warranty statement including these features shall be provided as part of the owner's manuals. Warranty shall be administered by the same company that supplied the equipment.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

- A. Section includes the requirements for 600 V class Low Voltage Motor Control Centers (MCCs) for use on alternating current power systems
- B. The MCCs shall be installed as specified in this section and as shown on the contract drawings.
- C. The MCC shall have non-bused sections for the transfer switch.
- D. MCCs shall be Allen Bradley NEMA Centerline 2100 or approved equal.
- E. The variable frequency drives (VFD) shall be mounted in the MCC. The VFD's shall be Mitsubishi only.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 16250 Transfer Switch
- B. Section 16483 Variable Frequency Drives
- C. Section 16280 Active Line Conditioner

1.3 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

- A. The MCC shall meet or exceed the requirements within the following standards for MCCs.
 - 1. NEMA ICS 18 Industrial Control and Systems: Motor Control Centers
 - 2. UL 845 UL Standard for Safety for Motor Control Centers. NOTE: UL 845 is a harmonized standard consisting of:
 - a. Underwriters Laboratories Inc. (UL) UL 845
 - b. Association of Standardization and Certification (ANCE) NMX-J-353-ANCE-2006
 - c. Canadian Standards Association (CSA) C22.2 No. 254-05
 - 3. NFPA 70 National Electrical Code
- B. The MCC shall be designed, manufactured and tested in facilities registered to ISO 9001

1.4 PRE-MANUFACTURE SUBMITTALS

- A. Refer to Division 1 for submittal procedures
- B. Manufacturer Drawings

- 1. MCC elevations showing dimensional information including details such as, but not limited to, the following:
 - a. MCC height (less any removable lifting angles or eyes)
 - b. MCC width
 - c. MCC depth
 - d. Location of shipping splits
- 2. Structure Descriptions showing
 - a. Bus ratings
 - b. Enclosure ratings
 - c. Short circuit withstand ratings
 - d. Other information as required for approval
- 3. Conduit locations
- 4. Required bus splices
- 5. Unit descriptions including starter sizes, circuit breaker frame sizes, circuit breaker continuous ampere ratings, pilot devices, etc.
- 6. Nameplate information
- 7. Schematic wiring diagrams
- 8. Manufacturer drawings shall be provided in DWG format.
- 9. Manufacturer drawings do not need to be stamped if a drawing schedule is provided which lists the drawing numbers, revision levels, and status of drawings (Preliminary, Approval, Final, etc)
- C. Product Data
 - 1. Data sheets and publications on all major components including but not limited to the following:
 - a. Motor starters
 - b. Overload relays
 - c. Circuit breaker and fuse information including time current characteristics
 - d. Control power transformers
 - e. Pilot devices
 - f. Relays
- D. Specification Response
 - 1. All clarifications and exceptions must be clearly identified.
- E. Installation Instructions

- 1. Provide a copy of the manufacturer's installation instructions which includes the following:
 - a. Receiving, Handling, and Storage instructions
 - b. General description for reading nameplate data, serial numbers, UL markings and short circuit ratings
 - c. Installation procedures including splicing procedures
 - d. Conduit and cable installation
 - e. Installing and removing plug-in units
 - f. Operation of operator handles and unit interlocks
 - g. Checklist before energizing
 - h. Procedure for energizing equipment
 - i. Maintenance procedures

1.5 FINAL SUBMITTALS

- A. Refer to Division 1 for procedure on submittal of final documentation.
- B. The contractor shall provide certification that the MCC has been installed in accordance with the manufacturer's instructions and with local codes and standards which govern MCC installations.
- C. The contractor shall provide certification that all circuit breaker settings have been adjusted per field requirements.
- D. The contractor shall provide certification that all power fuses have been selected and installed per field requirements.
- E. The contractor shall provide certification that all solid state motor overload settings have adjusted per installed motor characteristics.
- F. The contractor shall provide certification that all settings for solid state devices such as reduced voltage solid state controllers and variable frequency drives have been adjusted per the specific application requirements.
- G. The contractor shall provide certification that any timing devices have been properly adjusted.
- H. Final Drawings
 - 1. The manufacturer shall provide final drawings reflecting the "As-Shipped" state of the MCC documents previously submitted.
 - 2. Manufacturer drawings shall be provided in DWG format.
 - 3. Manufacturer drawings do not need to be stamped if a drawing schedule is provided which lists the drawing numbers, revision levels, and status of drawings (Preliminary, Approval, Final, etc)
 - 4. The contractor shall be responsible for making any changes to the "As-Shipped" drawings from the manufacturer to reflect any field modifications.

- I. Test reports indicating manufacturer's standard testing was performed.
- J. Maintenance Data
 - 1. MCC installation instructions.
 - 2. Installation / Operation instructions for major components such as automatic transfer switch, circuit breakers, etc.
 - 3. MCC spare parts listing and pricing.
 - 4. Name and phone number for a local distributor who can provide spare parts.

1.6 DELIVERY, STORAGE AND HANDLING

- A. The supplier shall coordinate the shipping splits with the MCC manufacturer for entry into the building.
- B. Shipping splits shall be noted on the MCC manufacturer drawings.
- C. The contractor shall store the MCCs in a clean, dry and heated space.
- D. The contractor shall protect the units from dirt, water, construction debris and traffic.
- E. During storage the contractor shall connect internal space heaters (if specified) with temporary power.
- F. MCCs are to be shipped with external lifting angles at the top and running continuously for each shipping split. Lifting eyelets are not acceptable.

1.7 WARRANTY

- A. The manufacturer shall provide their standard parts warranty for eighteen months from the date of shipment or twelve months from the date of being energized, whichever occurs first.
- B. The manufacturer shall confirm this warranty as part of the submittal.

1.8 DESIGN REQUIREMENTS

- A. Provide MCC based upon applicable NEMA and UL standards and in accordance with the detailed contract specifications and drawings. All control wires shall be individually identified with wire markers.
- B. The manufacturer of the MCC shall also be the manufacturer of the across-the-line motor starters, across-the-line contactors, and solid state reduced voltage starters. The use of third party supply and assembly for these components in the motor control center is not acceptable and will be rejected.

C. The contractor shall confirm motor full load amperage ratings and provide those to the MCC manufacturer to ensure proper sizing of motor branch circuit and overload protection.

1.9 QUALITY ASSURANCE

- A. The manufacturer of the MCC shall have a minimum of 35 years experience in the manufacturing and assembly of NEMA low voltage motor control centers.
- B. The manufacturer shall have ISO 9001 registered facilities for the design, manufacture and testing of MCCs.
- C. MCC sections and individual MCC units shall be designed and manufactured in accordance with UL 845 requirements.
- D. MCC sections and individual MCC units shall be UL listed, where possible.

1.10 REGULATORY REQUIREMENTS

A. Contractor shall ensure that the installation conforms to the requirements of the latest edition of the NFPA 70 "National Electrical Code" and/or other applicable installation standards.

1.11 ENVIRONMENTAL REQUIREMENTS

A. The MCC enclosure rating shall be appropriate for the environment where the MCC is to be located.

1.12 FIELD MEASUREMENTS

A. The Contractor shall verify all field measurements prior to the installation of the MCC.

1.13 SPARE MATERIALS

- A. Supplier shall review manufacturer's recommended spare parts list.
- B. Supplier to provide quotation for spare parts.

PART 2 - MOTOR CONTROL CENTER SPECIFICATIONS

2.1 MANUFACTURERS

A. MCCs shall be Allen-Bradley® CENTERLINE® 2100, or equal.

2.2 RATINGS

A. The MCC shall be rated for the system voltage as indicated on the contract drawings

- B. The MCC horizontal and vertical power bus bracing shall be rated to meet or exceed the available fault current as shown on the contract drawings, but shall not be less than 65,000 A RMS symmetrical
- C. All MCC units shall have a full rated short circuit rating which meets or exceeds the available fault current as shown on the contract drawings.
 - 1. Use of series short circuit ratings shall only be permitted for panelboards; series short circuit ratings for other types of units is not acceptable.
- D. All circuit breakers used in the motor control center shall have full-rated short circuit interrupting ratings based on the applied MCC voltage.
 - 1. Slash rated short circuit interrupting ratings for circuit breakers are not acceptable except for branch circuit breakers in panelboards, and then only if the power system specified in the contract drawings is a Wye with a solidly grounded neutral.

2.3 ENCLOSURE

- A. NEMA1 gasketed.
- B. Each section shall be equipped with two full metal side sheets to isolate each vertical section and to help reduce the likelihood of fault propagation between sections.
- C. All unpainted parts shall be plated for corrosion resistance.
- D. Removable closing plates on each end of the MCC shall cover all horizontal bus and horizontal wireway openings.
- E. Insulating sheets shall be provided on the inside of end closing plates for horizontal bus openings to help prevent burn-through of the end closing plate in the event that an internal arcing fault occurs in the horizontal bus compartment.

2.4 STRUCTURE

- A. The MCC shall be of dead front construction and shall consist of one or more vertical sections bolted together to form a rigid, free-standing assembly. The systems shall be designed to allow for the addition of future sections at either end and to permit the interchanging of units
- B. Vertical sections shall be rigid, free-standing structures.
 - 1. Vertical sections shall have internal mounting angles running continuously within the shipping block.
 - 2. An external mounting channel which is required to maintain structure integrity is not acceptable.

- 3. Vertical sections shall be 90 inches high, 20 inches deep and 20 inches wide except where larger dimensions are required.
- 4. Vertical sections shall be provided with a removable steel lifting angle on all shipping blocks. The angle shall run the length of the shipping block.
- 5. Lifting eyes are not acceptable.
- 6. Each standard section shall be capable of being subdivided into 12 usable, unit spaces.
- 7. Two unit spaces shall constitute one space factor and shall be 12 inches in height.
- 8. One unit space shall constitute one-half space factor and shall be 6 inches in height.
- C. Horizontal wireways
 - 1. Horizontal wireways shall be located at the top and bottom of the MCC.
 - 2. Horizontal wireways shall be 6 inches in height and extend the full depth of the vertical section to allow maximum flexibility in locating conduit for MCC feeds and loads.
 - a. Pull-boxes to extend the height of the top horizontal wireway by 12 inches shall be provided if specified on the contract drawings.
 - 3. Horizontal wireways shall be continuous across the length of the MCC.
 - a. Except where access needs to be denied due to electrical isolation requirements.
 - 4. The horizontal wireways shall be isolated from the power bus.
 - 5. The horizontal wireways shall have removable covers held in place by captive screws.
- D. Provide a full height vertical wireway, independent of the plug-in units, in each standard vertical section.
 - 1. The vertical wireway shall be isolated from the vertical and horizontal buses.
 - 2. The vertical wireway shall be covered with a hinged and secured door.
 - 3. Wireway tie bars shall be provided.
 - 4. Isolation between the wireway and units shall be provided.

5. Vertical wireway doors shall be provided with arc resistant latches to help keep the door latched in the event that an internal arcing fault occurs.

2.5 BUS BARS

- A. Horizontal Power Bus
 - 1. The horizontal bus shall be rated as shown on the drawings.
 - 2. The horizontal bus material shall be copper with tin plating.
 - 3. The horizontal bus shall be supported, braced and isolated from the vertical bus with a high strength, non-conductive, non-tracking, glass polyester material.
 - 4. For standard sections the horizontal bus shall be continuous within each shipping block and shall be braced within each section
 - 5. Horizontal bus splices shall have at least two bolts on each side.
- B. Vertical Bus
 - 1. The vertical power bus shall have an effective rating of 600A. If a center horizontal bus construction is utilized, then the rating shall be 300A above and below the horizontal bus for an effective rating of 600A. If a top or bottom mounted horizontal bus is utilized, then the full bus must be rated for 600A.
 - 2. The vertical bus material shall be copper with tin plating.
 - 3. The vertical bus shall attach to the horizontal bus with at least two bolts.
 - 4. The vertical bus shall be continuously braced by a high strength, nonconductive, non-tracking, glass-filled polyester material and isolated from the unit spaces by a non-conductive, polycarbonate molded cover.
 - 5. The vertical bus shall be isolated from the horizontal power bus except where necessary to connect the vertical power bus to the horizontal power bus.
 - 6. Automatic shutters shall cover plug-in stab openings when units are removed.
- C. Ground Bus
 - 1. Provide a ground bus system consisting of a horizontal ground bus connected to vertical ground buses mounted in each section.

- 2. Provide an tin-plated copper (0.25 inch by 1 inch or 0.25 inch by 2 inch) horizontal ground bus mounted in the bottom of the MCC unless otherwise specified in the drawings.
- 3. Provide a pressure type mechanical lug mounted on the ground bus in the incoming line section.
- 4. Provide a unit ground stab on all unit inserts. The ground stab shall establish unit insert grounding to the vertical ground bus before the plug-in power stabs engage the power bus. The grounding shall be maintained until after the plug-in power stabs are disengaged.
- 5. Provide a copper vertical unit load ground bus in each section which can accommodate plug-in units.
- 6. Provide a unit load connector on all units which require load wire connections. The load connector shall provide a termination point for the load ground conductor at the unit.

