

Section 02506

POLYVINYL CHLORIDE PIPE

PART 1 GENERAL

1.01 SUMMARY

This Section includes:

- A. Polyvinyl chloride pressure pipe for water transmission and distribution, in nominal diameters 4 inches through 30 inches.
- B. Polyvinyl chloride sewer pipe for gravity sewers in nominal diameters 4 inches through 60 inches.
- C. Polyvinyl chloride pressure pipe for gravity sewers and force mains in nominal diameters 4 inches through 24 inches.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

- 1. No separate payment will be made for PVC pipe under this Section. Include cost in unit price for Work included as specified in the following sections:
  - a. Section 02511 – “Water Lines”
  - b. Section 02531 – “Gravity Sanitary Sewers”
- 2. Refer to Section 01270 – “Measurement and Payment” for unit price procedures.

- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

- A. ANSI A21.16 (AWWA C116) - Protective Fusion-Bonded Epoxy Coating for the Interior and Exterior Surfaces of Ductile Iron and Grey-Iron Fittings.
- B. ASTM D1248 - Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
- C. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- D. ASTM D2122 – Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

- E. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
- F. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- G. ASTM D2412 – Standard Test Method for Determination of External Loading Characteristic of Plastic Pipe by Parallel Plate Loading
- H. ASTM D2444 - Standard Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight).
- I. ASTM D2680 – Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
- J. ASTM D3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- K. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
- L. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- M. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- N. ASTM F679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
- O. ASTM F794 - Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
- P. ASTM F949 - Standard Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with Smooth Interior and Fittings.
- Q. ASTM F1674 – Standard Test Method for Joint Restraint Products for Use with PVC Pipe.
- R. ASTM D618 - Standard Practice for Conditioning Plastics for Testing
- S. AWWA CANSI A21.10 (AWWA C110) - Ductile-Iron and Gray-Iron Fittings.
- T. AWWA CANSI A21.10 (AWWA C111) - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- U. ANSI A21.53 (AWWA C153) - Ductile-Iron Compact Fittings

- V. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
- W. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In., for Water Distribution.
- X. AWWA C909 - Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 In. Through 24 In. for Water, Wastewater, and Reclaimed Water Service.
- Y. AWWA M23 – PVC Pipe – Design and Installation
- Z. PPI TR-3 - Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Hydrostatic Design Stresses (HDS), Pressure Design Basis (PDB), Strength Design Basis (SDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe.
- AA. Texas Administrative Code (TAC) Rule §290.44 – Texas Commission on Environmental Quality Rules and Regulations for Public Water Systems.

#### 1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit shop drawings showing design of new pipe, laying dimensions, fabrication, fittings, flanges, and special details.
- C. Submit manufacturer’s data on materials furnished for tracer wire system and locations of test stations unless indicated on the Plans.
- D. Calculations and limits of thrust restraint shall be based on AWWA M23.
- E. At time of delivery, submit affidavit of compliance from manufacturer that materials and finished pipe comply with applicable requirements of referenced standards, including AWWA C900, and these specifications.
- F. Submit manufacturer’s data on materials furnished for buried warning and identification tape.

#### 1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 02317 – “Excavation and Backfill for Utilities”
- D. Section 02501 – “Ductile Iron Pipe and Fittings”

- E. Section 02511 – “Water Lines”
- F. Section 02528 – “Polyethylene Wrap”
- G. Section 02531 – “Gravity Sanitary Sewers”

