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**SECTION 33 11 50 (CHANGE ORDER)****INSTALLATION OF STEEL PIPELINE****PART 1 – GENERAL****1.01 SUMMARY**

- A. The work included in this section consists of the Contractor providing the labor, material, and equipment for the laying and placement of fabricated welded steel pipe, specials and fittings in trenches.

**1.02 RELATED SECTIONS**

- A. Section 01 11 00 – Summary of Work
- B. Section 01 33 00 – Submittal Procedures
- C. Section 01 71 33 – Protection of Adjacent Construction
- D. Section 09 97 72 – Coating and Lining
- E. Section 26 42 40 – Corrosion Control
- F. Section 31 23 36 – Excavation and Backfill for Water Work
- G. Section 33 11 55 – Fabrication of Steel Pipe
- H. Section 33 11 56 – Field Welding of Steel Pipe
- I. Section 33 12 24 – Pipe Appurtenances

**1.03 REFERENCES**

- A. AWWA M11 – Steel Pipe – A Guide for Design and Installation, latest edition
- B. AWWA C200 – Steel Water Pipe 6-Inches and Larger, latest edition
- C. AWWA C206 – Field Welding of Steel Pipe, latest edition
- D. AWWA C210 – Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings
- E. AWWA C222 – Polyurethane Coatings for the Interior and Exterior of Steel Water

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Pipe and Fittings

- F. American Welding Society (AWS) – Structural Welding Code – Steel, D1.1
- G. American Welding Society – A3.0, Standard Welding Terms and Definitions.

**1.04 SUBMITTALS**

- A. Submit in accordance with Section 01 33 00.
- B. Pothole data
  - 1. Submit data showing top and bottom elevations of existing pipes/utilities crossing or adjacent to proposed 36-inch water transmission main.
- C. Shop Drawings:
  - 1. Layout and Schematics: Prior to preparing shop drawings, Contractor shall survey street grade and pothole along the proposed pipe alignment for verification of the alignment and location of existing utilities. Submit detailed installation drawings of all piping and connected equipment. The drawings shall include each pipe piece, all fittings, reducers, closures, valves and other appurtenances. Identify each fitting and piece of pipe using field location numbers and show stations and invert elevation of ends of each pipe section along with lay direction. Show invert elevations and station of all changes in elevation or horizontal alignment.
  - 2. Identify each fitting and piece of pipe using field location numbers and show stations and invert elevation of ends of each pipe section along with lay direction. Show invert elevation and station of all changes in elevation or horizontal alignment.
  - 3. Working Profile: Submit a working profile together with AutoCAD files of this pipeline prior to start of construction. The working profile shall be on profile grid and drawn to scales approved by the City Representative. It shall show the pipeline grades, elevation, existing and final street grade, type and location of each pipeline joint, details and location of all specials including vertical and horizontal angles and the type and location of all appurtenances including temporary outlets to the pipeline, and intersecting utilities found from potholing.
  - 4. Submit data showing the pipe, fittings, joints, linings and accessory items conform to the specification requirements.
  - 5. Submit connection details to existing pipe as required in Article 3.13 and reinforcement calculations with design details for bulkhead, fittings, and outlets.