2.6 UNIT INFORMATION

- A. The minimum compartment height shall be 6.5 inches and this shall be considered one-half space factor.
- B. NEMA Size 5 FVNR starters and below shall be provided as plug-in units.
- C. Plug-in units
 - 1. Plug-in units shall consist of unit assembly, unit support pan and unit door assembly.
 - 2. Units shall be supplied with removable doors. The unit doors shall be fastened to the structure so that the doors can be closed when the unit is removed.
 - 3. A unit support pan shall be provided for support and guiding units. Unit support pans shall remain in the structure when units are removed to provide isolation between units.
 - 4. A service position shall be provided for plug-in units which allows for the unit to be supported, but disengaged from the bus. The unit shall be capable of being padlocked in the service position. This position is to be used to isolate a unit from the bus to allow service to be performed on the connected load equipment.
- D. Power Stabs
 - 1. Unit stabs for engaging the power bus shall be tin plated copper and provided with stainless back-up springs to provide and maintain a high pressure 4-point connection to the vertical bus.

- 2. Wiring from the unit disconnecting means to the plug-in stabs shall not be exposed on the rear of the unit. A separate isolated pathway shall be provided for each phase to minimize the possibility of unit fault conditions reaching the power bus system.
- 3. The power cable termination at the plug-in stab shall be a maintenancefree crimp type connection.
- E. Disconnect Handle
 - 1. Plug-in units shall be provided with a heavy-duty, non-conductive, industrial duty, flange mounted handle mechanism for control of each disconnect switch or circuit breaker.
 - 2. Use of rotary operators is not acceptable
 - 3. The disconnect handle may pivot in the vertical or horizontal plane.
 - 4. The on-off condition shall be indicated by the handle position, red and green color indicators with the words ON and OFF, and the international symbols 1 and O along with a pictorial indication of the handle position.
 - 5. Handles shall be capable of being locked in the OFF position with up to three padlocks.
 - Plug-in units shall be provided with interlocks per NEMA and UL requirements. Interlocks shall be provided for the following:
 - a. Prevention of unit insertion or withdrawal with the disconnect in the ON position
 - b. Prevention of the unit door from being opened when the disconnect is in the ON position
 - 1) A feature for intentionally defeating this interlock by qualified personnel shall be provided
 - c. Prevention of the disconnect switch from being moved to the ON position if the unit door is open
 - 1) A feature for intentionally defeating this interlock by qualified personnel shall be provided

F. Pilot Devices

- 1. Where specified, units shall be furnished with pushbuttons, selector switches or pilot lights as shown on the contract drawings.
- 2. Pilot devices shall be rated NEMA Type 4/13 water tight / oil tight, push-totest LED type.
- 3. For units with vertically operated disconnect handles

- a. When three or less pilot devices are utilized, they shall be Allen-Bradley Bulletin 800T or 800H 30.5mm devices or approved equal.
- b. When more than three devices are required, the use of Allen-Bradley Bulletin 800F 22.5mm devices (or approved equal) is permitted.
- 4. For units with horizontally operated disconnect handles
 - a. The devices shall be Allen-Bradley Bulletin 800F.
- G. Terminal Blocks
 - 1. Control terminal blocks shall be provided on all contactor and starter units.
 - a. Control terminal blocks shall be a pull-apart design on all plug-in units for easy removal of the unit from the structure.
 - 2. Control terminal blocks on non-plug-in contactor and starter units shall be fixed type.
 - 3. Power terminal blocks shall be provided on all contactor and starter units, rated NEMA size 3 (100 A) and below which utilize vertically operated disconnects
 - a. Power terminal blocks shall be pull-apart for NEMA size 1 and 2 (30 A and 60 A contactors).
 - b. Power terminal blocks for NEMA size 3 starters (100 A contactors) shall be non-pull apart.
 - 4. Terminal blocks shall not be located adjacent to or inside the vertical wireway.
- H. Doors
 - 1. Each unit shall be provided with a removable door mounted on removable pin type hinges.
 - 2. The unit doors shall be capable of being opened at least 110 degrees.
 - 3. The unit doors shall be removable from any location in the MCC without disturbing any other unit doors.
 - 4. The unit door shall be fastened to the structure so it can be closed to cover the unit space when the unit is removed.
 - 5. The unit doors shall be held closed with quarter-turn latches.
 - 6. Unit door latches shall be provided with arc resistant latches to help keep the door latched in the event that an internal arcing fault occurs.

2.7 DISCONNECTS

- A. Main Disconnect
 - 1. Main circuit breaker disconnect (if indicated in contract drawings)
 - a. Lugs to accommodate the incoming power conductors as indicated on the contract drawings shall be provided by the MCC manufacturer.
 - b. Size the circuit breaker frame and trip rating as shown on the drawings. Provide 100% ratings where indicated.
 - c. The interrupting capacity rating shall meet or exceed the available fault current as shown on the contract drawings
 - 1) Interrupting capacity based on a slash rating is not acceptable
 - d. Provide a circuit breaker with thermal magnetic trip unit for 400A and smaller frames; provide electronic trip unit for 600A and larger frames.
 - e. Provide a removable protective barrier to reduce the possibility of contact with the line terminals.
 - f. Provide one normally open and one normally closed circuit breaker auxiliary contact which follows the position of the circuit breaker main contacts for indication of "On" or "Off/Tripped."
 - g. The main disconnect door shall be painted yellow. Provide kirk-key interlocks where indicated.
- B. Feeder Disconnects and Transformer Disconnects
 - 1. The disconnecting means for feeders and transformers shall be circuit breakers with thermal-magnetic trip units for 400A and smaller frames; provide electronic trip unit for 600A and larger frames.
 - 2. The interrupting capacity rating shall meet or exceed the available fault current as shown on the contract drawings
 - a. Interrupting capacity based on a slash rating is not acceptable
 - 3. The minimum frame size shall be 150 amps
 - 4. Provide one normally open and one normally closed circuit breaker auxiliary contact which follows the position of the circuit breaker main contacts for indication of "On" or "Off/Tripped."
- C. Motor Starter Disconnect
 - 1. Electro-mechanical NEMA starters
 - a. The disconnecting means for the across the line starters shall be motor circuit protectors.

- b. The unit short circuit rating shall be greater than or equal to the available fault current as shown on the contract drawings.
- c. Units shall be supplied based upon the rules / requirements set forth in the UL 845, NEMA ICS-18, and NFPA 70.
- d. Units shall be shipped at the motor circuit protector set at lowest setting per UL standards. The contractor shall field adjust the units based upon the particular motor application.
- e. The minimum frame size shall be 150 amps.
- f. Provide one normally open and one normally closed circuit breaker auxiliary contact which follows the position of the circuit breaker main contacts for indication of "On" or "Off/Tripped."

2.8 COMBINATION NEMA RATED ACROSS THE LINE STARTERS

- A. Starters shall meet applicable NEMA and UL requirements.
- B. Starters shall be minimum NEMA Size 1
 - 1. Fractional NEMA sizes are not acceptable.
- C. Motor starter shall be Allen Bradley Bulletin 500 or 300 or approved equal
- D. Starters shall be provided with a 3-pole solid state overload relay.
- E. In addition to the hold-in contact, starters shall be provided with auxiliary contacts shown on the contract drawing wiring diagrams. The starter shall be capable of accommodating up to six contact in addition to the hold-in contact.
- F. Provide a control power transformer with a rated secondary voltage of 120V AC. The control power transformer shall be provided with primary and secondary fusing.
- G. Overload relays shall have an reset button located on the outside of the unit door.
- H. Provide a door mounted selector switch for Hand-Off-Auto operation. The Hand Mode shall provide local control at the MCC unit door. In the Auto Mode, control shall be provided through a remote contact.
- I. Provide door mounted 120V AC push-to-test pilot lights with LED lamps for On Red and status indication.

2.9 CONTROL AND LIGHTING TRANSFORMER

- A. Specifications in the MCC section override corresponding specifications in transformer section
- B. Provide control and lighting transformers as shown on drawings. The rating shown on the drawings shall be the minimum acceptable rating.
- C. The insulation shall be 180 Deg C insulation with 80 Deg C rise.

- D. Provide circuit breaker with thermal magnetic trip for primary protection.
- E. Provide secondary fuse protection for the transformer.
- F. The primary circuit breaker compartment and transformer compartment shall be interlocked together and factory wired together.
- G. Unit construction is dependent on MCC NEMA enclosure type
 - 1. Units in a NEMA Type 1 enclosure shall be provided with vented doors.
 - 2. Units in a NEMA Type 1 enclosure with gasketed doors shall be provided with filters over the vent openings.
 - 3. Units in a NEMA Type 12 enclosure shall be provided with a non-vented door. If transformer derating is required, then the transformer shall be upsized to provide equivalent rating as shown on the contract drawings.
- H. Control and power transformers which are specifically designed for use in motor control centers and for use with motor control circuits are exempt from NEMA TP-1 energy efficient requirements.

2.10 LIGHTING AND POWER PANELBOARD

- A. Provide lighting panel as shown on the drawings.
- B. The lighting panel shall be rated for 10kA interrupting capacity.
- C. Provide bolt-on branch breakers as shown on the drawings.

2.11 NON-BUSSED SECTIONS

A. Provide non-bussed sections where indicated for Active Harmonic Filter, Transfer switch, and customer installed equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Contractor shall install MCC in accordance with manufacturer's instructions.
- B. Contractor shall tighten accessible bus connections and mechanical fasteners to the manufacturer's torque requirements.
- C. Contractor shall select and install fuses in fusible switches based upon field requirements.
- D. Contractor shall adjust circuit breaker settings based upon field requirements.

E. Contractor shall adjust solid state overloads to match the installed motor characteristics.

3.2 MANUFACTURER'S SERVICES

- A. The manufacturer of the MCC shall be capable of providing the programming for the programmable logic controller and the operator interface if provided within the MCC.
- B. The manufacturer of the MCC shall be capable of providing start-up services as part of the supply of the MCC.

3.3 TRAINING

- A. A course outline shall be submitted as part of the MCC submittals.
- B. The manufacturer shall offer off-site training on the concepts, knowledge and tools necessary to design, specify, install, troubleshoot the MCC.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Provisions: Applicable provisions of Section 16010 become a part of this Section as if repeated herein.
- B. Work Included: Furnish and install all control devices complete, including, as applicable, enclosures, engraved escutcheons or nameplates, gaskets, lenses, lamps and mounting provisions.

1.2 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

- A. National Electrical Manufacturers Association (NEMA) Publications:
- 1. ICS1 General Standards for Industrial Controls and Systems
- 2. ICS2 Standards for Industrial Control Devices, Controllers and Assemblies
- 3. ICS6 Enclosures for Industrial Controls and Systems

1.3 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Review category of the General Conditions and the submittal requirements of Section 16010.

PART 2 - PRODUCTS

2.1 GENERAL

A. All control devices shall conform to applicable provisions of NEMA Standards ICS1 and ICS2.

2.2 CONTROL AND TIMER RELAYS

- A. General: Relays shall be provided as necessary to perform switching functions required of control panels and other control circuits. Relays shall be of the following types (abbreviations in parentheses correspond to labels on the Drawings):
 - 1. Size 0 Magnetic Contactors: Provide Size 0 magnetic contactors for driving Size 4 and Size 5 ac operated motor starters. Motor starters shall be Allen Bradley Bulletin 500 NEMA rated.
 - 2. Relays:
 - a. Provide machine tool relays for the following applications:

SECTION 16955 – CONTROL DEVICES

- 1) All relays driving 120 Vac motor starters up to and including Size 3.
- 2) All relays driving non-motor loads up to 6 amps (or 720 VA).
- b. Provide machine tool type relays with convertible contacts rated 10 amperes continuous with NEMA Rating Designation A600 for ac applications and N600 for dc applications. Coils shall be designed for continuous duty and shall have the voltage rating indicated on the Drawings.
- c. Relays shall be the magnetically held type unless designated otherwise on the Drawings. For each relay provide one spare Form C contact over and above the number indicated on the Drawings. In addition, for latching relays, provide coil clearing contacts as necessary.
- d. Manufacturer: Square D, Class 8501, Type X; General Electric CR120B; or equal.
- 3. General Purpose Control Relays (plug-in):
 - a. Provide plug-in style 2-, 3-, or 4-pole enclosed relays with integral neon or LED indicators for the following applications:
 - 1) Relay logic (relays driving other relays, including machine tool relays) operating at voltages up to 120 Vac.
 - 2) Control power switching.
 - 3) All relays driving non-motor loads up to 2 amps (240 VA) at 120 Vac.
 - b. Provide relay sockets rated for 10 amp, 240 Vac with screw-type barriered terminals.
 - c. Manufacturer: Square D, Class 8501, Type R; Allen-Bradley Bulletin 700; or equal.
- 4. Analog or Digital Signal Switching Relays: Provide plug-in style indicating type relays with gold plated silver contacts for switching low level currents (less than 100 mA). Provide relay sockets screw-type barriered terminals.
- 5. Latching Relays: Latching relay shall be general purpose plug-in relay, two-coil magnetically held with an integral neon or LED indicators. Relay contacts shall be rated for 10 amp, 240 volts with coil voltage as shown on the Drawings. Relay shall be complete with socket and shall be Square D, Class 8501, Type K; Idec RR2KP Series; or equal.
- 6. Timing Relays:
 - a. One shot relays shall have LED on indication with dip switch setting for time adjustment. Relays shall be plug-in type with matching base. Provide ATC TBE series or approved equal.
- 7. General Requirements:

- a. Provide relays rated for 1 million operations at 10 amp, 120 Vac, at power factor of 0.2.
- Where timing relays are interfaced to motor starters or adjustable speed motor controllers, provide auxiliary machine-tool relays or Size 0 magnetic contactors. Refer to previous specifications for machine-tool relays and Size 0 magnetic contactors.
- c. Where timing relays or control relays require additional contacts, provide auxiliary control relays, properly sized for the application as described previously in this Section.

