SECTION 15076

cement mortar lined and coated steel pipe

# GENERAL

## WORK OF THIS SECTION

### Steel pipe with fittings and special pieces, fabricated in accordance with AWWA C200.

### Cement-mortar lining and cement-mortar or wax tape coatings for steel pipe.

### Welded joints, O-ring gasket joints, grooved-end or shouldered couplings, or flanged ends for steel pipe.

## REFERENCE codes and standards

### 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.

#### AWWA C200 – Steel Water Pipe – 6 In. and Larger

#### AWWA C205 – Cement-Mortar Protective Lining and Coating for Steel Water Pipe 4 In. and Larger - Shop Applied

#### AWWA C206 – Field Welding of Steel Water Pipe

#### AWWA C207 – Steel Pipe Flanges for Waterworks Service – Sizes 4 In. Through 144 In.

#### AWWA C208 – Dimensions for Fabricated Steel Water Pipe Fittings

#### AWWA C209 – Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines

#### AWWA C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

#### AWWA C214 – Tape Coatings for Steel Water Pipe

#### AWWA C217 – Petrolatum and Petroleum Wax Tape Coatings for the Exterior of Connections and Fittings for Steel Water Pipelines

#### AWWA C606 – Grooved and Shouldered Joints

#### AWWA M11 – Steel Pipe - A Guide for Design and Installation

#### ASME – Boiler and Pressure Vessel Code

#### ASTM A47/A47M – Standard Specification for Ferric Malleable Iron Castings

#### ASTM A36/A36M – Standard Specification for Carbon Structural Steel

#### ASTM A53 – Standard Specification for Pipe, Steel, Black & Hot Dipped, Zinc-Coated, Welded, and Seamless

#### ASTM A105 – Standard Specification for Carbon Steel Forgings for Piping Applications

#### ASTM A183 – Standard Specification for Carbon Steel Track Bolts and Nuts

#### ASTM A216 – Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding for High Temperature Service

#### ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs

#### ASTM A536 – Standard Specification for Ductile Iron Castings

#### ASTM A568/A568M – Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality and Cold Rolled

#### ASTM A1011/A1011M – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

#### ASTM A1018/A1018M – Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Carbon, Commercial, Drawing, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

#### ASTM C150 – Standard Specification for Portland Cement

#### ASTM D2000 – Standard Classification System for Rubber Products

#### ANSI A13.1 – Scheme for the Identification of Piping Systems.

#### ANSI B1.1 – Unified Inch Screw Threads

#### ANSI B1.2 – Gages and Gaging for Unified Inch Screw Threads

#### ANSI B1.20.1 – Pipe Threads, General Purpose (Inch)

#### ANSI B16.1 – Pipe Flanges and Fittings Package

#### ANSI B16.25 – Butt Welding Ends

#### ANSI B31.3 – Process Piping

#### OSHA 1910.144 – Safety Color Code for Marking Physical Hazards.

#### SSPC Volume 2, Systems and Specification – Surface Preparation Guide and Paint Application Specifications.

## RElated work specified elsewhere

### EVMWD Standard Drawings

### Section 01300 – Shop Drawings and Submittals

### Section 02140 – Groundwater Dewatering

### Section 02223 – Trenching, Backfilling and Compacting

### Section 09800 – Painting and Coating

### Section 15000 – General Piping Systems and Appurtenances

### Section 15044 – Hydrostatic Testing and Flushing of Pressure Pipe

## Submittals

### Submittals shall be in accordance with SECTION 01300.

### The following items shall be submitted to the DISTRICT for review and approval prior to fabrication of steel pipe and specials:

#### Affidavits including manufacturer's certificates compliance with AWWA C200, and all applicable AWWA, ASTM, ANSI or other required or referenced standards.

