STANDARD SPECIFICATION
SECTION 15251 INSTALLATION OF STEEL TRANSMISSION PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes the installation of cement mortar lined and di-electric coated and/or cement-mortar coated steel pipe including pipe bedding, pipeline closures, connections, encasement, marking tape, and marker posts.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Standard Drawings.

B. Record Drawings and Submittals: STD SPEC 01300.

C. Trenching, Backfilling, and Compacting: STD SPEC 02223.

D. General Concrete Construction: STD SPEC 03000.

E. Miscellaneous Metalwork: STD SPEC 05121.

F. Painting and Coating: STD SPEC 09900.

G. Polyethylene Sheet or Tube Encasement: STD SPEC 09954.

H. Polyethylene Tape Pipe Coating: STD SPEC 09957.

I. Corrosion Control for Buried Piping: STD SPEC 13110.

J. General Piping Requirements: STD SPEC 15050.

K. Steel Transmission Pipe: STD SPEC 15061.

L. Flexible Pipe Couplings: STD SPEC 15122.

M. Disinfection of Piping: STD SPEC 15141.

N. Pressure Testing of Piping: STD SPEC 15144.

1.03 SUBMITTALS

A. Submit submittal packages in accordance with Standard Specification Section 01300.

B. Submit installation schedule.

C. Submit welder qualification certificates and records for each welder.

D. Submit certificates of welding rods used for field welding.

E. Submit manufacturer's catalog data and descriptive literature on marking tape.

PART 2 - MATERIALS

2.01 PIPE MATERIAL

See Standard Specification Section 15061.

2.02 BOLTS, NUTS AND GASKETS FOR FLANGES

See Standard Specification Section 15050.

2.03 POLYETHYLENE TAPE PIPE COATING

See Standard Specification Section 09957.

2.04 POLYETHYLENE ENCASEMENT

See Standard Specification Section 09954.

2.05 CORROSION CONTROL COMPONENTS

See Standard Specification Section 13110.

2.06 CEMENT MORTAR

A. Cement mortar for buttering, pointing, and grouting shall consist of one part cement to 1-1/2 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 C 150, Type II. Sand for buttering and pointing the inside joints shall conform to ASTM C 144 for masonry sand. Sand for grouting the exterior joints shall conform to ASTM C 33 for fine aggregate or to ASTM C 35 for plaster sand.

B. Where time is of the essence or at the option of the Contractor, a rapid set cement may be used to point the inside joint or grout the exterior pipe joint and shorten the set up time before backfilling. Use a non gas-liberating type, chloride free, cement base, premixed product in 50-pound bags requiring only the addition of water for the required consistency. Grout shall be CTS Cement Manufacturing Company "Rapid Set Non-Shrink Multipurpose Grout" or District approved equal.

2.07 MARKING TAPE

Use detectable 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 can not be separated by hand. Tape shall be a minimum of 5 mils thick and 6 inches wide. 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.

2.08 MARKER POSTS

Provide marker posts for buried pipelines at 500 feet on center except where pipeline is located in a paved street or as directed by the District's Representative. Use construction heart garden grade redwood per Standard Specifications for Grades of California Redwood Lumber issued by the Redwood Inspection Service. Provide seasoned redwood, 4 inches by 4 inches, and surfaced on four sides. As an alternate to the redwood post, use 4-inch diameter, Schedule 80 PVC pipe, filled with cement grout, and painted white.

PART 3 - EXECUTION

3.01 DELIVERY AND TEMPORARY STORAGE OF PIPE

A. Limit onsite pipe storage to a maximum of one week. Place the pipe in the numerical order in which it is to be installed and secure it from rolling. Support the pipe on wooden blocks, sandbags, mounds of sand, or other suitable supports. Place the supports at about the one quarter point from the pipe ends. Do not roll or drop the pipe on the ground or allow the pipe to fall from the pipe trailer trucks.

B. Do not remove the plastic caps placed over the ends until the pipe is ready to be placed in the trench. Plastic caps may be opened temporarily to spray water inside the pipe for moisture control. Replace plastic caps damaged during shipment.

3.02 HANDLING OF PIPE

A. Lift pipes and specials with mechanical equipment using spreader beams or wide belt slings. Do not use cable slings or chains directly bearing on the pipe. Lift pipes at two points, at approximately 1/3 to 1/4 of the pipe length from the pipe ends.