2.3 INTRINSICALLY SAFE RELAYS

A. Unit shall be fixed sensitivity type and either UL or FM approved for use with a remote pilot device (dry contact) located in Class 1, Division 1, Groups C and D atmospheres. Supply power shall be 120 Vac, 60 Hz. Provide load contacts as shown on the Drawings, except provide a minimum of one single-pole double-throw set. Contact ratings shall be 10 amperes or better at 120 Vac. Unit shall be BW Series 53; Warrick Series 7; or equal.

2.4 CONTROL PANEL ACCESSORIES

- A. Relays, timers and other internally mounted equipment shall be of the types specified in other sections of these Specifications.
- B. Panel face mounted equipment shall be of the types specified in other sections of these Specifications.
- C. Standards: All control devices shall conform to applicable provisions of NEMA Standards ICS 1 and ICS 2.
- D. Pushbuttons, Selector Switches and Pilot Lights:
 - 1. Shall be heavy-duty oiltight units; each unit shall have an engraved escutcheon plate unless nameplates are indicated on the Drawings or are necessary because of length of identification. Pushbuttons and selector switches shall have contacts rated 10 amperes continuous, Rating Designation A600 in conformance with NEMA ICS 2.
 - 2. Indicating lights shall be push-to-test transformer LED type with lenses of the colors shown on the Drawings.
- E. Multiposition control switches shall have rotary action, round knurled handle and the number of positions and stages shown on the Drawings. They shall be suitable for panel mounting. Each position shall have a positive detent. Contacts shall have a continuous current rating of 10 amperes at 300 Vac. Switches shall have integral indicator.
- F. For 4-20 mAdc and 1 to 5 Vdc signal selector switches, provide oiltight selector switches with electronic duty gold contact blocks. Provide sliding contacts for reliable operation without benefit of thermal cleaning action.
- G. Colors and Descriptions:
 - 1. Indicating Lamps: Unless otherwise noted on the Drawings, the following color code and inscriptions shall be followed for the lenses of all indicating lights.

Indicating Inscription	Lamp	Color
ON/START		Green
OFF/STOP		Red
CLOSED		Green
LOW		Amber
FAIL		Red
HIGH		Amber
OPEN		Red
POWER ON		White
RESET		Red
AUTO		Blue

- 2. Lettering shall be black on white and amber lenses. Lettering shall be white on red and green lenses.
- 3. Pushbuttons: Follow color coding for indicating lamp above.
- 4. All unused or noninscribed buttons shall be black. Lettering shall be black on white and yellow buttons. Lettering shall be white on black, red and green buttons.
- H. Nameplates: Unless specified otherwise in the Drawings, nameplates shall be black lamacoid with minimum 3/16-inch-high white letters for major area titles, 5/32-inch for component titles, and 1/8-inch for subtitles, and shall be fastened with a permanent but dissolvable adhesive or by screws.

2.5 CONTROL STATIONS

- A. Provide control stations complying with NEMA ICS 6 for manual control functions as follows and as shown on the Drawings: start-stop pushbutton, hand-off-auto, forward-reverse-jog-stop, etc. Control stations shall include selector switches, pushbuttons, and indicators as specified in this Section.
- B. Enclosures shall be as follows:
 - 1. Outdoor Locations: NEMA Type 4X
 - 2. Hazardous Locations (Gases): NEMA Type 7

- C. Nameplates: Provide an engraved plastic nameplate for each control station and escutcheons or nameplates for devices mounted thereon.
- D. Provide pushbuttons, selector switches, indicators, etc., as shown on the Drawings and as required. Provide control devices with NEMA ratings matching that of the control station.
- E. Manufacturer: Provide Allen-Bradley; Square D; Crouse-Hinds; or equal.

2.6 MANUAL MOTOR STARTERS

- A. Standards:
 - 1. NEMA 250, NEMA ICS 2.
 - 2. UL 508.
- B. Quick-make, quick-break toggle mechanism that is lockable in the OFF position.
- C. Types:
 - 1. Horsepower rated, for ON/OFF control.
 - 2. Horsepower rated, for ON/OFF control and thermal overload protection.
 - 3. Switch to clearly indicate ON and OFF position.
- D. Voltage and current ratings and number of poles as required for the connected motor.
- E. Enclosures:
 - 1. NEMA 4X rated:
 - a. Thermoplastic.
 - b. No knockouts, external mounting flanges.
- F. Manufacturers: Leviton Powerswitch MS4X or approved equal.

2.7 DISCONNECT SWITCHES

A. The disconnect switches shall be externally operated with quick-make/quick-break mechanisms. The handle shall be interlocked with the switch cover by means of a defeatable interlock device. The switch shall be padlockable in the "off" position. Switches shall have nameplates stating manufacturer, rating, and catalog number. Heavy-duty switches shall have arc suppressors, pin hinges, and shall be horsepower rated at 600-volts. All switches rated at 100 amperes or larger shall have auxiliary contact for remote status indication. Provide Heavy-duty switches for all motor circuits where indicated.

- B. Switch rating shall match the horsepower requirements of the load at the particular voltage if not otherwise shown.
- C. Switch enclosure shall meet the area classification requirements. Enclosures shall be NEMA 4X 316 SST in outdoor, damp, and corrosive locations.
- D. Manufacturers:
 - 1. Square D
 - 2. Cutler Hammer
 - 3. General Electric

PART 3 - EXECUTION

3.1 GENERAL

- A. Identify all control devices with engraved plastic nameplates or escutcheons, as applicable. Install control devices as recommended by the manufacturer.
- B. Coordinate with City software programmer for electronic overload relay settings.

END OF SECTION

PART 1 - GENERAL

1.1 **DESCRIPTION**

A. This section provides specifications for all instrumentation and control equipment, control panel, and necessary appurtenances for an integrated control system. These specifications and drawings include descriptions of functional operation and performance, as well as standards, but do not necessarily enumerate detailed specifications for all components and devices which are necessary. However, all components and devices shall be furnished and installed as required to provide complete and operable systems capable of providing the functions and meeting the performance set forth hereinafter.

B. <u>PLC, OIT and SCADA hardware and software programming will be provided</u> by the District's preferred supplier - Tesco Controls, Inc. The Contractor shall obtain quotes and utilize the preferred supplier.

- C. Wherever submittals are required hereunder, all such submittals by the CONTRACTOR shall be submitted to the ENGINEER.
- D. In these Contract Documents all systems, meters, instruments, and other elements are represented schematically, and are designated by numbers, as derived from criteria in Instrument Society of America Standard ANSI/ISA S5.1. The CONTRACTOR shall assign nomenclature and instrument tags on their submittal drawings. ANSI nomenclature and numbers shall be employed exclusively throughout shop drawings, data sheets, computer programming and similar materials. Any other symbols, designations, and nomenclature unique to the manufacturer's standard methods shall not replace those prescribed above.
- E. Should an error be found in a shop drawing during installation or testing of equipment, the correction, including any field changes found necessary, shall be noted on the drawing and submitted finally "as-built" prior to acceptance of the project.
- F. The submittal shall be submitted complete at one time within 60 working days after date of Notice to Proceed. Any incomplete submittal will be rejected and returned without comments.

1.2 **RESPONSIBILITIES**

- A. The CONTRACTOR through the use of a System Integrator shall be responsible to the OWNER for the implementation of the Control System, with other required electrical, instrumentation, and control devices.
- B. Due to the complexities associated with the interfacing of numerous control system devices, it is the intent of these specifications that the System Integrator be responsible to the CONTRACTOR for the integration of the SCADA system with existing devices and devices provided under other sections with the objective of providing a completely integrated control system free of signal incompatibilities.

- C. Provide all engineering, documentation, labor, and materials required to resolve signal, power, or functional incompatibilities between the control and instrumentation system and interfacing devices. This includes all interfaces to existing instruments and equipment.
- D. As a minimum, the System Integrator shall perform the following work:
 - 1. Prepare field instrument submittal
 - 2. Prepare a test plan submittal
 - 3. Procure field instrumentation
 - 4. Verify calibration of field instruments after installation
 - 5. Oversee and certify installation of instruments.
 - 6. Oversee, document, and certify loop testing
 - 7. Oversee, document, and certify system commissioning
 - 8. Conduct the performance test
 - 9. Coordinate with the District for PLC I/O software functional testing
 - 10. Prepare Owner's Manuals
 - 11. Prepare record drawings
- E. Integration of the SCADA system with instrumentation and control devices being provided under other sections:
 - 1. Resolve signal, power, or functional incompatibilities between the SCADA system and interfacing devices.
- F. Any System Integrator responsibilities in addition to the list above are at the discretion of the CONTRACTOR and the System Integrator. Additional requirements in this Section and throughout Division 17 that are stated to be the CONTRACTOR'S responsibility may be performed by a qualified System Integrator if the CONTRACTOR and System Integrator so agree.

1.3 NOT USED

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Electrical work specified hereunder shall conform to the requirements of this section and the applicable requirements of section entitled "Basic Electrical Requirements". (See Section 16010).

1.4 **REFERENCE SPECIFICATIONS, CODE AND STANDARDS**

A. The installation and fabrication of all items within the scope of this section of the specifications shall be accomplished according to the requirements of the regulatory agencies as specified in Electrical Section 16000 and the referenced standards listed including UL, IEEE, ICEA, and NEMA.

The primary reference standards for this section of the specifications shall be ISA-Instrument Society of America.

Without limiting the generality of other requirements of these specifications, all work specified herein shall conform to or exceed the applicable requirements of the referenced documents to the extent that the requirements therein are not in conflict with the provisions of this section; provided, that where such documents have been adopted as a code or public ordinance by the public agency having jurisdiction, such code or ordinance shall take precedence.

1.5 SUBMITTALS

- A. General Submittal Requirements:
 - 1. Submittals shall be provided per Section 01300.
- B. Shop Drawings
 - 1. The term "Shop Drawings" as used herein shall be understood to include detail design calculations, shop drawings, fabrication, and installation drawings, erection drawings, list, graphs, catalog sheets, data sheets, and similar items. Whenever the CONTRACTOR is required to submit design calculations as part of a submittal, such calculations shall bear the signature and seal of an engineer registered in the appropriate branch and in the state wherein the project is to be built, unless otherwise directed.
 - 2. Fabrication of an item shall be commenced only after the ENGINEER has reviewed the pertinent submittals and declared to the CONTRACTOR either "NO EXCEPTIONS TAKEN" or MAKE CORRECTIONS NOTED." Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis for changes to the contract requirements.
 - 3. All CONTRACTOR shop drawings submittals shall be carefully reviewed by an authorized representative of the CONTRACTOR, prior to submission to the ENGINEER. The Engineer's review of Contractor shop drawings submittals shall not relieve the Contractor of the entire responsibility for the correctness of details and dimensions. The Contractor shall assume all responsibility and risk for any misfits due to any errors in Contractor submittals. The Contractor shall be responsible for the dimensions and the design of adequate connections and details.
- C. Field Instrument Submittal

- 1. This submittal to include field instrumentation and RTU modifications in a singular, all-inclusive submittal which shall include but not be limited to.
 - a. A complete index appearing in the front of each bound submittal volume. Labeled tags shall separate system groups.
 - b. Installation, mounting, and anchoring details for all components and assemblies, including access requirements and conduit connection or entry details.
 - c. Drawings showing schematic diagrams for control circuits. Complete details on the circuit interrelationship of all devices within and outside each Control Panel shall be submitted using schematic control diagrams. The diagrams shall show numbered terminals on components together with the unique number of the wire to be connected to each terminal. The diagrams shall also show terminal assignments from all primary measurement devices, such as flowmeters, and to all final control devices. The CONTRACTOR shall furnish all necessary equipment suppliers' shop drawings to facilitate inclusion of this information by the System Integrator.
 - d. Complete and detailed bills of materials: A bill of material list, including quantity, description, manufacturer, and part number, shall be submitted for cabinet assemblies and subassemblies. Bills of material shall include all items within an enclosure.
 - e. Data sheets for each component, together with a technical product brochure or bulletin: The data sheets shall show:
 - 1) Component functional description used herein and on the Drawings;
 - a) Manufacturer's model number or other product designation;
 - b) Project tag number used herein and on the Drawings;
 - c) Project system or loop of which the component is a part;
 - d) Project location or assembly at which the component is to be installed;
 - e) Input and output characteristics;
 - f) Scale range and units (if any) and multiplier (if any);
 - g) Requirements for electric supply (if any);
 - h) Materials of construction and of component parts to be in contact with or otherwise exposed to, process media;
 - i) Special requirements or features, such as specifications for ambient operating conditions.
 - j) Features and options which are furnished.
 - 2) A separate technical brochure or bulletin shall be included with each instrument data sheet. The data sheets shall be indexed in the submittal by systems or loops, as a separate group for each system or loop. If within a single system or

loop, a single instrument is employed more than once, one data sheet with one brochure or bulletin may cover all identical uses of that instrument in that system. Each brochure or bulletin shall include a list of tag numbers for which it applies. Special options and features, which are furnished, shall be identified.

