

**SPECIAL PROVISION  
STREET EXCAVATION  
SP 110S**

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**SPECIAL PROVISION To  
Standard Specification Item 110S (Version 11-18-04)  
STREET EXCAVATION**

For this project, Item No. 110S Street Excavation, dated 11-18-04, of the City of Austin Standard Technical Specifications is hereby amended with respect to the clauses cited below. No other clauses or requirements of this Section of the City of Austin Standard Specifications are waived or changed.

1. 110S.6, Payment: **Replace** the entire section with the following text and Pay Items:

- A. "Due to the nature of the Work, Street Excavations will vary from Work Assignment to Work Assignment. Work required in this section shall not be measured separately for payment, but shall be considered subsidiary to the cost of the pay item to which it relates in SP 501S and SP 510.

**End**

**SPECIAL PROVISION To  
Standard Specification Item 210S (Version 2-24-10)  
Flexible Base**

For this project, Item No. 210S Flexible Base, dated 2-24-10, of the City of Austin Standard Technical Specifications is hereby amended with respect to the clauses cited below. No other clauses or requirements of this Section of the City of Austin Standard Specifications are waived or changed.

1. 210S.7, Payment: **Replace** the entire section with the following text and Pay Items:

- A. "Due to the nature of the Work, Street Excavations will vary from Work Assignment to Work Assignment. Work required in this section shall not be measured separately for payment, but shall be considered subsidiary to the cost of the pay item to which it relates in SP 340S.

**End**

**SPECIAL PROVISION**  
**Hot Mix Asphaltic Concrete Pavement**  
**SP 340S**

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**SPECIAL PROVISION To**  
**Standard Specification Item 340S (Version 9-26-12)**  
**Hot Mix Asphaltic Concrete Pavement**

For this project, Item No. 340S Hot Mix Asphaltic Concrete Pavement, dated 9-26-12, of the City of Austin Standard Technical Specifications is hereby amended with respect to the clauses cited below. No other clauses or requirements of this Section of the City of Austin Standard Specifications are waived or changed.

1. 340S.14, Payment: **Remove** the following Pay items  
Pay Item No. 340S-A  
Pay Item No. 340S-B  
Pay Item No. 340S-PW  
Pay Item No. 340S-L

2. **Add** the following Pay Items:

<b>Pay Items SP</b>	<b>Description</b>	<b>units</b>
<b>Pay Item No. SP340S-D2:</b>	Flexible Base with Asphalt Surface Trench Repair – Existing Pavement (Detail 1100S-2).	Per Linear Foot.
<b>Pay Item No. SP340S-D3:</b>	Asphalt Overlay of Reinforced and Nonreinforced PC Pvt. Trench Repair (Detail 1100S-3).	Per Linear Foot.
<b>Pay Item No. SP340S-D5:</b>	Full Depth Asphaltic Concrete Pavement Trench Repair (Detail 1100S-5).	Per Linear Foot.

**End**

**SPECIAL PROVISION  
JACKING OR BORING PIPE  
SP 501S**

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**SPECIAL PROVISION  
TO  
ITEM NO. 501S JACKING OR BORING PIPE**

For this Project, Item No. 501S, "Jacking or Boring Pipe" 09/26/12, of the Standard Specifications is hereby amended with respect to the clauses cited below and no other clauses or requirements of this section are waived or changed hereby.

**501S.1 Description**

**INSERT** the following at the end of section 501S.1 Description:

This item shall also include tunneling. Contractor has the option of employing Jacking or Boring, or Tunneling, as specified herein, at his discretion.

