

San Antonio Water System Standard Specifications for Construction

ITEM NO. 816

Steel Pipe Installation

816.1 DESCRIPTION: This item shall consist of steel pipe installation in accordance with these specifications and as directed by the Engineer.

816.2 REFERENCED STANDARDS: Reference standards cited in this Specification Item No. 816 refer to the current reference standard published at the time of the latest revision.

1. San Antonio Water System (SAWS):
 - a. Specifications for Water and Sanitary Sewer Construction
 - b. SAWS Materials Specifications
2. City Of San Antonio (COSA) Standard Specifications for Construction
3. Texas Commission of Environmental Quality (TCEQ) Chapter 290 Public Water System
4. American Society for Testing and Materials (ASTM) International:
 - a. ASTM A 36 - Standard Specification for Structural Steel.
 - b. ASTM A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - c. ASTM A 135 - Standard Specification for Electric-Resistance-Welded Steel Pipe.
 - d. ASTM A 139 - Standard Specification for Electric-Fusion (ARC) - Welded Steel Pipe (NPS 4 and Over).
 - e. ASTM A 570 - Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.
 - f. ASTM B3 Standard Specification for Soft or Annealed Copper Wire
 - g. ASTM B8 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
 - h. ASTM B80 Magnesium-Alloy Sand Castings
 - i. ASTM B843 Magnesium-Alloy Anodes for Cathodic Protection.
 - j. ASTM C94 Standard Specification for Ready-Mixed Concrete
 - k. ASTM D1248 Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
 - l. ASTM D1785 Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - m. ASTM D2220 Standard Specification for Polyvinyl Chloride (PVC) Insulation for Cable and Wire
 - n. ASTM D3005 Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape
 - o. ASTM D4388 Standard Specification for Nonmetallic Semi-conducting and Electrically Insulating Rubber Tapes
 - p. ASTM C 33 - Standard Specification for Concrete Aggregates.
 - q. ASTM C 35 - Standard Specification for Inorganic Aggregates for Use in Gypsum Plaster.

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- r. ASTM C 150 - Standard Specification for Portland Cement.
 - s. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.
 - t. ASTM C 595 - Standard Specification for Blended Hydraulic Cements.
 - u. ASTM C 881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
 - v. ASTM C 1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
 - w. ASTM D 512 - Standard Test Methods for Chloride Ion in Water.
 - x. ASTM D 1293 - Standard Test Methods for pH of Water.
 - y. ASTM D 3363 - Standard Test Method for Film Hardness by Pencil Test.
 - z. ASTM D 4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Tests.
 - aa. ASTM D 4752 - Standard Test Method for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub.
5. American Water Works Association (AWWA)
- a. AWWA C 200 - Steel Water Pipe 6 in. and Larger.
 - b. AWWA C 205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe.
 - c. AWWA C 206 - Standard for Field Welding of Steel Water Pipe.
 - d. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 in. through 144 in.
 - e. AWWA C 208 - Dimensions for Fabricated Steel Water Pipe Fittings; Addendum C 208A.
 - f. AWWA C 210 - Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
 - g. AWWA C 216 – Heat-Shrinkable Cross-Linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
 - h. AWWA C 217 – Petrolatum and Petroleum Wax Tape Coatings for the Exterior of Connections and Fittings for Steel Water Pipelines .
 - i. AWWA C 602 - Cement-Mortar Lining of Water Pipelines - 4 in. (100 mm) and Larger - In Place
 - j. AWWA C 604 – Installation of Buried Steel Water Pipe – 4 In. and Larger.
 - k. AWWA M 11 - Steel Pipe-A Guide for Design and Installation.
6. Society of Protective Coatings
- a. SSPC Good Painting Practice, Volume 1.
 - b. SSPC SP 1 - Surface Preparation Specification No. 1 Solvent Cleaning.
 - c. SSPC SP 5 - Joint Surface Preparation Standard White Blast Cleaning.
 - d. SSPC SP 6 - Surface Preparation Specification No. 6 Commercial Blast Cleaning.
 - e. SSPC SP 10 - Surface Preparation Specification No. 10 Near-White Blast Cleaning.
 - f. SSPC VIS 1 - Visual Standard for Abrasive Blast Cleaned Steel.