1.06 QUALITY ASSURANCE

- A. Submit manufacturer’s certifications that PVC pipe and fittings meet requirements of this Section and AWWA C900 or AWWA C909 for pressure pipe applications, or appropriate ASTM standard specified for gravity sewer pipe.
- B. Submit manufacturer's certification that PVC pressure pipe for water lines and force mains has been hydrostatically tested at factory in accordance with AWWA C900 and AWWA C909, and this Section.
- C. For 24-inch and larger, have material tested for conformance to applicable ASTM requirements by certified independent testing laboratory located in the United States. Certification from other source is not acceptable. Furnish copies of test reports to Project Manager for review. Cost of testing paid by Contractor. Material testing shall include:
  - 1. Dimensional test in accordance with AWWA C 900, Paragraph 4.3.2 . The dimensions and tolerances of the pipe barrel and bell ends shall conform with the applicable requirements listed in AWWA C 900, Table 1, when measured as specified in ASTM D2122.
  - 2. Flattening test in accordance with AWWA C 900 Paragraph 4.3.3.4 . When tested in accordance with ASTM D2412, the rate of flattening shall be uniform and such that the compression is completed within 2 to 5 minutes.
  - 3. For 24-inch and larger, hydrostatic proof test in accordance with AWWA C 900, Paragraph 4.3.3.3. The pipe, including any integral bell end or affixed coupling, shall not fail, balloon, burst, or weep when subjected to an internal pressure equal to 2.0 times its designated pressure class for a minimum dwell time of two minutes.
- D. Markings:
  - 1. PVC pipe shall be clearly marked in accordance with the pipe’s standard.
  - 2. Markings shall be of sufficient size to be legible from the top of the ground when the pipe is in the trench.
  - 3. Include manufacturer’s production code, including day, month, year, shift, plant and extruder of manufacturer for 24-inch and larger pipe.
  - 4. Pipe shall bear National Sanitation Foundation Seal of Approval (NSF-PW).

5. Include insertion or home marks on spigot end of pipe.
- E. Acceptance: Pipe may be rejected for failure to comply with any requirement of this specification.
- F. Prior to beginning pipe installation of 24-inch and larger, Contractor to conduct meeting to review PVC pipe installation procedures with pipe laying crew and supervisors. Pipe manufacturer's representative may conduct meeting, or conduct review using Uni-Bell Installation Guides and these Specifications. Project Manager's representative to be in attendance. Notify Project Manager minimum five business days prior to meeting. Meeting may be held at field office or other location designated by Contractor and approved by Project Manager

1.07 – 1.13 NOT USED

## PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Use PVC compounds in manufacture of pipe that contain no ingredient in amount that has been demonstrated to migrate into water in quantities considered to be toxic.
- B. Furnish PVC pressure pipe manufactured from Class 12454 virgin PVC compound as defined in ASTM D1784, latest version. PVC pipe conforming to AWWA C900 and AWWA C909 shall carry the National Sanitation Foundation (NSF) seal of approval and shall be listed with Underwriters Laboratories, Inc. (U.L.). Use compounds qualifying for rating of 4000 psi for water at 73.4 F per requirements of PPI TR-3. Provide pipe which is homogeneous throughout, free of any significant voids, cracks, inclusions, and other defects, uniform as commercially practical in color, density, and other physical properties. Deliver pipe with surfaces free from nicks, scratches and gouges. Joining surfaces of spigots and joints must be free of gouges and imperfections which could cause leakage. Reject pipe older than 18 months from manufacturing.
- C. Gaskets:
  1. Gaskets shall meet requirements of ASTM F477. Use elastomeric factory-installed gaskets to make joints flexible and watertight.
  2. Flat Face Mating Flange: Full faces 1/8 inch thick ethylene propylene (EPR) rubber.
  3. Raised Face Mating Flange: Flat ring 1/8 inch ethylene propylene (EDR) rubber, with filler gasket between OD of raised face and flange OD to protect flange from bolting moment.

- 4. Do not use PVC for offset sections with depth of cover greater than 20 feet or less than 4 feet. Do not use PVC in potentially petroleum contaminated area.
  
- D. Lubricant for rubber-gasketed joints: Water soluble, non-toxic, non-objectionable in taste and odor imparted to fluid, non-supporting of bacteria growth, having no deteriorating effect on PVC or rubber gaskets.
  
- E. Do not use PVC in potentially or known contaminated areas.
  
- F. Do not use PVC in areas exposed to direct sunlight.
  
