

# Special Specification 4173

## Storm Sewer Steel Pipe



### 1. DESCRIPTION

Furnish labor, materials, and equipment necessary to provide a complete storm sewer system in conformance with the plans and specifications and in compliance with the Department's Utility Accommodations Policy (Title 43, T.A.C., Sections 21.31-21.55). Construct storm sewer of the sizes, materials, and dimensions shown on the plans including pipe, joints, and connections to concrete junction boxes as required to complete the work.

Furnish material and equipment for the steel pipe using the open cut method in accordance with this specification.

The abbreviations AWWA, ASA, ASTM, ANSI, AASHTO, NACE, NSF, SSPC, and TCEQ used in this specification refer to the following organizations or technical societies:

- AWWA American Water Works Association,
- ASA American Standards Association,
- ASTM American Society for Testing and Materials,
- ANSI American National Standards Institute,
- AASHTO American Association of State Highway and Transportation Officials,
- AREMA American Railway Engineering and Maintenance-of Way Association,
- NACE National Association of Corrosion Engineers,
- NSF National Sanitation Foundations,
- SSPC Steel Structural Painting Council, and
- TCEQ Texas Commission on Environmental Quality.

References to specifications of the above organizations mean the latest standard or tentative standard in effect on the date of the proposal.

### 2. MATERIALS

All materials must conform to the requirements of this Item, the plans, and the following Items:

- Item 421, "Hydraulic Cement Concrete,"
- Item 440, "Reinforcement for Concrete,"
- Item 441, "Steel Structures,"
- Item 465, "Junction Boxes, Manholes, and Inlets," and
- Item 471, "Frames, Grates, Rings, and Covers."

2.1. **General.** Provide new materials for this project unless otherwise stated on the plans or proposal.

2.2. **Steel Pipe.** Steel pipe shall have a minimum yield strength of 35 ksi. The pipe shall meet ASTM A-139, Grade B, or approved equal, and shall meet Cooper E80 loading. Pipe shall be coated in accordance with AWWA C-210 or approved equal. Pipe joints shall be welded in accordance with AWWA C-206 or Pipe joints shall be continuous circumferential welds in accordance with AWS D1.1. Smooth steel pipe shall have welded straight longitudinal seam. The ends of each section of the pipe shall be square cut. One end shall be suitably beveled for field welding sections together. After pipe is welded, coating shall be repaired. Steel pipe shall have smooth walls. No corrugated pipe shall be permitted.

Where work is in the public right of way or railroad right of way, the Contractor shall observe regulations and instructions of the right of way Owner as to the methods of performing the work and take precautions for the safety of the public and safeguarding property. Negotiations and coordination with the right of way Owner shall be carried out in advance by the Contractor, as shown on the "Contractor's Right of Entry Agreement" with the right of way Owner before commencement of Contractor's work on the right of way.

No explosives shall be allowed. The Contractor shall verify the location and elevation of any utilities, pipelines, and telephone cable before proceeding with the construction and plan his construction so as to avoid damage to the existing pipelines, telephone cables, or other utilities. Verification of location of existing utilities shall be the complete responsibility of the Contractor.

2.3. **Field Welding.** Welder must possess valid certification.

2.4. **Steel Pipe Protective Coatings**

**General.** Use shop-applied protective coatings except for field repairs and coatings of field welded joints. The Engineer may provide for witness of inspection and testing of shop-applied coatings; however, such witness does not relieve the Contractor of the responsibility to furnish material, perform work, and provide quality control in conformance with the applicable AWWA Standard and the requirements of these specifications.

The substrate surface profile and minimum and maximum individual and total dry film thickness (DFT) indicated in this specification apply. No requirement of this specification cancels or supersedes the specific written directions and recommendations of the specific coating manufacturer so as to jeopardize the integrity of the applied system. Measure the dry film thickness in accordance with SSPC PA2.

Field test shop coating and field repairs for holidays, pinholes, or discontinuities, at voltage levels required by the applicable AWWA Standard and in accordance with the applicable NACE procedure, i.e., PRO 188, RPO 274, TMD 384, etc. Submit the test procedure, including voltage levels to be used, before testing. Repair holidays in conformance with the applicable AWWA Standard. Provide documentation by a NACE-certified inspector of compliance with the required tests.

Handle, store, and use field procedures for shop-coated pipe in conformance with the applicable AWWA Standards. Adequately seal and protect pipe ends from damage during handling and storage. Do not remove such protection until immediately before installing. Do not lift pipe using caliper clamps or hooks at ends of the pipe.