#### Tabulated “Layout Schedule” including:

##### Pipe internal diameter, wall thickness, and internal design pressure.

##### Pipe station and bottom of pipe elevation at each change of grade and alignment.

##### Elements of curves and bends, both in horizontal and vertical alignment.

##### Locations of valves, flanges, appurtenances and other mechanical equipment.

##### Order of installation and closures.

##### Locations of closures, including cut-to-fit allowances, for length adjustment and for construction convenience.

##### Locations of bulkheads for field hydrostatic testing. (Testing against valves will not be permitted).

#### Calculations supporting selected wall thickness of pipe and specials.

#### Calculations supporting welded joint design and joint welding details.

#### Calculations supporting the sizing of reinforcing collar plates, wrapper plates or crotch plates.

#### Cathodic protection design and installation details. During the design phase of the project, a cathodic protection study shall be performed to evaluate site conditions and measures to be taken to prevent corrosion from occurring to steel piping. Cathodic protection design plans and specifications shall be incorporated into the overall final engineering construction drawings and specifications.

#### Details of all specials including the lining and coating.

#### Current shop welder and field welder certifications.

#### Submit proof of at least two years of continuous recent experience in the application of cement-mortar coating systems for steel pipe for supervisors of cement-mortar coating operations.

#### Submit certified original copies of mill test reports on each heat from which steel is rolled.

##### Tests shall include physical and chemical properties.

##### Submit certified original copies of mill test reports for flanges including details of stress relief used.

##### Manufacturer's certificates of compliance with referenced pipe standards.

##### Provide recertification by an independent domestic testing laboratory for materials originating outside of the United States.

#### Certification of dye penetrant shop-weld testing.

#### Submit coating application test records for field measuring paint coating thickness and holiday detection for each pipe section and fitting. Describe repair procedures used.

## PIPe SCHEDULE

### Refer to the Drawings for the Pipe Schedule.

## Quality Control

### Pipe lining and coating, whether factory applied, or field applied, is an element of the completed pipe. Only manufacturers who provide completed lined and coated pipe are considered qualified for project work.

### Supervisors of cement-mortar coating operations shall have at least two years of continuous, recent experience in the application of cement-mortar coating systems for steel pipe.

### Field welders shall be certified under Section IX, Part A of the ASME Boiler and Pressure Vessel Code or in accordance with AWWA C206, Section 4.4.

#### Welders shall present a copy of their certification to the DISTRICT prior to performing any field welding.

#### Certifications shall be dated within three (3) years of the job to be performed.

### Personnel performing welding inspections shall meet the requirements of AWWA C200, Section 5 or shall be qualified as an AWS Certified Welding Inspector (CWI or SCWI) or shall hold a current AWS Radiographic Interpreter Certification.

### Plainly mark each length of straight pipe and each special to identify the proper location of the pipe item in the submitted Layout Schedule.

### The top of all pipe and specials shall be clearly identified by marking the top with “T.O.P.” for easy identification in the field.

## SERVICE APPLICATION

### Generally, cement-mortar lined and coated welded steel pipe is used for water transmission mains of 16 inches or larger.

#### These mains may form the major distribution lines in urban water systems between pressure zones; or yard piping on reservoir, pump station and processing sites; or they may be long distance transmission lines.

## Warranty

### Each supplier shall warranty their materials and workmanship for a period of 12 months (from acceptance by DISTRICT) against material and fabrication defects.

# materials

## DESIGN REQUIREMENTS

### A special is defined as any piece of pipe other than a normal full length of straight pipe. This includes, but is not limited to, elbows, short pieces, reducers, tees, crosses, spools, sections with outlets, beveled sections, and manholes.

### All steel used for pipe or specials shall have a 36,000-psi minimum yield point unless otherwise directed by the DISTRICT. See “Part 2.02 Steel Pipe and Specials” for requirements.

### Design stress in steel cylinders shall not exceed 50% of the specified minimum yield strength of the steel used.

#### The internal operating pressure used for design shall be a minimum of 150 psi or as given on the Drawings, whichever is greater.

#### If no specific surge analysis has been performed, the internal operating pressure used in circumferential stress calculations shall include at least a 10% increase for surge conditions.

#### No allowance shall be made for the tensile strength of the cement mortar lining and coating.

### Specials shall be designed per AWWA M11 and as a minimum shall conform to the pressure rating, grade of steel and cylinder thickness of the adjoining standard pipe sections.

#### Fitting dimensions shall conform to AWWA C208.

#### Reinforcing collars, wrappers, crotch plates, and anchor rings shall be designed and fabricated per AWWA M11.

#### Outlets may be built into the wall of the pipe or may be fabricated as steel plate specials.

#### Outlets of size 2" and smaller in piping 4" and larger shall be of the “threadolet” type or shall be extra-heavy half couplings to fit the pipe in accordance with AWWA M11.