- G. Water Distribution and Transmission Pipe
  - 1. Pipe 4-inch through 12-inch in diameter with nominal 20-foot lengths and cast-iron equivalent outside diameters:
    - a. AWWA C900, DR 18 or
    - b. AWWA C909, Pressure Class 165 psi minimum.
  
  - 2. Pipe 14-inch through 30-inch in diameter: AWWA C900; Pressure Rated 165 psi; DR 25 minimum; nominal 20-foot lengths; cast-iron equivalent outside diameter.
  
  - 3. Make curves and bends by offsetting (i.e. deflecting) joints. Maximum joint offset is 1 degree, or 4-inch offset per 20-ft joint, unless otherwise approved by pipe manufacturer. Do not exceed maximum offset recommended by pipe manufacturer. For deflections exceeding 1 degree, use ductile iron fittings. No joint offsetting allowed for restrained joints.
  
  - 4. Provide PVC pipe that bears Underwriters’ Laboratories mark of approval and is acceptable without penalty to Texas State Fire Insurance Committee for use in fire protection lines.
  
  - 5. Hydrostatic Test: Per AWWA C900, AWWA C909, ANSI A21.10 (AWWA CANSI A21.10 (AWWA C110)); at point of manufacture; submit manufacturer’s written certification.
  
- H. Gravity Sewer Pipe
  - 1. PVC gravity sanitary sewer pipe and storm sewer pipe shall be in accordance with provisions in following table:

Wall Construction	ASTM Designation	SDR (Max.)/ Stiffness (Min.)	Diameter Size Range
Solid	D3034	SDR 26 / PS 115	4" to 10"
	D3034	SDR 35 / PS 46	12" & 15"

Wall Construction	ASTM Designation	SDR (Max.)/ Stiffness (Min.)	Diameter Size Range
	F679	SDR 35 / PS 46	18" to 60"
	AWWA C900	DR 18 / N/A	4" to 12"
	AWWA C909	PC165 / N/A	4" to 12"
	ASTM D2241	DR 18 / N/A	14" to 36"
Truss (Gasketed)	D2680	N/A /200 psi	8" to 15"
Profile	F949	N/A / 46 psi	12" to 36"
	F949	N/A / 115 psi	8" to 10"
	F794	N/A / 46 psi	8" to 30"
	F794/F949	N/A / 46 psi	24" to 36"

2. When solid wall PVC pipe 18 inches to 60 inches in diameter is required in PS 115, provide pipe conforming to ASTM F679, except provide wall thickness as required for SDR 26 and pipe stiffness of 115 psi.
3. For sewers crossing water lines, conform to requirements of Texas Administrative Code (TAC) Rule § 290.44.
4. Joints: Spigot and integral wall section bell with solid cross section elastomeric or rubber ring gasket conforming to requirements of ASTM D3212 and ASTM F477, or ASTM D3139 and ASTM F477. Gaskets shall be factory-assembled and securely bonded in place to prevent displacement. Manufacturer shall test sample from each batch conforming to requirements ASTM D2444.
5. Fittings: Provide PVC gravity sewer sanitary bends, tee, or wye fittings for new sanitary sewer construction. PVC pipe fittings shall be full-bodied, either injection molded or factory fabricated. Saddle-type tee or wye fittings are not acceptable.
6. Conditioning. Conditioning of samples prior to and during tests is subject to approval by Program Manager. When referee tests are required, condition specimens in accordance with Procedure A in ASTM D618 at 73.4 degrees F plus or minus 3.6 degrees F and 50 percent relative humidity plus or minus 5 percent relative humidity for not less than 40 hours prior to test. Conduct tests under same conditions of temperature and humidity unless otherwise specified.
7. Pipe Stiffness. Determine pipe stiffness at 5% deflection in accordance with Test Method D 2412. Minimum pipe stiffness shall be 46psi. For diameters 4 inches through 18 inches, test three specimens, each a minimum of 6 inches

(152 mm) in length. For diameters 21 inches through 48 inches, test three specimens, each a minimum of 12 inches (305 mm) in length.