Repair damage to the pipe or the protective coating caused while installing the pipe and before final acceptance by the owner, as directed and in conformance with the applicable standards.

Keep the interior of the pipe and fittings clean of foreign matter before installing and until the work is accepted. Keep joint contact surfaces clean until jointing is complete.

Furnish an affidavit of compliance that all materials and work furnished comply with the requirements of the applicable AWWA Standard and these specifications.

2.4.1. **Internal Lining for Steel.** Ensure the material used for the internal coating of the steel carrier pipe is NSF61-listed as suitable for contact with potable water as required by Chapter 290, Rules & Regulations for Public Systems, Texas Commission on Environmental Quality (TCEQ.)

2.4.1.1. **Epoxy Lining.** Use Liquid Epoxy meeting the requirements of AWWA C-210, "Liquid Epoxy Coating System for the Interior and Exterior of Steel Water Pipelines," except as modified in this specification. Provide a Liquid Epoxy system consisting of three coats of polyamide epoxy (no coal tar material) as follows:

- Prime Coat: 2-part, chemically cured, NSF certified epoxy, 4-6 mils dry film thickness (DFT);
- Intermediate Coat: 2-part NSF certified epoxy, 4-6 mils (DFT); and
- Finish Coat: 2-part NSF certified epoxy, 4-6 mils (DFT).

Ensure the total system has a minimum DFT of 12 mils and a maximum DFT of 18 mils. Apply each coat in contrasting colors, using a buff prime and intermediate coat and a white finish coat. Use the same manufacturer to supply all material. Coal-tar epoxy material is not permitted. For surfaces to be coated, abrasive blast clean them to a near-white **metal blast in accordance with SSPC SP-5/NACE No. 1, White Metal Blast Cleaning** to establish an average anchor profile of 2.0 to 3.0 mils, with no individual reading greater than 4.0 mils or less than 1.5 mils. Before applying, inspect the prepared and cleaned surface for evidence of non-visible contaminants such as soluble salts or chlorides in accordance with NACE Technical Committee Report "Surface Preparation of Contaminated Steel Surfaces," NACE Publication 6G 186.

Perform an interior adhesion test on pipe 30 in. in diameter and larger in accordance with ASTM D 4541.

Minimum field adhesion: 700 psi. Perform a cure test in accordance with ASTM D 4752 (solvent rub test) for each section of pipe. Repair tested areas with approved procedures.

#### 2.4.2. **External Coating.**

Coat buried steel pipe with either of the following systems:

- 2.4.2.1 **Tape Coating.** Provide an approved tape for external tape coating. Apply in accordance with AWWA C214 and the requirements of this section; 80 mil shop-applied, Polyken YG-III, Tek-Rap Yard-Rap, or approved equal. Components: Primer, one 20 mil layer of inner-layer tape for corrosion protection and two 30 mil layers of outer-layer tape for mechanical protection. Bond coupling to adjacent pipes with bonding cables as shown on the plans.

Use approved filler putty, type Polyken 939 insulating putty, or approved equal, to fill in the gap and create a smooth sloped transition between the top of the reinforcing plate and the pipe, before applying the tape coating.

Primer: Compatible with the tape coating, supplied by the coating-system manufacturer.

Provide pipe with shop coatings cut back approximately 4 to 4-1/2 in. from the joint ends to facilitate joining and welding of pipe. Taper successive tape layers by 1 in. staggers to facilitate field wrapping and welding of joints. Inner and outer tape width: 12 in. or 18 in. Do not expose tape coating to direct sunlight for more than 60 days.

Wrap specials and fittings that cannot be machine wrapped due to configuration, with primer layer and two layers of prefabricated tape, each 35 mils thick. Overlap machine applied tape with hand applied tape by minimum of 2 in. and bind to it. Apply Polyken approved 30 mil filler tape 931, or approved equal, parallel to spiral weld seams if weld height measures greater than or equal to 1/8 in.

- 2.4.3. **Inspections and Testing of Coatings.** Perform holiday testing in accordance with ASTM D5162 – 15, Standard Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates, on the inner layer of tape before applying the intermediate layer of tape. Do not damage the coating from holiday testing. If holidays are detected, repair holidays immediately before applying the outer layer of tape. Clear the holiday area of material and re-prime if necessary. Re-coat the area with inner wrap tape. Overlap the inner wrap tape onto the surrounding inner wrap coating by at least 2 in. Perform an electrical re-test at the repaired area after repairing the holiday, and before continuing the outer wrap. Shrink Wrap: Perform an electrical inspection on the shrink wrap to check for holidays. Perform peel tests over the heat affected zone per ASTM D-4541. Minimum acceptable result: 15 lbs. ft. per inch.