#### Outlets shall be 3,000 lb. WOG forged steel per ASTM A105.

#### Threads shall comply with ANSI B1.20.1.

#### Outlets larger than 2" shall use a tee or nozzle with a flanged outlet.

#### All outlets larger than 2" in diameter shall be provided with steel reinforcing collars, wrapper plates, or crotch plates per AWWA M11.

#### At the option of the manufacturer, wrappers may be used in place of collars, and crotch plates may be used in place of collars or wrappers.

### Tees, wyes, and crosses shall be dimensioned in accordance with AWWA C208, Table 1, or as modified on the Drawings.

### Bends shall have a minimum radius of not less than 2½ times the pipe diameter unless otherwise approved by the DISTRICT.

#### The maximum deflection at mitered girth seams shall be 22½ degrees.

#### At the option of the Contractor, a bend may be welded to the adjacent pipe section.

### All specials shall be marked at both ends of the fitting with “Field Top” indicators.

#### Minimum cylinder thickness for pipe and specials shall be 0.250" or ¼” or as directed by the DISTRICT.

### The wall thickness tolerances for steel pipe 12” diameter and larger shall be governed by the requirements of the ASTM specifications to which the plates or sheets are ordered, but in no case shall the thickness be less than 0.250" or ¼” or as directed by the DISTRICT.

### Standard pipe sections shall not be less than 20' nor more than 40' in length, except where shorter lengths are required to fit horizontal and vertical alignment or are otherwise shown on the Drawings.

### The term "diameter of pipe" as used in these specifications or as shown on the Drawings shall mean the net inside diameter of the mortar lining.

## STEEL PIPE AND SPECIALS

### Steel pipe and specials shall conform to the requirements of the AWWA C200 and AWWA M11, except as modified herein.

#### Steel for fabricated cylinders shall conform to ASTM A36/A36M, ASTM A1011/A1011M, Grade 36, or ASTM A1018/A1018M, Grade 36.

#### Other steel grades may be used only upon approval of the DISTRICT.

## Coatings and linings

### Mortar coating and lining:

#### Coatings and linings shall conform to AWWA C205, except as noted below.

#### All exterior metal surfaces intended for direct buried service shall be coated.

#### Mortar coating thickness shall be 1¼".

#### Mortar lining thickness shall be as follows:

##### Pipelines 16” and smaller:

###### Lining Thickness 5/16”, Tolerance -1/16” to + 1/8”

##### Pipelines 18” through 36”:

###### Lining Thickness 3/4”, Tolerance -1/16” to + 1/8”

##### Pipelines larger than 36”:

###### Lining Thickness 3/4”, Tolerance -1/16” to + 3/16”

#### Cement used in mortar lining and coating shall be Portland Cement per ASTM C150, Type V for coating and Type II or Type V for lining.

#### Cement-mortar coating shall be reinforced in accordance with AWWA C205.

#### Cement mortar grout for field joints shall consist of a mixture of 1½ to 2 parts sand to 1-part Type II or Type V Portland Cement with enough clean, potable water to permit packing and troweling without crumbling.

##### The sand shall be washed and well-graded such that all will pass a No. 8 sieve.

##### The quantity of water to be used in the preparation of grout shall be the minimum required to produce a mixture sufficiently workable for the purpose intended.

##### Grout shall attain a minimum compressive strength of 1,800 psi in 28 days.

#### In certain circumstances, rapid-setting mortar may be required.

##### Acceleration admixtures may be used in the mix as permitted by the DISTRICT.

##### Calcium chloride shall not be used in the mix.

### The exterior surfaces of areas of pipes and fittings that are not mortar coated, such as flanges, grooved ends, or plain ends for butt-straps or flexible couplings, shall be sandblasted in accordance with SSPC-SP10 - Near White Blast Cleaning, and coated in accordance with SECTION 09800.

### Where indicated on the Drawings polyethylene tape wrap pipe coating shall be applied per AWWA C-209 and AWWA C-214 with a ¾” thick reinforced cement-mortar overcoat (rockshield) in accordance with AWWA C205 for steel pipe sizes 4” and larger.