**501S.2 Submittals**

G. Tunneling submittals. Provide description of proposed tunnel methodology for review. Description should be sufficient to convey following:

1. Hoisting plan for placement of tunnel shield, jacking equipment and pipe, and for muck removal.
2. Proposed method of tunnel construction and type of face support and lining system.
3. Manufacturer and type of tunneling equipment proposed; type of lighting and ventilation systems.
4. Number and duration of shifts planned to be worked each day.
5. Sequence of operations.
6. Location of access shafts and work sites.
7. Method of spoil transportation from face, surface storage, and disposal location including water that separates from the muck.
8. Method of installing pipe and verifying tunnel and pipe line and grade.
9. Identification of critical utility crossings and special precautions proposed.
  - a. The Contractor's selection of means and methods is integral to the planning and execution of the work under this Contract. Accordingly, the Engineer or Owner will review and may offer comments for the Contractor's consideration. However, for this specific submittal, neither response nor lack of response by the Engineer or Owner shall be considered to represent approval or rejection of the Contractor's means and methods for accomplishing tunnel construction for the project or any specific work site. Neither the Engineer nor owner accept any responsibility for the adequacy of the Contractor's means and methods nor for any damages to public or private property resulting there from, such responsibilities remaining with the Contractor.
10. Provide Drawings and Calculations. Submit drawings and calculations for tunnel support system designed by Contractor. Drawings shall be adequate for construction, and include installation details. Documents must be signed and sealed by Professional Engineer registered in State of Texas. Include calculations with clear statement of criteria used for design, as described in Paragraph 1.06, Design Criteria.
11. Quality Control. Submit for review a description of quality control methods including:
  - a. Method and frequency of survey control.
  - b. Example of tunnel daily log.
  - c. Instrumentation plan showing location and frequency of monitoring relative to critical structures within zone of active excavation.
  - d. Settlement survey plan (may be included in instrumentation plan).

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12. Monitoring Plans:
  - a. Instrumentation Monitoring Plan. Submit for review, prior to construction, monitoring plan that includes schedule of instrumentation design, layout of instrumentation points, equipment installation details, manufacturer's catalog literature, and monitoring report forms.
  - b. Surface Settlement Monitoring Plan. Submit settlement monitoring plan for review prior to construction. Identify location of settlement monitoring points, reference benchmarks, survey frequency and procedures, and reporting formats on plan.
13. Structures Assessment. Submit preconstruction and post-construction assessment reports for critical structures, namely those located within zone of active excavation from proposed tunnel centerline. Include photographs or video of existing damage to structures in vicinity of piping in assessment reports.
14. Submit monitor readings to Owner and Engineer.
15. Daily Reports. Maintain shift log, Tunneling Data, and make available to City Engineer on request.

**501S.3 Materials**

**A. Pipe**

**REPLACE** the entire section with the following:

Carrier pipe and encasement pipe shall conform to Standard Specification [Item Nos. 505S](#), "Concrete Encasement and Encasement Pipe" and Special Provision SP510, "Pipe" and shall be size, type materials, thickness and class indicated on the Drawings, unless otherwise specified.

Pre-insulated chilled water pipe materials shall conform to "Pre-Insulated Chilled Water Piping - SS232114" Specification.

**B. Grout**

**REPLACE** the entire section with the following:

Grout shall conform to AE Specification "Low Density Cellular Grout - SS02426."

**501S.4 Construction Methods**

**INSERT** the following at the end of section 501S4.D. Tunneling:

1. Reference Standards
  - a. American Association of State Highway and Transportation Officials (AASHTO).
  - b. American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering.
  - c. American Society for Testing and Materials (ASTM).
  - d. ASTM A 36 - Standard Specifications for Carbon Structural Steel.
  - e. ASTM A 283 - Standard Specifications for Low and Intermediate Tensile Strength Carbon Steel Plates.
  - f. ASTM A 307 - Standard Specifications for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - g. Occupational Safety and Health Administration (OSHA).

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2. Definitions

- a. Primary liner: First tunnel support installed by Contractor.
- b. Zone of Active Excavation. Area located within radial distance about surface point immediately above face of excavation equal to depth to bottom of excavation.
- c. Critical Structure: Building, structure, bridge, pier, or similar construction partially or entirely located within zone of active excavation.
- d. Tunneling Methodology: Written description, together with supporting documentation that defines Contractor's plans and procedures for tunneling operations.
- e. Shield: Fabricated ground support, circular in section, providing 360-degree protection to those working in it. Shield will have cutting edge d. Liner is erected within tail attached to shield.
- f. Open Face: Face of heading or tunnel, which is unsupported during excavation (e.g., in hand mining or shield excavation).
- g. Closed Face: Face of heading or tunnel which is supported during excavation process, where cutter head allows both partial exposure of face and full closure.

