



IH-10: Boerne Stage Rd. To Heuermann Rd. 36-Inch Water Main Project RFCSP
Solicitation Number: CO-00587
Job No.: 21-7009

ADDENDUM 3
September 26, 2023

To Respondent of Record:

This addendum, applicable to work referenced above, is an amendment to the plans and specifications and as such will be a part of and included in the Contract Documents. Acknowledge receipt of this addendum by entering the Addendum number and issue date on the space provided in submitted copies of the bid proposal.

RESPONSES TO QUESTIONS

- 1. **Question:** In the response to Question 1 in Addendum 2, the answer came back no that C595 would not be allowed as an equal alternative to Type II or V cement. According to the most recent version of AWWA C205 (C205-18; Addendum Jan 2023), C595 is an allowed cement type. “4.2.2.1 *Type*. Cement for mortar shall conform to ASTM C150/C150M. Type I, Type II, or Type V; or ASTM C595/C595M Type IL, IL (MS), or IL (HS).” C150 cement types are no longer readily available and in many cases are not available at all. We ask that you reconsider the allowance of C595 for use in this project.

Response: ASTM C595/C595M Type IL, IL (MS), or IL (HS) cement for steel pipe mortar will be allowed for use on this project. Special Specification 15062 – Steel Pipe has been modified to address this question.

CHANGES TO THE SPECIFICATIONS

- 1. **Special Specification 15062:** Remove Special Specification 15062 in its entirety and replace with the version attached with this addendum. The section for cement lining materials was revised to include ASTM C595/C595M Type IL, IL (MS) or IL (HS).

CHANGES TO THE PLANS

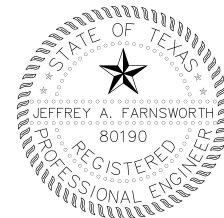
- 1. Sheet C47
 - Detail 4 was modified to include a ring and cover detail removing the words “Sanitary Sewer.”

END OF ADDENDUM

This Addendum, including this one (1) page, is thirty-four (34) pages with attachments in its entirety.

Attachments:
Special Specification 15062
Sheet C47

9/26/2023



Jeffrey A. Farnsworth
Kimley-Horn and Associates, Inc.

PART 1 - GENERAL

1.01 SCOPE

- A. This section covers the furnishing and installation of steel pipe 6 inches in diameter and larger. Steel pipe shall be furnished and installed complete with all fittings, specials, adapters, closure pieces, blowoffs, outlets, caps and plugs, temporary bulkheads, access manholes, jointing materials, pipe hangers and supports, anchors, blocking, encasements, cathodic protection, appurtenances, and accessories specified and indicated on the Drawings, and as required for proper installation and functioning of the piping.
- B. Steel pipe smaller than 6 inches in diameter, light wall steel pipe, miscellaneous small piping, pipe hangers and supports, cathodic protection, pressure and leakage tests, and cleaning and disinfection are covered in other sections. Pipe trenching, embedment, and backfill shall be in accordance with SAWS Standard Specification 804 – Excavation Trenching and Backfill.
- C. The size, service, and location of steel pipelines shall be as shown in the Plans.
- D. Piping furnished hereunder shall be complete with all joint gaskets, bolts, nuts and other jointing materials required for installation of any valves and equipment, including any valves and equipment furnished by Owner or others for installation under this Contract.

1.02 GOVERNING STANDARDS

Except as modified or supplemented herein, all steel pipe, fittings, and specials shall conform to the applicable requirements of the following standards:

<u>ANSI/AWWA Standards</u>	<u>Title</u>
C200	Steel Water Pipe - 6 In. and Larger
C205	Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. and Larger - Shop Applied
C206	Field Welding of Steel Water Pipe

C207	Steel Pipe Flanges for Waterworks Service – Sizes 4 In. through 144 In.
C208	Dimensions for Fabricated Steel Water Pipe Fittings.
C209	Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
C210	Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
C214	Tape Coating Systems for the Exterior of Steel Water Pipelines
C216	Heat-Shrinkable Cross-Linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
C217	Petrolatum and Petroleum Wax Tape Coatings for the Exterior of Connections and Fittings for Steel Water Pipelines
C222	Polyurethane Coating for the Interior and Exterior of Steel Water Pipe and Fittings
C602	Cement Mortar Lining of Water Pipelines in Place – 4 In. and Larger
C604	Installation of Steel Water Pipe – 4 In. and Larger
C606	Grooved and Shouldered Joints
M11	Steel Pipe – A Guide for Design and Installation

ANSI/ASME Standards

B1.1	Unified Inch Screw Threads (UN and UNR Thread Form)
B16.47	Large Diameter Steel Flanges NPS 26 through NPS 60

B18.2.1	Square and Hex Bolts and Screws (Inch Series)
B18.2.2	Square and Hex Nuts (Inch Series)
B36.10	Welded and Seamless Wrought Steel Pipe

1.03 QUALIFICATIONS

- A. Pipe manufacturer shall be ISO-9001 or SPFA certified with 5 years' experience in the manufacture of steel pipe, fittings, coatings, and linings specified. All pipe, fittings, specials, coatings, linings, and appurtenances shall be fabricated at one company facility for quality control purposes, unless otherwise acceptable to the Engineer.
- B. Pipe Manufacturer's Experience and Services. All steel pipe, fittings, specials, bolts, gaskets, other jointing materials and appurtenances shall be fabricated, lined, coated, and furnished under the direction and management of one pipe manufacturer. The pipe manufacturer's responsibilities, shall include, at a minimum; coordinating and furnishing all pipe materials, gaskets, bolts, and other jointing materials and pipe appurtenances (except for furnishing coupled joints and other similar products by a specified manufacturer) for a complete piping system that meets the specified pipe test pressure and service conditions; certifying that all pipe, fittings, specials, and other pipe materials, gaskets, and bolts specified herein are being manufactured in full accordance with the Contract Documents; preparing and submitting all submittal information and shop drawings; and making any corrections that may be required to submittal information and shop drawings.
- C. The pipe manufacturer's minimum required experience qualifications shall include manufacture of interior and buried steel pipelines of similar diameters for at least two water transmission pipelines with the same type joints, linings, and coatings and suitable for the same or higher pressure rating, which has performed satisfactorily for the past 5 years.
- D. All steel pipe shall be installed as specified herein and indicated on the drawings, in accordance with the pipe manufacturer's recommendations.

1.04 SUBMITTALS

Drawings, details, specifications, installation schedules, welding procedures and welder qualifications, and other data showing complete details of the fabrication, construction, weld locations, joint details and certification, and installation of pipe, fittings, specials, and connections, together with complete data covering all materials proposed for use, shall be submitted in accordance with the Submittals Procedures section. The drawings and data shall include, but shall not be limited to, the following:

- A. **Certifications and Affidavits of Compliance:** Contractor shall submit all certifications and affidavits of compliance. Performing and paying for sampling and testing as necessary shall be the Contractor's responsibility. The following certifications and affidavits of compliance are required for all pipe and other products or materials furnished, as specified in ANSI/AWWA C200 and herein.

1. Mill Certificates. Material lists and steel reinforcement schedules which describe all materials to be utilized. Metallurgical test reports for steel proposed for use on the project. Chemical and physical test reports from each heat of steel that indicate the steel conforms to the Contract Documents. Records shall indicate heat of steel for each pipe joint listed in the pipe laying schedule.
 2. List cross-referencing pipe mark numbers with pipe sequence numbers, heat numbers, and can numbers.
 3. Hydrostatic test reports.
 4. Results of production weld tests.
 5. Sand, cement and mortar tests.
 6. Rubber gasket tests and gaskets certification by pipe manufacturer, including a written statement from the gasket material manufacturer, certifying that the gasket materials are compatible with the joints specified and are recommended for the specified field test pressure and service conditions.
 7. All materials in contact with treated or potable water are ANSI/NSF 61 approved.
 8. Pipe temperature complies with Contract Documents prior to placing backfill material and prior to and during welding.
 9. All welds were performed in conformance with these Contract Documents.
 10. Affidavit of compliance for each ANSI/AWWA standard covering materials and work furnished for the project.
 11. Certification of pipe manufacturer's minimum experience requirements. Certification to be submitted prior to award of contract if required in the bidding documents or requested by Engineer.
- B. Shop Drawings: The Contractor shall submit Shop Drawings of piping in accordance with the requirements of ANSI/AWWA C200 and the following supplemental requirements:
1. Certified dimensional drawings of all pipe, fittings, specials, and appurtenances. The ASTM designation for the material from which each class of pipe is fabricated.
 2. Production schedule for manufacturing/fabricating pipe for the work as part of Contractor's Progress Schedule. Steel pipe production schedule shall be included in all versions of the Contractor's Progress Schedule beginning with the first Progress Scheduled submittal.
 3. Joint and pipe wall construction details which indicate the type and thickness of cylinder; the position, type, size and area of wire or other reinforcement; coatings and linings including holdbacks; manufacturing tolerances; maximum angular joint deflection limitations; and all other pertinent information required for the manufacture and installation of the product. Joint details and design criteria shall be submitted for all welded joint types, including beveled ends for alignment conformance and any deep butt strap joints required for control of temperature stresses.
 4. Pipe design criteria sufficient to ascertain conformance of pipe and fittings with the Contract Documents. Submit certification from manufacturer that design was performed for the project in accordance with the requirements of this specification. Certification to be signed and sealed by a professional Engineer registered in the State of Texas. Pipe design criteria shall include, but shall not be limited to, minimum pipe diameter, minimum pipe wall thickness, pressures, external loads, yield strength, allowable fiber stress, longitudinal stress for restraint, temperature changes, lining and coating materials, and other factors used for pipe design.
 5. Table(s) showing E', K, soil weight, deflection lag factor, external loads, and percent deflection from minimum to maximum cover depth shown in the Steel Pipe Schedule