- 3) Calibration, adjustment and test details for all components and systems.
- D. Submittals Test Procedures
 - 1. Submit the procedures proposed to be followed during each test. Procedures shall include test descriptions, forms, and checklists to be used to control and document the required tests.
 - 2. Upon completion of each required test, document the test by submitting a copy of the signed off test procedures. Testing documentation shall consist of the following:
 - a. The summary check-off index shall be an index of all PLC and telemetry systems in the project and shall include the following as a minimum for each system:
 - 1) System description
 - 2) Physical installation check-off box
 - 3) Functional check-off box for each point
 - 4) Satisfactory completion check-off box for each point
 - 5) Comments box
 - 6) Sign-off area for the SI, the Engineer, and the Agency
 - b. The individual instrument sign-off sheet(s):
 - 1) The instrument tag number
 - 2) The manufacturer and part number
 - 3) Description of instrument
 - 4) Power requirements
 - 5) Calibration procedure including calibration ideal vs. actual chart for 0%, 25%, 50%, 75%, and 100% of full scale value
 - 6) Calibration range
 - 7) Calibration data (setpoint, deadband, etc.)
 - 8) Switch settings
 - 9) PLC I/O address(es)
 - 10) Additional comments as required
 - 11) Signoff space for the SI, the Engineer, and the Agency
 - c. The System Integrator shall submit the Test Plan and receive a satisfactory review approval by the Engineer before any witnessed testing can occur.

- E. Submittals Operations and Maintenance Manuals
 - 1. The CONTRACTOR shall submit technical operation and maintenance information for each item of mechanical, electrical and instrumentation equipment in an organized manner in the OWNER'S MANUAL. It shall be written so that it can be used and understood by the DISTRICT's operation and maintenance staff.
 - 2. All drawings developed for the RTU shall be generated utilizing a commercial CAD system and shall be delivered on CD-ROM in a DWG format, as completely compatible with/readable by the latest AutoCAD software package.
 - 3. The OWNER'S MANUAL shall be in both hard copy and electronic as stated in Section 01630 in latest version of MSWord and Adobe Acrobat PDF formats on CD-ROM, subdivided first by specification section number; second, by equipment item; and last, by "Part." "Parts" shall conform to the following (as applicable):
 - a. Part 1 Equipment Summary:
 - 1) Procedures: Manufacturer-recommended procedures on the following shall be included in Part 2:
 - 2) Form: The ENGINEER will supply an Equipment Summary Form for each item of mechanical, electrical and instrumentation equipment in the WORK. The CONTRACTOR shall fill in the relevant information on the form and include it in Part 1.
 - b. Part 2 Operational Procedures:
 - Summary: A summary table shall indicate the equipment name, equipment number, and process area in which the equipment is installed. Installation

Adjustment Location of controls, special tools, equipment required, or related instrumentation needed for operation Operation procedures Load changes Calibration Shutdown Troubleshooting Disassembly Reassembly Realignment Testing to determine performance efficiency Tabulation of proper settings for all pressure relief valves, low and high-pressure switches, and other protection

devices List of all electrical relay settings including alarm and contact settings

- c. Part 3 Preventive Maintenance Procedures:
 - 1) Procedures: Preventive maintenance procedures shall include all manufacturer-recommended procedures to be performed on a periodic basis, both by removing and replacing the equipment or component, and by leaving the equipment in place.
 - Schedules: Recommended frequency of preventive maintenance procedures shall be included. Lubrication schedules, including lubricant SAE grade, type, and temperature ranges, shall be covered.
- d. Part 4 Parts List:
 - Parts List: A complete parts list shall be furnished, including a generic description and manufacturer's identification number for each part. Addresses and telephone numbers of the nearest supplier and parts warehouse shall be included.
 - 2) Drawings: Cross-sectional or exploded view drawings shall accompany the parts list.
- e. Part 5 Wiring Diagrams:
 - 1) Diagrams: Part 5 shall include complete internal and connection wiring diagrams for electrical equipment items.
- f. Part 6 Shop Drawings:
 - 1) Drawings: This part shall include approved shop or fabrication drawings.
- g. Part 7 Safety:
 - 1) Procedures: This part describes the safety precautions to be taken when operating and maintaining the equipment or working near it.
- h. Part 8 Documentation:
 - 1) All equipment warranties, affidavits, and certifications required by the Technical Specifications shall be placed in this part.
- 4. OWNER'S MANUALS shall be submitted in final form to the ENGINEER not later than the 75 percent of construction completion date. The CONTRACTOR shall correct all discrepancies found by the ENGINEER in

the TECHNICAL MANUALS within 30 days from the date of written notification by the ENGINEER.

5. Incomplete or unacceptable OWNER'S MANUALS at the 75 percent construction completion point shall constitute sufficient justification to withhold adequate amount, proportional in value, from any monies due the CONTRACTOR.

1.6 SPARE PARTS

A. The CONTRACTOR shall include in the Owner's Manual a list of spare parts as per the specifications requirements

1.7 QUALITY ASSURANCE

A. Unless otherwise specified, each individual instrument shall have a minimum accuracy of +0.5 percent of full scale and a minimum repeatability of +0.25 percent of full scale.

1.8 GUARANTEE

- A. The CONTRACTOR shall guarantee the performance and the hardware of all the CONTROL PANEL equipment as specified herein, for a period of one year following the date of completion and formal acceptance of the WORK as specified under the General Conditions of these Specifications. Services shall begin within 24 hours for critical items and within 3 days for non-critical items after notification by the DISTRICT.
- B. Equipment, software, and materials which do not achieve design requirements after installation shall be replaced or modified by the System Integrator to attain compliance, at no additional cost to the DISTRICT. Following replacement or modification, the CONTRACTOR shall retest the system and perform any additional procedures needed to place the complete system in satisfactory operation and attain design compliance approval from the ENGINEER.
- C. All parts, material (excluding consumables), labor, travel, subsistence, or other expenses incurred in providing all the services and service visits during the one-year warrantee period shall be borne by the CONTRACTOR under the guarantee.
- D. The warrantee period shall start when the work has been completed and accepted by the DISTRICT and the ENGINEER.

PART 2 - PRODUCTS

2.1 MATERIALS AND STANDARD SPECIFICATIONS

A. Provide instruments, equipment and materials suitable for service conditions and meeting standard specifications such as ANSI, ASTM, ISA, and SAMA. The intent of this Specification is to insure instruments and equipment are of a uniform quality

and manufacture throughout the plant. All instruments in the plant of the same type shall be made by the same manufacturer.

2.2 NAME TAGS

- A. All instrumentation and equipment items or systems shall be identified by name tags. Field equipment shall be tagged with the assigned instrumentation tag number listed in the Instrument Schedule.
- B. Name tags shall be stainless steel with engraved or stamped black characters of 3/16 inch minimum height. Tags shall be attached to equipment with a tag holder and stainless steel band with a worm screw clamping device. Use 20-gauge stainless steel wire where banding is impractical. For field panels or large equipment cases use stainless steel screws; however, such permanent attachment shall not be on an ordinarily replaceable part.

2.3 FIELD-MOUNTED EQUIPMENT

A. All instrument and control equipment mounted outside of protective structures shall be equipped with suitable surge arresting devices to protect the equipment from damage due to electrical transients induced in the interconnecting lines from lightning discharges or nearby electrical devices. Protective devices used on 120 Vac inputs to field mounted equipment shall be secondary valve surge protectors conforming to the requirements of ANSI C62.1.

2.4 EQUIPMENT OPERATING CONDITIONS

- A. All equipment shall be rated for normal operating performance with varying operating conditions over the following minimum ranges.
 - 1. Operation and Maintenance (O&M) Manuals shall be prepared respective to the Work of this Instrumentation Section. Preliminary and final O&M Manuals shall be submitted for Engineer approval.
 - 2. Field Instruments:

a. Outdoor Areas: Ambient Temperature: +15°F to +120°F Ambient Relative Humidity: 5% to 100% Weather: Rain, and ice

b. Indoor Unheated Areas: Ambient Temperature: +30°F to +110°F Ambient Relative Humidity: 10% to 95%, non-condensing

c. Indoor Environmentally Controlled Areas: Ambient Temperature: +60°F to +104°F Ambient Relative Humidity: 10% to 90%, non-condensing

2.5 EQUIPMENT LOCATIONS

A. Provide equipment and materials suitable for the types of locations in which they are located as defined under Division 16. All equipment specified for field mounting shall be weatherproof and splash proof as a minimum.

2.6 CURRENT TECHNOLOGY

A. All meters, instruments, and other components shall be the most recent fieldproven models marketed by their manufacturers at the time of submittal of the shop drawings unless otherwise required to match existing equipment.

2.7 LOOP ACCURACY

A. The accuracy of each instrumentation system or loop shall be determined as a probable maximum error; this shall be the square-root of the sum of the squares of certified "accuracies" of the designated components in each system, expressed as a percentage of the actual span or value of the measured variable. Each individual instrument shall have a minimum accuracy of plus and minus 0.5 percent of full scale and a minimum repeatability of plus and minus 0.25 percent of full scale unless otherwise indicated. Instruments which do not conform to or improve upon these criteria are not acceptable.

2.8 ANALOG SIGNAL INDICATED UNITS

A. For all instruments with local or remote indicators, provide indicators scaled in actual engineering units, i.e., gallons per minute, feet, psi, etc., rather than 0 to 100%, unless noted otherwise on the Drawings or Instrument Schedule.

2.9 SIGNAL TRANSMISSION

- A. Analog:
 - 1. Signal transmission between electric or electronic instruments shall be 4-20 mA and shall operate at 24 Vdc. Signal output from all transmitters and controllers shall be current regulated and shall not be affected by changes in load resistance within the unit's rating.
 - 2. Nonstandard transmission systems such as impulse duration, pulse rate, and voltage regulated will not be permitted except where specifically noted in the Instrument Schedule or shown on the Drawings. When transmitters with nonstandard outputs do occur, their output shall be converted to 4-20 mA prior to transmission.
- B. Discrete: All alarm and status signals shall be 24 VDC unless specified otherwise on the Instrument Schedule.

2.10 FASTENERS

A. Fasteners for securing equipment to walls, floors and the like shall be 316 stainless steel. When fastening to existing walls, floors, and the like, provide capsule

anchors, not expansion shields. Size capsule anchors to meet load requirements. Minimum size capsule anchor bolt is 3/8 inch.

2.11 ELECTRONIC MEDIA

A. As-built drawings shall be provided in AutoCAD 7 (DWG) format on CD – ROMs. The CD shall be organized to simplify user browsing.

PART 3 – EXECUTION

3.1 GENERAL

A. Elements such as transmitters, and the like, shall be tested and exercised to demonstrate correct operation, first individually and then collectively as functional analog networks. Each analog system shall be tested to verify proper performance. Individual component uncertainty requirements shall be as specified by the manufacturer.

3.2 MOUNTINGS

- A. Mount and install equipment as indicated. Mount field instruments on pipe mounts or other similar means in accordance with suppliers' recommendation. Where mounted in control panels, mount according to requirements of that section.
- B. Equipment specified for field mounting shall be suitable for direct pipe mounting or surface mounting, surface-mounted indicators and equipment with calibration adjustments or requiring periodic inspection shall be mounted not lower than 3 feet 6 inches nor higher than 6 feet above walkways, platforms, catwalks, and the like.
- C. All devices shall be accessible to operators for servicing, operating, reading, etc. Provide permanent platforms to assure devices are continuously accessible.