3. Tunnel Shield

- a. The Tunnel shield shall be affixed to the lead pipe with an arc length equal to the full pipe circumference, and create no more than a one inch annular overcut. If steering head section is attached to the pipe, the shield may be incorporated into the head or fabricated to abut against it. The shield must be capable of being jacked into the soil.
- b. The tunnel shield shall be fabricated with enough strength and rigidity to provide support of those soils above and adjacent to the shield.
- c. The shield shall be equipped with breasting tables or baffles (or equivalent) for ballast support of running or unstable soils at the tunnel face.
- d. Compatibility with pipe jacking and structural capacity of the jacked pipe support system when trusting or reacting against it.
- e. Capable of controlling the advance of the heading to maintain line and grade with specified tolerances.
- f. Capability of preventing soil and water infiltration between excavation at the face and installation of the pipe being jacked.
- g. Capability of installing the jacked pipe at the tail of the shield.
- h. Full capability of meeting the construction needs of the project.

4. Muck Removal System

- a. Provide method or system for handling and transport of excavated material from the tunnel face, through the jacked pipe, to the disposal area, with a capacity to sustain peak hourly penetration, peak shift, and peak daily advance rates.
- b. The muck removal system shall be able to handle all excavated material.

5. Ventilation System

- a. Ventilation system should be designed to provide a required minimum fresh air at the face of tunnel, per 29 CFR 1926.

6. Illumination System

- a. The Contractor shall illuminate the entire tunnel in accordance with the requirements of 29 CFR 1926.

7. Equipment

- a. Provide equipment and components that are sturdy, resistant to water leakage and to deterioration and corrosion under the conditions of the project.
- b. Materials shall be adequate for the purposes intended and shall satisfy all the requirements of the various codes and regulations pertaining to the system and types of construction.
- c. All electrical components shall bear Underwriters Laboratory (U.L.) labels where applicable.
- d. Ground electrical tools and equipment following latest requirement of the National Electrical Code (NEC).

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8. Liner Plate
  - a. Provide primary liner designed by Contractor's Professional Engineer for appropriate loading conditions and deflection criteria, including but not limited to: overburden and lateral earth pressures; handling and installation stresses; loads imposed by tunnel shield or tunnel boring machine thrust jacks; subsurface soil and water loads; grouting; and other conditions of service. Assume responsibility for design of primary liner to carry construction loads in combination with overburden, earth and hydrostatic loads.
  - b. At railroad crossings conform to Cooper E-80 locomotive loading distributions in accordance with AREMA specifications for culverts. In design, account for additive loadings due to multiple tracks. Provide liner type for railroad crossings as specified or as shown on Drawings.
  - c. For truck loading use HS-20 vehicle loading distributions in accordance with AASHTO.
  - d. Use liner system compatible with special requirements shown on Drawings.
  - e. In locations shown on Drawings, manufacture liner plate (2-flange or 4-flange) certified by manufacturer for compliance with Specifications.
  - f. Provide bolts and nuts conforming to ASTM A 307, Grade A.
  - g. Punch plates for bolting on both longitudinal and circumferential seams and fabricate to permit complete erection from inside tunnel. Provide plates of uniform fabrication. Plates intended for one size tunnel shall be interchangeable.
  - h. Material used for construction of liner plates shall be in good condition.
  - i. Provide sufficient number of bolted steel liner plates with approximately 2-inch diameter grout holes furnished with plugs. Locate holes near plate center.
9. Preparation
  - a. Use methods for tunneling operations that will minimize ground settlement. Select method, which will control flow of water, prevent loss of soil into tunnel, and provide stability of face under anticipated conditions.
  - b. Conduct tunneling operations in accordance with applicable safety rules and regulations, OSHA standards, and Contractor's safety plan. Use methods, which include due regard for safety of workmen, adjacent structures, utilities, and public.
  - c. Maintain clean working conditions inside tunnel and shafts.
  - d. For tunneling under railroad embankments, highways, or streets, perform installation so as to avoid interference with operation of railroads, highways, or streets, except as approved by owner of facility.
  - e. Support ground continuously in manner to prevent loss of ground and keep perimeters and faces of tunnel stable.
  - f. Completed primary tunnel lining shall have full bearing against ground. Grout peripheral space between support elements and excavated surface or close by expanding support elements against ground to achieve full bearing as tunnel advances.
  - g. Be aware that various existing soil borings, piezometers, or instrument wells, where indicated on Drawings, may coincide with proposed tunnel alignment. These may or may not have been backfilled with grout and, therefore, caution should be used in tunneling through these locations. Contractor shall take mitigating measures to counter effect these boreholes, piezometers, or instrument wells may have on tunneling operations.
10. Ground Water Control
  - a. Provide necessary ground water control measures to perform work and to provide safe working conditions, as per standard City of Austin specification 510 PIPE, para 510.4.
  - b. Anticipate that portions of tunnel excavation may be below ground water table and in cohesionless soils, even when not indicated on soil borings, and in conditions, which may require ground water control system for tunneling operations. Install filter fabrics, backer rods and other means as necessary to prevent piping of fines into tunnel.