- in one foot increments covering each size and class of pipe. Two tables shall be submitted for each size and class of pipe, one with live load and the design deflection lag factor specified herein and one without live load and a deflection lag factor of 1.0.
6. Ground Elevation and Utility Locations:
 - a. Prior to preparation of the pipe laying schedule, Contractor shall verify the existing ground elevations and the location and depth of all submerged utilities using centerline stakes set by the Contractor at no more than 50 feet intervals. Contractor shall carefully locate and excavate utility, survey, document and submit this information to the Engineer.
 - b. Engineer will review this information and if necessary make adjustment to the pipeline profile. Any Drawings that are modified by the Engineer shall be reissued to the Contractor.
 7. Pipe Laying Schedule Information:
 - a. Pipe laying schedule and marking diagrams compatible with the requirements of AWWA Manual 11 (M11) which indicate the specific number of each pipe, fitting, and special and the location and direction of each pipe fitting, and special in the completed pipeline. In addition, the pipe laying schedule shall include: the station and centerline or invert elevation coordinated with the Drawings to which the bell end of each pipe will be laid; all elements of curves and bends, both in horizontal and vertical alignment; and the limits within each reach of restrained and/or welded joints or of concrete encasement. The location of all mitered pipe sections, beveled ends for alignment conformance, and any deep butt strap joints for temperature stress control shall be clearly indicated on the diagrams.
 - b. The pipe laying schedule shall have a sequence of laying and an explanation of all abbreviations used in the schedule. For long, straight pipe runs, the pipe laying schedule shall list the pipeline station and either the pipe centerline or invert elevation coordinated with the Drawings at least every 50 feet.
 - c. Drawings showing the location and details of bulkheads for hydrostatic testing of the pipeline including details for removal of test bulkheads and repair of the lining.
 - d. Details and locations of closures and cutoffs for length adjustment, temporary access manholes, vents and weld lead pass holes as specified or indicated on the Drawings, and as required for construction convenience.
 - e. The method that the Contractor proposes to use for measuring deflection of pipe joints.
 - f. Annotated laying schedule showing all changes made during the progress of the Work.
 8. Welding Information: Submit the following prior to performing any welding work:
 - a. Full and complete information regarding location, type, size and extent of all welds with reference called out for Welding Procedure Specifications (WPS) numbers shall be shown on the Shop Drawings. The Shop Drawings shall distinguish between shop and field welds. Shop Drawings shall indicate welding symbols for the details of the welded joints, and the preparation of parent metal required to make them. Joints or groups of joints in which welding sequence or technique are especially important shall be carefully controlled to minimize shrinkage stresses and distortion.
 - b. Written welding procedures for shop and field welds (including Welding Procedure Specifications (WPS's) and Procedure Qualification Records (PQR's). All WPS used to fabricate and install pipe shall be qualified under the provisions of ANSI/AWS D1.1 – Structural Welding code – Steel or the ASME Boiler and Pressure Vessel Code (BPVC) for shop welds and ANSI/AWS D1.1 for field

- welds. Written WPS shall be required for all welds, both shop and field. WPS's qualified per the ASME BPVC shall include Supplementary Essential Variables for notch-tough welding. All provisions of ANSI/AWS D1.1 pertaining to notch-tough welding shall apply.
- c. Written nondestructive testing (NDT) procedure specifications and NDT personnel qualifications.
 - d. Current welder performance qualifications (WPQ'S) shall be submitted for each welder prior to performing any work either in the shop or field. Qualification testing shall be in accordance with ASME Section IX or AWS B2.1 and as defined in Section 4 of ANSI/AWWA C206 or ANSI/AWWA C200, as applicable.
 - e. Credentials of the Contractor's certified welding inspectors (CWI's) and quality control specialists for review prior to starting any welding in the shop or field. The credentials shall include, but not be limited to, American Welding Society QC-1 Certification. Other NDT quality control personnel shall be certified as required by AWS D1.1 and in accordance with written practice ASNT SNT-TC-1A.
 - f. All NDT data for each shop-welded and field-welded joint. This data shall include all testing on each weld joint, including re-examination of repaired welds, using visual, radiographic, magnetic particle dye penetrant examination, ultrasonic or air test examination methods specified. Test data shall be reviewed and signed by the welding inspector(s).
 - g. Welder logs for field and shop welding. Logs shall list all welders to be used for the work, the welding process, position, welder stamp number, certification date and certification status for each welder.
 - h. A welding map showing the sequence of welds for all field welds.
 - i. A written weld repair procedure for each type of shop and field weld proposed for use on the project.
 - j. A written rod control procedure for shop and field operations demonstrating how the Contractor intends to maintain rods in good condition throughout the work. The rod control procedure shall also demonstrate how the Contractor intends to ensure that the proper rods are used for each weld.
9. Control of Temperature Stresses for Welded Joints:
 - a. Plan and installation instructions to avoid the accumulation of expansion and contraction to minimize temperature stresses in the pipe wall during installation and when the pipeline is in service. The plan and installation instructions shall include the sequencing of events during and after installation, including backfilling and welding, use of a lengthened bell, and other methods to control temperature stresses in the pipeline.
 - b. Plan for monitoring pipeline temperatures.
 10. Detail drawings indicating the type, number and other pertinent details of slings, strutting, and other methods proposed for pipe support and handling during manufacturing, transport, and installation. The recommended methods of handling and placement of the pipe shall be submitted as a record copy prior to transporting any pipe to the Site. All pipe handling equipment and methods shall be acceptable to the Engineer.
 11. For record copy, detailed drawings indicating loading and shipping procedures that are designed to minimize damage to coating.
 12. Pipe manufacturer's written Quality Assurance/Control Program.
 13. Field services.

- a. Certification of pipe manufacturer's field services, including a copy of the initial services, and all subsequent inspection reports.
- b. Field service representative resume.

1.05 SHIPPING, HANDLING, AND STORAGE.

- A. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section, and as specified herein.
- B. Pipe, fittings, and accessories shall be handled and stored as recommended by the pipe manufacturer and shall be handled in a manner that will ensure installation in sound, undamaged condition. Equipment, tools, and methods used in handling and installing pipe and fittings shall not damage the pipe and fittings. Forks and other lifting devices shall have broad, well-padded contact surfaces.
- C. Contractor-furnished pipe and fittings in which the lining has been damaged shall be replaced by and at the expense of Contractor. With the concurrence of Engineer, small and readily accessible damaged areas may be repaired as recommended by the pipe manufacturer.
- D. Contractor shall repair any damage to pipe coatings and linings before the pipe is installed.
- E. Stulling. Adequate stulling shall be designed and provided by the pipe manufacturer on all specials, fittings, and straight pipe so as to avoid damage to the pipe during handling, storage, hauling, and installation. The stulling shall be tight fitting to prevent pipe deflection and to maintain roundness of +/- 1.0 percent. Stulling shall not damage the lining. The stulling shall be placed as soon as practicable after the pipe lining is applied and shall remain in place while the pipe is loaded, transported, unloaded, and installed at the site.

PART 2 - PRODUCTS

2.01 BASIS OF DESIGN

- A. Steel pipe, fittings, and specials shall be fabricated type for pipe 14 inches and larger, and may be either fabricated or mill type for pipe 12 inches and smaller. All items shall be the sizes, dimensions, and shapes indicated on the Drawings or specified herein.
 1. The specified size of fabricated pipe, fittings, and specials shall be the nominal inside diameter, in inches [mm], where 12 inches and smaller, and the actual inside diameter of pipe lining, where 14 inches and larger.
 2. The specified size of mill pipe, fittings, and specials shall be the nominal pipe size as set forth in ANSI/ASME B36.10.
 3. Pipe ellipticity (out-of-roundness) shall not exceed one percent.
 4. Pipe design shall be performed by the pipe manufacturer. Minimum design criteria shall be as specified.
 5. In addition to the pipe markings required by ANSI/AWWA C200, each pipe section, fitting, and special shall be clearly marked to indicate the service, the wall thickness, and the minimum yield strength of the pipe material.

B. Pipe Wall Thickness. Pipe shall be designed for all conditions indicated in the on the drawings.

1. The wall thickness for internal pressure due to hoop stress shall be determined by the following formula.

$$t = (PD)/(2s),$$

where

t = the pipe wall thickness in inches

s = the allowable fiber stress in psi shall not exceed 50 percent of the minimum yield strength of the steel plate at working pressure or 75 percent of the minimum yield strength at the larger of field test pressure or working pressure plus surge pressure. The yield strength used in the calculation for cement mortar coated pipe shall not exceed 36,000 psi. The yield strength used in the calculation for cement mortar lined pipe shall not exceed 46,000 psi.

P = the pipe working pressure or the larger of field test pressure or working pressure plus surge pressure in psi.

D = the pipe outside diameter, in inches, of straight pipe sections or the larger outside diameter of tapered sections.

2. Pipe shall be designed for a minimum of 175 psi working pressure with an additional 50% of the working pressure allowance for surge pressure unless otherwise specified. Pipe design shall be in accordance with AWWA M-11.
3. The pipe wall thickness shall be in accordance with ANSI/AWWA M11, except that all pipe shall have a minimum wall thickness of 1/4 inch, and a diameter to wall thickness ratio not to exceed 240.
4. Pipe wall thickness shall be constant for the entire length of pipe for each pipe class, location, or service indicated in the Steel Pipe Schedule unless otherwise indicated on the drawings or specified.
5. External loads on buried pipe shall be based on the prism load and the following design conditions.

Maximum pipe deflection, percent of nominal pipe diameter	3.0 percent for flexible lining 2.0 percent for cement mortar lining
Minimum design cover depth	Refer to Drawings
Maximum design cover depth	Refer to Drawings
E', Modulus of Soil Reaction	1,000 psi
K, Bedding Constant	0.090
Weight of soil	120 lbs/cu. ft.
Deflection Lag Factor	1.25
Live load	AASHTO HS-20
Impact Factor	1.5

6. The maximum pipe deflection shall be reduced if required by the jointing system furnished
 7. Cement mortar lining or coating shall not be used in the pipe deflection calculations.
 8. The pipe shall be designed to withstand full internal vacuum (0 psia) under the buried conditions and for external loading under the flood conditions at ground surface or as otherwise indicated on the Drawings, when empty.
- C. Fitting Dimensions. All dimensions for buried pipe fittings shall conform AWWA C208. Any fittings used for buried vertical bends and buried eccentric reducers shall be restrained.
- D. Joints. Acceptable joints of the type indicated on the Drawings and as specified herein shall be provided for all pipe installations in the locations indicated or accepted by Engineer. To facilitate installation, additional field-welded or mechanically coupled joints may be provided, but shall be kept to a minimum, and their locations shall be acceptable to Engineer. Field-welded joints shall not be used in pipe smaller than 30 inches, except in locations where the interior coating can be satisfactorily repaired and inspected.
1. Buried pipelines shall have lap-welded joints unless otherwise specified or indicated on the drawings. Restrained joints shall be lap-welded unless otherwise specified or indicated on the drawings. Rolled-groove rubber gasket joints will not be allowed.
 2. Each joint, including restrained joints, shall be checked by Contractor as recommended by the pipe manufacturer to verify that the joint and the restraints are installed properly. The pipe manufacturer shall furnish a metal gauge or other tools as required to measure joints.