3.3 FIELD WIRING

A. Ring out signal wiring prior to termination and perform surge withstand tests where required. Verify all terminations are tight and shields are uniformly grounded at one location.

3.4 CALIBRATION

- A. General: All devices provided under Division 17 shall be calibrated according to the manufacturer's recommended procedures to verify operational readiness and ability to meet the indicated functional and tolerance requirements.
- B. Calibration Points: Each instrument shall be calibrated at 0, 25, 50, 75, and 100% of span using test instruments to simulate inputs. The test instruments shall have accuracies traceable to National Institute of Testing Standards.
- C. Bench Calibration: Instruments which have been bench-calibrated shall be examined in the field to determine whether any of the calibrations are in need of

adjustment. Such adjustments, if required, shall be made only after consultation with the ENGINEER.

- D. Field Calibration: Instruments which were not bench-calibrated shall be calibrated in the field to insure proper operation in accordance with specification data sheets.
- E. Analyzer Calibration: Each analyzer system shall be calibrated and tested as a workable system after installation. Testing procedures shall be directed by the manufacturers' technical representatives. All samples and sample gases shall be furnished by the manufacturers.
- F. Calibration Sheets: Each instrument calibration sheet shall provide the following information and a space for sign-off on individual items and on the completed unit.
 - 1. Project name
 - 2. Loop number
 - 3. Tag number
 - 4. Manufacturer
 - 5. Model number
 - 6. Serial number
 - 7. Calibration range
 - 8. Calibration data: Input, output, and error at 0, 25, 50, 75, and 100% of span
 - 9. Switch setting, contact action, and deadband for discrete elements
 - 10. Space for comments
 - 11. Space for sign-off by System Integrator and date
 - 12. Test equipment used and associated serial numbers
- G. Calibration Tags: A calibration and testing tag shall be attached to each piece of equipment or system at a location determined by the ENGINEER. The CONTRACTOR shall have the System Integrator sign the tag when calibration is complete.

3.5 LOOP TESTING

A. Control Valve Tests: All control valves, cylinders, drives and connecting linkages shall be stroked from the operator interface units as well as local control devices and adjusted to verify proper control action, hand switch action, limit switch settings, torque settings, remote control actions, and remote feedback of valve

status and position. Control valve actions and positioner settings shall be checked with the valves in place to insure that no changes have occurred since the bench calibration.

- B. Interlocks: All hardware and software interlocks between the instrumentation and the motor control circuits, control circuits of softstarters and packaged equipment controls shall be checked to the maximum extent possible.
- C. Instrument and Instrument Component Validation: Each instrument shall be field tested, inspected, and adjusted to its indicated performance requirement in accordance to its Manufacturer's specifications and instructions. Any instrument which fails to meet any Contract requirement, or, in the absence of a Contract requirement, any published manufacturer performance specification for functional and operational parameters, shall be repaired or replaced.
- D. Loop Validation: Controllers and electronic function modules shall be field tested and exercised to demonstrate correct operation. All control loops shall be checked under simulated operating conditions by impressing input signals at the primary control elements and observing appropriate responses of the respective control and monitoring elements, final control elements, and the graphic displays associated with the PLC. Actual signals shall be used whenever available. Following any necessary corrections, the loops shall be restested. Specified accuracy tolerances for each analog network are defined as the root-mean-squaresummation of individual component accuracy requirements. Individual component accuracy requirements shall be as indicated by Contract requirements or by published manufacturer accuracy specifications, whenever Contract accuracy requirements are not indicated. Each analog network shall be tested by applying simulated analog or discrete inputs to the first element of an analog network. For networks which incorporate analog elements, simulated sensor inputs corresponding to 0, 25, 50, 75, and 100% of span shall be applied, and the resulting element outputs monitored to verify compliance to calculated root-meansquare-summation accuracy tolerance requirements. Continuously variable analog inputs shall be applied to verify the proper operation and setting of discrete devices. Provisional settings shall be made on controllers and alarms during analog loop test. All analog loop test data shall be recorded on test forms which include calculated root-mean-square-summation system accuracy tolerance requirements for each output.
- E. Loop Validation Sheets: The CONTRACTOR shall prepare loop confirmation sheets for each loop covering each active instrumentation and control device except simple hand switches and lights. Loop confirmation sheets shall form the basis for operational tests and documentation. Each loop confirmation sheet shall cite the following information and shall provide spaces for sign-off on individual items and on the complete loop by the System Integrator:
 - 1. Project name
 - 2. Loop number

- 3. Tag number, description, manufacturer and model number for each element
- 4. Installation bulletin number
- 5. Specification sheet number
- 6. Loop description number
- 7. Adjustment check
- 8. Space for comments
- 9. Space for loop sign-off by System Integrator and date
- 10. Space for sign-off by System Integrator and date
- 11. Space for sign-off by Engineer or District and date
- F. Loop Certification: When installation tests have been successfully completed for all individual instruments and all separate analog control networks, a certified copy of all test forms shall be retained by the CONTRACTOR.

3.6 FIELD FUNCTIONAL TESTING

- A. General: Field functional testing shall commence after acceptance of all wire test, calibration tests and loop tests, and all inspections have demonstrated that the instrumentation and control system complies with all Contract requirements. Field functional testing shall demonstrate proper operation of all systems with process equipment operating over full operation ranges under conditions as closely resembling actual operation conditions as possible.
- B. Field functional Test Procedures and Documentation: All field functional testing activities shall follow detailed test procedures and check lists accepted by the ENGINEER. All test data shall be acquired using equipment as required and shall be recorded on test forms accepted by the ENGINEER, which include calculated tolerance limits for each step. Completion of all system field functional testing activities shall be documented by a certified report, including all test forms with test data entered and retained by the CONTRACTOR.
- C. Operational Validation: Where feasible, system field functional testing activities shall include the use of water to establish service conditions that simulate, to the greatest extent possible, normal final control element operation conditions in terms of applied process loads, operation ranges, and environmental conditions. Final control elements, control panels, and ancillary equipment shall be tested under start-up and steady-state operation conditions to verify that proper and stable control is achieved using motor control center and local field mounted control circuits. All hardwired and software control circuit interlocks and alarms shall be tested using both manual and automatic (where provided) control circuits. The

stable steady-state operation of final control elements running under the control of field mounted controllers as required eliminating oscillatory final control element operation. The transient stability of final control elements operation under the control of field mounted, and software based automatic analog controllers shall be verified by applying control signal disturbances, monitoring the amplitude and decay rate of control parameter oscillations (if any) and making necessary controller adjustments as required to eliminate excessive oscillatory amplitudes and decay rates.

- D. Field Functional Test Validation Sheets: Field functional testing shall be documented on one of two types of test forms as follows:
 - 1. For functions which can be demonstrated on a loop-by-loop basis, the form shall include:
 - a. Project name
 - b. Loop number
 - c. Loop description
 - d. Tag number, description, manufacturer and data sheet number for each component
 - e. Space for sign-off and date by both the System Integrator and ENGINEER
 - 2. For functions which cannot be demonstrated on a loop-by-loop basis, the test form will be a listing of the specific tests to be conducted. With each test description the following information shall be included:
 - a. Specification page and paragraph of function demonstrated
 - b. Description of function
 - c. Space for sign-off and date by both the System Integrator and ENGINEER
- E. Field Functional Test Certification: The CONTRACTOR shall submit an instrumentation and control system field functional test completion report which shall state that all Contract requirements have been met and shall include a listing of all instrumentation and control system maintenance and repair activities conducted during the field functional testing. Acceptance of the instrumentation and control system field functional testing must be provided in writing by the ENGINEER before the acceptance testing may begin. Final acceptance of the control system shall be based upon plant completion as stated in the General Conditions:

3.7 ACCEPTANCE TEST

A. General: Subsequent to Field Functional Test and instrument calibration, verifying substantial completion of field installation and start-up, the system will be given a final 14-day acceptance test. The 14-day test must be successfully completed, including resolution of punch-list items generated during the test period, prior to the date of substantial completion of the entire project. The system must run continuously for 14 consecutive days. During this period, all system functions shall

be exercised, and any system interruption and accompanying component, subsystem, or hardware failure shall be logged for cause of failure, as well as time of occurrence and duration of each failure. The CONTRACTOR shall provide a competently trained technician on call during all normal working days and hours from the start of the acceptance test until final acceptance of the system.

- B. Testing: The systems to be tested on-line will include general operations as well as the Report Generator and Operation as specified herein. Each system function, e.g., status report-backs, logs, and displays shall be exercised several times at a minimum, and in a manner which approximates "normal" system operation. Failure of the system during the above program testing shall be considered as indicating that the programs and operating system do not meet the requirements of the specifications and corrective action shall be required before restarting the acceptance test. Only those components, subsystems, and systems covered in this specification shall be considered for this acceptance test. Problems and failures of other systems shall not be considered as part of this test (except as they display the capabilities of this system to detect failures).
- C. Failures: Failures shall be classified as either major or minor. A minor failure would be a small and non-critical component failure, which can be corrected by the OWNER operators. This occurrence shall be logged but shall not be reason enough for stopping the test and shall not be grounds for non-acceptance. However, should the same or similar component failure occur repeatedly, this may be considered as grounds for non-acceptance. A major failure shall be considered to have occurred when a component, subsystem, or program fault causes a halt in operation of the system and/or when a technician's work is required to make a repair or to re-initiate operation of the system. A major failure shall cause termination of the acceptance test. When the causes of a major failure have been corrected, a new acceptance test with a new 14-day duration shall be started.
- D. Technician Report: Each time a technician is required to respond to a system malfunction, he or she must complete a report which shall include details concerning the nature of the complaint or malfunction and the resulting repair action required and taken. If a malfunction occurs which clears itself or which the operator on duty is able to correct, no report shall be required (logged as specified above). If a technician has performed work but no report is written, then a major failure shall be considered to have occurred. Each report shall be as specified above). Each report shall be submitted within 24 hours to the ENGINEER or its representative, and the OWNER.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This section contains the control system description for each process and subprocess in the facility.

1.2 GENERAL CONDITIONS

A. References to drawing numbers and final control elements provided in these strategies are provided as a convenience only. An incorrect or omitted drawing number or final control element reference shall have no impact on the scope or price of work required under this contract.

PART 2 - PRODUCTS

2.1 CONTROL STRATEGIES

A. General: The control strategies included in this Section are written descriptions of control functions executed by the MCC, field control panels and field instruments provided under this contract. These strategies are provided as an aide to the Contractor in understanding the overall objective of each process subsystem and as a guide for testing activities. In case of any apparent conflict between the control descriptions in the control strategies and any new controls specified elsewhere in the Contract Documents, the controls specified in the Control Strategies shall be provided. The Contractor shall notify the Engineer in a timely fashion of any such apparent conflict. Refer to the project drawings for PLC input and output assignments and points that are generally monitored for status or alarm.

2.2 CONTROL SYSTEM OPERATION

- A. Telemetry: The station includes interface with the existing SCADA system located at the 4S Ranch WWTP. Signals at the pump station will be directly transmitted to and directly received from the 4S Ranch WWTP SCADA system via radio telemetry.
- B. Programmable Logic Controller: The station will be controlled from a programmable logic controller (PLC) located in the Remote Terminal Unit enclosure (RTU) in the control room. The RTU will have a graphic user interface display with touchscreen. The display will indicate the status of the station, list current alarms, and provide an alarm history with time stamp.
- C. Pumps: The station will be comprised of four vertical pumps. The pumps are in two series connected groups. The groups will logically operate as two pumps, providing a duty, standby operation.
- D. Pump Starters.
 - 1. The motor control center (MCC) will house the variable frequency drives

SECTION 17050 - CONTROL SYSTEM DESCRIPTION

(VFD) for the pumps. The VFD's will act as soft starters and will not 'modulate' pump speed. The VFD's will have full voltage bypass contactors. The starters will have a bypass selector switch that will allow normal pump operation should the soft starter fail. A VFD failure alarm will annunciate and be transmitted to SCADA.