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- c. When Contractor chooses pumping installations to control ground water level or installs pervious liner through water bearing layers, install and maintain instrumentation system to monitor water level and to detect movement in adjacent structures and property.
  - d. Operate dewatering system for tunnels until carrier pipe has been installed and annular space is fully grouted, or until watertight liner designed for hydrostatic pressures is installed.
  - e. Do not proceed with tunneling for which ground water control is necessary until monitoring data indicates that ground water control system is operating in accordance with Contractor's plan.
11. Equipment
- a. Assume responsibility for selection of tunneling equipment which, based on past experience, has proven to be satisfactory for excavation of soils to be encountered.
  - b. Employ tunneling equipment that will be capable of handling various anticipated ground conditions and which minimizes loss of soil ahead of face and allows satisfactory support of excavated face.
  - c. TBM or shield shall conform to shape of tunnel with uniform perimeter that is free of projections that could produce over excavation or voids. An appropriately sized over cutting head may be provided to facilitate steering. In addition it shall:
    - i) Be capable of full directional guidance.
    - ii) Be capable of full-face closure, or permit ready installation of breasting boards.
    - iii) Be equipped with appropriate tail in which liner is erected.
    - iv) Be capable of correcting roll.
    - v) Be designed to handle adverse ground conditions including ground water ingress.
    - vi) Be equipped with visual display to show operator actual position of shield relative to design reference.
  - d. Air Quality. Provide equipment to maintain proper air quality of tunnel operations during construction in accordance with OSHA requirements.
  - e. Enclose light fixtures in watertight enclosures with suitable guards. Provide separate circuits for lighting and other equipment.
  - f. Conform to requirements of National Electrical Code - NFPA70 for Electrical systems.
  - g. Contractor shall provide rubber skids in tunnel floor to assist with installing piping.
12. Tunneling Data
- a. Maintain shift logs of construction events and observations. Owner and Engineer shall have access to Contractor's logs with regard to the following information:
    - vii) Location of face by station and progress of tunnel drive during shift.
    - viii) Hours worked per shift on tunneling operations.
    - ix) Completed field forms for checking line and grade of tunneling operation, showing achieved tolerance relative to design alignment.
    - x) Location, elevation and brief soil descriptions of soil strata and strata boundaries.
    - xi) Ground water control operations and piezometric levels, ground water inflow location and rates.
    - xii) Observation of lost ground or other ground movement.
    - xiii) Unusual conditions or events.
    - xiv) Reasons for operational shutdown in event drive is halted.
  - b. Clearly mark primary liner with paint every 20 feet along tunnel with distance in feet from centerline of preceding shaft.