2.02 MATERIALS

Pipe, Fittings, and Specials	ANSI/AWWA C200. All steel shall be fully killed, with a maximum carbon content of 0.25 percent, made to a fine austenitic grain size practice, and manufactured from continuous cast steel. Minimum yield strength (point) for the grade of steel used shall not exceed 46,000 psi
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Gaskets – Where Required	Synthetic rubber unless otherwise specified; natural rubber will not be acceptable. All gaskets shall be furnished by the pipe manufacturer, unless another manufacturer’s product is specified. Pipe manufacturer shall submit certificates of gasket suitability, certifying that the gasket materials are compatible with the joints specified and are recommended for the specified field test pressure and service conditions. Gaskets for treated or potable water service shall also be certified for chlorinated and chloraminated potable water.
Joint Lubricant	Vegetable-based lubricant recommended by the pipe manufacturer. Petroleum or animal-based lubricants will not be acceptable. Lubricants that will be in contact with treated or potable water shall be certified as being in compliance with ANSI/NSF 61.
Joint Diapers	
Diapers	Non-woven polypropylene fabric, lined with polyethylene foam, minimum weight 3 oz. per square yard. “Typar” as recommended by pipe manufacturer for the joint furnished.
Liner	100 percent closed cell polyethylene foam, 1.9 to 2.1 pounds per cubic foot density, Dow Chemical Company “Ethafoam 221”, minimum thickness of ¼ inch and full width of diaper.
Steel Straps	Class 1, Type 1, hot-rolled or heat treated cold rolled, Fed Spec QQ-S-781H, 0.020” thick, waxed or painted and waxed.
Seal Clips	Push or overlap type, providing single notch-joint on ½ inch or 5/8 inch wide seals; double notch joint on ¾ inch wide seals.
Flanged Joints	
Flanges	ANSI/AWWA C207, slip-on, except where otherwise specified or indicated on the Drawings.
Dimensions and Drilling	ANSI/AWWA C207, Class D except as otherwise indicated on the Drawings or specified.
Blind Flanges	ANSI/AWWA C207, Class D except as otherwise indicated on the Drawings or specified.

Gaskets	ANSI/AWWA C207. Pipe manufacturer shall submit certification of gaskets furnished as indicated above under Gaskets – All Joint Types.
Insulated Flanges	
Flanges	As specified herein, except bolt holes shall be enlarged as needed to accept bolt insulating sleeves.
Insulation Kits	See Section 134713 Corrosion Monitoring System.
Insulating Gaskets	Type E, G10, 1/8 inch [3 mm] thick, with Nitrile or EPDM sealing element unless otherwise required by pipe manufacturer and acceptable by Engineer. Pipe manufacturer shall submit certification of gaskets furnished as indicated above under Gaskets – All Joint Types.
Bolt Insulating Sleeves	G-10, 1/32 inch [0.7 mm] thick.
Insulating Washers	G-10, 1/8 inch [3 mm] thick, two for each flange bolt.
Backing Washers	Steel, 1/8 inch [3 mm] thick, two for each flange bolt.

Flange Bolting	
Material	ANSI/AWWA C207, unless otherwise required by the pipe manufacturer including higher strength and accepted by the Engineer. Exposed flange hardware shall be carbon steel Grade B7. Buried flange hardware shall be Type 316 stainless steel Grade B8M.
Type	Bolt and nut; bolt-stud and two nuts permitted for 1 inch [25 mm] and larger.
Bolts and Bolt-Studs	
Length	As required for ends to project 1/4 to 1 inch [6 to 25 mm] beyond outer face of nut.
Ends	Chamfered or rounded.
Threading	ANSI/ASME B1.1, coarse thread series, Class 2A fit. Bolt-studs may be threaded full length.

Bolt Head Dimensions	ANSI/ASME B18.2.1; regular pattern for square, heavy pattern for hexagonal.
Nuts	Hexagonal.
Dimensions	ANSI/ASME B18.2.2, heavy, semi-finished pattern.
Threading	ANSI/ASME B1.1, coarse thread series, Class 2B fit.
Mechanical Couplings	
Gaskets	Gaskets shall be as recommended by the coupling manufacturer. Coupling manufacturer shall submit certification of gaskets furnished as indicated above under Gaskets – All Joint Types.
Full Ring Type	
Insulating	Baker "Series 216", Dresser "Style 39", or Smith- Blair "416"; without pipe stop.
Reducing	Baker "Series 220", Dresser "Style 62", or Smith- Blair "413" and "415"; without pipe stop.
All Others	Baker "Series 200", Dresser "Style 38", or Smith- Blair "411 Steel Coupling"; without pipe stop.
Split Ring Type – Nonrestrained	Victaulic Depend-O-Lok, Inc. Bolted Split Sleeve"Style 230" or "Style 231".

Split Ring Type - Restrained	
16 inches or smaller	Victaulic, Inc. "232 Type 1".
Larger than 16 inches	Victaulic, Inc. "232 Type 2".
Buried Service	Victaulic Depend-O-Lok, Inc. "233 Type 2".
Flanged Coupling Adapters	

Restrained (4 inch through 12 inch). Unless otherwise indicated on the Drawings, flanged coupling adapters shall be restrained.	Dresser "Style 128", Smith-Blair "Type 913", or Romac "Style FCA501", with anchor studs of sufficient size and number to withstand test pressure.
Unrestrained (14 inch and larger)	Smith-Blair "Type 913" or Romac "Style FC400", 14 inches and larger.
Dismantling Joints	
Restrained 3 inch and larger. Unless otherwise indicated on the Drawings, dismantling joints shall be restrained.	Romac "DJ400", Dresser "Style 131 Dismantling Joint", or Viking Johnson. For use in potable water systems, coating to be in accordance with NSF-61.
Grooved Couplings	
When Joint Movement and Deflection is not Acceptable	ANSI/AWWA C606; Victaulic "07 Zero-Flex" and "W07 AGS".

When Joint Movement and Deflection is Acceptable	ANSI/AWWA C606; Victaulic "Style 77" and W77".
Restrained Joints	
Welded	ANSI/AWWA C200 and C206.
Lugs or Collars	ASTM A283, Grade B or C; or ASTM A36.
Tie Bolts	ASTM A193, Grade B7.

Threading	ANSI/ASME B1.1, Class 2A fit, coarse thread series for 7/8 inch and smaller, and 8-thread series for 1 inch and larger.
Ends	Chamfered or rounded.
Nuts	Hexagonal, ASTM A194, Grade 2H or better.
Threading	As specified for tie bolts, except Class 2B fit.
Dimensions	ANSI/ASME B18.2.2, heavy semifinished pattern.
Flat Washers	Hardened steel, ASTM A325.
Small Branch Connections	
Pipe Nipples	Seamless black steel pipe, ASTM A53, standard weight (Schedule 40).
Welding Fittings	
Threaded Outlets	Bonney Forge "Thredolets" or Flowserve/Vogt "Weld Couplets".
Welded Outlets	Bonney Forge "Weldolets" or Flowserve/Vogt "Weld Couplets".
Coatings and Linings	All materials in contact with treated or potable water shall be certified as being in compliance with ANSI/NSF 61.
Polyurethane	ANSI/AWWA C222. See Section 09811 Polyurethane Coating For Steel Pipe
Liquid Epoxy	ANSI/AWWA C210.
Field Tape Coating	[ANSI/AWWA C209 and C214 or C216, with ultraviolet light stabilizers, manufactured by PolyKen.] [see separate Polyethylene Tape Coating specification section]
Cement Mortar	ANSI/AWWA C205 and C602.
Cement	ASTM C150, Type II or ASTM C595/C595M Type IL, IL (MS) or IL (HS).
Sand	ANSI/AWWA C205, Section 4.2.3, except sand for field-applied lining shall pass a No. 16 sieve.
Epoxy Bonding Agent	ASTM C881, Type II, moisture insensitive and suitable for service conditions.



Latex Admixture	Euclid "Flex-Con" or Sika "SikaLatex".
Universal Primer	Pipe manufacturer's standard.
Watertight/Dusttight Pipe Sleeves	"GPT Link-Seal", insulating type with modular rubber sealing elements, nonmetallic pressure plates, and stainless steel bolts and nuts.
Anti-Seize Thread Lubricant	Jet-Lube "Nikal", John Crane "Thred Gard Nickel", Bostik/Never-Seez "Pure Nickel Special" or Permatex "Nickel Anti-Seize".
Anchor Bolts	ASTM A307.
Joint Grout and Diapers	ANSI/AWWA C205.

Joint Grout and Diapers	ANSI/AWWA C205.
Corrosion Protection	
Heat-shrinkable Coating and Primer (Shrink Sleeve)	ANSI/AWWA C216, cross-linked polyethylene sheeting precoated with adhesive; minimum 80 mils; type and recovery as recommended by Shrink Sleeve manufacturer; Canusa-CPS or Berry Plastics Water Wrap.
Underlying Sleeve	Heavy cross-linked polyethylene backing; Canusa- CPS I2/PE Backing.
Wax Tape and Primer	ANSI/AWWA C217. Cold-applied petroleum wax primer and cold-applied petroleum wax tape; Trenton Wax-Tape and Primer.
Medium Consistency Coal Tar	Carboline "Bitumastic 50" or Tnemec "46-465 H.B. Tnemecol".

2.03 ENDS OF SECTIONS

- A. For Field Welding. Ends of pipe, fittings, and specials for joints butt-welded in the field shall have the ends beveled for butt welding in accordance with the governing standards.

Ends of pipe, fittings, and specials for field-welded lap joints, as shown within the drawings, shall have both the bell and the spigot expanded by pressing, if necessary, (not rolling) to obtain the required shape and welding tolerances

- B. For Fitting with Flanges. Ends to be fitted with slip-on flanges shall be prepared to accommodate the flanges in accordance with the governing standards.
- C. For Mechanical Couplings. Ends to be joined by mechanical couplings shall be plain end type. Pipe seam welds on ends to be joined by mechanical couplings without pipe stops shall be ground flush to permit slipping the coupling in at least one direction to clear the pipe joint. The welds on ends to be joined by split ring type couplings shall be ground flush to allow uniform contact of the shoulder and pipe wall. Outside diameter and out-of-round tolerances shall be within the limits specified by the coupling manufacturer.

Where retainer rings for split ring mechanical couplings are required to be fixed to the ends of pipe to provide restraint within a mechanical coupling, at least one of the restraint rings shall be welded in place in the field to assure the coupling is installed with the pipe in a fully-extended position.

- D. For Grooved Couplings. Ends to be joined by grooved couplings shall be of the shouldered type, conforming to the governing standard and as recommended by the coupling manufacturer for the size and wall thickness of the pipe, fitting, or special being coupled, and for the maximum test or working pressure to which the couplings will be subjected.

- E. For Flanged Coupling Adapters. Ends to be fitted with flanged coupling adapters shall be plain end type in accordance with the governing standard for mechanical couplings. Welds shall be ground flush to permit installation of the coupling. For restrained flange coupling adapters, holes shall be field drilled at the proper location for anchor studs.
- F. For Connection to Dissimilar Pipe Materials. Steel pipe connections to dissimilar materials shall be made with an insulated flange per Section 134713 Corrosion Monitoring System.

2.04 SEAMS

- A. Except for seamless mill-type pipe, all piping shall be made from steel plates rolled into cylinders or sections thereof with the longitudinal seams butt-welded, or shall be spirally formed and butt-welded. There shall be not more than two longitudinal seams. Girth seams shall be butt-welded and shall be spaced not closer than 10 feet apart except in specials and fittings.