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- D. Submit certified test reports of tests performed as required herein and by the referenced standard specifications including optional documents.
- E. Valid certification, name, and contact information of accepted testing laboratory.
- F. Field Hydrostatic Pressure and Leakage Test Plan:
1. Contractor shall develop a plan to perform hydrostatic leakage tests and provide labor, equipment, and material to implement the plan. Plan shall include details such as the source of water, fill point, discharge point, leak detection procedure, test lengths, repair measures, pressure head to be applied, and other specified requirements.
  2. Hydrostatic Leakage Test Plan shall be submitted to the City Representative for acceptance not less than one (1) month prior to the hydrostatic leakage test.
- G. Pipeline Installation Plan
1. Contractor shall develop a plan to perform installation of the (N) steel pipeline and provide labor, equipment, and material to implement the plan. Plan shall include details regarding coordination between excavation, shoring installation, demolition, pipe installation, backfilling; and general construction sequence in accordance with specified requirements.
  2. Pipeline Installation Plan shall be submitted to the City Representative for acceptance not less than two (2) weeks prior to the arrival of steel pipe to the project site.
- H. Thermal-Stress Control Plan
1. Contractor shall design thermal-stress control plan consisting of a written description of proposed sequencing of events or special techniques such as, but not limited to:
    - a. Controlling pipe wall temperature stress during installation
    - b. Minimizing distortion of steel
    - c. Monitoring temperature of steel pipe in the trench
- I. Reinforcement calculations and design details for bulkhead, fittings, and outlets.

## **1.05 QUALITY CONTROL**

- A. Contractor shall only use qualified personnel and appropriate tools and materials to install steel pipeline. A licensed surveyor or qualified grade setter shall be used to properly set the pipeline's alignment and grade.
- B. Out of Roundness Inspection per Article 3.12 below.

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C. Hydrostatic Leakage Test

1. Test pressure shall be 150% of the maximum operating pressure or 225 psi, whichever is greater, or as specified or as determined by the City Representative. No pressure drop is allowed during the 2 hours minimum test time during which no additional water shall be added to the line under test. See Article 3.14 for additional requirements.
2. After successful low pressure hydrostatic leakage test, the pipeline will be tested at a higher pressure of 350 psi. See Article 3.14 for additional requirements.
3. Hydrostatic Leakage Test Procedures:
  - a. Before testing, all lining and coating of joints and repair of interior lining shall be completed, all concrete anchors shall have attained their design strength, and all backfill shall be completed. Testing may, as accepted by City Representative, be done prior to placement of asphaltic concrete or roadway structural section.
  - b. Test section length shall not exceed 5,000 lineal feet.
  - c. Furnish, install and remove all bulkheads needed to close ends of test section. Brace or secure bulkheads as necessary to prevent movement while pipe is under test pressure. Bulkhead details shall be submitted to the City Representative for acceptance prior to use.
  - d. Furnish pumps, calibrated recording pressure gages, calibrated water meters or other accepted means of measuring water consumption and all other equipment, labor, and material necessary for tests. Contractor will furnish water for making tests.
  - e. Fill test section of pipeline with water. Maximum filling velocity shall be determined by the City Representative. Expel all air through air release valve or as accepted by City Representative, corporation stop installed at high points and other strategic points. There shall be zero leakage at the flanged joints and the welded joints and all pipeline appurtenances.
  - f. Testing against closed valves is not allowed.
4. Repairs
  - a. Any damage to the pipe, protective lining or coating of the pipe and the caulking or jointing material after the testing shall be repaired per manufacturer's recommendation to the original condition in accordance to Section 33 11 55.
  - b. The hydrostatic leakage test, retests, and the furnishing, installation and removal of test bulkheads shall all be considered as incidental work and no direct payment therefore will be made.

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**PART 2 – PRODUCTS****2.01 STEEL PIPE**

- A. Pipe to be installed shall meet all requirement in Section 33 11 55 Fabrication of Steel Pipe

**PART 3 – EXECUTION****3.01 UTILITY VERIFICATION**

- A. Prior to pipe submitting shop drawings and fabrication, Contractor shall verify the depth and location of all existing underground utilities. Since the results of the field investigation may affect the initial proposed pipe alignment and profile, it is critical for the Contractor to submit results to the City Representative to determine if any changes are necessary.
1. Work involved in utility verification, such as but not limited to changes or delays, shall be considered incidental to pipeline installation work, and shall not be subjected to claim for any extra payment.
  2. Changes or delays resulting from utility verification shall not be a valid claim for extra payment