8. Flattening. Flatten three specimens of pipe, prepared in accordance with Paragraph 2.02.I.5, in suitable press until internal diameter has been reduced to 60 percent of original inside diameter of pipe. Rate of loading shall be uniform. Test specimens, when examined under normal light and with unaided eye, shall show no evidence of splitting, cracking, breaking, or separation of pipe walls or bracing profiles. Perform the flattening test in conjunction with pipe stiffness test.
9. Joint Tightness. Test for joint tightness in accordance with ASTM D3212, except that joint shall remain watertight at minimum deflection of 5%. Manufacturer shall be required to provide independent third party certification for joint testing each diameter of storm sewer pipe.
10. Purpose of Tests. Flattening and pipe stiffness tests are intended to be routine quality control tests. Joint tightness test is intended to qualify pipe to specified level of performance.

I. Sanitary Sewer Force Main Pipe

1. Acceptable pipe joints are integral bell-and-spigot, containing a bonded-in elastomeric sealing ring meeting requirements of ASTM F477. In designated areas requiring restrained joint pipe and fittings, use approved joint restraint device conforming to ASTM F1674, for PVC pipe 24-inch diameter and less.
2. Fittings: Provide ductile iron fittings as per Section 02501 – “Ductile Iron Pipe and Fittings”, Paragraph 2.04, except furnish fittings with one of following internal linings:
  - a. Nominal 40 mils (35 mils minimum) virgin polyethylene complying with ASTM D1248, heat fused to interior surface of fitting
  - b. Nominal 40 mils (35 mils minimum) polyurethane
  - c. Nominal 40 mils (35 mils minimum) ceramic epoxy
  - d. Nominal 40 mils (35 mils minimum) fusion bonded epoxy
3. Exterior Protection: Provide polyethylene wrapping of ductile-iron fittings as required by Section 02528 – “Polyethylene Wrap”.
4. Hydrostatic Tests: Hydrostatically test pressure rated pipe in accordance with Paragraph 2.02.G.5.

J. Bends and Fittings for PVC Pressure Pipe



1. Bends and Fittings: ANSI A21.10 or ANSI A21.53, ductile iron; ANSI A21.11 single rubber gasket push-on type joint; minimum 150 psi pressure rating. Certa-Lok PVC restrained joints, 250 psi, may be provided for up to 16 inches in diameter (water or sanitary).
  2. Provide approved restrained joint fittings: Integral restrained joint fittings and pipe do not require secondary restraint.
  3. For ductile iron fittings, provide polyethylene wrap in accordance with Section 02528 – “Polyethylene Wrap”.
  4. Provide devices for prevention of over-insertion of pipe spigots or plain ends into push-on bell joints for all pipe in tunnels or trenchless installation. Devices shall consist of the following:
    - a. Bell stop; manufactured of ductile iron conforming to ASTM A536, coated with fusion bonded epoxy, polyurethane or approved coating,
      - 1) EBAA Iron 5000 MEGA-STOP or equal
    - b. Shall allow for pipe expansion and contraction.
- K. Tracer Wire and Warning and Identification Tape
1. Warning and identification tape, tracer wire and test stations shall comply with the requirements of this Section and Section 02317 – “Excavation and Backfill for Utilities”.
  2. Tracer wire shall be AWG #8 solid strung soft drawn copper insulated with high molecular weight HDPE, suitable for direct bury application.
  3. Warning and identification tape shall be polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic manufactured specifically for warning and identification of buried utility lines. Provide tape on roles, 4 inch minimum width, blue color for water line with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, “CAUTION, BURIED WATER LINE BELOW” or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

2.03 – 2.04 NOT USED

PART 3 EXECUTION

3.01 GENERAL / MANUFACTURER(S) (NOT USED)

3.02 PROTECTION

Store pipe under cover out of direct sunlight and protect from excessive heat or harmful chemicals in accordance with manufacturer's recommendations.