2.05 PIPE LENGTHS

- A. Straight pipe section lengths shall be pipe manufacturer's standard lengths, unless otherwise indicated on the Drawings.
- B. All pipe to be connected with mechanical couplings shall be fabricated so that the space between pipe ends within the couplings will not exceed the amount recommended by the coupling manufacturer, but shall be at least 1/2 inch.

2.06 SMALL BRANCH CONNECTIONS

- A. Branch connections 2-1/2 inches and smaller shall be made with welding fittings with threaded outlets. Where the exact outlet size desired is in doubt, but is known to be less than 1 inch, a 1 inch outlet shall be provided and reducing bushings used as needed.
- B. Branch connections sized 3 through 12 inches shall be made with pipe nipples or with welding fittings with welded outlets. Pipe nipples and welding fittings shall be welded to the pipe shell and reinforced as needed to meet design and testing requirements.
- C. Small branch connections shall be so located that they will not interfere with joints, supports, or other details, and shall be provided with caps or plugs to protect the threads during shipping and handling.

2.07 ACCESS MANHOLES

- A. If access to the pipe is needed during construction for welding or other activities, the manhole shall be pre-cast and shall follow the requirements in the Plans on Sheet C47, Detail 4.

2.08 FLANGED JOINTS

- A. Flange faces of flanged joints shall be normal to the pipe axis. Angular deflection (layback) of the flange faces shall not exceed the allowable set forth in ANSI/AWWA C207. All flanges shall be refaced after welding to the pipe, if necessary to prevent distortion of connecting valve bodies from excessive flange bolt tightening and to prevent leakage at the joint.

- B. Pipe lengths and dimensions and drillings of flanges shall be coordinated with the lengths and flanges for valves, pumps, and other equipment to be installed in the piping. All mating flanges shall have the same diameter and drilling and shall be suitable for the pressures to which they will be subjected.
- C. Flanges shall be of the slip-on type, except that welding-neck or slip-on flanges welded to short lengths of pipe shall be used where installation of flanges in the field is permitted or required.
- D. For welding neck flanges, the pipe shall be concentrically reduced as necessary for proper alignment of the pipe wall with the welding neck flange for butt welding. The interior of the weld joint and flange shall be cement lined in the shop as specified in ANSI/AWW C205.

2.09 MECHANICAL COUPLINGS

- A. The middle ring of mechanical couplings shall have a thickness at least equal to the wall thickness specified herein for the size of pipe on which the coupling is to be used. If the coupling manufacturer's standard thickness is less, that thickness may be used unless allowable pressures are exceeded. The length of each middle ring shall be not less than 10 inches for 36 inches and larger pipe and not less than 7 inches for pipe smaller than 36 inches.
- B. All surfaces, including the interior surfaces of the middle rings, shall be prepared for coating in accordance with the coating manufacturer's instructions and shall then be coated with liquid epoxy in accordance with ANSI/AWWA C210.
- C. Factory pipe spacers shall be provided where indicated on the drawings. The spacers shall be factory coated and lined with 16 mils of liquid epoxy.
- D. All split ring style couplings shall be designed for not less than 150 psi working pressure. Where pressure may exceed 150 psi, the coupling shall be designed for the required pressure and provided with the coupling manufacturer's "high pressure modification". Use of the 232 Type 1 split ring coupling shall be limited to piping 16 inches and less in diameter. A 232 Type 2 split ring coupling shall be provided for pipe diameter greater than 16 inches size. Where split ring couplings are permitted in buried applications, they shall be 233 Type 2.

2.010 GROOVED COUPLINGS

- A. Grooved couplings shall be sized for proper installation on the pipe ends provided. The couplings shall be restrained or have movement and deflection requirements as required.
- B. After fabrication, all housing clamps forming the coupling shall be cleaned and primed (as specified for the pipe) by the coupling manufacturer.

2.011 FLANGED COUPLING ADAPTERS

Unless otherwise indicated on the Drawings, all flange coupling adapters shall be restrained.

- A. The inner and outer surfaces of couplings, except flange mating surfaces, shall be prepared for coating in accordance with instructions of the coating manufacturer and shall then be coated with liquid epoxy in accordance with ANSI/AWWA C210. The flange mating surfaces shall be cleaned and shop primed with universal primer.

2.012 DISMANTLING JOINTS

- A. Dismantling joints shall be provided for restrained couplings 6 inches and larger. Dismantling joints shall comply with AWWA C219 and shall be restrained flange by flange couplings manufactured as a single unit. Unless otherwise indicated on the Drawings, dismantling joints shall be restrained.
- B. The inner and outer surfaces of dismantling joints, except flange mating surfaces, shall be prepared for coating in accordance with instructions of the coating manufacturer and shall then be coated with liquid epoxy in accordance with ANSI/AWWA C210. The flange mating surfaces shall be cleaned and shop primed with universal primer.

2.013 RESTRAINED JOINTS

- A. Restrained joints shall be flanged, welded, flanged coupling adapters with anchor studs, split ring fixed type couplings, rigid groove couplings, or harnessed, as specified or as indicated on the Drawings.
- B. Where indicated on the Drawings, mechanically coupled joints shall be restrained with harness bolts and lugs or collars. Joint harnesses shall conform to the details indicated on the Drawings. Lugs or collars shall be shop welded to the pipe and coated as specified for the adjacent pipe.
- C. Split ring style couplings used for restraint shall be restrained shoulder style. Grooved couplings used for restraint shall be rigid type.
- D. Any fittings used for buried vertical bends and eccentric reducers shall be restrained.

2.014 PROTECTIVE COATINGS AND LININGS

All steel pipe, fittings, specials, wall fittings, and accessories shall be lined, coated, or wrapped as specified herein.

- A. Type of Coating and Lining. Surface preparation shall be in accordance with the pipe manufacturer's and coating and lining manufacturer's instructions. Types of protective coating and lining shall be as follows:

Coatings	
Interior Locations	Shop-applied universal primer with the polyurethane finish. Field painting is covered in the Protective Coatings section.
Underground, Including those Encased in Concrete	Shop-applied universal primer with the polyurethane finish. Field painting is covered in the Protective Coatings section.

Linings	
Suction Piping	20 mil DFT (3 coats total) of Liquid- Epoxy (NSF certified systems) per ANSI/AWWA C210
Discharge Yard Piping, Well Piping, and Discharge Piping Inside Pump Station	Cement mortar - shop applied, ANSI/AWWA C205. The governing standards shall be as modified herein.
Pipe Joints	
Couplings	Shop coating as specified for each type of coupling. Field coating as specified for ends of sections in the Joint Holdbacks and Coatings and Linings paragraph and the Corrosion Protection paragraph for buried couplings.
Ends of Sections	As specified in the Joint Holdbacks and Coatings and Linings paragraph.
Machined Surfaces	Rust-preventive compound.
Blind Flanges	Shop coat with 20 mil dry film thickness of liquid epoxy in accordance with ANSI/AWWA C210.

B. Modifications to the Governing Standards.

C. Cement Mortar Lining. Cement mortar lining for all pipe shall be shop applied Except as modified herein, shop-applied mortar linings shall comply with ANSI/AWWA C205.

1. Specials. Wire fabric reinforcement shall be used in the lining of fittings and specials in accordance with ANSI/AWWA C205.
2. Adjacent to Valves. If the specified nominal pipe size is the actual outside diameter, cement mortar lining installed in steel pipe adjacent to butterfly valves shall be tapered so that the lining material will not interfere with the valve disc during valve operation.

D. Polyethylene Tape Coating. Prefabricated Multi-layer Cold Applied Tape Coating - the coating system for straight-line pipe shall be in accordance with AWWA Standard C214. The system shall consist of three layers of polyethylene material with a nominal thickness of 80 mills when complete.

2.015 MARKING

A. In addition to the pipe markings required by ANSI/AWWA C200, each pipe section, fitting, and special shall be clearly marked to indicate the service, the wall thickness, and the minimum yield strength of the pipe material. Pipe piece identification shall be shown on both the inside and outside of each pipe section, fitting, and special.

2.016 SHOP INSPECTION AND TESTING

- A. Except as otherwise indicated or acceptable to Engineer, all materials and work shall be inspected and tested by the pipe manufacturer in accordance with ANSI/AWWA C200. All costs in connection with such inspection and testing shall be borne by Contractor.
1. Copies of all test reports shall be submitted in accordance with the Submittals Procedures section.
 2. Owner reserves the right to sample and test any pipe after delivery and to reject all pipe represented by any sample which fails to comply with the specified requirements.
 3. Steel greater than or equal to 1/4 inch thickness used in production manufacturing of pipe and specials shall be tested for notch toughness using Charpy V-Notch tests in accordance with ASTM A370 – Test Methods and Definitions for Mechanical Testing of Steel Products. The test acceptance for full size specimens (0.394 in. by 0.394 in. size) shall be 25 foot-pounds at a test temperature of 32 degrees F; tests shall include three impact specimens and shall be conducted in the direction transverse to the final direction of rolling. When full-size specimens are not obtainable, the minimum required Charpy value is permitted to be reduced by multiplying the ratio of the (actual width along the notch / 0.394 in.) x 25 ft-lbs. For sub size specimens the test temperature shall be reduced as follows: Width along the notch > 0.296 in. (no reduction required); 0.295 in. (3/4 size bar): 5 degrees F reduction; 0.236 in.: 15 degrees F reduction. Straight line interpolation for intermediate values shall be used. Tests shall be conducted in accordance with ASTM A20 for two coils of each heat. Only welding consumables that are classified by the applicable AWS filler metal standard (e.g. A5.1, A5.17, A5.18, A5.20) with Charpy impact test requirements at a temperature 32 degrees F or lower are permitted.
- B. Owner's Inspection at the Shop. If Owner elects to inspect any work or materials, as permitted under Section 5.1 of ANSI/AWWA C200, all costs in connection with the services of Owner's inspector will be paid for by Owner.
1. A fabrication schedule shall be submitted to Owner at least 30 days prior to fabrication activities. Each time the schedule is changed, the Contractor shall revise and resubmit the schedule. The Contractor shall notify the Engineer at least 5 days prior to any change in the revised and current schedule. If the Owner's representatives make an inspection and the manufacturer is not performing the work as indicated in the revised and current schedule for that date, the expense shall be the sole responsibility of the Contractor.
 2. Additional weld test specimens shall be furnished to Owner's inspector for testing by an independent testing laboratory whenever, in the judgment of Owner's inspector, a satisfactory weld is not being made. Test specimens shall also be furnished when Owner's inspector desires. The entire cost of obtaining, inspecting, and testing of such additional specimen plates, welds, or materials will be borne by Owner. If any specimen is found not to conform to the specified requirements, the materials represented by the specimen will be rejected. The expense of all subsequent tests due to failure of original specimens to comply with the specifications shall be the responsibility of Contractor.