B. For pipes 24 inches in diameter and larger, maintain internal braces placed in pipes until backfilling is completed. Where the pipe is to be concrete encased, do not remove internal braces until the concrete has set hard and the subsequent backfill has been completed.

C. Measure each pipe and special to check the laying length against the tabulated layout schedule for fabrication accuracy. Mark the required stab depth of the spigot end around the circumference of each pipe and special prior to joint assembly.

3.03 SANITATION OF PIPE INTERIOR

A. During laying operations, do not place tools, food, clothing, trash, or other materials in the pipe. Keep the interior of the pipe clean as the pipeline construction progresses. The purpose of maintaining a clean interior is to aid in the passage of the bacteriologic quality testing after disinfection.

B. When pipelaying is not in progress, including the noon hour, close the ends of the installed pipe with a plug to deter entry of vermin, children, dirt, and storm water.

3.04 INSTALLING PIPE IN TRENCH

A. See Standard Specification Section 02223 for earthwork requirements.

B. Lay pipes uphill if the grade exceeds 10 percent.

C. Place and compact the pipe base material (imported sand).

D. Cut a depression to accommodate the pipe bell, external joint filler form, and polyethylene encasement at valves and flanges; and, spaces to permit removal of the pipe handling slings.

E. Handle pipe and specials in a manner to avoid any damage to the pipe or coatings. Do not drop pipe or specials into trenches under any circumstances.

F. Lay each pipe and special in the order and position shown on the tabulated layout schedule. Lower the pipe onto the pipe base and install it to line and grade along its full length on firm bedding except at the bell and at the sling depressions. 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 tabulated layout schedule.

G. When installing pipe with beveled joints or mitered bends at the bell end, do not deviate the pipe top mark by more than 2 inches from the vertical line passing through the pipe center.

H. Do not cut or modify a fabricated steel special in the field. Notify the District's Representative immediately in the event of interferences with the installation of adjoining components.

I. For pipes smaller than 24 inches in diameter, the District will require that the Contractor provide video camera inspection with tape recording of the completed interior mortar joints in the installed pipe at an interval of approximately 960 feet or less. This inspection will be reviewed by the District's Representative. No additional pipe will be allowed to be installed in the trench until the interior joints have been inspected and repaired. An interior joint will be considered a failed joint when cement mortar does not fill the gap 100 percent between the adjacent mortar linings of the two joined pipes. All failed joints will be repaired by cutting out the joint and installing a butt strap closure. The inspection equipment shall be capable of providing distance readings; high quality visual transmission to the monitor; tape recording; brightness, contrast, and focus adjustments; 360-degree camera head rotation within a 90-degree plane from the longitudinal centerline of the pipe; and remote operation.

J. For pipes 24 inches in diameter and larger, the amount of pipe to be laid and assembled in a trench shall be limited to a distance of approximately 320 feet. No additional pipe will be allowed to be installed in the trench until the other related operations of pipeline construction are completed. Other operations include, but are not limited to, joint welding or bond wires, grouting of exterior pipe joints, backfilling and compacting, removal of internal braces, completion of interior joints, and inspection by the District’s Representative. The intent of this limitation is to provide a safe environment for the construction and inspection of the pipeline. The interior of the pipeline is considered a confined or enclosed space having a limited means of egress which is subject to the accumulation of toxic or flammable contaminants or has an oxygen deficient atmosphere.

3.05 INSTALLING POLYETHYLENE ENCASEMENT

Wrap buried valve and flanges with polyethylene material per Standard Specification Section 09954. Repair polyethylene material damaged during construction.

3.06 ASSEMBLING PIPE JOINTS

A. Clean the ends of the pipe to be joined of foreign material.

B. For rubber gasket joints, apply a nontoxic water soluble vegetable soap solution to the inside of the bell of the pipe in the trench and to the rubber gasket and spigot groove of the pipe to be installed. Stretch the rubber gasket into the groove of the spigot end of the pipe to be inserted and distribute it uniformly around the circumference. Immediately lower the pipe to be installed into the trench and, without tilting the pipe, enter its spigot into the bell of the pipe in the trench. Use come-a-longs or pipe jacks to drive spigot end home horizontally. Maintain joint recess recommended by pipe manufacturer for made-up joint.