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13. Tunnel Excavation and Primary Liner Installation

- a. Tunnel Excavation.
  - i) Conduct tunneling operations in accordance with applicable safety rules and regulations, and Contractor's safety plan. Use methods, which include due regard for safety of workmen, adjacent structures, utilities, and public.
  - ii) Maintain tunnel excavation within easements and rights-of-way indicated on Drawings, to lines and grades shown on Drawings. Excavation shall be of sufficient size to allow installation of pipe to lines and grades indicated on Drawings.
  - iii) Open-face excavations:
    - Keep face breasted or otherwise supported and prevent falls, excessive raveling, or erosion. Maintain standby face supports for immediate use when needed.
    - During shut-down periods, support face of excavation by positive means; do not rely solely on hydraulic pressure for support.
  - iv) Closed-face excavation:
    - Control volume of spoil removed. Determine that advance rate and excavation rate are compatible to avoid over excavation or loss of ground.
    - When cutting head is withdrawn, keep excavated face supported and stabilized.
    - When face of machine is open for maintenance, monitor conditions that might threaten stability of heading. Take appropriate action to prevent or limit influx of soils and water, which would threaten stability of heading.
    - Whenever condition is identified which could endanger tunnel excavation or adjacent structures, operate continually for 24 hours day, including weekends and holidays, without intermission until condition no longer exists.
- b. Determination of primary liner size and section shall be sole responsibility of Contractor, to match construction methods and equipment described in tunneling methodology submittal. Provide tunnels of sufficient size to permit efficient excavation operations, sufficient working space for placing primary tunnel liner, and to allow for installation of chilled water pipe.
- c. Primary Liner Installation:
- d. Provide method to ensure full bearing of soil against primary liner without significant settlement or movement of surrounding soil. To fill void behind primary liner, either expandable liner (e.g., ring beams and timber lagging) or non-expandable liner (e.g., bolted steel liner plates) may be used provided grout is placed behind non-expandable liner. Box tunnel where ground is excavated to true shape may be ungrouted.
- e. When using TBM or tunnel shield, advance equipment only far enough to permit construction of one primary liner set, entirely within equipment shield.
- f. Install filter fabric around exterior of primary liner when using steel ribs and lagging. Install backer rods at ribs as required to control migration of fines. Close windows in lagging.
- g. After grouting, ensure deflection of liner is no more than allowable, nor liner is distorted by excessive pressure.
- h. Seal blind headings with temporary bulkhead.

14. Control Of Tunnel Line and Grade

- a. Construction Control.
  - i) Engineer's Surveyor will establish baselines and benchmarks indicated on Drawings. Contractor's Surveyor to check baselines and benchmarks at beginning of Work and report errors or discrepancies to Owner and Engineer.
  - ii) Use baselines and benchmarks established by Engineer to establish and maintain construction control points, reference lines, and grades for locating tunnel.
  - iii) Establish control points sufficiently far from face so as not to be affected by tunneling operations.
- b. Line and Grade.

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- i) Maintain means sufficient to check alignment and grade continuously.
  - ii) Check survey control for tunneling against aboveground undisturbed reference at least once each week and once for each 250 feet of tunnel constructed.
  - iii) When excavation is off line or grade, make alignment corrections to avoid reverse grades in gravity sewers.
  - iv) Construct primary liner to such tolerances that permit installation of chilled water pipe per grades established in drawings.
- c. Earth Movement. Assume responsibility for damages due to settlement from construction-induced activities or occurrences.
- i) Survey crown, invert, and springline on each side of primary liner at 50-foot intervals, or minimum of once per shift, or more frequently when line and grade tolerances have been exceeded, to ensure alignment is within tolerances specified. Conduct survey immediately behind tunnel excavation to allow immediate correction of misalignment.