3. In addition to making or witnessing specified tests and submitting any required reports to Engineer and Owner, Owner's inspector will submit written reports to Contractor concerning all materials rejected, noting the reason for each rejection.
 4. Inspection by Owner's inspector, or Owner's option not to provide inspections, shall not relieve Contractor of his responsibility to provide materials and to perform the work in accordance with the Contract Documents.
 5. The Owner reserves the right to sample and test any pipe after delivery and to reject all pipe represented by any sample which fails to meet with the specified requirements.
- C. Welding Procedures, Welder Qualifications, and Testing. All welding procedures, welders, welding operators, and tackers shall be qualified in accordance with ASME Section IX or AWS B2.1 as defined in ANSI/AWWA C200. All qualifications shall be in accordance with the position in which the welding is to be accomplished.
1. All shop welds shall be visually inspected by a Certified Welding Inspector (CWI). All shop welds shall be visually inspected in accordance with the requirements of AWS D1.1, Table 6.1, Visual Inspection Acceptance Criteria table for statically loaded nontubular connections. All shop butt welds on steel pipe and fittings, except cylinders that are hydrostatically tested, shall be ultrasonically or radiographically tested by qualified and certified personnel. Shop ultrasonic weld tests and evaluation shall be in accordance with Section 9 of API 5L or ASME Section VIII, Division 1, Part UW-53. Radiographic weld tests and evaluation shall be in accordance with ASME Section VIII, Division I, Part UW-51. All other shop welds shall be either liquid penetrant examined in accordance with ASTM
 2. E 165, or magnetic particle examined in accordance with ASTM E 709. Acceptance criteria shall be in accordance with ASME Code, Section VIII, Division I, Appendix 6 for magnetic particle examination and Appendix 8 for liquid penetrant examination.
 3. Personnel performing visual inspection of welds shall be qualified and currently certified as Certified Welding Inspectors (CWI) in accordance with AWS QC1, Standard for Qualification and Certification of Welding Inspectors. Personnel performing ultrasonic and radiographic tests shall be qualified and certified in accordance with written practice ASNT SNT-TC-1A.
 4. Nondestructive examination procedures shall be submitted in accordance with the Submittals Procedures section at the time welding procedures are submitted. Records of inspection, nondestructive examination, and material certification shall be submitted to Engineer.
 5. The welder and welding operator qualification records shall be available at the shop facility or Site and shall be made available for review when requested.
 6. All costs for inspection and testing of shop welds shall be paid by Contractor.

2.017 STULLING

- A. Adequate stulling shall be designed and provided by the pipe manufacturer on all specials, fittings and straight pipe so as to avoid damage to the pipe and fittings during handling, storage, hauling and installation. The stulling shall be tight fitting to prevent pipe deflection. The following requirements shall apply:

- B. The stulling shall be placed as soon as practicable after the mortar lining has been applied and shall remain in place while the pipe is loaded, transported, unloaded, installed, and backfilled at the Site.
- C. The stulling materials, size and spacing shall be the responsibility of the Contractor, with the following exceptions:
 - 1. One stull shall be placed vertical when pipe is oriented with top up.
 - 2. For pipe joints up to 36 feet long, stulls shall be placed at a maximum spacing 12 feet apart. For pipe joints 36 to 50 feet long, a minimum of 4 stulls shall be placed at a maximum spacing of 15 feet apart.
 - 3. The stulling shall include the number of points shown in the table below:

Pipe Diameter	# of Stull Points
36" – 42"	4
48" – 54"	6
60" – 72"	6
78" and larger	8

- D. Stulling is for handling and transportation, as well as preventing egging before backfilling. Proper placement of embedment material controls deflection. Stulls are not structural members as they are eventually removed.
- E. Stulling on shop-lined pipe shall consist of stulls and wood wedges. Stulling shall be installed in a manner that shall not harm the lining.

2.018 PIPELINE MARKING TAPE

- A. Pipeline marking tape shall be minimum 4 mil thick polyethylene which is impervious to alkalis, acids, and chemicals and solvents which are likely in the soil. Tape shall be 12 inches wide. Imprinted lettering shall be one-inch tall, permanent black on a blue background, and shall read "WATER LINE BURIED BELOW." Tape shall be as manufactured by Reef Industries (Terra Tape), Allen (Markline) or equal.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation. Pipe ends shall be examined with particular care. All defective pipe and fittings shall be removed from the Site.
- B. All shop-applied exterior tape or other dielectric coatings on pipe, fittings, or specials shall be electrically inspected for holidays and other defects, and repaired if necessary. All electrical inspection shall be made in accordance with the standard to which the coating was applied.
- C. Inspection and repair of linings and coatings shall be performed by and at the expense of Contractor, after receipt of the pipe, fittings, or specials on the Site and before installation. Electrical inspection of exterior tape or other dielectric coatings after installation of the pipe,

fitting, or special in the trench shall be made where, in the opinion of Engineer, the coating may have been damaged by handling during installation.

- D. Confined Space Entry Supervision. Contractor shall provide above ground confined space entry supervision whenever Engineer is required to enter the pipe to verify Contractor's deflection measurements, inspect joints, or any other time the Engineer is required to enter the pipe.

3.02 PROTECTION AND CLEANING

- A. The interior of all pipe and fittings shall be thoroughly cleaned of all foreign material prior to installation and shall be kept clean until the work has been accepted. Before jointing, all joint contact surfaces shall be wiped clean.
- B. Precautions shall be taken to prevent foreign material from entering the pipe during installation and until the work has been accepted.
- C. Whenever pipe laying is stopped, the open end of the pipe shall be closed to prevent entry of dirt, mud, rodents, and other material. All water in the trench shall be removed prior to removing the closure.

3.03 ALIGNMENT AND GRADE

- A. Buried pipe shall be laid to the lines and grades as specified and indicated on the Drawings. Pipelines or runs intended to be straight shall be laid straight. Maximum joint openings and deflections shall be as recommended by the pipe manufacturer. For welded lap joints, deflections up to 4-1/2 degrees [0.079 rad] may be made by shop-mitering the bell end of one pipe. For welded butt joints, deflections up to 22-1/2 degrees [0.393 rad] may be made by shop-mitering the ends of two adjacent sections of pipe by equal amounts. Deflections greater than 22-1/2 degrees [0.393 rad] shall be made by use of fabricated bends.
- B. Where deflections would exceed the pipe manufacturer's recommendations, either shorter pipe sections or fittings shall be installed where needed to conform to the alignment or grade indicated on the Drawings and as acceptable to the Engineer.
- C. High points which allow air to collect in pipelines will not be permitted unless an air release valve is indicated on the Drawings at that location.
- D. Unless otherwise specified or acceptable to Engineer, laser beam equipment, surveying instruments, or other suitable means shall be used to maintain alignment and grade. At least one elevation reading shall be taken on each length of pipe. If laser beam equipment is used, periodic elevation measurements shall be made with surveying instruments to verify accuracy of grades. If such measurements indicate thermal deflection of the laser beam due to differences between the ground temperature and the air temperature within the pipe, precautions shall be taken to prevent or minimize further thermal deflections.
- E. Additional requirements for alignment and grade are covered in the Project Requirements and Trenching and Backfilling sections and on the Drawings.
- F. Tolerances. Each section of pipe shall be laid to the alignment and grade indicated on the Drawings and pipe laying schedule with pipe ends within the following tolerances;

- +/- 0.10 foot in grade at any point
- +/- 0.20 foot in alignment at any point

- G. In addition, piping shall be visually straight or on a smooth curve between the points of deflection or curvature indicated on the Drawings. Stricter tolerances than specified above shall be used as necessary to maintain minimum cover, to maintain required clearances, to make connections to existing pipe, to maintain the correct slope to avoid high or low points along the pipeline other than at locations indicated on the Drawings, or to meet other restrictions as required or directed by the Engineer.
- H. 3-3.02. Annotated Pipe Laying Schedule. The pipe laying schedule shall be annotated during the progress of the Work to show all changes made during construction for record documentation. Upon completion of the installation of the piping, the annotated pipe laying schedule shall be submitted to Engineer in accordance with the Submittals Procedures section.

3.04 INSTALLATION

- A. Buried Piping. Field installation of buried steel water piping shall be in accordance with ANSI/AWWA C604 unless otherwise specified or indicated on the Drawings.
1. For buried piping, all trenching, embedment, and backfilling shall conform to the Trenching and Backfilling section and the details indicated on the Drawings.
 2. Pipe embedment and backfilling shall closely follow the installation and jointing of steel pipe in the trench to prevent floatation of the pipe by water and minimize longitudinal movement caused by thermal expansion or contraction of the pipe.
 3. Pipe shall be protected from floatation during installation when subjected to groundwater or flood conditions.
 4. Manufacturer's Technician for Pipe Installation
 5. During the construction period, the pipe manufacturer shall furnish the services of a factory trained, qualified, job experienced technician to advise and instruct as necessary in pipe laying and pipe jointing.
 6. The technician shall assist and advise the Contractor in his pipe laying operations and shall instruct construction personnel in proper joint assembly and joint inspection procedures.
 7. The technician is not required to be on-site full time; however, the technician shall be regularly on-site during the first 2 weeks of pipe laying and thereafter as requested by the Engineer, Owner or Contractor.
 8. Each joint, including restrained joints, shall be checked by Contractor as recommended by the pipe manufacturer to verify that the joint and the restraints are installed properly.
 9. For restrained joint pipe, not more than 160 feet of pipe shall be exposed ahead of the backfilling in any section of trench. The backfill adjacent to field joints may be temporarily omitted to provide adequate space for field coating the joints.
 10. Closure welds on restrained joint pipe shall be made during the cool part of the day.
- B. Pipe Deflection. All buried pipe larger than 30 inches in diameter shall be tested for excessive deflection at 25-foot intervals unless otherwise required by Owner.