- 2. The VFD's will have HOA switches at the MCC to allow manual or automatic operation. The pumps are normally in the AUTO mode and controlled by the PLC.
- 3. The motor protective features that will prevent the pump from running under a now flow condition (loss of suction or shutoff head).
- 4. In the automatic mode (HOA in AUTO) the first and second stage pumps will operate together from a single start command. The second stage pump will be controlled by the first stage call and run contact along with a PLC permissive and suction pressure switch permissive. Should the second stage fail to start then the first stage pump will be locked out by the PLC with a sequence fail alarm.
- E. Pump Interlocks
 - 1. In the HAND mode the pump will run continuously unless a hard wired low level float is actuated or a protective feature actuates (as described above). The pump has local lock-out stop switch that will break the starter control power and shut the pump down and prevent a stop.
 - 2. In the AUTO mode the pump has the same interlocks as the HAND mode. In addition, PLC interlocks are also included. The PLC shall only allow single pump group operation when the station is being powered by the standby generator.
- F. Pump Controls
 - 1. PLC operation
 - a. The PLC shall call the duty pump to start/stop based on wetwell level and a fill/draw operating mode. The pumps shall operate in a duty/standby sequence as described herein. A float backup system will also call the pumps if the wetwell level goes outside the normal control band of the PLC.
 - b. The program will have an alternation program that rotates the duty pump group based on subsequent stops or runtime hours. The graphic display touch screen will have the ability to select the duty pump or select auto rotation. The standby pump will be in the normal rotation and will stand in for a pump that is either failed or is in the off position. A warning shall be displayed when auto rotation is not selected.
 - 2. Backup operation

- a. A backup float circuit, operating outside the PLC programmed level band, will operate the pumps in case of PLC failure or failure of wetwell analog signals. The floats will control both pump groups. The high level float will actuate one pump group. A highhigh float will actuate the second pump group. The pumps will turn off when the low-low level float is actuated. All floats are alarmed to SCADA.
- 3. A pump 'soft fail' will occur if the PLC calls for a pump and it does not respond with a 'run' signal after a programmed time delay. A soft fail will lock the pump out of the sequence and annunciate locally.
- G. Wetwell Analog Level Control
 - 1. Level Sensing System: The pumps will be controlled based on the liquid level in the wet well, as indicated, by two analog level measuring systems, and will include provisions to transmit via telemetry to the WWTP. The level measurement shall be done by two separate sensing schemes. One will be a submersible pressure (level) transducer and the second system will be a Tesco reactive trapped air type system as shown on the plans. The system will continuously monitor the liquid level. The reactive system shall be for primary controls and pressure transducer shall provide the backup controls. Use of the backup system shall be selectable manually by the operator via the telemetry system or local graphic display. A float switch will be provided for high high and low low wet well alarms and backup control described above.
 - 2. Level setpoints shall be as follows:
 - 402.55 High-high float alarm and start second set of pumps
 - 402.45 High level float alarm and start first set of pumps.
 - 402.30 High level alarm
 - 401.80 PLC Start duty pump group
 - 398.80 PLC Stop duty pump group
 - 398.50 Low level alarm
 - 398.25 Low-low float alarm and stop all pumps.
- H. Not Used
- I. Pump Station Flowmeter: A magnetic flowmeter shall be provided to measure the flow in the discharge piping from the pump station. Signals to indicate pump station flow and total flow shall be made available to the telemetry system for transmission to the WWTP and locally on the graphic display. If Pump station flow exceeds a predetermined flowrate indicated by the 4-20mA signal from the flowmeter a "HIGH STATION FLOW" alarm shall occur but the pump station shall operate normally. The highest daily peak flow (gallons/hour) shall be recorded for reporting purposes.
- J. Emergency Generator Set: An emergency generator and appurtenances

SECTION 17050 – CONTROL SYSTEM DESCRIPTION

including sound attenuation shall be provided to supply power to the station in the event of commercial power failure. The emergency is sized to provide power to the station load and two pumps with a 24 hour run time. Transfer switch position and generator run, fail, low fuel, low battery voltage, and fuel leak alarms will be sent to the WWTP.

- K. Ventilation: The drywell shall have continuous mechanical ventilation to prevent the accumulation of hazardous gases within the pump room. The supply and exhaust fans shall be equipped with an ON/OFF selector switch. The status of the fans are monitored by the PLC. A loss of ventilation will cause an audio/visual alarm in all spaces. The horn has a silence switch on the RTU door. An alarm will be sent to the WWTP. These controls allow the drywell to be unclassified per NFPA 820.
- L. Gas Detection System: A hydrogen sulfide, low oxygen, and methane gas detector shall be located in the pump room (drywell). A gas monitoring panel near the entry door will monitor and display the analog levels and generate a common alarm to the RTU. The alarm will activate the station audio and visual alarms. The audio alarm can be silenced at the RTU. The alarm will be transmitted to the WWTP.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. General System Description: The I/O from the Neighborhood 1Lift Station (station) site shall be relayed to the 4S-1 Reservoir. A radio installed at the Reservoir site and its client companion installed at the station site shall provide the necessary link. The Contractor shall provide the equipment indicated at the station site and provide additional programming of the human-machine interface (HMI) software at the WWTP to define the use of this radio link and to provide screens with data from the station site for operational use.
- B. The work shall consist of furnishing, installing and testing of the field-mounted instruments and communication equipment.
- C. The Contractor shall be responsible for providing a complete and operable system. The material components specified herein, as well as components not specified but necessary to make the system operable, are part of the work.
- D. The installation shall be in accordance with generally accepted practices within the electrical, communication, and instrumentation trades.
- E. The Contractor shall be responsible for coordinating the instrumentation, communication, and telemetry system components provided by all vendors and subcontractors.
- F. Unless otherwise specified in these specifications, Contractor shall size the cable and connectors. The cable and connectors shall be sized to minimize signal loss.
- G. The Contractor shall ensure that the specified equipment is the most appropriate equipment currently available at the time of construction for use with the District's existing SCADA system.
- H. The Contractor shall submit per OMWD Standard Specification Section 01300 manufacturer's catalog data, descriptive literature, assembly drawings, system diagrams, panel layouts and wiring diagrams for field-mounted instruments, and enclosures to the District for approval prior to starting the installation of any components.

PART 2 - MATERIALS

2.1 MATERIALS

A. Refer to the drawings for materials.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation requirements for station site:

SECTION 17100 - COMMUNICATION EQUIPMENT

- 1. Install communications equipment in accordance with the manufacturer's recommendations, and as directed by the District's Representative.
- 2. The Contractor shall provide any and all equipment necessary to produce an ambient environment that meets or exceeds the environmental specifications of the specified equipment.
- 3. Provide all wiring, labor, materials, and equipment necessary for the installation setup, testing, and successful operation of the equipment.
- 4. The Contractor shall perform testing of field-mounted instruments and communications equipment in the presence of the District's Representative. The Contractor shall be responsible for performing all field testing necessary to construct, install, and test all field-mounted instruments and communications equipment.

END OF SECTION

PART 1 – GENERAL

1.1 SCOPE

A. This section covers Programmable Logic Controllers (PLCs), and Operator Interface Terminals (OIT), including associated input/output hardware to control process equipment and serve as the interface to field devices.

1.2 GENERAL

- A. Equipment furnished and installed under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.
- B. General Equipment Stipulations.
 - 1. The General Equipment Stipulations shall apply to all equipment and materials furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

PART 2 - PRODUCTS

2.1 GENERAL

- A. General: Each PLC shall be of solid-state design. All central processor (CPU) operating logic shall be contained on plug-in modules for quick replacement. Chassis-wired logic is not acceptable. The controller shall be capable of operating in a hostile industrial environment and designed to provide high reliability specifically in this process application. The internal wiring of the controller is to be fixed, with the logic functions it must perform in a given application to be programmed into its memory. The controller shall be supplied with the CPU, input/output scanner, inputs, outputs, memory, power supply, and all power and interface cables necessary to function as a complete and operable PLC system.
- B. Design: Each PLC shall have all of the facilities required to implement the control schemes and database indicated. Instrumentation and control system shall have the following functions and features:
 - 1. Modular, field-expandable design allowing the system to be tailored to this process control application. The capability shall exist to allow for expansion of the system by the addition of hardware and/or user software.
 - 2. The processor plus input and output circuitry shall be of a modular design with interchangeability provided for all similar modules. Modules are

defined herein as devices that plug together to form an interlocking modular chassis. The design must prohibit upside-down insertion of the modules.

- 3. The PLC shall have downward compatibility whereby all new module designs can be interchanged with all similar modules in an effort to reduce obsolescence.
- 4. All hardware shall operate at an ambient temperature of 0 to 60 degrees C (32 to 140 degrees F), with an ambient temperature rating for storage of 40 to + 85 degrees C (- 40 to + 185 degrees F), and shall function continuously in the relative humidity range of 5 percent to 95 percent with no condensation. The PLC system shall be designed and tested to operate in the high electrical noise environment of an industrial plant.
- 5. The PLC shall provide a means for mounting the chassis in a standard cabinet.
- C. Central Processors: The CPU shall contain all the relays, timers, counters, number storage registers, shift registers, sequencer, arithmetic capability, and comparators necessary to perform the indicated control functions. It shall be capable of interfacing sufficient discrete inputs, analog inputs, discrete outputs, and analog outputs as shown on the drawings. The Processor shall be an Allen Bradley ControlLogix 1756-L61, as shown on the Drawing, no exceptions. The CPU shall be supplied with a 64 MB Compactflash card Allen-Bradley 1784-CF-64, or equal. The instrumentation and control system shall have the following features and capabilities:
 - 1. Modular, field-expandable design allowing the system to be tailored to this process control application. The capability shall exist to allow for expansion of the system by the addition of hardware and/or user software.
 - 2. The CPU shall be a self-contained unit, and shall provide control program execution and support remote or local programming. This device shall also supply I/O scanning and inter-processor and peripheral communication functions.
 - 3. The operating system shall be contained in removable programmable devices which allow for easy field replacement.
 - 4. The CPU within the system shall perform internal diagnostic checking and give visual indication to the user by illuminating a "green" indicator when no fault is detected and a "red" indicator when a fault is detected.
 - 5. Non-volatile memory shall store the operating system information to protect against loss in the case of power loss or system shut-down. Only at the time of a hardware change shall this configuration status be altered or re-entered.

- 6. Storage (Memory).
 - a. The program storage medium shall be of a static RAM type.
 - b. The PLC system shall be capable of addressing up to 768 kilobytes, where each word is comprised of 8 data bits.
 - c. Memory capacity shall be configurable to allow for the most economical match to the intended application. It shall be possible to upgrade to a processor with a larger memory size simply by saving a program, replacing the processor, and downloading the program to the new system without having to make any program changes.
 - d. Memory shall contain battery back-up capable of retaining all stored program data through a continuous power outage for 4 months under worst case conditions. The capability shall exist to remove all batteries from the system without removing system power. A low battery condition must be detectable in ladder logic, but shall not automatically generate a major fault.
 - e. The operator shall be able to backup volatile memory, including data and program logic, onto external hard disk, at their option.
 - f. All user memory in the processor not used for program storage shall be allocatable from main memory for the purpose of data storage. The PLC system shall be capable of storing the following data types:
 - i. External Output Status
 - ii. External Input Status
 - iii. Timer Values
 - iv. Counter Values
 - v. Signed Integer Numbers (16-bit)
 - vi. Floating Point Numbers
 - vii. Decimal Numbers
 - viii. Binary Numbers
 - ix. BCD Numbers
 - x. Direct and Indexed Addressing
 - xi. Internal Processor Status Information

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- xii. ASCII Character Data
- xiii. ASCII String Data
- xiv. Block Transfer Control Structures
- xv. Floating Point PID Control Structures
- xvi. File Instruction Control Structures
- xvii. Message Control Structures
- 7. Control logic programs shall have immediate access to the sub-elements of control structures by address and sub-element mnemonic, such as timer accumulator value, timer done bit, or PID Process Variable value.
- 8. Each unit shall be supplied with memory to implement the indicated control functions. The memory shall be programmed in a multi-mode configuration with multiple series or parallel contacts, counters, timers, and arithmetic functions.
- D. Ethernet Interface and Network.
 - 1. The PLC system shall offer industry standard Ethernet TCP/IP communication capabilities. The controller shall be able to connect to industry standard 10baseT media types by implementing a standard RJ-45 transceiver port that can connect to different transceivers. The PLC shall have a selectable option of using 802.32 as the interface to the network as well as DIX Ethernet II. There shall be a software protocol layer that uses TCP/IP as the transport mechanism to deliver packets of data to other instrumentation and control system devices that use the same protocol. This protocol handles the addressing and transfer of all the specific data file types in the PLC to allow for peer-to-peer messaging.
 - a. Token passing system
 - b. Peer-to-peer communication
 - c. Message error checking
 - d. Retries of unacknowledged messages
 - e. Diagnostic checks on other stations
 - f. Interface to more than one network
 - g. A user-oriented command language for manipulation of data

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structures of variable size and organization, such as setting or resetting bits, word and file transfers in a peer processor

- h. The ability to perform PLC memory uploads and downloads
- i. The ability to communicate with all other models of PLC manufactured by said manufacturer
- j. The ability to monitor the status of any processor remotely via the network
- k. The ability to automatically broadcast data to (and receive data from) all compatible stations on the link. Once configured, this operation shall be continuous without operator intervention
- I. A gateway interface to the Ethernet TCP/IP network for connectivity to host computers as well as other instrumentation and control system devices that have direct Ethernet connectivity
- 2. The PLC system shall allow industry standard repeaters, bridges, routers, and gateways on the network in order to access other instrumentation and control system devices and host computers. The controller shall be able to name a specific gateway/router IP address in order to direct data to other networks.
- 3. On-line programming and upload/downloads of control programs shall be able to occur over the Ethernet network.
- E. PLC Power Supply
 - 1. The PLC shall operate in compliance with an electrical service of 24 VDC. The power supply shall be mounted in the PLC housing and be sized to power all modules mounted in that housing and an "average module load" for any empty housing slots plus 25 percent above that total. Power supply shall be by the same manufacturer as the PLC and shall be of the same product line. A single main power supply shall have the capability of supplying power to the CPU and local input/output modules. Auxiliary power supplies shall provide power to remotely located racks.
 - 2. The power supply shall be Allen-Bradley 1756-PB75.
- F. PLC Input/Output (I/O) Modules
 - I/O Modules General: All I/O housings and modules shall be suitable for hostile industrial environments. The I/O's shall be 4-20 mA DC for all analog inputs and outputs and shall be 24VDC for discrete inputs and dry relay contacts for safe discrete outputs. Each PLC I/O location shall contain the I/O module quantity and type as shown on the Drawings.
 - 2. Discrete Input Modules: Defined as contact closure inputs from devices

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external to the programmable controller module. Input modules shall be Allen-Bradley 1756-IB16.