### Where indicated on the Drawings a “Petrolatum” tape coating shall be applied per AWWA C217.

#### Buried ferrous valves may use a Petrolatum tape coating.

## joints

### Bell and spigot joints with rubber gasket:

#### In accordance with AWWA C200 and AWWA M11.

#### Bell ends that are pressed or rolled shall be limited to maximum pipe diameter of 21" nominal.

#### Joint rubber gaskets shall be coordinated with the pipe manufacturer.

##### Refer to the Drawings for the selected gasket material.

##### If soil contaminated with organic solvents or petroleum products is encountered during the course of the work, alternate gasket materials or joint treatment may be required by the DISTRICT.

### Lap welded joints:

#### Use expanded bell with matching spigot end.

#### The bell on lap welded joints can be mitered up to 5 degrees.

### Flanges for use in construction of steel pipe shall be as described below.

#### AWWA C207, Class D flanges (matching ANSI B16.1, Class 125 flanges for bolt hole size and drilling) shall be used for pressures up to 150 psi.

#### AWWA C207, Class E flanges (matching ANSI B16.1, Class 125 flanges for bolt hole size and drilling) shall be used for pressures between 150 psi and 250 psi.

#### AWWA C207, Class F flanges (matching ANSI B16.1, Class 250 flanges for bolt hole size and drilling) shall be used for pressures between 250 psi and 300 psi or when Class 250 butterfly valves or other appurtenances using flanges corresponding to AWWA C207 Class F are required.

#### Flanges shall be flat-faced type only. Segmented flanges shall not be used.

#### Bolts and nuts.

##### Refer to the Drawings for carbon steel or stainless steel bolt and nut location requirements.

##### Refer to SECTION 15000 – General Piping Systems and Appurtenances for ASTM requirements.

#### Gaskets.

##### Flange gaskets shall be 1/8-inch thick aramid fiber bound with nitrile for all sizes of pipe.

###### If soil contaminated with organic solvents or petroleum products is encountered during the course of the work, alternate gasket materials or joint treatment may be required by the DISTRICT.

##### Gaskets shall be full-face type with pre-punched holes or ring-type extending to the inner edge of the bolt circumference of the flange.

##### Ring-type gaskets may only be used as directed by the DISTRICT.

### Butt straps:

#### Use two-piece rolled steel straps with a minimum thickness of ¼", and a minimum width of 10".

#### Straps shall be fabricated to snugly fit over the plain pipe ends and shall be centered over the ends of the pipe sections to be joined.

#### Weld one standard 5”, 3000 lb. threaded half-coupling to the butt strap section for butt straps up to and including 20” in nominal diameter.

#### Weld two standard 5”, 3000 lb. threaded half-couplings to the butt strap section for butt straps greater than 20” in nominal diameter.

#### Provide a threaded steel plug for each half-coupling.

### Grooved-end or shouldered couplings:

#### Use square-cut shouldered or grooved ends per AWWA C606.

#### Grooved-end couplings shall be malleable iron per ASTM A47, or ductile-iron per ASTM A536.

#### Gaskets shall be per ASTM D2000.

#### Nuts and bolts in exposed service shall conform to ASTM A183, 110,000 psi tensile strength.

### Flexible pipe couplings:

#### Use plain-end pipe with flexible pipe couplings per AWWA C200.

#### Provide joint harnesses per AWWA M11 where indicated on the Drawings.

### Angles or curves in alignment:

#### Minor changes of direction in the grade or alignment may be made by a deflection in the joint up to a maximum of ¾” on one side of the joint.

#### For greater angular deflections, pipe with ends beveled up to a maximum of 5 degrees measured from a plane perpendicular to the pipe’s axis may be used.

#### The short point on the bevel shall be so marked on the pipe.

#### Pipe lengths shorter than 20’ may be used on curves.

#### Where curves that have a shorter radius than can be accommodated by beveled pipe are required, or where indicated on the Drawings, special short-radius bends shall be provided.

# EXECUTION

## Fabrication

### Product Marking

#### Plainly mark each length of straight pipe and each special and fitting at the bell end to identify the design pressure or head, the steel wall thickness, the date of manufacture, and the proper location of the pipe item by reference to the Layout Schedule.