- C. Deflection Measurements. Pipe deflection for all buried pipe shall be determined by measuring initial pipe vertical and horizontal inside diameters before the backfill load is supported by the pipe and a second vertical and horizontal inside diameters at least 24 hours after the backfill load is supported by the pipe. The second pipe deflection measurement shall be taken and the results determined before continuing. Initial and second measurements shall be made for at least two locations on each piece of pipe and approximately equally spaced along the pipe. The points of initial deflection measurements shall be marked so that final deflection measurements are at the same points. The tolerance for deflection measurements shall be 1/8 inch. The percent deflection shall be the largest difference between the initial and second measurements at each point divided by the nominal pipe diameter. Pipe embedment and backfill not exceeding one foot above the top of pipe shall be in place during initial measurements. Struts that allow access may remain in place during initial measurements but shall be removed after initial measurements. Pipe deflection will be measured and documented by Contractor and verified by Engineer for each piece of pipe. Engineer shall be notified in advance of when deflection measurements are made. The deflection documentation shall be submitted daily unless otherwise acceptable to the Engineer.
- D. Allowable Deflection. The allowable deflection shall be the calculated design percent of nominal diameter with a deflection lag factor of 1.0 and excluding live load, for the depth of the installed pipe to the nearest foot. Pipe exceeding the allowable deflection shall be uncovered and the embedment and backfill replaced as needed to prevent excessive deflection. After replacing embedment and backfill, the pipe shall be retested. Pipe damaged by over deflection or otherwise shall be satisfactorily repaired or removed and replaced with new pipe.
- E. Flanged Joints. Flange faces shall be flat and perpendicular to the pipe centerline. The rust-preventive coating on the flange faces shall be soluble and shall be removed before the joint is made.
1. Care shall be taken in bolting flanged joints to avoid restraint on the opposite end of the pipe or fitting, which would prevent uniform gasket compression or would cause unnecessary stress in the flanges. The pipe or fitting shall be free to move in any direction while the flange bolts are being tightened. Bolts shall be tightened gradually in a crisscross pattern at a uniform rate, to ensure uniform compression of the gasket around the entire flange. All flange joint bolting procedures shall be in accordance with the pipe manufacturer's recommendations.
- F. Welded Joints. All welds shall be sound and free from embedded scale or slag and shall be watertight. Butt welds shall have tensile strength across the weld not less than that of the thinner of the connected sections., Butt welds shall be used for all welded joints in pipe assemblies and in the fabrication of bends and other specials. Field-welded joints, where permitted, shall be either butt- welded or lap-welded Lap-welded joints shall have full fillet welds. Any weld that undercuts the parent metal shall be cut out, filled, and ground smooth.
1. Field welding of joints shall conform to ANSI/AWWA C206 and M11. Where acceptable to the Engineer, single field-welded butt joints with outside backing rings may be used for pipe larger than 30 inches in diameter. Backing rings will not be permitted for 30 inch and smaller pipe. Butt straps shall be welded on both the inside and outside of the pipe and at each end of the pipe and strap to avoid stress multiplication.
 2. Field-welded lap joints may have only a single fillet weld on the inside of the pipe joint as detailed in Figure 1-15062(B) , except where double-welded joints as detailed

in Figure 1-15062(A) are indicated on the Drawings, details or specified. The interior joint may be welded after the exterior joint has been coated with a shrinkable wrapped sleeve or other specified coating and backfilled with at least 3 feet [900 mm] of backfill material. The field welding shall be performed so that the interior lining, the exterior coating, and the field applied joint coating are not damaged.

3. A field test, including excavation of a welded joint for inspections, shall be performed to verify that the interior lining, the exterior coating, and the field applied joint coating are not damaged by the interior welding at the start of the project. The field test shall be repeated if welding procedures are modified.
4. Provisions shall be made to minimize stresses in welded steel pipe to account for temperature changes and to avoid the accumulation of expansion and contraction during installation and after the pipe is in service as recommended by the pipe manufacturer and in accordance with ANSI/AWWA M11 and C604. The allowable temperature range of the pipe during welding shall be established by the pipe design and monitored during installation as recommended by the pipe manufacturer.

G. Special Procedure Inspection and Testing. Special procedure shop inspection and testing shall be in accordance with the shop inspection and testing provisions specified herein. Field welding procedures, welders, welding operators, and tackers shall be qualified in accordance with ASME Section IX or AWS B2.1 and as defined in Section 4 of ANSI/AWWA C206 or ANSI/AWWA C200, as applicable. All qualifications shall be in accordance with all-position pipe tests as defined in the applicable qualification code.

1. The welder qualification testing for field welding shall be conducted at the Site. Results of previous qualification tests will not be accepted. The Contractor is responsible for the qualification of welders or welding operators. Field welder or welding operator performance qualification testing shall be performed under the full supervision and control of the Contractor. It is permissible to subcontract the work for preparation of test specimens, performance of NDE, and mechanical tests, provided the Contractor accepts the responsibility for the work. Copies of all test data and certifications shall be submitted to Engineer. All costs of welder qualification testing shall be paid by Contractor.
2. Upon completion of each field-welded joint, the welder or welding operator shall mark his regular identification number and the last two digits of the year the work was completed, or Contractor may have a records system that traces a welder's work. Steel stamping directly on piping will not be permitted unless "low stress" die stamps, such as interrupted dot or round-nose types, are used.
3. All field welds shall be visually inspected by a CWI. All field welds shall be visually inspected in accordance with the requirements of AWS D1.1, Table 6.1, Visual Inspection Acceptance Criteria table for statically loaded nontubular connections. Contractor shall be responsible for all costs to provide the visual inspection.
4. Field welds will be randomly inspected and tested by an independent testing laboratory as directed by Engineer. Field lap welds will be inspected by magnetic particle or the liquid penetrant method. Field butt welds will be inspected by the radiographic method and in accordance with the acceptance criteria of API 1104. Contractor shall inform Engineer before welded joints are to be backfilled so that the joint may be inspected. Contractor shall be responsible for all costs of exposing joints that were backfilled before inspection.

5. Personnel performing visual inspection of welds shall be qualified and currently certified as Certified Welding Inspectors (CWI) in accordance with AWS QC1, Standard for Qualification and Certification of Welding Inspectors. Personnel performing nondestructive tests shall be qualified and certified in accordance with written practice ASNT SNT-TC-1A.
 6. Engineer may also order nondestructive testing by an independent testing laboratory in addition to any testing specified herein.
 7. Except as otherwise specified herein, all costs for inspection and testing of field welds by the independent testing laboratory will be paid by Owner. If the weld is defective, the inspection costs shall be paid by Contractor. Defective welds shall be repaired and retested at Contractor's expense.
 8. Test reports of all NDE examinations or laboratory tests shall be submitted as provided for in the Quality Control and Submittals Procedures sections.
- H. Couplings. Surfaces of pipe ends and couplings in contact with the sealing gasket shall be clean and free from foreign material when the coupling is installed on the pipe. Wrenches used in bolting couplings shall be of a type and size recommended by the coupling manufacturer. All bolts shall be tightened by approximately the same amount, with all parts of the coupling square and symmetrical with the pipe. Following installation, the exterior coating of each coupling shall be touched up or re-primed.
1. Where restraint is required, Contractor shall verify that tie bolts have been stressed to assure the pipe will not creep when pressurized. When split ring, fixed type couplings are installed, piping shall be in a fully-extended position to engage the restraint rings at the pipe ends. Submerged couplings shall be bonded for electrical continuity as detailed on the Drawings and specified in Section 13110.
- I. Flanged Coupling Adapters. Flanged coupling adapters shall be installed in accordance with the coupling manufacturer's recommendations. After the pipe is in place and all bolts have been properly tightened, the location of holes for the anchor studs shall be determined and the pipe shall be field drilled. Holes for anchor studs shall extend completely through the pipe wall. Hole diameter shall be not more than 1/8 inch larger than the diameter of the stud projection. Unless otherwise indicated on the Drawings, all 12 inches and smaller flange coupling adapters shall be restrained and all 14 inches and larger flange coupling adapters may only be used in unrestrained applications.
- J. Dismantling Joints. Dismantling joints shall be installed in accordance with the coupling manufacturer's recommendations. Unless otherwise indicated on the Drawings, dismantling joints shall be restrained.
- K. Mechanical Couplings. Mechanical couplings shall be installed in accordance with the coupling manufacturer's recommendations. A space of at least 1/4 inch [6 mm], but not more than 1 inch, shall be left between the pipe ends. Pipe and coupling surfaces in contact with gaskets shall be clean and free from dirt and other foreign matter during assembly. All assembly bolts shall be uniformly tightened so that the coupling is free from leaks, and all parts of the coupling are square and symmetrical with the pipe. Following installation of the coupling, damaged areas of shop coatings on the pipe and coupling shall be repaired to the satisfaction of Engineer.

L. Grooved-End Joints. Grooved-end joints with rigid type grooving shall be installed in accordance with the coupling manufacturer's recommendations. Completed joints shall be rigid and shall allow no angular deflection or longitudinal movement. Except for closure pieces, field grooving of pipe will not be acceptable.

1. Grooved-end couplings shall not be used in the following applications: chemical services, except lime slurry piping; flammable liquid or flammable gas piping, compressed air or compressed gas piping operating at pressures above 25 psi; toxic gas piping; hot liquid with operating temperatures above 120° F [48° C]; or steam piping.

3.05 WALL SLEEVES AND WALL PIPES

- A. Wall sleeves and wall pipes shall be installed as indicated on the Drawings and shall be installed where steel pipe passes through concrete or masonry walls, unless otherwise noted.
- B. Where specified or indicated on the Drawings for sleeves detailed, one or two sets of modular casing seals shall be installed at the face of walls to seal against soil or provide a dust or water tight seal. Contractor shall coordinate the diameter of wall sleeve with the modular casing seal manufacturer. When soil may be present at wall sleeves, a set of modular casing seals shall be installed at each face of the wall. Modular casing seals shall not be used in submerged conditions unless the hydrostatic pressure is less than 20 feet and piping is less than 24 inches size.

3.06 REDUCERS

- A. Reducers shall be eccentric or concentric as indicated on the Drawings. Reducers of eccentric pattern shall be installed with the straight side on top, so that no air traps are formed.

3.07 ACCESS MANHOLES

- A. Pipe manufacturer shall be responsible for providing adequate access to the inside of the pipe to allow for the internal joint welding during construction.
- B. If access to the pipe is needed during construction for welding or other activities, the Contractor shall include pricing for facilitating access as incidental to the per linear foot price of the pipe.

3.08 PIPE ANCHORS, BLOCKING, CONCRETE ENCASEMENT, HANGERS, AND SUPPORTS

- A. Pipe anchors, blocking, hangers, and supports shall be installed where and as specified and indicated on Drawings and shall be fabricated in accordance with the Pipe Supports section and the details indicated on the Drawings, and shall be furnished and installed complete with all concrete bases, anchor bolts and nuts, plates, rods, and other accessories required for proper support of the piping. All piping shall be rigidly supported and anchored so that there is no movement or visible sagging between supports. Where the details must be modified to fit the piping and structures, all such modifications shall be subject to acceptance by Engineer. Unless otherwise permitted, lugs for lateral or longitudinal anchorage shall be shop welded to the pipe.
- B. Concrete reaction anchorage, blocking, encasements, and supports shall be installed as indicated on the Drawings or as permitted by Engineer. Concrete and reinforcing steel for anchorages,

blocking, encasements, and supports shall conform to the Cast-in-Place Concrete section. All pipe to be encased shall be suitably supported and blocked in proper position, and shall be anchored to prevent floatation. A pipe joint shall be provided within 12 inches of each end of the concrete encasement.

- C. The concrete blocking size shall be of the dimensions indicated on the Drawings, shall extend from the fitting to solid undisturbed earth, and shall be installed so that all joints are accessible for repair. If adequate support against undisturbed earth cannot be obtained, restrained joints shall be installed to provide the necessary support. If the lack of suitable solid vertical excavation face is due to improper trench excavation, restrained joints shall be furnished and installed by and at the expense of Contractor.
- D. Reaction blocking, anchorages, or other supports for fittings installed in fills or other unstable ground, installed above grade, or exposed within structures, shall be provided as indicated on the Drawings.
- E. All ferrous metal clamps, rods, bolts, and other components of reaction anchorages or joint harness, subject to submergence or in contact with earth or other fill material and not encased in concrete, shall be protected from corrosion as specified in the Corrosion Protection paragraph of this section.