- 3. Discrete Output Modules: Defined as contact closure outputs for ON/OFF operation of devices external to the programmable controller module. Discrete output contacts shall be provided with interposing relays in the control panel. Output modules shall be Allen-Bradley 1756-OX8I.
- 4. Analog Input Modules: Defined as 4 to 20 mA DC signals, where an analog to digital conversion is performed with 14-bit precision and the digital result is entered into the processor. The analog to digital conversion shall be updated with each scan of the processor. Input modules shall be source or sink to handle 2-wire or 4-wire transmitters, respectively. Input modules shall be Allen-Bradley 1756-IF8.
- 5. Analog Output Module: Defined as 4 to 20 mA DC signals, where an analog to digital conversion is performed with 13-bit precision and the digital result is entered into the processor. Output modules shall be Allen-Bradley 1756-OF6CI.

2.2 NOT USED

2.3 **PROGRAMMING SOFTWARE**

- A. System Supplier shall furnish one licensed copy of PLC programming software for the District.
- B. The software shall be suitable for running on a laptop computer running Windows XP operating system software. A full legal set of programming software documentation shall accompany each copy of the software. Each copy of the programming software shall include all necessary device drivers and add-on software packages.
- C. The PLC programming software shall be RSLogix 5000 Professional by Rockwell Automation.

2.4 SYSTEM ENCLOSURES

A. Programmable logic controllers and input/output hardware shall be housed in shop-assembled panels as described in the Panels section.

2.5 OPERATOR INTERFACE TERMINALS

A. Operator interface terminals (OIT) shall be microprocessor-based flat panel type. The unit shall have data entry capabilities and shall include a password security function. The unit shall be connected to the PLC and shall display status, alarm, and diagnostic information. The unit shall provide a nominal diagonal display area dimension of 5. The operator interface unit shall be provided with an

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Ethernet port for communications, and one serial RS-232 or RS-485 port for programming. The OIT shall be rated NEMA 4X, suitable for panel face.

- B. Terminals shall be powered from 24 VDC. Terminals shall be suitable for ambient temperatures of +32 to +130°F and a relative humidity of 5 to 95 percent.
- C. One licensed copy of the OIT software used to create the screens shall be turned over to the District upon successful startup and commissioning of the system.
- D. The operator interface unit shall be an Allen Bradley Panelview 7 with color touch screen.
- E. The OIT shall provide graphic screens that shall be used by the operators to access all functions and setpoints necessary for comprehensive control. The supplier shall be responsible for developing and configuring the custom graphic displavs. Each piece of major process equipment that is monitored and controlled by the control system shall be displayed on the graphic screens. Graphic screens shall be representations of the equipment and piping. The screens must accurately show all devices and equipment that is part of the control loops. The supplier shall use the software configuration standards and conventions to be established by direct coordination with the District that shall describe and define such items as proposed graphic display process line colors/representations; color standards for "on", "off", "opened", "closed", and "alarm" conditions; alarm handling conventions; how items will be selected for control; methods for navigation between displays; address usage/naming conventions; and security setup. Displays will be designed and programmed by the District's System Integrator. The System Integrator will load the displays into the OIT and test them at Factory Test and during startup with Contractor's support.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. Field check, testing, and training shall be as specified in the Instrumentation and Control System section.

3.2 SOFTWARE CONFIGURATION

- A. PLC Programming and Configuration (by District)
 - 1. The PLC software program will be fully configured and tested by the District's Programmer with full support of the Contractor.
- B. Communications Configuration

- 1. The communications shall be fully configured and installed by District Programmer. Communication requirements, such as IP addressing shall be coordinated with the District.
- C. District SCADA HMI
 - 1. The District's Programmer will modify the District's SCADA software at Central to add the new pump station PLC and will test the changes with Contractor's support.

END OF SECTION

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Requirements of Division 1 and Section 17000 form a part of this Section. This Section specifies field instrument devices for process instrumentation, auxiliary equipment and supplies directly related to the installation of and operation of these devices, to perform the required functions in conjunction with information and equipment specified in other sections of Division 17.

1.2 SUBMITTALS

- A. Shop drawings to be submitted in this section shall be made in one package under the Product Review Category of Shop Drawings.
- B. Shop Drawings: In addition to the requirements of Section 17000, shop drawings shall include for each type of instrument: supply voltage and frequency, electrical load, accuracy, description of operation, operating instructions, and calibration procedure.
- C. Installation Method: The proposed method of mounting sensors and instruments shall accompany all shop drawings.

1.3 QUALITY ASSURANCE

- A. Manufacturer: In addition to the requirements of Section 17000, field instrument devices furnished shall be manufactured by firms regularly and currently engaged in the design and manufacture of similar equipment. All equipment furnished shall be new and of current design.
- B. Maintainability: All equipment shall be designed for ease of maintenance and repair, and access to critical parts shall not require a major disassembly. Internal field adjustments where permitted or required herein shall be easily accessible upon removal of a panel or cover.
- C. Materials and Installation: Materials and installation shall comply with the requirements of the current editions of referenced electrical codes and standards, and the codes and standards referred to shall be used for establishing the minimum quality of the materials and equipment supplied and installed. All equipment of the same type shall be products of the same manufacturer. Capacities of all equipment shall not be less than that indicated in the Instrument Index.

PART 2 – PRODUCTS

2.1 PRESSURE GAUGES

A. Pressure gauges shall be 4-1/2 inches in diameter, bottom connected, with white laminated dials and black graduations. Gauges shall have a blowout disc and safety glass, encased in phenolic, steel or cast iron. Measuring element shall be a stainless steel bourdon tube with welded, stress-relieved joints. Socket shall

SECTION 17200 – FIELD INSTRUMENTS

have wrench flats. Movement shall be rotary geared, all stainless steel material. All pressure gauges shall be provided with a pulsation snubber constructed of 316 stainless steel and an isolation valve. Accuracy shall be plus and minus ½ percent range. The pressure gauge shall be Ashcroft 1279, or approved equal.

2.2 CABINET INTRUSION SWITCH

- A. Each intrusion alarm limit switch shall transmit a signal when the monitored door or hatch is not in the closed position.
- B. Each limit switch shall be SPDT, rated for 5 amps. Conduit entrance and terminals shall be epoxy sealed. Limit switch mounting and actuator shall be determined by the Contractor to provide a reliable, positive, and accurate indication of entrance. The switch shall be normally open (actuated closed when the door or hatch is closed). Switch shall be mounted for minimum obstruction of access. Limit switches shall be Type "C" by Square D, Allen Bradley 802T, or equal.

2.3 PRESSURE TRANSMITTERS

A. The pressure transmitters shall be SMAR Model LD291 series, no equal. Provide +/- 0.075% accuracy, 40 to 1 turndown, Integral LCD Display, 316SS body, 316SS Internal diaphragm with integral temperature compensation and silicone fill fluid, variable capacitance sensing cell, NEMA 4X housing, explosion proof, 4 to 20 mADC output with HART super-imposed on 4 to 20 mADC signal, 2 wire device, loop powered 24 VDC, 32 seconds of programmable dampening, range 0 to 9 psig to 0 to 360 psig (programmable), 1/2" FNPT bottom connection 316SS. Provide Oliver Model G12MFS integral mounted 316SS Block & Bleed Valves with 1/2" NPT hex head adapter for each transmitter for proper bleeding of air out of the transmitter on start-up and blocking the instrument from the process for removal and installation.

2.4 LIMIT SWITCHES

A. Door limit switches shall be the mechanical turret head type. Provide limit switch with one Form C contact. Switch mounting shall be located in the top of the door and frame such that switch transfers when door is not fully closed. Limit switch shall Allen Bradley 802MC, or equal.

2.5 FLOOD SWITCH

A. Switch shall be a stem mounted float device with 304 stainless steel stem, Buna N Float Material, Lucite Slosh Shield, IMO/GEMS Model LS-270 or approved equal.

2.6 BUBBLER

A. Provide Tesco Reactive Air Level Monitor, pressure bell and associated tubing and conduit indicated.

2.7 LEVEL TRANSMITTER

A. Transmitter shall be suitable for Class 1, Division 1 locations. Provide Druck PTX 1290 submersible transmitter. Provide enclosure with aneroid bellows for the transmitter reference tube termination as indicated. Bellows shall be KPSI 815 or approved equal. Dessicant terminations are not allowed.

2.8 LEVEL SWITCHES

- A. Level switches shall be Form C mechanical microswitches in a plastic casing, freely suspended at the desired height from its own cable. The switch will tilt and not float when submerged.
- B. The switch casing shall be polypropylene with a PVC cord and protective EPDM rubber sleeve. The switch body shall be hermetically sealed without use of adhesives.
- C. The level switches shall be non mercury, FLYGT ENM-10 or approved equal. Provide intrinsically safe barriers as indicated.

2.9 GAS DETECTION

- A. The gas monitoring display shall consist of a NEMA 4X enclosure with viewing window. The control system will have four-channel receiver and three individual gas transmitters. The receiver shall have a common three-digit LED display of gas concentration which will scan through all channels or can be locked on an individual channel, plus individual channel LED indications of low, high, and fail alarms. Common relays enable remote annunciation of alarm, power loss, and transmitter failure. A 24 vdc power supply provides power to all transmitters. The front panel also includes buttons for alarm reset, horn silence, alarm test, and channel/mode select. Provide multiple and common alarm relay output.
- B. The explosion proof gas transmitters provide local indication of gas concentration, as well as 4-20mA output back to the receiver. All transmitter parameter adjustments shall be non-intrusive. Transmitter manufacturer shall be same as system controller. Provide detectors for the following gases and locations.

Pump Room	Low O2
Pump Room	H2S
Pump Room	Combustibles (Methane)

- C. The gas monitoring system shall be Sierra Monitor Corporation (SMC) Sentry Controller with associated SMC 5100 detectors, no equal. Provide wall mounting plates and hardware.
- D. Combustible gas detector shall be infrared type.

PART 3 - EXECUTION

3.1 INSPECTION
A. Inspect each instrument and piece of equipment for damage, defects, completeness and correct operation before installing. Inspect previously installed related work and verify that it is ready for installation of instruments and equipment.

3.2 SYSTEM INSTALLATION AND SUPERVISION

A. Furnish the services of authorized factory personnel especially trained and experienced in the installation of the equipment to: 1) supervise the installation in accordance with the approved Instruction Manual, 2) be present when the instruments and equipment are first put into operation, 3) inspect, check, adjust as necessary and approve the installation, 4) calibrate the instruments, in accordance with the specifications herein, until all trouble or defects are corrected and the installation and operation are acceptable, and 5) prepare and submit the specified Certified Report.

3.3 INSTRUMENT CALIBRATION

A. Provide the services of factory trained instrumentation technicians, tools and equipment to field calibrate each instrument to its specified accuracy in accordance with the manufacturers specifications and instructions for Calibration. Each instrument shall be calibrated at 0 percent, 50 percent and 100 percent of span using test instruments to simulate inputs and read outputs that are rated to an accuracy of at least 5 times greater than the specified accuracy of the instrument being calibrated. Such test instruments shall have accuracies traceable to the National Bureau of Standards, as applicable. Provide a written report to the District on each instrument certifying that it has been calibrated to its published specified accuracy. This report shall include a listing of the published specified accuracy, permissible tolerance at each point of calibration, calibration reading as finally adjusted within tolerances, defects noted, correction action required and correction made. This requirement does apply to all Analog Inputs to the system even though the devices are furnished by others.

3.4 SYSTEM VALIDATION

- A. Provide the services of factory trained and field experienced control system engineer(s) to validate each system is operational and performing its intended function. During system validation, make provisional settings on pressure, alarms, etc. Verify controllers by observing that the final control element moves in the proper direction to correct the process variable as compared to the set point.
- B. Check all systems thoroughly for correct operation. Test equipment for this function shall be specified under "Instrument Calibration".
- C. Immediately correct all defects and malfunctions disclosed by tests. Use new parts and materials as required and approved and retest. Provide a report certifying completion of system validation. This report shall indicate that the system meets the complete intent of these specifications.