**3.02 LAYING PIPE IN TRENCHES**

- A. Contractor shall at all times have the trench prepared and ready to receive pipe, sufficiently in advance of laying, to permit proper inspection by the City Representative.
1. As the pipe is being installed a minimum of 20 feet shall be maintained between the end of the new pipeline and the end of the trench being excavated (except where trenching reaches the end of the design alignment) or from any visible obstructions, or at another minimum distance as directed by the City Representative. The purpose of this stipulation is to permit the City Representative to see in advance whether any horizontal or vertical adjustments in the pipe alignment will be required to avoid conflicts.
  2. Before lowering pipe into the trench, the Contractor shall remove all stakes, foreign materials, loose rock and other hard material from the bottom of the trench.
  3. Timber stulls shall be used to limit the deflection of the steel pipe as shown in the drawings. Stulls to remain in place until trench is backfilled and compacted.

4. Just prior to the placing of each pipe section in position in the trench, all foreign material shall be removed from the ends of the pipe preparatory for the making of field joints.
    - a. Steel pipe shall be handled with great care to prevent injury to the lining and coating.
    - b. Lifting and lowering of steel pipe shall be done with belts slings of sufficient width, using two slings if necessary, placed at the quarter points of the pipe section.
    - c. Pipe shall not be dragged into position.
  5. The pipe in the trench shall have continuous uniform bearing along its bottom, except at bell holes and locations where excavation below grade has been performed to accommodate structure.
  6. Blocking used to support the pipe during laying shall be placed at the end of the section and shall be removed before laying the next section.
  7. After final positioning of pipe joint for welding, pipe shall be held in place in the trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.
  8. After the joints are welded and coated, the material used to hold the pipe in position shall conform to the trench backfill details and Section 31 23 36 – Excavation and Backfill for Water Work.
  9. Except for short runs, which may be permitted by the City, pipes shall be laid uphill on grades exceeding 10 percent. Pipe which is laid on a downhill grade shall be blocked and held in place until sufficient support is furnished by the following pipe to prevent movement.
  10. Lay pipe section of the pipe in order and position as shown on the accepted pipe lay sheets.
  11. At the end of the day's work and when work is not in progress, the open ends of all pipe installed in the line shall be closed with wooden bulkheads to prevent the entry of dirt and other foreign material from entering the laid pipe. Other openings for manholes and outlets shall also be suitably covered.
- B. Contractor shall remove all plugs or caps prior to installation. Remove dirt, grease and foreign mater from piping before making connection in the field.

### **3.03 INSTALLATION OF STEEL PIPE**

- A. See Section 33 11 56 Field Welding of Steel Pipe for additional requirements.
- B. Spigot to Spigot Joints: steel pipe shall be double fillet butt-strap welded in

accordance to Article 3.07 herein. Butt-strap welds are only permitted in locations shown on the drawings. The City Representative may permit a butt strap girth joint in-lieu of a butt welded joint if a condition exists where a butt weld is not practical. Butt welded girth joints shall be performed in accordance with the Contractor's accepted welding procedure specifications.

- C. Butt Straps: Butt straps shall be shaped to fit the curvature of the pipe. The lap and thickness shall be as indicated on the drawings. Butt straps shall be fabricated in two semi-circular pieces. The welding details shall be as indicated on the drawings.
- D. Thermal-stress control joints shall be provided in accordance with AWWA C206 and as specified herein.

### **3.04 FLOATATION**

- A. Contractor shall take every precaution against the floatation of the new pipe due to water, CDF, or CLSM in the trench whether from natural ground seepage or from the operations of the Contractor.
- B. The use of water, CDF, or CLSM by the Contractor, for other construction purposes shall take into full consideration the possibility of the floatation of adjacent utilities.
- C. New pipe disturbed or damaged due to floatation shall be re-laid and repaired to the satisfaction of the City Representative at the expense of the Contractor.
- D. Existing utilities damaged by floatation due to the negligent operations of the Contractor shall be repaired and re-laid by the Contractor at his own expense.