### 3. CONSTRUCTION

All construction must conform to the requirements of this Item, the plans, and the following Items:

- Item 100, "Preparing Right of Way;"
- Item 400, "Excavation and Backfill for Structures;"
- Item 402, "Trench Excavation Protection;"
- Item 403, "Temporary Special Shoring;"
- Item 421, "Hydraulic Cement Concrete;"
- Item 465, "Junction Boxes, Manholes, and Inlets;"
- Item 476, "Jacking, Boring, or Tunneling Pipe or Box;" and
- Item 479, "Adjusting Manholes and Inlets."

#### 3.1. Excavation.

##### 3.1.1. Trenches. Steel in open cut trenches with vertical sides Construct the trenches to the dimensions shown in the excavation and backfill details.

Sheath and brace the trenches to the extent necessary to maintain the sides of the trench in a vertical position throughout the construction period. Protect excavation greater than 5 ft. in depth as specified by Item 402, or Item 403.

Open and excavate the trenches to the finished grade. To allow for possible adjustment of the alignment and grade, locate the junction boxes to which the pipe is to be connected.

The minimum trench width below the top of pipe is the outside diameter of pipe plus 24 in. Additional width will be required for unstable conditions. The Engineer will determine unstable conditions.

Before moving the supports, place and compact the embedment to enough depth to provide protection of the pipe and stability of the trench walls. As the supports are moved, finish placing and compacted the embedment.

Immediately before placing the embedment materials, ensure the bottoms and sidewalls of trenches are free of loose, sloughing, caving, or otherwise unsuitable soil.

Place and compact the embedment materials directly against the undisturbed soils in the trench sidewalls or against sheeting which will remain in place.

Do not place trench shields or shoring within the height of the embedment zone unless using some means to maintain the density of the compacted embedment material. If using moveable supports in embedment zone, lift the supports incrementally to allow placing and compacting of the material against undisturbed soil.

Place haunching material around the pipe and compact it to provide uniform bearing and side support.

Place trench dams in Class I embedment near the midpoint of line segments longer than 100 ft. between manholes.

Where damage to the completed pipe installation work is likely to result from withdrawal of the sheeting, leave the sheeting in place.

Construction along roads and railroads shall be performed in such manner that the excavated material and all operating equipment shall be kept off the roads and railroads at all times. Construction and pipe installation shall not interfere with the operation of streets, highways, railroads, or other facilities, and no work shall be performed so that embankment or structure is weakened or damaged.

##### 3.1.1.1. Pipe Bedding.

Refer to applicable specifications or construction plans.

- 3.2. **Handling Pipe and Accessories.** During pipe construction operations, use caution to prevent damage to the pipe, protective linings, and coatings in conformance with the manufacturer's recommendations. Do not place debris, tools, or other materials in the pipe.
- Repair any damage to the pipe or the protective lining and coating from any cause during the installation of the pipeline and before final acceptance by the Department. Perform this work as directed, in conformance with the applicable standards, and at no cost to the Department.
- Unload pipe, fittings, valves, and accessories at the point of delivery and haul them to the project site. Distribute the material opposite or near the place where it will be laid in the trench such that storm water or runoff will not enter or pass through the pipe. Do not drop the materials. Do not allow pipe handled on skid ways to be skidded or rolled against pipe already on the ground.
- Load, transport, unload, and otherwise handle pipe and fittings in a manner and by methods which prevent damage of any kind. Handle and transport pipe with equipment designed, constructed, and arranged to prevent damage to the pipe, lining, and coating. Do not allow bare chains, hooks, metal bars, or narrow skids or cradles to come in contact with the coatings. Provide pipe fittings with enough interior strutting or cross-bracing to prevent deflection under their own weight.
- Hoist the pipe and fittings from the trench side into the trench by means of a sling of smooth steel cable, canvas, leather, nylon, or similar material. Do not lift pipe by using hooks at each end of the pipe. When stacking pipe, ensure it is packaged on timbers. Place protective pads under the banding straps at the time of packaging.
- When using fork trucks to relocate pipe, pad the forks using carpet or some other suitable type of material. When relocating pipe using a crane or backhoe, use nylon straps or smooth steel cable, do not use chains, around the pipe for lift.
- 3.3. **Cutting Pipe.** Cut pipe in conformance with the manufacturer's recommendations. Perform each cut at right angles to the axis of the pipe and file or grind to remove sharp edges. Use a cutting machine unless otherwise approved by Engineer. Do not damage pipe or linings and coatings, while cutting.
- 3.4. **Defective or Damaged Material.** Inspect pipe and accessories for defects before lowering into the trench. Repair or replace any defective, damaged, or unsound material as directed.
- If pipe is damaged during handling or installation, furnish the labor and materials necessary to remove and replace the defective pipe and to restore the site to its original condition at no cost to the Department. If the Contractor damages the pipe after installation, the Engineer may permit the damaged section to be cut from the length, unless it is the opinion of the Engineer that the entire length was damaged. The cost of and replacement of broken pipe is at the expense of the Contractor.
- 3.5. **Cleaning Pipe and Accessories.** Remove lumps, blisters, and excess coating from the pipe. Wire brush the outside of the spigot and the inside of the bell and wipe clean, dry, and free from oil and grease before laying the pipe.
- Remove foreign matter or dirt from the interior of the pipe, before lowering the material into the trench. Keep the pipe and accessories clean during and after laying by approved means.