3.5 FINAL OPERATIONAL TESTING AND ACCEPTANCE

- A. Upon completion of system validation, test all systems under process conditions. The intent of this test is to demonstrate and verify the operational interrelationship of the system. This testing shall include, but not be limited to, taking process variables to their limits (simulated or process) at the field device to verify all wiring, alarms, failure interlocks, and operational interlocks between systems and/or mechanical equipment.
- B. Immediately correct defects and malfunctions with approved methods and materials in each case and repeat the testing. Upon completion of final operational testing, submit certified report indicating the control system meets all the functional requirements specified herein. Upon agreement that the system is operational and acceptable, the engineer shall countersign this report and it shall constitute final acceptance of the system.
- C. Testing shall be observed by the District or their representative. Notify the District in writing a minimum of 72 hours prior to the proposed date for commencing the test. Upon completion of this test the System Supplier shall begin or have begun system startup.

3.6 INSTRUCTION OF DISTRICT'S PERSONNEL

A. Provide the services of a factory trained and field experienced instrumentation engineer to conduct group training of designated personnel in the operation of each instrument system. This training shall be for the time period of at least 1day and shall be performed during the operational testing period. Include instruction covering basic system theory, operating principals and adjustments, routine maintenance and repair, and "hands on" operation. The text for this training shall be the operation and maintenance manuals furnished under these specifications. Supplemented text prepared outlining actual operation of the system in practical application.

3.7 MOUNTINGS

- A. Mount and install equipment as indicated. Mount field instruments on pipe mounts or other similar means in accordance with supplier's recommendation. Where mounted in panels, mount according to requirements of that section.
- B. Equipment specified for field mounting shall be suitable for direct pipe mounting or surface mounting, surface-mounted indicators and equipment with calibration adjustments or requiring periodic inspection shall be mounted not lower than 3 feet 6 inches nor higher than 6 feet above walkways, platforms, catwalks, and the like, unless shown or specified.
- C. All devices shall be accessible to District for servicing, operating, reading, etc.

3.8 PROCESS CONNECTIONS

A. Provide instrument impulse tubing where required to meet the intended process service and ambient environmental condition for corrosive resistance, etc. Install impulse tubing with a continuous slope according to service to promote self

SECTION 17200 – FIELD INSTRUMENTS

draining or venting back to the process. Terminate connection to process lines or vessels in a service rated roof valve, provided under other Divisions, that will permit closing off the impulse line or removal of the element without requiring shut down of the process. Include blowdown of drip legs and valves for terminations of impulse lines at the instruments.

B. Process vessels, line penetrations, and root valves shall be furnished and installed by others. Instrument tubing and valve manifolds are installed as part of this Specification.

3.9 IDENTIFICATION

A. Provide conductor identification under the provisions of Section 16195.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

A. The Panels and Appurtenances section covers the furnishing of panels and appurtenances as listed below:

NEIGHBORHOOD 1 PUMP STATION PLC CONTROL PANEL

1.2 GENERAL

- A. Equipment furnished and installed under this section shall be fabricated and assembled in full conformity with the Drawings, specifications, equipment schedules, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.
- B. General Equipment Stipulations
 - 1. The General Equipment Stipulations shall apply to all equipment and materials provided under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1.3 SUBMITTALS

A. Submittals shall be made as specified in the Instrumentation and Control System section.

1.4 DELIVERY, STORAGE AND HANDLING

A. Delivery, storage and shipping shall be as per The Instrumentation and Control System section.

PART 2 - PRODUCTS

2.1 PANEL DESIGN AND FABRICATION FEATURES

All panels furnished shall conform to the stipulations of NEMA ICS-6-1993. Unless indicated otherwise on the Drawings, the following paragraphs describe general fabrication specifications for the PLC cabinets, instrument panels, consoles, enclosures, and subpanels. Panels shall be UL-508 listed.

- A. Enclosure
 - 1. Enclosure shall be free-standing, single door, NEMA 12 90-inches high x 36-inches wide x 24-inches deep with full height backpanel.
- B. Power Entrance
 - 1. The power entrance to each panel shall be provided with a surge protection device. Surge arresters shall be Transtector "ACP-100-HW

Series", Power Integrity Corporation "ZTA Series", Phoenix Contact "Mains PlugTrab", or MCG Surge Protection "400 Series".

- C. Power Wiring
 - Power distribution wiring on the line side of panel fuses shall be minimum 12 AWG. Secondary power distribution wiring shall be minimum 14 AWG. Wiring for ac power distribution, dc power distribution, intrinsically safe, and control circuits shall have different colors and shall agree with the color-coding legend on System Supplier's panel wiring diagrams. With the exception of electronic circuits, all interconnecting wiring and wiring to terminals for external connection shall be stranded copper, insulated for not less than 600 volts, with a moisture resistant and flame retardant covering rated for not less than 90°C.
- D. Instrument and Control Wiring
 - 1. All internal panel wiring shall be type MTW stranded copper wiring rated not less than 600 volts. Electronic analog circuits shall be twisted and shielded pairs rated not less than 300 volts. Analog circuits shall be separated from ac power circuits. Intrinsically safe circuits shall be physically separated from other circuits in accordance with applicable codes. Wires within the panel shall conform to the minimum size as shown in the table below.

Туре	Min. Wire Size	Color
AC Control	16 AWG	Red
DC Control	16 AWG	Blue
Analog Circuits	18 AWG Twisted Pair	Insert colors

- 2. All wiring shall be grouped or cabled and firmly supported inside the panel. Each individual wire in power, control, and instrumentation circuits shall be provided with identification markers at each point of termination. The wire markers shall be positioned to be readily visible for inspection and the identification numbers shall match the identification on the supplier's panel wiring drawings. Wiring shall be bundled in groups and bound with nylon cable ties or routed in Panduit or similar nonmetallic slotted ducts. Ducts shall be readily accessible within the panel, with removable covers, and with space equal to at least 40 percent of the depth of the duct remaining available for future use after completion of installation and field wiring. Sufficient space shall be provided between cable groups or ducts and terminal blocks for easy installation or removal of cables.
- E. Terminal Blocks
 - 1. Terminal blocks for external connections shall be suitable for 12 AWG wire and shall be rated 30 amperes at not less than 300 volts. Terminal blocks shall be fabricated complete with marking strip, covers, and pressure connectors. Terminals shall be labeled to agree with identification shown on the supplier's submittal drawings. A terminal shall

be provided for each conductor of external circuits, plus one ground for each shielded cable. Not less than inches of clearance shall be provided between the terminal strips and the base of vertical panels for conduit and wiring space. Not less than 25 percent spare terminals shall be provided. Each control loop or system shall be individually fused, and all fuses or circuit breakers shall be clearly labeled and located for easy maintenance.

- F. Device Tag Numbering System
 - 1. All devices shall be provided with permanent identification tags. The tag numbers shall agree with the Contract Drawings and with the supplier's equipment drawings. All field-mounted transmitters and devices shall have stamped stainless steel identification tags. Panel, subpanel, and rack-mounted devices shall have laminated phenolic identification tags securely fastened to the device. Hand-lettered labels or tape labels will not be permitted.
- G. Nameplates
 - 1. Nameplates shall be provided on the face of the panel or on the individual device. Panel nameplates shall have legends and approximate dimensions as indicated on the Drawings and shall be made of laminated phenolic material having engraved letters approximately 3/16 inch [5 mm] high extending through the black face into the white layer. Nameplates shall be secured firmly to the panel. Panel face nameplates do not replace the requirement for device identification tags as specified under the Device Tag Numbering System paragraph.
- H. Indicating Light Color Designations
 - 1. Indicating lights shall be colored as shown in the following table unless indicated otherwise on the Drawings, in other specification sections, or in the instrument device schedule.

	Meaning
Red	Associated equipment or device is "stopped, " "open," or is in an "unsafe" state or position
Green	Associated equipment or device is "running," "closed " or is in a "safe" state or position
Yellow or Amber	Associated equipment or device has "failed" or a process alarm condition is present or imminent.
White	All other conditions not defined above.

- I. Panel-Mounted Instruments
 - 1. Instruments, power supplies, pilot devices, and appurtenances shall be provided as required for proper, efficient use of the control panel.

- J. Factory Test
 - 1. Panels shall be factory tested electrically and pneumatically by the panel fabricator before shipment.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Installation requirements are specified in the Instrumentation and Control System section. In addition, equipment furnished under this section shall conform to the following manufacturing stipulations.
 - 1. Wiring
 - a. All wiring shall be grouped or cabled and firmly supported inside the panel. Wiring shall be bundled in groups and routed in Panduit or similar nonmetallic slotted ducts. Ducts shall be readily accessible within the panel with removable covers and shall have a space of at least 40 percent of the depth of the duct available for future use after installation is complete and all field wiring installed. Sufficient space shall be provided between cable groups or ducts and terminal blocks for easy installation or removal of cables.

END OF SECTION

APPENDIX A

SDG&E INFORMATION



Project 300000229671

November 7, 2018

Joe Moraes Joe@Moraespham.com

Dear Mr. Moraes:

Subject: YOUR PROJECT HAS BEEN ISSUED TO CONSTRUCTION

The electric service order to serve your project has been issued to our Construction Department. Please feel free to call 760-432-5805 (Northern Projects) to arrange a pre-construction meeting or to discuss any construction-related questions.

PROJECT IDENTIFIERS

When calling our Construction Department, the following will identify your project:

Project Name:	New UG Svc – Olivenhain MWD	
Service Order #:	Electric: 300000229671	

SITE ACCESS – LINE TRUCK, METER, SERVICE, AND TRANSFORMER

SDG&E must have line truck access to gas and electric facilities for the purpose of installation, reading, testing, inspection, maintenance, and emergencies (refer to SDG&E Service Standards and guide sections 016, 005, 604, and 1006-1008).

CHECKLIST

The following items must be completed before meter can be set:

- □ Your work must be completed and accepted, and SDG&E's portion of the work must be completed.
- Ensure that the address on your building permit is the same address you provided to SDG&E for your project. If not, delays in meter set(s) and any applicable refunds may result.
- ❑ Whoever is going to be responsible for the billing needs to call our Customer Contact Center and make application. The Center is open 24/7 and the number is toll free: 1-800-411-SDGE (7343).
- We must receive either permanent or temporary inspection clearances from the County of San Diego.

Please be advised that prior to construction, County approval is required for your meter and/or service. Once the authority having jurisdiction notifies us that your equipment has been inspected and passed, and SDG&E's work is complete, it will take approximately three days to set the meters. This assumes we already have an approved address list and application from whomever is to have the service in their name. These last few items can cause unfortunate delays if not attended to in a timely manner.

THANK YOU

We appreciate your business and hope you are very satisfied with our service. If I may be of further assistance or should you have any non-construction-related questions (easements, charges, etc.), please call me or my assistant at the number below. Our normal office hours are 7:00 a.m. to 4:00 p.m., Monday through Friday. For additional general information, please visit our website at <u>http://sdge.com/index.html</u>.

Sincerely,

Jaíme García by ds

Jaime Garcia Associate Customer Project Planner Telephone: (760) 739-7414 JG2/dms

From:	Persing, Andrea
To:	Karen Ogawa
Subject:	FW: Olivenhain MWD New UG service (not in Encinitas)
Date:	Wednesday, October 6, 2021 6:34:17 AM
Attachments:	image006.png

Good morning. Due to the time the job was sitting in construction, they sent it back to planning. I will re-send over to construction. When you're ready for trench inspection, just call 760-432-5805 to schedule an inspector.



Andrea Persing Project Planner III T 760-480-7729 E apersing@sdge.com A 571 Enterprise St, Escondido, Ca 92029 SDG&E Construction Manuals www.sdge.com/builder-services/standards-manuals Track your project(s) with the Builder Services Customer Portal: www.sdge.com/builder-services/builder-services-portal Build a Better Business www.sdgenews.com Follow us: () () () () ()

From: Karen Ogawa <kogawa@olivenhain.com>
Sent: Tuesday, October 5, 2021 10:47 AM
To: Pasqualini, Paola B <<u>PPasqual@sdge.com</u>>
Subject: [EXTERNAL] Olivenhain MWD New UG service (not in Encinitas)

*** EXTERNAL EMAIL - Be cautious of attachments, web links, and requests for information ***

Hi Paola-it was good to 'see' everyone at the utility meeting today.

We have a project that is not in Encinitas, but I was wondering of you could help me out with a contact.

The project number is 300000227623/order no. 300000229671.

This began sometime in 2018, and made it through engineering and the (then) Rule 16 UG service costs were paid.

The project was then postponed due to budget (I'm sure you are familiar with that scenario). We are ready to place the project out to bid, but don't know the status of the project with SDG&E. Our project planner was Jaime Garcia. I've left him several messages but what is odd is that his VM says