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7. International Organization of Standardization (ISO)
 - a. ISO9001
8. National Association of Corrosion Engineers (NACE)
 - a. SP0169 Control of External Corrosion on Underground or Submerged Metallic Piping Systems
 - b. SP0286 Electrical Isolation of Cathodically Protected Pipelines.
 - c. RP0375 Wax Coating Systems for Underground Piping System
 - d. M0497 Measurement Techniques Related to Criteria for Cathodic Protection on Underground or Submerged Metallic Piping Systems
9. National Fire Protection Association
 - a. 70 National Electric Code
10. National Electrical Manufacturers Association (NEMA)
 - a. TC2 Electrical Polyvinyl Chloride (PVC) Tubing and Conduit TC3 PVC Fittings
11. Underwriters Laboratories, Inc.
 - a. 83 Thermoplastic-Insulated Wires and Cables.
 - b. 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors.
 - c. 510 Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
 - d. 514 Outlet Boxes and Fittings.

816.3 SUBMITTALS: Contractor shall submit manufacturer's product data, instructions, recommendations, shop drawings, and certifications.

1. Contractor to submit details of all specials, and of the lining and coating.
2. Submit shop drawings signed and sealed by Professional Engineer registered in State of Texas showing containing the following:
 - a. Manufacturer's pipe design and thrust restraint calculations based on AWWA M11, latest edition.
 - b. Provide lay schedule of pictorial nature indicating alignment and grade, laying dimensions, welding procedures, fabrication, fitting, flange, and special details, with plan view of each pipe segment sketched, detailing pipe invert elevations, horizontal bends, welded joints, and other critical features.
 - c. Indicate station numbers for pipe and fittings corresponding to Drawings.
 - d. Do not start production of pipe and fittings prior to review and approval by SAWS Engineer.
 - e. Provide final approved lay schedule to SAWS Engineer.
 - f. Include hot tapping procedure.
 - g. Submit certification from manufacturer that design was performed for project in accordance with requirements of this section. Certification to be signed and sealed by professional Engineer registered in State of Texas.
 - h. Submit manufacturer's certifications that pipe and fittings have been hydrostatically tested at factory in accordance with AWWA C 200.

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- i. Submit certification from NACE Certified Coatings Inspector for coatings and linings, that steel pipe furnished on project was properly inspected and defective coatings detected properly repaired.
- j. Submit inspection procedures to be used by manufacturer and for quality control and assurance for materials and welding.
- k. Submit following for nonshrink grout for special applications:
 - (1) Manufacturer's technical literature including specifications for mixing, placing, and curing grout.
 - (2) Results of tests performed by certified independent testing laboratory showing conformance to ASTM C 1107, Nonshrink Grout and requirements of this specification.
 - (3) Certification product is suitable for use in contact with potable water.
- l. Submit proof of certification for welders.
- m. Submit affidavit of compliance that materials and work furnished comply with applicable requirements of referenced standards and these specifications.
- n. Make available copy of testing reports.
- o. Submit manufacturer's affidavits that coatings and linings comply with applicable requirements of these specifications and coatings were applied in accordance with manufacturer's recommendation applied and allowed to cure at appropriate temperatures.
- p. Mortar coatings and linings were applied and allowed to cure at appropriate temperatures.
- q. Test Results:
 - (1) Compressive strength (7 and 28 day) test results for mortar coating.
 - (2) Hydrostatic testing, magnetic particle testing and non-destructive weld test reports as required.
- r. All required submittals as required in Specification Item No. 819 Galvanic Anode Cathodic Protection.
- s. System check-out report with certification by the Contractor's Corrosion Engineer stating that the testing criteria in these specifications have been met.
- t. Record Drawings shall be submitted and approved by the ENGINEER before the WORK is considered complete.

816.4 MATERIALS: The materials for steel pipe shall conform to the specifications contained within the latest revision of SAWS' Material Specification Item No. 05-30, "Steel Pipe."

- 1. For pipe 14 inch nominal diameter and larger, the finished ID after lining shall be the nominal size.
- 2. For pipe 12 inch nominal diameter and smaller, standard OD pipe sizes shall be furnished.

816.5 CONSTRUCTION: Steel pipe shall be installed as specified within Item No. 812, "Water Main Installation" of these specifications.