- 3.6. **Laying Pipe.** For the work of laying the pipe, employ only workers who are skilled and experienced in laying pipe of the type and joint configuration being furnished.

Lay pipe to the lines and grades shown on the plans. To ensure proper placement, use adequate surveying methods and equipment and employ personnel competent in using this equipment. Ensure the pipe does not deviate from the horizontal and vertical alignment indicated on the plans by more than 0.10 ft., without prior approval. Measure and record the "as-built" horizontal alignment and vertical grade at a maximum of every 50 ft. on the on-site recorded plans.

During pipe laying operations, keep pipe trenches free of water which might impair the laying operations. Ensure holes for bells are of ample size to prevent the bells from coming in contact with the subgrade. Carefully grade pipe trenches to provide uniform support along the bottom of the pipe.

Do not lay more than 50 ft. of pipe in the trench ahead of the backfilling operations. If pipe laying operations are interrupted overnight, cover the pipe laid in the trench simultaneously on each side of the pipe or completely backfill, to avoid lateral displacement of the pipe and damage to the joints. If adjustment of the position of a length of pipe is required after it is laid, remove and re-lay it in conformance with these specifications and at no expense to the Department. After pipe laying and joining operations are complete, clean the inside of the pipe and remove debris.

Use care to prevent damage to the coating when placing backfill.

Lay pipe in a straight line unless otherwise shown or approved.

If the vertical deflection exceeds the maximum, recommended by the manufacturer, remove the entire portion of the deflected pipe section and install new pipe as directed. Perform this work at no expense to the Department. The Engineer may measure assessment of deflection at any location along the pipe. Arithmetical averages of the vertical deflection or similar average measurement methods will not be deemed as meeting the intent of the standard.

Where field conditions require horizontal deflection curves, not shown on the plans, the Engineer will determine the methods to be used.

When pipe laying is discontinued for the day or for an indefinite period, tightly place a cap or plug in the end of the last pipe laid to prevent the intrusion of water. When water is excluded from the interior of pipe, place enough backfill on the pipe to prevent floating. Schedule the work to prevent the possibility of floatation. Remove from the trench any pipe that has floated and re-lay as directed.

- 3.7. **Welded Joints for Steel Pipe.** Ensure the joints receive a full-penetration, butt-weld type, double weld, in accordance with AWWA C206. It is the Contractor's option to use either automatic or hand welders. Before starting the work, provide proof of certification of qualification for welders employed on the project for every type of work procedure and position involved. Ensure qualification is in accordance with AWWA C206. Ensure complete penetration of deposited metal with the base metal. Provide inside fittings and joints that are free from globules of weld metal that would restrict flow or become loose.

Miter end cuts of both ends of butt-welded joints may be used for joint deflections of up to 2.5°.

Set fittings and joints square and true and preserve the alignment during welding operations. Align the butting ends to minimize the offset between surfaces. For pipe of the same nominal wall thickness, do not exceed 1/16 in. offset. Use line-up clamps for this purpose; however, exercise caution to avoid damaging to the linings and coatings.