#### For beveled pipe, show the degree of bevel and the point on the circumference to be laid uppermost.

### Beveled ends for butt-welding shall conform to ANSI B16.25.

#### Remove slag by chipping or grinding.

#### Surfaces shall be clean of paint, oil, rust, scale, slag, and other material detrimental to welding.

#### When welding the reverse side, chip out slag before welding.

#### Surface preparation shall comply with SSPC-SP3 or higher.

### Fabrication shall comply with ANSI B31.3, Chapter V.

### Welding procedure and performance qualifications shall be in accordance with Section IX, Articles II and III, respectively, of the ASME Boiler and Pressure Vessel Code.

### Welds shall be full penetration.

### Use the (SMAW); submerged arc welding (SAW), gas-shielded flux-cored arc welding (FCAW), or gas-metal arc welding (GMAW) process for shop welding.

### Welding preparation shall comply with ASME B31.3, paragraph 328.4.

#### Limitations on imperfections in welds shall conform to the requirements in ASME B31.3, Table 341.3.2 and paragraph 341.4 for visual examination.

### Identify welds in accordance with ASME B31.3, paragraph 328.5.

### 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.

### Welding electrodes for carbon steel piping shall comply with AWS A5.1, A5.17, A5.18, A5.20, or A5.23. Carbon steel flux cored wire shall have a maximum boron content of 0.006%.

## Shop Testing Of Fabricated Or Welded Components

### After completion of fabrication and welding in the shop and prior to the application of any lining or coating, test each component according to the referenced standards.

#### Test fabricated fittings per AWWA C200.

#### Test the seams in fittings that have not been previously shop hydrostatically tested by the dye penetrant method as described in ASME Boiler and Pressure Vessel Code Section VIII, Appendix 8 and Section V, Article 6.

#### In addition to the shop hydrostatic testing performed on pipe cylinders required per AWWA C200, all welds of specials and attachments (joint rings and nozzles) shall be tested by a dye penetrant process.

##### Certification of such testing shall be submitted to the DISTRICT.

#### In lieu of the dye penetrant method of testing, completed fittings may be hydrostatically tested.

##### Use the field hydrostatic test pressure or 150% of the design pressure, whichever is higher.

## Delivery, storage, and handling

### Delivery, storage, and handling of the pipe and specials shall be as follows:

#### Pipe and fittings shall be carefully handled and shall be protected against damage to linings and coatings due to impact shocks

#### Pipe shall not be placed directly on rough ground but shall be supported in a manner which will protect the pipe against injury whenever stored at the site or elsewhere.

#### Pipe shall be handled and stored per these requirements and in accordance with the Manufacturer’s recommendations.

### Temporary internal bracing shall be installed in all pipe 16" and larger prior to shipment to the job site.

#### Temporary internal bracing shall be 4" x 4" wooden struts installed in both the horizontal and vertical directions.

#### Each set of struts shall be nailed together as a unit.

#### Wooden wedges may be used to maintain the proper tight fit of the internal bracing.

#### The bracing shall be located 12" in from each end of the pipe section for all pipe, and additionally at the mid-point for piping 24" and larger.

### Transport pipe to the job site on padded bunks with nylon tie-down straps or padded bonding to protect the pipe.

### Pipes and specials shall only be handled with appropriate spreader bars and wide nylon slings.

#### Chains or wire rope slings shall not be used.

#### Under no circumstances shall pipe or specials be pushed or dragged along the ground.

#### All pipe sections over 20' in length shall be lifted at the quarter points from each end.

### Store pipe on earth berms or padded timber cradles adjacent to the trench in the numerical order of installation.

#### Place the supports at about the one-quarter point from the pipe ends.

### Maintain plastic end caps on all pipe and specials in good condition until the pipe is ready to be installed in the trench.

#### Periodically open the plastic end caps and spray potable water inside the pipe to moisten the mortar lining as directed by the DISTRICT.

## Pipe installation

### General

#### Trenching, backfilling and compacting.

##### Refer to SECTION 02223 – Trenching, Backfilling and Compacting for requirements.

##### Pipe shall be laid directly on the bedding material.

###### No blocking will be permitted, and the bedding shall be such that it forms a continuous, solid bearing for the full length of the pipe.