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1. The Contractor shall furnish all steel piping including fittings, couplings, specials, pipe supports, eyebolts, nuts, and accessories which are shown in the contract documents and as required for proper connection to existing piping.
2. **The Contractor's attention is directed to the fact that the exact location and elevation of existing piping must be determined in the field prior to fabrication of connecting piping.**
3. All steel pipe and specials may be either milled pipe or fabricated pipe and, in either case, shall be fabricated to the sizes, dimensions and shapes as indicated in the contract documents.
4. Unless otherwise indicated in the contract documents, all steel pipe, bends, or specials, shall have an outside diameter minimum wall thickness and unit weights as shown in Standard Drawing DD- 856-01.
5. Any pipe section, fitting, or special which shows dents, kinks, abrupt changes of curvature other than specified, or any other damage will be rejected.
6. Any pipe section, fittings, or special section that has been dropped from a truck or crane will be rejected.
7. The Contractor shall, at his own expense, replace each rejected section.
8. Ends of pipe sections, bends, and specials shall be beveled for field welding, unless shown otherwise in the contract documents.
9. All piping shall be made from steel plate rolled into cylinders or sections thereof, with not more than two longitudinal butt welds, or shall be spirally formed and butt welded.
10. Girth seams shall be butt welded and shall not be closer than 6 feet apart except in specials and bends.
11. Standard and special sections shall be within 1/16 inch (plus or minus) of the specified or theoretical lengths.
12. Except where ends are shown in the contract documents to be joined by mechanical couplings, all joints for steel pipe installed on the bridge structure and in open trench shall be welded.
13. Welders appointed to do welding on steel pipe shall present to the Inspector and Engineer all applicable 4F and 5G certifications.
14. All welds shall be sound; free from embedded scale and slag; shall have a tensile strength across the weld not less than that of the thinner of the connected sections, and shall be watertight.
15. Butt welds shall be used for all welded joints in line-pipe assemblies and in the fabrication of bends and other specials.
16. All welds shall be subject to pre-manufacturing inspection and available to the Inspector and Engineer upon request.
17. Welding for field joints shall conform to the latest provision of AWWA "Standard Specifications for Field Welding of Steel Water Pipe Joints, C206" or most applicable approved equal provision.
18. Parties involved in the construction of main(s) shall pay special attention to the latest provision of AWWA "Standard Specifications for Field Welding of Steel Water Pipe Joints, C206, "Control of Temperature Stresses" or most applicable approved equal provision.
19. After welding, the joints shall be prepared, primed, and painted, or wrapped

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- in accordance with these Specifications.
20. Joint preparation shall include mechanical grinding in order to remove all slag, splatter, rough edges, and surface irregularities.
 21. Joints shall be tested per SAWS Engineer. Testing may include particle testing and x-ray testing.
 22. Leaks in welds shall be repaired by chipping out the defective material and re-welded. No hammering will be permitted.
 23. All steel pipe, bends, and specials shall be prepared, primed, painted, or wrapped in the field as specified herein.
 - a. Exterior Surfaces Above Ground:
 - (1) Exterior surfaces of all new pipe and appurtenances installed shall be thoroughly cleaned to bare metal by high speed wire brushing, scraping, or other suitable methods approved by the Engineer, given a single coat of industrial grade, rust inhibitive primer, and two finish coats of aluminum paint.
 - b. Exterior Surfaces Underground:
 - (1) Exterior surfaces of all steel pipe, bends, and specials which are to be installed in open trench shall be thoroughly cleaned to bare metal by high speed wire brushing, scraping, or other suitable methods approved by the Engineer, given a single coat of rust inhibitive primer, and wrapped with polyvinyl tape in accordance with the latest provision of AWWA C203, "Protective Coatings for Steel Water Pipelines" or most applicable approved equal provision.
 - c. Buried Couplings: Mechanical
 - (1) Couplings which are to be installed underground shall be protected in accordance with Item No. 816.4.6, "Protective Coatings," of these Specifications.
 - d. Field Welded Joints:
 - (1) After installation of pipe, bends, and specials, all ends of pipe adjacent to welded field joints, including the weld proper, shall be cleaned, primed, painted or wrapped as specified for the pipe adjacent to the weld.
 - (2) Joint preparation shall include mechanical grinding in order to remove all slag, splatter, rough edges, and surface irregularities.
 - (3) Joints shall be tested per SAWS Engineer. Testing may include particle testing and x-ray testing.
 - e. Interior Surfaces:
 - (1) The interior surfaces of all steel pipe, fittings and specials shall be cleaned by sandblasting and then primed and coated with a cement mortar lining.
 - f. Cement mortar-lined and coated steel pipe shall be used for mains 4 inches and larger.
 - g. Cathodic protection shall meet requirements outlined in contract documents and Specification Item No. 819 Galvanic Anode Cathodic Protection.