Furnish each welder employed with a steel stencil for marking welds, so the work of each welder can be identified. Mark pipe with the assigned stencil adjacent to the weld. If a welder leaves the job, void that stencil and do not duplicate it. Welders making defective welds must discontinue work and leave the project site. Such welders may return to the project site only after recertification.

During welding, protect the lining by draping an 18 in. wide strip of heat-resistant material over the top half of the pipe on each side of the lining holdback to avoid damage to the lining by the hot splatter. Protect the tape coating similarly.

Provide welding rods of a type compatible with the metal being welded, to obtain the strongest bond, E-70XX.

Deposit the metal in successive layers so there will be at least 2 passes or beads for automatic welding and 3 passes or beads for manual welding in the completed weld.

On welds, do not deposit more than 1/4 in. of metal on each pass. Thoroughly clean the weld by wire brushing and hammering on each individual pass including the final one, to remove dirt, slag, or flux.

Do not perform welding under any weather condition that would impair the strength of the weld, such as wet surface, rain or snow, dust or high winds, unless the work is properly protected.

If using tack welds, ensure they are of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during the welding operation.

Remove dirt, scale, and other foreign matter from the inside of piping before tying in sections, fittings, or valves.

Provide a minimum overlap of 4 in. of butt strap over the adjacent piece on butt strap closures.

In addition to the welding requirements contained in this specification, conform to the protection fitting manufacturer's installation recommendations.

### 3.8. Backfilling.

**General.** Backfill trenches in accordance with the requirements of Item 400. Use surplus excavated materials in the embankments or dispose of them as directed.

#### 3.8.1. Backfilling Pipe.

##### 3.8.1.1. **Open Cut.** After the pipe joints are made up and inspected, backfill the trenches with excavated materials or any other backfill material covered by this specification, as approved. Backfill the portion from the spring line of the pipe (or from 6 in. on top of pipe if sand bedding is used) to the top of the trench in maximum lifts of 9 in. Mechanically compact the backfill material using vibratory equipment, or any other acceptable equipment, so that no settlement occurs. Compact to a density of at least 95% of the maximum dry density, as determined in accordance with Tex-114-E. The Engineer reserves the right to perform compaction tests on an as-needed basis. Compaction by water tamping is prohibited.

Do not allow dirt, clods, or trench sides to fall or rest against the pipe before completing the embedment or backfill.

Continue backfilling and compacting in this manner to the minimum elevation shown in the excavation and backfill diagram.

### 3.9. Testing for Leakage.

For welded steel pipe in which no leakage is permitted, repair portions of the pipe showing visible leaks. Remove and replace defective pipes. Upon connecting the pipe to precast concrete structures, test and ensure that there are no leaks at the connections. Any repair to leaks shall be as directed at no cost to the Department.

- 3.10. **Lowering Mains.** When lowering the pipe, perform the initial excavation in such a manner to permit the pipe to rest on a number of dirt benches. If soil conditions are unsatisfactory for dirt benches, use wooden blocks to support the pipe. Then attach the pipe by using ropes, cable, or chains to overhead supports; remove the dirt benches or wooden blocks; and slowly and evenly lower the pipe into position. After lowering the pipe, repair each damaged joint as directed.
- 3.11. **Inspections.** The following inspections will be made jointly by the Engineer and representatives of Union Pacific Railroad:
- Final Inspection – conducted after the backfill is in place, the cover is installed, the cleanup is completed, and the surface is restored.

#### 4. MEASUREMENT

- 4.1. **Smooth Wall Steel Pipe.** Measured by the foot complete in place for the size and thickness of the pipe as shown on the plans.

#### 5. PAYMENT

The work performed and materials furnished, in accordance with this Item and measured as provided under "Measurement," will be paid for at the unit prices bid for "Smooth Wall Steel Pipe" of the size and thickness specified. This price is full compensation for furnishing, hauling, placing, and installing the materials; for inspecting and testing; and for other materials, labor, equipment, tools, and incidentals.

Unless otherwise shown on the plans or specifications, excavating, disposing of unsuitable excavated material, backfilling, and the material for backfill, for the complete installation of the pipe, are subsidiary to this bid Item.

Protection methods for excavations greater than 5 ft. deep will be measured and paid for as required under Item 402 "Trench Excavation Protection," or Item 403 "Temporary Special Shoring." Excavation, shaping, bedding, and backfill will be paid for in accordance with Item 400, "Excavation and Backfill for Structures."