### **3.05 CHANGES IN PIPE ALIGNMENT AND GRADE**

- A. Small and moderate changes in pipeline alignment and grades shall be made with small deflections in square-end pipes and with beveled-end pipe within the limitations indicated on the drawings and specified in Section 33 11 55 Fabrication of Steel Pipe. Any proposed pipeline alignment and grade changes shall be shown in the Working Profile in accordance with Article 1.04 herein.

### **3.06 FABRICATED PIPE BENDS**

- A. Abrupt changes in pipeline alignment and grades shall be made with fabricated pipe bends.
  - 1. The detail of each fabricated pipe bend shall be as indicated on the drawings and as specified in Section 33 11 55 Fabrication of Steel Pipe.
  - 2. Field joints for joining fabricated pipe bends to straight sections or for joining different sections of fabricated pipe bends shall be made using

complete joint penetration circumferential butt-welds.

### 3.07 CLOSURE PIECES

- A. Contractor shall make and be responsible for all measurements necessary for closure pieces required.
- B. Double welded butt-strap field joints conforming to the details indicated on the drawings will be required for closure and at other locations.

### 3.08 THERMAL-STRESS CONTROL JOINTS

- A. Install in accordance with AWWA C206, the accepted thermal-stress control submittal and as specified herein.
- B. The un-backfilled Thermal-Stress Control Joint area of pipe shall be shaded from the direct rays of the sun by use of properly supported awnings, umbrellas, tarpaulins or other suitable materials until the pipe is backfilled at least 1-foot over the top of the pipe. The Thermal-Stress Control Joint area is defined as the entire length of pipe left exposed. Shoring materials shall not rest directly on pipe but shall be supported to allow air circulation around the pipe. Shading of Thermal-Stress Control Joints is not required when the ambient air temperature is below 50°F.
- C. Locate Thermal-Control Joints at 300-foot intervals.
- D. Temperature Control Requirements:
  - 1. Prior to and during placement of pipe backfill, the pipeline steel temperature shall be at or below 90°F. The specified temperature shall be monitored and controlled for at least 3 hours after placement of pipe backfill. Provide supplemental cooling as required.
  - 2. Place pipe backfill from a single heading starting at one Special Temperature Control Joint and proceed toward next Special Temperature Control Joint.
  - 3. During period of pipe backfill placement, pipeline section that is partially backfilled shall be shaded as indicated above. Temperature of partially backfilled pipe shall not be allowed to exceed 110°F. Provide supplemental cooling as required.
  - 4. Prior to welding the Thermal-Stress Control Joints, the pipeline extending 300-feet each direction from the joint shall be maintained at or below 85°F. Additionally, the pipeline extending 300-feet each direction from the joint shall be backfilled to at least 1-foot over the top of the pipe. At the

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specified temperature of 90°F or below, the Thermal-Stress Control Joint shall be welded. Begin and complete the weld during the coolest time interval of the 24-hour day. Use the pipeline temperature monitoring system data to demonstrate to City Representative the coolest interval of the day.

5. After welding of the Thermal-Stress Control Joint, the pipe temperature for 150-feet in each direction shall be maintained below 110°F for a minimum of 24 hours after the Thermal-Stress Control Joint area has been backfilled to at least 1-foot over the top of the pipe.