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- h. All cement-lined steel pipe shall be prepared with the following processes:
 - (1) Steel pipe shall not be tested until the factory-applied mortar lining and coatings on all piping and specials have been in place for a minimum of 14 days.
 - (2) Steel piping with cement mortar field applied to the interior of the pipe shall not be filled with water until a minimum of 8 hours has elapsed after the final placement of cement mortar, unless otherwise approved by the Engineer.
 - (3) Use lining conforming to the latest provision of AWWA C205 or most applicable approved equal provision, except as be noted otherwise in the contract documents.
 - (4) Cement used in mortar lining shall be Portland Cement, per the latest provision of ASTM C150 or most applicable approved equal provision, Type II or V for lining.
 - (5) Pipe shall be cement mortar lined in the shop by the centrifugal process, in accordance with the latest provision of AWWA C205 or most applicable approved equal provision.
 - (6) Cement mortar-lined pipe shall be braced as required to maintain roundness during the shipping and handling activities and shall have ends capped prior to shipment.
- 24. Trench, Bedding and Backfilling
 - a. All trenching, bedding and backfilling for steel piping to be laid in open trench shall be in accordance with the requirements specified in Specification Item No. 804 - Excavation, Trenching and Backfill.

816.6 MEASUREMENT: Steel pipe will be measured by the linear foot for each size and type as follows:

- 1. Measurements will be from the center line intersection of runs and branches of tees to the end of the valve of a dead end run.
- 2. Measurements will also be between the center line intersection of runs and branches of tees.
- 3. Where the branch is plugged for future connection, the measurement will include the entire laying length of the branch or branches of the fitting.
- 4. The measurement of each line of pipe of each size will be continuous and shall include the full laying lengths of all fittings and valves installed between the ends of such line except that the laying length of reducers will be divided equally between the connected pipe sizes.
- 5. Lines leading to a tapping connection with an existing main will be measured to the center of the main tapped.

816.7 PAYMENT: Payment for Steel Pipe installed will be made at the unit price bid per linear foot of pipe of the various sizes installed by the open cut method.

- 1. Such payment shall also include excavation, selected embedment material, backfill, compaction, compaction testing, polyethylene sleeve, hauling and disposition of

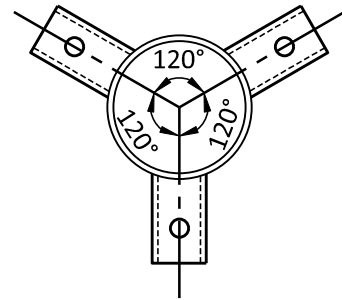
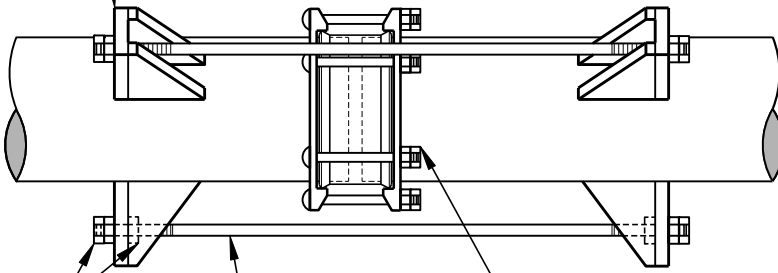
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surplus excavated material, including all existing pipe, fittings, cathodic protection, appurtenances to be abandoned or removed, all weather surface, and other required testing as per Specification Item No. 804 – Excavation, Trenching and Backfill.

2. All requirements for welding, protective coatings, and testing must be completed and accepted by SAWS Engineer or Inspector prior to payment.