C. For field welded joints and pipes smaller than 24 inches in diameter, lower the pipe to be installed into the trench. Slightly tilt up the pipe to be installed and enter its spigot into the top portion of the bell of the pipe in the trench. Continue to lower the pipe to be installed and push the spigot end into the bell horizontally to the marked stab depth on the spigot. Maintain a minimum 1/4-inch joint space, or as recommended by the pipe manufacturer.

D. For field welded joints and pipes 24 inches in diameter and larger, lower the pipe to be installed into the trench. Slightly tilt up the pipe to be installed and enter its bell onto the top portion of the spigot of the pipe in the trench. Continue to lower the pipe to be installed and push the bell onto the spigot horizontally to the marked stab depth on the spigot. Maintain a minimum 1/4-inch joint space for welded joints or as recommended by the pipe manufacturer.

E. Where deflections at joints are required to maintain horizontal and vertical alignment, the joint can be pulled up to the maximum limits as specified per Standard Specification Section 15061. Do not exceed the deflection limits indicated.

3.07 INSTALLING PIPE IN VAULTS

A. Install pipe in vaults without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment. Provide temporary supports and place the assembled piping at the correct grade and position in the vault.

B. Provide pipe supports per Standard Specification Section 05121.

3.08 INSTALLING FLANGED JOINTS

See Standard Specification Section 15050 for installation instructions.

3.09 INSTALLING INSULATING FLANGE KITS

Install insulating flange kits with coatings per Standard Specification Section 13110.

3.10 INSTALLING MECHANICAL CLAMP-TYPE COUPLINGS

A. Install mechanical clamp-type couplings in accordance with the manufacturer’s recommendations and the following.

B. Clean oil, grease, and dirt from the grooved and shouldered ends of pipe. Repair any damage or holidays in the shop applied coating before installing couplings. Apply the

coupling manufacturer's gasket lubricant to the gasket exterior including lips, pipe ends, and housing interiors.

C. Lubricate threads of bolts and nuts with oil or graphite prior to installation. Uniformly tighten bolts and nuts alternately and evenly until coupling segments are seated. Apply torque to nuts with a calibrated torque wrench as recommended by the coupling manufacturer.

3.11 INSTALLING FLEXIBLE PIPE COUPLINGS

Install flexible pipe couplings and joint harnesses where shown per Standard Specification Section 15122.

3.12 FIELD WELDED JOINTS

A. Field welding shall be completed and inspected prior to the application of cement mortar to the interior joint and cement grout to the exterior joint.

B. Provide single or double welded lap joints and butt strap closures where indicated on the Drawings. The minimum overlap of the assembled lap joint shall be 1-inch or 3 times the pipe wall thickness, whichever is greater per AWWA C206.

C. Field welding shall be in accordance with AWWA C206. Welder's qualifications shall be in accordance with AWWA C206 Section 4.4. Any welder performing work shall have been qualified for the process involved within the past three years. Welders shall present a copy of their certification to the District's Representative prior to performing any field welding.

D. If joint faying surfaces are rusted or pitted where weld metal is to be deposited, clean them by wire brushing or abrasive blast cleaning.

E. Provide a 2-inch minimum overlap for the butt strap on each of the adjoining pipe ends. Butt weld the longitudinal seams of the butt strap before completing the circumferential fillet welds. The longitudinal seams of the butt strap shall be offset from the pipe seams by a minimum of 3 inches. Do not install butt straps with angular deflections.

F. To apply a fillet weld to the exterior joint of lap welded pipe or butt strap closures, deposit weld material in successive layers. Minimum size of fillet weld shall be equal to the steel cylinder thickness. Complete each pass around the entire circumference of the pipe before commencing the next pass. Use electrodes recommended by the pipe fabricator. Do not deposit more than 1/8-inch of throat thickness per pass. The minimum number of passes or beads in the completed weld shall be as follows:

Steel Cylinder Thickness (inches)	Fillet Weld Minimum Number of Passes
0.2500 and Less	2
Greater than 0.2500	3

G. Clean each layer of deposited weld metal prior to depositing the next layer of weld metal, including the final pass, by a power-driven wire brush.

H. In lieu of exterior welded joints, the interior may be welded where the pipe diameter is greater than 24 inches. Backfill to one foot over the top of pipe except at the joints. Complete the interior weld prior to filling the outside joint recess with cement mortar.

3.13 PIPELINE CLOSURE ASSEMBLIES

A. Use pipeline closure assemblies (butt straps) to unite sections of pipeline laid from opposite directions and to adjust the field length of the pipeline to meet structures, other pipelines, and points established by design stations.