###### Excavations shall be made as needed to facilitate removal of handling devices after the pipe is laid.

###### Bell holes shall be formed at the ends of the pipe to prevent point loading at the bells or couplings and to permit visual inspection of the joint.

##### Excavation shall be made as needed outside the normal trench section at field joints to permit adequate access to the joints for field connection operations and for application of coatings on field joints

#### Dewatering

##### Refer to SECTION 02140 – Groundwater Dewatering for requirements.

#### Supports for piping installed above ground.

##### Refer to SECTION 15020 – Pipe Supports for requirements.

#### Thrust restraint.

##### Refer to SECTION 15000 – General Piping Systems and Appurtenances for requirements.

#### Identification of piping.

##### Refer to SECTION 15000 – General Piping Systems and Appurtenances for requirements.

#### Warning tape, Tracer wire.

##### Refer to Standard Drawing W-35 for requirements.

#### Pressure testing of pipe.

##### Refer to SECTION 15044 – Hydrostatic Testing and Flushing of Pressure Pipelines for requirements.

#### Disinfection of piping.

##### Refer to SECTION 15044 – Hydrostatic Testing and Flushing of Pressure Pipelines for requirements.

## Installation Of Steel Pipe

### When the work requires and the size of the pipe allows entry of personnel into the pipe, the Contractor shall comply with all Federal and State regulations for confined space entry.

#### Work inside pipelines 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.

##### Generally, the aforementioned safety provisions apply to pipe 24" and larger.

##### Note that for pipe less than 24" diameter, more stringent safety procedures apply.

### The Contractor shall provide and install all required piping and accessories in accordance with the contract documents and manufacturer’s recommendations.

#### Pipe installation as specified in this section supplements AWWA M11.

#### Only approved certified Welders shall weld joints.

#### Inspect each pipe and fitting before lowering into the trench.

##### Inspect the interior and exterior protective coatings.

##### Patch damaged areas in the field with material similar to the original.

##### Remove foreign matter and dirt from inside the pipe and keep it clean during and after laying.

#### Handle pipe in a manner to avoid any damage to the pipe. Do not roll or drop the pipe into trenches under any circumstances.

#### Grade the bottom of the trench and place a 6-inch layer of select or scarified material under pipe.

##### Before laying each section of pipe, check the grade and correct any irregularities found.

##### The trench bottom shall be a uniform bearing and support for the pipe.

#### At the location of each joint, dig bell holes in the bottom of the trench and at the sides to permit completion and visual inspection of the entire joint.

#### Interior and exterior joint surfaces shall be completed in accordance with the appropriate lining and coating requirements.

#### Keep the trench in a dewatered condition during pipe laying.

#### When the pipe laying is not in progress, close the open ends of the pipe. Do not permit trench water, animals, or foreign objects to enter the pipe.

## Assembly And Erection

### Field welded joints:

#### Use the shielded metal arc welding (SMAW) process for field welding.

#### Welded joints shall be completed in the trench per AWWA C206.

##### Joints shall remain exposed until inspection has been performed

#### Inspection of field welded joints:

##### The DISTRICT shall arrange for the welds to be inspected. Inspection of welds shall take place during welding operations or as soon as possible following the completion of the welds.

##### Visual inspections of welds shall be performed by an AWS QC1 Certified inspector.

##### Nondestructive testing, such as liquid dye penetrate testing shall only be performed by individuals qualified per AWS D1.1 as a NDT Level II or greater.

##### The Contractor shall coordinate and supply ventilation, lighting, and other equipment deemed necessary for inspection.

##### The Contractor shall be responsible for providing safe entry into and out of the trench, safety of inspection personal, traffic control and other safety precautions deemed necessary for the inspections

### Butt strap joints

#### Butt strap closure joints shall be installed where shown on the Drawings in accordance with AWWA C206.

##### Butt straps shall be field welded to the outside plain end of the pipe along both edges with a full circumferential weld. A minimum of two weld passes shall be used.

##### The interior of the joints shall be filled with a rapid-set mortar and finished off smoothly to match the pipe interior diameter.