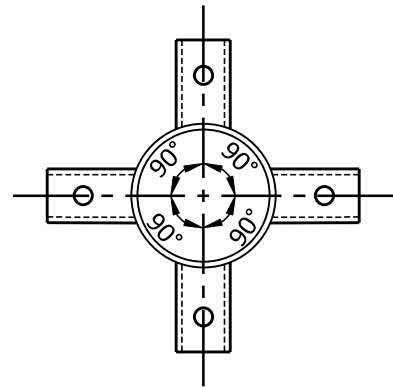
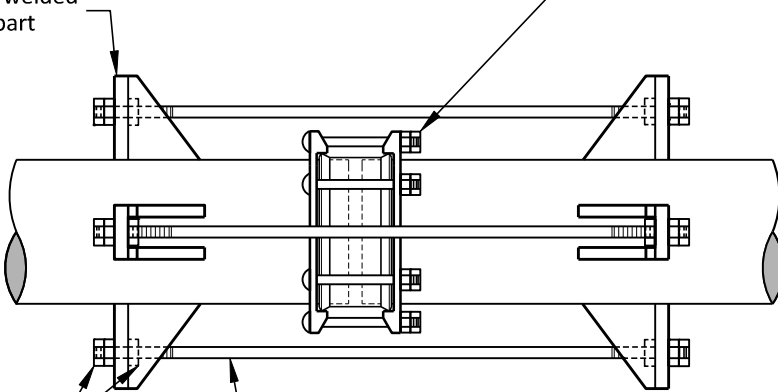
-End of Specification-

Harness Clips welded to pipe 120° apart



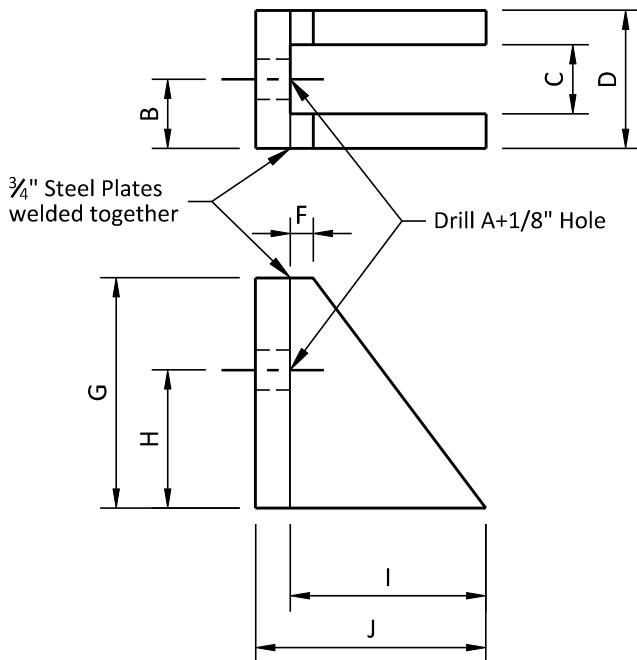
A = Rod Diameter
E = Rod Length

Harness Clips welded to pipe 90° apart



3 - A Hex Nuts (everywhere)

A x E Steel Rod Thd. 4" each end



Dimension Schedule In Inches

Dim.	Pipe Size									
	8	12	16	20	24	30	36	42	48	54
A	5/8	3/4	7/8	1	1-1/8	1-1/8	1-1/8	1-1/4	1-3/8	1-1/2
B	1-1/2	1-1/2	1-1/2	1-3/4	2	2	2	2	2-1/4	2-1/4
C	1-1/2	1-1/2	1-1/2	2	2-1/2	2-1/2	2-1/2	2-1/2	3	3
D	3	3	3	3-1/2	4	4	4	4	4-1/2	4-1/2
E	32	32	34	35	37	45	49	51	56	56
F	1/2	1/2	1	1	1	1	1-1/4	1-1/4	1-1/4	1-1/4
G	5	5	5	5-1/2	5-1/2	5-1/2	6	6	6	6
H	3	3	3	4	4	4	4	4	4	4
I	4-1/4	4-1/4	5-1/4	5-1/4	6	6	8	8	10	10
J	5	5	6	6	6-3/4	6-3/4	8-3/4	8-3/4	10-3/4	10-3/4