B. Center the shaped steel butt straps over the ends of the pipe sections they are to join and provide a minimum of 2 inches of overlap on the pipe ends. Weld the butt straps to the outside of the pipes with complete circumferential fillet welds equal in size to the thinnest part being joined and on the inside where indicated. Butt weld the longitudinal seams of the butt strap before completing the circumferential fillet welds.

1. Where butt straps are to be installed with no interior access available, perform welding from the outside of the pipe only. Prepare the longitudinal seams of the butt strap for a full penetration butt weld. Use an interior backing plate in the gap for the full width of the joint. Provide carbon steel plates equal to the thickness of the pipe wall by 1-inch wide by the width of the joint. Fillet weld the backing plates to each interior side of the bottom half of the butt strap. Each backing plate shall project 1/2-inch above the longitudinal seam of the bottom half of the butt strap. Once the butt welds of the longitudinal seams are complete, then the circumferential fillet welds at each end of the butt strap can be completed.

2. Where butt straps are to be installed with interior access available, perform welding from both the inside and outside of the pipe. Prepare the outside longitudinal seams of the butt strap for a full penetration butt weld. Use an interior backing plate in the gap for the full width of the joint minus 1-inch. Provide carbon steel plates equal to the thickness of the pipe wall by 1-inch wide by the width of the joint minus 1-inch. Fillet weld the backing plates to each interior side of the bottom half of the butt strap. Each backing plate shall project 1/2-inch above the longitudinal seam of the bottom half of the butt strap and be centered in the longitudinal length of the butt strap. Once the butt welds of the outside longitudinal seams are complete, then the outside circumferential fillet welds at each end of the butt strap can be completed. When the outside welds are complete, fillet weld around the inside backing plate and then complete the inside circumferential fillet welds at each end of the butt strap.

C. Cement mortar line the interior of closure assemblies to a mortar thickness equal to the adjoining pipe sections. Clean the inside steel surfaces by wire brushing or power brushing. Apply a cement and water wash coat prior to applying the cement mortar. Pack the cement mortar into the recess of the joint and steel trowel finish to match the adjoining pipes.

D. Apply a cement and water wash coat to the inside face of the closure plug and once dry apply cement mortar to the inside face. Thread plug into coupling once cement mortar is dry and seal weld.

E. Where the pipe is di-electric coated, install field applied polyethylene tape pipe coating with cement mortar overcoat to the exterior surfaces of the closure assemblies. As an alternative to finishing the field joint coating, install field applied heat-shrinkable pipe joint

sleeves with cement mortar overcoat to the closure assemblies. Install field joint coating per Standard Specification Section 09957.

F. Cement mortar coat the exterior of closure assemblies. Clean the outside steel surfaces of the butt strap and adjoining pipes by wire brushing or power brushing. Apply a cement and water wash coat to the steel surfaces and allow to dry. Wrap welded wire fabric reinforcement or expanded metal lath around the exposed steel and secure in place. Crimp the metal wires of the fabric or the metal lath at 4-inch spacing around the pipe to support the fabric or lath 3/8-inch from the exposed steel surface. Trowel cement mortar over the exposed steel surfaces in a two coat application. Apply the scratch coat and four hours later the finish coat. The finish coat may be applied sooner if the scratch coat is hard and self supporting. The cement mortar coating shall be equal in thickness to the adjacent coatings and have no voids, cracks, or blisters. Keep the coating moist by sprinkling or spraying with water to retard drying while curing.

3.14 CONNECTION TO EXISTING WATERLINES

Where new pipelines are to be connected to existing steel 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. Where rod wrapped concrete cylinder pipe exists, weld the reinforcing rod wrap to the cylinder wall of the pipe for a sufficient distance to anchor the rod wrap from movement at the point of connection. Do not cut or damage the rod wrap under any circumstances and do not cut the concrete cylinder pipe until the rod wrap has been anchored. This field verification shall be performed in the presence of the District's Representative.

3.15 INSTALLING CORROSION CONTROL COMPONENTS

Install bond wires, anodes, and test stations per Standard Specification Section 13110.

3.16 COMPLETING INTERIOR MORTAR JOINTS FOR PIPES SMALLER THAN 24 INCHES IN DIAMETER

A. Insert a tight-fitting swab or squeegee in the bell end of the pipe in the trench.

B. When ready to insert the spigot, coat the face of the cement mortar lining at the bell with a sufficient amount of stiff cement mortar to fill the space between adjacent mortar linings of the two pipes to be joined.