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

- A. Conform to requirements of Section 02511 – “Water Lines” and Section 02531 – “Gravity Sanitary Sewers”, as applicable.
- B. Install PVC pipe in accordance with Section 02317 – “Excavation and Backfill for Utilities”, AWWA C605, ASTM D2321 for Sewer Pipe, and manufacturer's recommendations.
- C. Install PVC water service pipe to clear utility lines with minimum 6-inch separation and have minimum depth of 6 feet of cover below property line grade of street, unless otherwise required by Plans.
- D. Avoid imposing strains that overstress or buckle pipe when lowering pipe into trench.
- E. Hand shovel pipe bedding under pipe haunches and along sides of pipe barrel and compact to eliminate voids and ensure side support. Ensure barrel is fully supported along entire length of pipe, prior to backfilling.
- F. Store PVC pipe under cover out of direct sunlight. Protect pipe from excessive heat or harmful chemicals. Prevent damage by crushing or piercing.
- G. Allow PVC pipe to cool to ground temperature before backfilling when assembled out of trench to prevent pullout due to thermal contraction.
- H. Pipe Assembly Procedures:
  - 1. Do not remove gasket from pipe. Verify gasket is properly seated in bell groove and both bell and spigot are clean.
  - 2. For plain ends, use a factory finished pipe end as guide to establish angle and length of bevel. Use guide to make a reference mark prior for proper assembly. Remove any burrs from field operations prior to inserting.
  - 3. Do not assemble joint by swinging or stabbing.
  - 4. Do not assemble joint using machinery or equipment such as backhoe bucket.

5. For pipe in tunnels or trenchless installation, install over-insertion device on spigot or plain end of pipe, in accordance with manufacturer's recommendations.
  6. Lay pipe by inserting spigot end unto bell flush with reference mark (insertion line). Brace bell while spigot or plain end are pushed under gasket to prevent completed joints from further insertion.
  7. Assemble joint only to assembly mark provided on spigot end. At no time shall spigot go past insertion line or reference mark.
  8. Continuously observe and check each reference mark for proper length, and install pipe with reference mark visible.
  9. If undue resistance to insertion is encountered, or reference mark does not reach flush position, disassemble joint and verify position of gasket prior to re-inserting.
  10. Prior to backfilling, verify reference mark is flush with end of bell.
- I. PVC Restrained Mechanism
1. For low-profile coupling with spline-type joints:
    - a. Do not apply lubricant to spline or pipe or coupling spline grooves.
    - b. Do not use excessive force while inserting spline through coupling.
    - c. Insert spline until fully sealed around circumference of pipe.
  2. Field Cutting of Pipe Ends:
    - a. Perform by workers certified by manufacturer.
    - b. Use a PVC pipe cutter and provide square ends.
    - c. For low-profile coupling with spline-type joints, use manufacturer-approved power routing and grooving tool to field fabricate required pipe groove.
    - d. Follow manufacture's recommendation to disassemble restrained joint after it has been locked in place.
- J. Tracer Wire and Warning and Identification Tape
1. Trace wire shall be installed on all water mains. The wire shall be installed in such a manner as to be able to properly trace all water mains without loss or

deterioration of signal or without the transmitted signal migrating off the tracer wire.

2. Install in the same trench and inside bored holes and casing with pipe during pipe installation. It shall be secured to the pipe as required to insure that wire remains on top of pipe. Tape tracer wire to the top of pipe at a maximum spacing of every 10 feet. Tracer wire shall be installed such that there are no buried splices between test stations. Tracer wire shall be accessible at test stations.
3. After installation, all tracer wire shall be tested in the presence of Project Manager to verify continuity of the system and a report indicating continuity shall be submitted to Engineer as part of the as-built construction records. Any deficiencies in continuity shall be repaired at contractor's expense and retested in the presence of Engineer.
4. Warning and identification tape shall be centered above water main and buried 36-inches below finished grade.

3.04 – 3.10 NOT USED

END OF SECTION