### **3.09 EXISTING UTILITIES OR IMPROVEMENTS**

- A. The Contractor shall assume full responsibility for the suitability and use of the utility information. Any changes of alignment and delay of work schedule due to utility conflicts shall not be a valid change of condition claim for extra compensation to the Contractor. Since the results of the field investigation may affect the initial proposed pipe alignment and profile, it is critical for the Contractor to submit the utility location results to the City Representative as soon as possible to determine if any changes are necessary.
- B. During pipeline installation, any existing utilities or improvements including, but not limited to traffic loops, landscape improvements, and irrigation systems that may be damaged shall be replaced or restored back to its original condition.
- C. As described in Section 01 71 33 Protection of Adjacent Construction, the Contractor shall use any necessary means such as photographs and video to provide good record of the existing condition prior to construction. These records shall be used for restoration after the pipeline installation is complete.
- D. If any traffic loop protectors are damaged, they shall be restored by qualified (C-10 Electrical licensed) contractors only, or they can be replaced with loops following current local jurisdiction standards.
- E. Work involved in restoring or replacing traffic loop protectors, landscape improvement, irrigation system, and other damaged utility or improvements shall be considered incidental to pipeline installation work and shall not be subjected to claim for any extra payment.
- F. Existing abandoned pipe 12-inch or larger that was cut during the day must be capped before the end of the business day.

### 3.10 TEMPORARY MANHOLES

- A. Contractor will be permitted to construct temporary manholes in the pipeline at locations approved by the City Representative.
  - 1. No more than one will be permitted between any two permanent manholes.
  - 2. Temporary manholes shall be in the top of the pipe, shall be no larger than the permanent manholes, and shall be of the same construction as required for permanent manholes. Precast concrete risers will not be required at temporary manholes.
  - 3. After the completion of his work inside the pipe, the Contractor shall seal all temporary manholes and finish the inside and outside of the manholes with the lining and coating that is specified for that section of pipeline.
  - 4. All costs for installing, sealing and coating temporary manholes shall be at the expense of the Contractor.

### 3.11 PASS HOLES

- A. The Contractor may install outlets between pipeline manholes or other outlets for the passing of material and lines into the interior of the pipe for construction purposes. The temporary outlets shall be installed and later sealed after they are no longer required, all as indicated on the drawings and as specified in Section 33 11 55 Fabrication of Steel Pipe. Pass holes shall be rated for the working design pressure of 350 psi. The locations of pass holes shall be subject to approval of the City Representative.

### 3.12 OUT-OF-ROUNDNESS INSPECTION

- A. Following backfilling of the trench and after all stulling and bracing has been removed; Contractor's QC manager shall measure the pipe for out-of-roundness and supply a report to the City Representative. Any pipe exceeding "X" dimensions, found in paragraph B below, will be rejected and shall be replaced by the Contractor.
- B. "X" shall equal to  $(D_h - D_v)/D_o$ , where:
  - $D_h$  = diameter measured at the springline (inches)
  - $D_v$  = diameter measured from the pipe's crown to the invert (inches)
  - $D_o$  = nominal diameter of the pipe as computed from measuring the pipe cylinder's circumference (inches)
  - X =
    - 0.01, if the pipe's coating and lining is cement mortar
    - 0.02, if the pipe's coating or lining (but not both) is a liquid film
    - 0.04, if the pipe's coating and lining is a liquid film

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- C. When pipe sections are not horizontal, Dh and Dv shall be measured in mutually perpendicular axis that yield the maximum and minimum dimensions for diameters.
- D. If the pipe is within a casing or other structure that will carry the expected loads, add 0.01 to the allowable “X”.

### **3.13 CONNECTION TO EXISTING PIPELINE**

- A. Prior to pipe fabrication, Contractor shall pothole as necessary to verify the depth, location and sizes of all existing underground utilities including all the existing pipe connection points, as incidental work to the pipe installation. Contractor shall field measure the circumference of the existing pipes and make all necessary field measurements before fabricating connecting pipes.
- B. The Contractor shall assume full responsibility for the suitability of the utility information. Any changes of alignment and delay of work schedule due to utility conflicts shall not be a valid change condition claim for extra by the Contractor. Since the results of the field investigation may affect the initial proposed pipe alignment and profile, it is critical for the Contractor to submit the results to the City Representative to determine if any changes are necessary.
- C. The Contractor shall expect out-of-roundness in the existing pipeline at the connection point to the new pipeline. Jacking and fitting the existing pipe with filler materials to complete the connection to the new pipeline are incidental work.
- D. The Contractor shall repair coating and lining of existing steel pipe.