C. Immediately after joining the pipes, draw the swab or squeegee through the pipe to remove all excess mortar and expel it from the open pipe end.

D. Do not move the pipe after the swab has been pulled past the joint.

E. For pipes that have field welded joints, tack weld the joint after the swab has been pulled. Allow the mortar to harden before completing the field welded joint. Welding on pipes with fresh mortar joints will evaporate the moisture in the mortar and result in failure of the joint.

3.17 COMPLETING INTERIOR MORTAR JOINTS FOR PIPES 24 INCHES IN DIAMETER AND GREATER

A. Backfill the trench before applying interior lining at joints. Joints shall be lined immediately after backfilling and at no time shall the completion of the lining be further than 320 feet behind pipe laying.

B. Do not remove the internal braces until backfilling has been completed or until the concrete encasement and subsequent backfill are completed.

C. Working inside the pipe, remove foreign substances which adhere to the steel joint rings, clean them, and pack cement mortar into each joint. Finish the surface with a steel trowel to match the adjoining pipes.

D. Remove by sweeping excess mortar and other construction debris from the pipe interior as the pipeline construction progresses.

3.18 COMPLETING EXTERIOR PIPE JOINTS WHERE DI-ELECTRIC COATED

Install field applied polyethylene tape pipe coating with cement-mortar overcoat. As an alternative to finishing the field joint coating, install field applied heat-shrinkable pipe joint sleeves with cement mortar overcoat to the closure assemblies. Install field joint coating per Standard Specification Section 09957.

3.19 COMPLETING EXTERIOR PIPE JOINTS WHERE CEMENT-MORTAR COATED

A. Fill exterior joint recess with cement grout using a fabric form placed around the joint and secured with steel straps. At the option of the Contractor, a rapid set cement grout may be used to shorten the set up time before backfilling.

B. Pour and rod the grout from one side only until it is visible on the opposite side.

C. In approximately one hour, top off the joint with additional grout and shade with backfill material.

3.20 TRENCH BACKFILL

A. Provide sufficient space along each side of the pipe and trench wall to observe that the pipe zone material (imported sand) fills all spaces below pipe spring line.

B. Start the backfilling operations specified in Standard Specification Section 02223 after completing the exterior pipe joints and the cement grout is hard enough to be self-supporting.

C. No exterior pipe joint shall be backfilled until it has been inspected by the District's Representative.

3.21 PROTECTION OF MORTAR LINING

Until the pipeline is filled with water, install bulkheads and apply moisture inside the bulkheaded portions in a manner that will effectively prevent the drying out of the mortar lining.

3.22 INSTALLING MARKING TAPE

After the pipe zone has been backfilled and compacted, place the marking tape on the compacted pipe zone material and center over the pipe. Run tape continuously along the trench and tie ends of tape together. Wrap marking tape around valve box extension pipes and continue along pipe.

3.23 SETTING MARKER POSTS

Locate marker posts on centerline of buried pipeline and space at 500 feet on center. Cut redwood post to a 5-foot length and chamfer the top. Paint post per Standard Specification Section 09900, System No. 60. Use white paint for the finish coats. For potable water, use blue paint for the top 4 inches of the chamfered end and stencil in 2-inch-high blue letters the work “WATER” on the post. For recycled water, use purple paint for the top 4 inches of the chamfered end and stencil in 2-inch-high purple letters the abbreviation "RW" on the post. Excavate a hole 16 inches in diameter by 2 feet deep. Set the redwood post plumb, fill hole with concrete to 2 inches above finish grade, and crown to slope away from post. Concrete shall be Class C per Standard Specification Section 03000.

3.24 PAINTING AND COATING

A. Coat exterior surfaces of bare steel pipe in vaults per Standard Specification Section 09900, System No. 10. Apply finish coats in the field.

B. Coat exterior surfaces of mechanical clamp-type couplings and flexible pipe couplings the same as the adjacent pipes.

C. Do not paint or coat exposed insulating flange kits in vaults. Kits shall be electrically non-conductive and any paint on the washers and nuts will prevent the proper function of the kit.

3.25 PRESSURE TESTING

See Standard Specification Section 15144 for pressure testing requirements.

3.26 DISINFECTION

See Standard Specification Section 15141 for chlorination requirements.

END OF SECTION