3.09 JOINT HOLDBACKS AND COATINGS AND LININGS

- A. Shop Holdbacks and Coatings and Linings and Field Repair. Entry into the pipe or pipeline for application of interior linings to unlined ends shall be from open ends or through access manholes, except as otherwise permitted by Engineer. Pour holes will not be permitted.

Holdbacks, coatings and linings for pipe ends at joints shall conform to the following:

For Field-Welded Joints		
	Polyurethane	Hold back coating and lining 4 to 6 inches from joint. Field repair in accordance with ANSI/AWWA C222.
	Cement Mortar	Hold back coating and lining 4 to 6 inches from joint. Field repair in accordance with ANSI/AWWA C205 as modified herein.
	Liquid Epoxy	Hold back coating and lining 4 to 6 inches from joint. Field repair in accordance with ANSI/AWWA C210.
For Flanged Joints		Extend lining to ends of pipe. Field coat buried exterior surfaces as specified in the Corrosion Protection paragraph for flanges.

For Mechanically Coupled Joints	
Cement Mortar	Hold back coating 16 inches (or greater if required to clear harness lugs) from joints. Shop coat exposed surfaces with liquid epoxy to end of pipe in accordance with ANSI/AWWA C210 Epoxy. Lining shall extend to end of pipe. Field coat buried exterior surfaces as specified in the Corrosion Protection paragraph for mechanical couplings.
Liquid Epoxy	Epoxy shop coating shall extend to ends of pipe; epoxy shop lining shall extend to ends of pipe; in accordance with ANSI/AWWA C210 . Field coat buried exterior surfaces as specified in the Corrosion Protection paragraph for mechanical couplings.

B. Modifications to the Governing Standards.

C. Field Repair of Cement Mortar Lining. Field repair of interior joint surfaces shall be done in accordance with ANSI/AWWA C205, except that an epoxy bonding agent and latex admixture shall be used in conjunction with the sand and cement mortar. The addition of lime or pozzolan will not be permitted.

1. The exposed steel shall be thoroughly cleaned and all grease shall be removed. A coat of epoxy bonding agent shall be applied over the area to be lined in accordance with the coating manufacturer's recommendations. A soupy mixture of cement and water shall be applied over the epoxy after it becomes tacky.
2. Cement mortar to which the latex admixture has been added shall then be packed into the area to be patched and screeded off level with the adjacent cement mortar lining. The patched area shall be given an initial floating with a wood float, followed by a steel trowel finish. Defective or damaged cement mortar linings shall be removed, the surfaces cleaned, and the lining repaired as specified above for joint repair. Wire fabric reinforcement shall be used in the lining of fittings and specials in conformance with ANSI/AWWA C205.

3.010 CONNECTIONS WITH EXISTING PIPING

- A. Connections between new work and existing piping shall be made using fittings suitable for the conditions encountered. Each connection with an existing pipe shall be made at a time and under conditions which will least interfere with service to customers, and as authorized by Owner.
- B. Facilities shall be provided for dewatering and for disposal of the water removed from the dewatered lines and excavations without damage to adjacent property.
- C. Special care shall be taken to prevent contamination when dewatering, cutting into, and making connections with potable water piping. Trench water, mud, or other contaminating substances

shall not be permitted to enter the lines. The interior of all pipe, fittings, and valves installed in such connections shall be thoroughly cleaned and then swabbed with or dipped in a 200 mg/L chlorine solution.

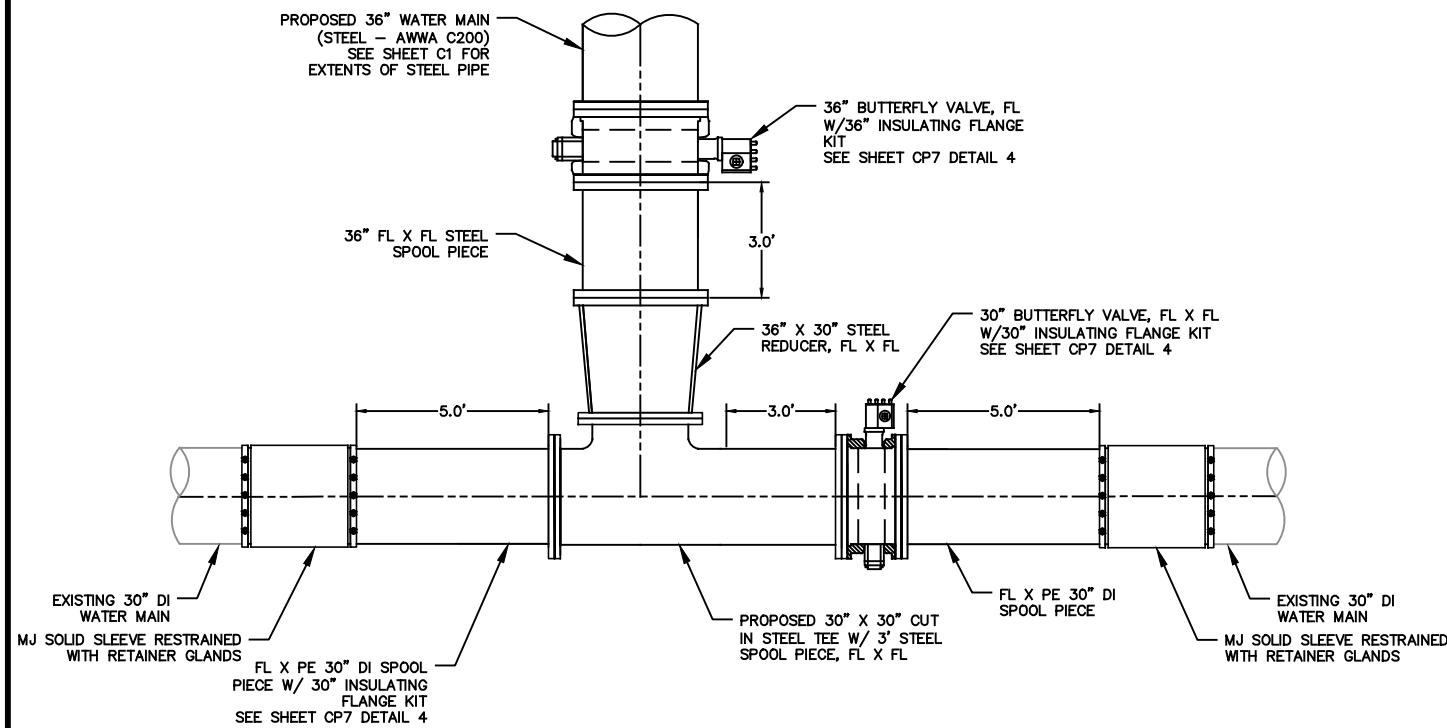
3.011 PRESSURE AND LEAKAGE TESTS

- A. After installation, pipe and fittings shall be subjected to a pressure test and a leakage test in accordance with the SAWS Standard Specification 841 – Water and Reclaimed Water Mains Hydrostatic Testing Operations. This main is located in an area designated as a SAWS High Pressure Area.

3.012 DISINFECTION

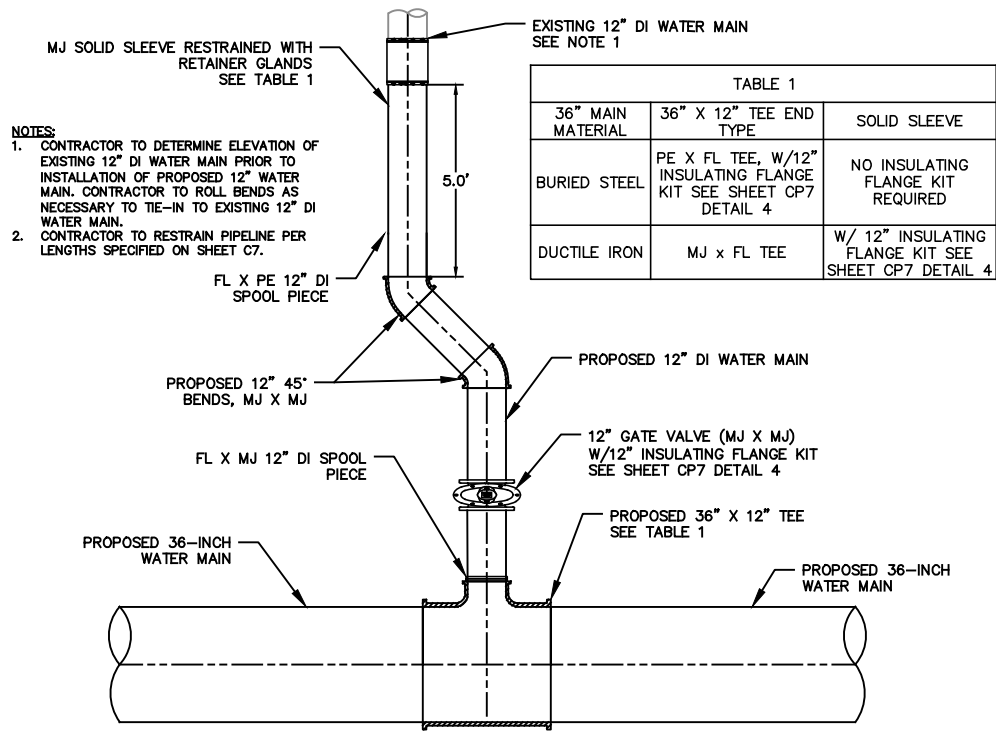
- A. After installation, all potable water pipelines shall be disinfected as specified in Section 015080 Disinfection of Water Mains.