### **3.14 HYDROSTATIC FIELD PRESSURE AND LEAKAGE TEST**

- A. Test pressure shall be 150% of the maximum operating pressure or 225 psi, whichever is greater, or as specified or as determined by the City Representative. No pressure drop is allowed during the 2 hours minimum test time during which no additional water shall be added to the line under test.
  - a. 36” welded steel main “Future Sutro Outlet Project” shall be tested to 250 psi.
- B. Low Pressure, Hydrostatic Pressure and Leakage test Procedures:
  - 1. At each new pipe joint to be inspected by the SFWD, the Contractor shall provide shoring/trench support meeting/exceeding the requirements of DPW/OSHA regulations in order to have the pipe joint(s) exposed and physically accessible for the duration of the line fill and hydrostatic testing. The City Representative will make the final decision regarding the adequacy of the shoring/trench supports.

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2. The Contractor shall be responsible for engineering, furnishing and installing, prior to the test, suitable temporary thrust blocks and other anchorages, to prevent any movement of the 36-inch pipeline during the test.
3. The Contractor shall provide all assistance (minimum personnel shall include the journeyman plumber and two laborers) for filling the line during both the line fill and hydrostatic test, including releasing trapped air, etc.
4. The Contractor shall provide a water truck with the required connecting fittings and hoses conforming to the CCSF standards at no cost to the City along with pressurizing the line to be hydrostatically tested. The Contractor shall also provide the water truck with the require fittings and hoses for the hydrostatic test.
5. For the higher-pressure hydrostatic test, the contractor shall provide a pumper truck to gradually increase the pressure to 350 PSI (or a lower pressure when approved by the City Representative). The final test pressure shall be held for a minimum of 30 minutes prior to the City Representative verifying the joints for leaks.
6. The pressure will be maintained by the contractor for a sufficient time for the City Representative to visually check for leakage on every pipe, fitting and valve joint, including joint(s) to existing pipes were installed.
7. The test is successful if no leaks are found, and pipes do not shift from their installed positions.
8. The contractor shall provide a pumper truck for any retest at his/her own expense, provide the equipment to accomplish the retest to the satisfaction of the City Representative. The City Representative will still witness this retest and subsequently physically check all pipe joints for leakage. The Contractor shall notify the City Representative in writing at least forty-eight hours (two (2) full working days) in advance thereof of the time when the installation is ready for hydrostatic test.

C. Contractor Responsible for All Cost Related to Retest

1. Should the test fail, it is the responsibility of the Contractor to provide all labor, material and equipment to fix the leaks and conduct the test(s) to the satisfaction of the City Representative at no additional cost to the City. This may include, but shall not be limited to, excavating trenches to expose pipes, fittings, cutting into new pipeline, disassembling pipes

and fittings, installing new gaskets and glands, etc. Additionally, the Contractor shall be required to pay the standard fee for retesting prior to the retest.

**D. Repairs**

1. Any damage to the pipe, protective lining or coating of the pipe and the caulking or jointing material after the test shall be satisfactorily repaired according to Section 33 11 55 Fabrication of Steel Pipe.
2. The hydrostatic field tests, retests, and the furnishing, installation and removal of test bulkheads shall be all considered as incidental work and no direct payment therefore will be made.

**E. Out of roundness inspection to be performed per Article 3.12.**

**3.15 SANITARY WORK PRACTICES AND DISINFECTION**

- A. Refer to Section 01 35 55 – Sanitary Work Practices, Disinfection, and Other Regulatory Requirements.

**3.16 RECORDS OF CONSTRUCTION INSPECTION**

- A. The Contractor shall maintain complete inspection and testing records and make them available to the City Representative in both hard copy and electronic form, as requested.

**END OF SECTION**