##### Clean the butt strap with a wire brush and apply a cement and water wash coat prior to applying cement mortar.

###### Galvanized wire mesh, 2-inch by 4-inch pattern of No. 13 gauge shall be installed to the exterior of the joint prior to applying the mortar coating.

###### Coat the exterior of the closure assemblies with mortar to cover all steel with a minimum of 1¼”.

##### Seal weld the steel plug to the hand hole after the interior of the joint has been inspected and approved by the DISTRICT.

##### Following grouting, the joint shall then be wrapped with two layers of polyethylene encasement in accordance with SECTION 15000.

### Flanged connections

#### Flanged connections shall be installed where indicated on the Drawings.

##### Bolt holes shall straddle the vertical centerline.

##### The bolts, nuts and flange faces shall be thoroughly cleaned by wire brush prior to assembly.

###### Bolts and nuts shall be lubricated with a DISTRICT approved anti-seize compound.

##### Nuts shall be tightened in an alternating "star" pattern to the manufacturer's recommended torque.

##### Slip-on type flanges intended for field fit-up and welding shall be welded inside and outside in accordance with AWWA C207.

##### Coat the exterior of exposed flanges, bolts and nuts in accordance with SECTION 09800.

## Application Of Mortar For Repairing Mortar-Lined And Coated Steel Pipe

### Remove deteriorated mortar surfaces of dirt, oil, grease, and bond-inhibiting materials.

### Repair area shall be at least 1/8-inch deep.

#### The exposed aggregate surface shall have a minimum surface profile of ±1/16 inch.

#### Clean surface by saturating with clean water.

##### Then allow to dry such that there is no standing water during mortar application.

##### Apply primer.

##### Scrub repair mortar into the substrate, filling pores and voids.

##### Apply mortar material against the edge of the area to be repaired, working toward the center.

##### After filling repair, consolidate and then screed.

#### Apply mortar in multiple lifts to the thickness necessary to match the thickness of the mortar lining or coating.

##### Where multiple lifts are required, score the top surface of each lift to produce a roughened surface for the next lift.

##### Allow the preceding lift to reach final set per the mortar manufacturer’s recommended minimum time before applying additional mortar material.

##### Saturate surface of the lift with clean water.

##### Scrub fresh mortar into the preceding lift.

##### Allow mortar to set and then finish for a smooth surface.

#### Moist cure with wet burlap and polyethylene, a fine mist of water, or water-based curing compound.

##### Commence curing immediately after finishing the final mortar lift.

##### Protect mortar from direct sunlight, wind, rain, and frost.

## Pipeline Closure Assemblies

### The location and size of existing pipelines at tie-in locations are approximate.

#### The Contractor shall field verify all dimensions, locations, and materials of construction of existing piping and shall make all modifications required including furnishing and installing all transition pieces and fittings required for a complete and operable system.

#### The Contractor shall report all field verified deviations to the DISTRICT prior to fabrication of the proposed pipe segments.

### Field trimming of pipe when approved by the DISTRICT shall be normal to the axis of the pipe only.

### Employ pipeline closure assemblies to connect 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.

#### Select either follower ring design or butt strap design.

##### Install follower ring closures as recommended by the pipe manufacturer.

##### Center the shaped steel butt straps over the ends of the pipe sections they are to join.

###### Weld the butt straps to the outside of the pipes with complete circumferential fillet welds equal in size to the thinnest part being joined.

### Refer to the details shown in the Drawings when joining larger pipes.

### Cement-mortar line closure assemblies to a mortar thickness at least equal to the adjoining standard pipe sections.

#### Clean the steel with wire brushes and apply a cement and water wash coat prior to applying the cement mortar.

#### Where more than a 4-inch joint strip of mortar is required, place welded wire mesh reinforcement in 2-inch by 4-inch pattern of No. 13 gauge over the exposed steel.

#### Install the mesh so that the wires on the 2-inch spacing run circumferentially around the pipe.

#### Crimp the wires on the 4-inch spacing to support the mesh 3/8 inch from the metal pipe surface.

#### Steel-trowel finish the interior mortar to match adjoining mortar-lined pipe sections.

#### Coat the exterior of closure assemblies with mortar, or pour a concrete encasement, to cover all steel by at least 1 ½ inches.

#### Protect exterior mortar to retard drying while curing.

END OF SECTION