END OF SECTION



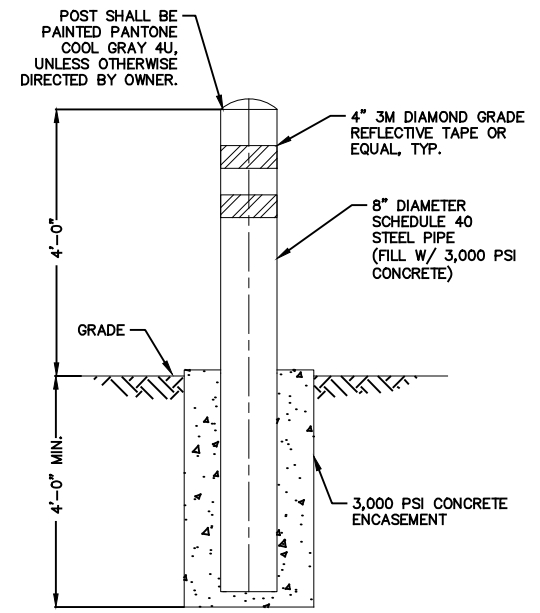
1 TIE IN AT STA. 1+56.39 - EXISTING DUCTILE IRON TO PROPOSED STEEL WATER MAIN

SCALE: 1" = 5'



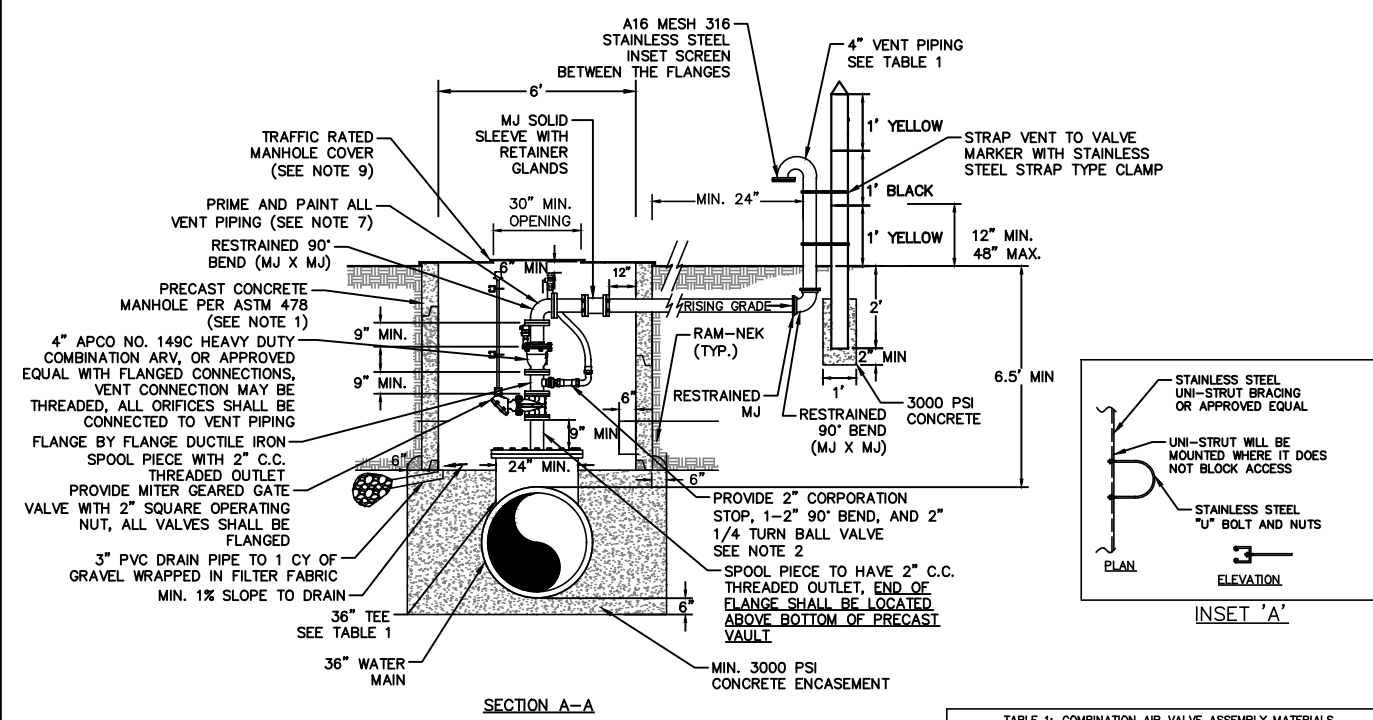
2 TIE IN AT STA. 25+89.79 DETAIL - EXISTING DI TO PROPOSED STEEL OR DI WATER MAIN

SCALE: NTS



3 BOLLARD DETAIL

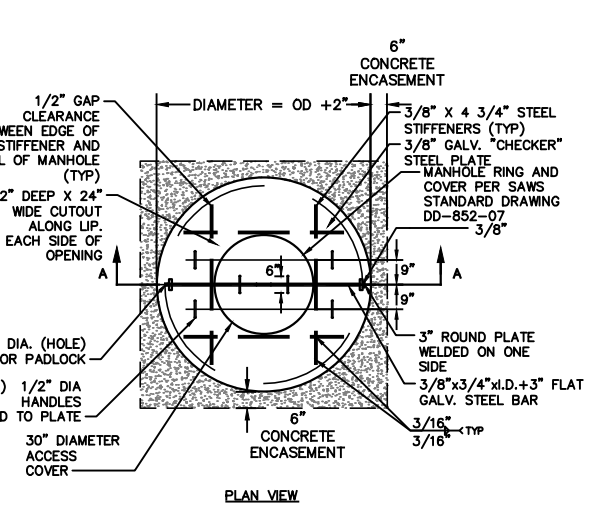
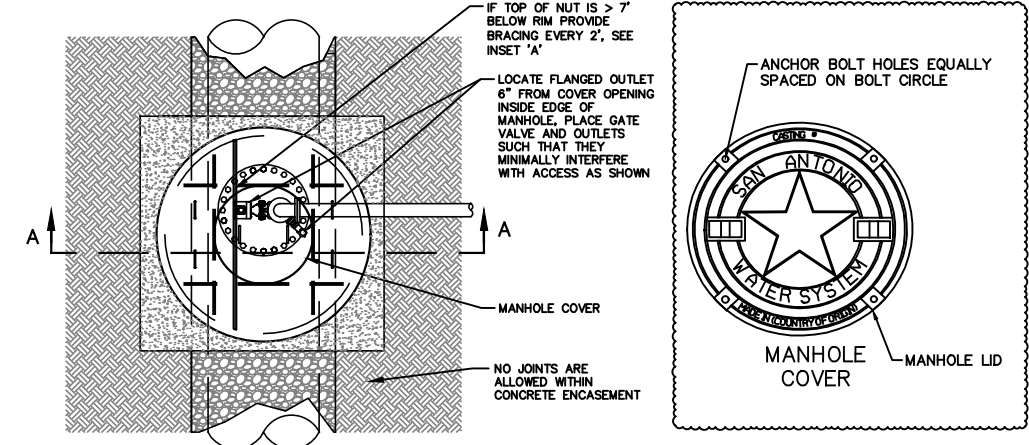
SCALE: NTS



- VAULTS SHALL ONLY BE PRE-CAST MANHOLES.
- SECURE VALVE AND BLOW-OFF PIPING TO MANHOLE WALL WITH STAINLESS STEEL BRACKET OR UNI-STRUT.
- INLET PIPING, ISOLATION VALVE, AND VENT PIPING SHALL BE SAME SIZE AS COMBINATION AIR RELEASE VALVE AS SPECIFIED IN THE DRAWINGS.
- PIPE PENETRATION THROUGH VAULT WALL SHALL BE SEALED WITH A NON-SHRINK EPOXY GROUT.
- WHERE TOP OF OPERATING NUT IS GREATER THAN 7" BELOW RIM, PROVIDE BRACING PER INSET 'A' EVERY 2'.
- THE VENT PIPE SHALL EXTEND ABOVE THE 100-YR FLOODPLAIN UNLESS OTHERWISE SHOWN IN DRAWINGS. IF THE VALVE IS LOCATED WITHIN THE 100-YEAR FLOODPLAIN, A THREADED OR FLANGED BALL CHECK VALVE WITH FLOATING TYPE BALL SHALL BE INSTALLED AT TURN DOWN OPENING OF VENT. SEE TABLE 2 FOR COMBINATION AIR RELEASE VALVES WITHIN THE FLOODPLAIN.
- ALL EXPOSED DUCTILE IRON PIPE ABOVE GRADE SHALL BE SHOP PRIMED AND COATED WITH MINIMUM 5.0 MILS DRY FILM THICKNESS OF SHERWIN WILLIAMS MACROPOXY HS.
- ALL COMPONENTS ARE SUBSIDIARY TO ITEM NO. 846 - 4" COMBINATION AIR RELEASE VALVE (NSP).
- CONTRACTOR TO SUBMIT SHOP DRAWINGS FOR PROPOSED MANHOLE RING AND COVERS. MANUFACTURER MUST BE LISTED ON SAWS APPROVED PRODUCTS LIST. MANHOLE COVER SHALL BE FLUSH WITH SURROUNDING GRADE.
- ALL MANHOLES SHALL BE WATERTIGHT AND EQUIPPED WITH PRE-TESTED AND APPROVED RING AND COVERS.
- THE MANHOLE RING AND COVER SHALL BE OF DUCTILE IRON OR GRAY CAST IRON CONSTRUCTION. THE COVER SHALL BE SOLID WITH NO VENT OR PICK HOLES; HINGED WITH UNDERLYING SPECIAL HINGE LEAKAGE PROTECTION; THE COVER SECURED WITH FOUR (4) STAINLESS STEEL BOLTS; AND SHALL HAVE A RECESSED "TRICK BAY" FOR COVER OPENING. RAM LOCK JOINT COVERS SHALL NOT BE ALLOWED.
- THROAT RINGS SHALL BE MADE OF HDPE AND HAVE A MAXIMUM THICKNESS OF 2 INCHES. A MINIMUM OF TWO AND A MAXIMUM OF FOUR THROAT RINGS MAY BE USED.

MAIN MATERIAL	FLANGE/TEE/OUTLET	INLET PIPING	OUTLET PIPING	SPECIAL REQUIREMENTS
BURIED STEEL	FABRICATED STEEL REDUCING FLANGE	FLANGED STEEL	FLANGED DUCTILE IRON	PROVIDE ISOLATION KIT BETWEEN STEEL SPOOL PIECE AND GATE VALVE, WAX TAPE ALL FLANGES
DUCTILE IRON	MJ X FL TEE, BLIND FLANGE WITH THREADED OR WELDED FLANGED OUTLET	FLANGED DUCTILE IRON	FLANGED DUCTILE IRON	WAX TAPE ALL FLANGES

STA.	GROUND ELEV.	BFE
10+34.24	1132.31	1133.10
30+54.25	1132.33	1133.60
53+13.00	1117.49	1119.45
69+13.00	1110.90	1113.70
87+85.10	1103.07	1107.40
98+79.13	1091.37	1103.40
121+21.25	1092.60	1096.05
138+44.64	1085.26	1089.20



PLAN VIEW




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No.	Revision	By	Date
ADDENDUM NO. 3		JAF	9/26/2023



IH-10: BOERNE STAGE RD TO HEUERMAN RD

36-INCH WATER MAIN

SHEET

WATER DETAILS

(SHEET 1 OF 3)

DATE: AUGUST 2023	SAWS PROJECT NO. 21-7009	SHEET NO. C47
DESIGN: JAF	KHA PROJECT NO. 068665064	
DRAWN: MVB		
CHECKED: KS		

PLOTTED BY: BOYD, MIKAELA 9/25/23 1:51 PM
 DWG NAME: K:\SNA_UTL\UTILS\068665064\CAD\PLANS\WATER DETAILS.DWG
 DATE PLOTTED: 9/25/23 1:51 PM