15. Monitoring

- a. Instrumentation Monitoring. Instrumentation requirements are shown on Drawings. Ensure instrumentation specified is accessible to Owner and Engineer. Submit readings promptly to Owner and Engineer.
- i) Install and maintain instrumentation system to monitor and detect movement of ground surface and adjacent structures. Establish vertical control points at distance from construction areas that avoids disturbance due to ground settlement.
  - ii) Installation of instrumentation shall not preclude Owner/Engineer, through independent contractor or consultant, from installing instrumentation in, on, near, or adjacent to construction work. Provide access to work for such independent installations.
  - iii) Install instruments in accordance with Drawings and manufacturer's recommendations.
- b. Surface Settlement Monitoring
- i) Establish monitoring points on all critical structures.
  - ii) Record location of settlement monitoring points with respect to construction baselines and elevations. Record elevations to accuracy of 0.01 feet for each monitoring point location. Monitoring points should be established at locations and by methods that protect them from damage by construction operations, tampering, or other external influences.
  - iii) Ground surface elevations must be recorded on centerline ahead of tunneling operations at minimum of 100-foot intervals or at least three locations per tunnel drive. For primary lined tunnels greater than 60 inches cut diameter also record similar data at approximately 20 feet each side of centerline. Clearly mark settlement monitoring points by studs or paint for ease of locating.
  - iv) Railroads. Monitor ground settlement of track subbase at centerline of each track.
  - v) Utilities and Pipelines. Monitor ground settlement directly above and 10 feet before and after utility or pipeline intersection.
- c. Reading Frequency and Reporting. Submit to Owner and Engineer, records of readings from various instruments and survey points.
- i) Instrumentation monitoring results to be read at frequency specified, unless otherwise specified. Start monitoring before zone of active excavation is passed and until no further detectable movement occurs.
  - ii) Record surface settlement monitoring readings:
    - Prior to zone of active excavation reaching that point,
    - When tunnel face reaches monitoring point (in plan), and
    - When zone of active excavation has passed and no further movement is detected.
  - iii) Submit monitoring readings promptly to Owner and Engineer.
  - iv) Immediately report to Owner and Engineer movement, cracking, or settlement, which is detected.

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- v) Following substantial completion, but prior to final completion, perform final survey of monitoring points.
16. Tunnel Cleanup
- a. Prior to pipe placement in tunnel, remove temporary tunnel utilities, such as electrical and ventilation. Remove loose material, dirt, standing water, and debris prior to pipe placement.
  - b. Temporary steel construction tracks or steel pipe skids may be left in place when they do not interfere with alignment of pipe or interfere with final placement of annular grout.
  - c. Remove spoil from job site and dispose in City of Austin approved location.

**501S.6 Payment**

**REPLACE** the entire section with the following:

- A. The work performed and materials furnished as prescribed by this item and measured as provided under "Measurement" will be paid for at the unit bid price per linear foot for "Jacking or Boring Pipe" OR for "Tunneling", as the case may be, of lengths and in soils types indicated, to include full compensation for furnishing, preparing, hauling and installing required materials, safety provisions, **including pre-insulated chilled water supply and return pipe of sizes indicated (in accordance with specifications SS 232114 PRE-INSULATED CHILLED WATER PIPING), two 4" communications conduits (as per AE Standard Trench Detail R3 and in accordance with specifications SS260533 RACEWAYS AND BOXES, 3 Single Raceway Fiber Optic Inner Ducts installed within non-metallic conduit and tubing, installed within tunnel or jack & bore casement),** grouting, and for labor, tools, equipment and incidentals necessary to complete work, including excavation, backfilling and disposal of surplus material.
1. In Rock: Base Unit Price upon any of the following rock types, as defined in *Tunnelman's Ground Classification for Soils*: stratified, blocky & seamy, and moderately jointed.

**Excerpts from Tunnelman's Ground Classification for Rock (Terzaghi, 1946)**

Class	Description
Stratified	Consists of individual strata with little or no resistance against separation along the boundaries between the strata. The strata may or may not be weakened by transverse joints. In such rock the spalling condition is quite common.
Moderately Jointed	Contains joints and hair cracks, but the blocks between joints are locally grown together or so intimately interlocked that vertical walls do not require lateral support. In rocks of this type, both spalling and popping conditions may be encountered.
Blocky and Seamy	Consists of chemically intact or almost intact rock fragments which are entirely separated from each other and imperfectly interlocked. In such rock, vertical walls may require lateral support.

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2. In Soil: Base Unit Price upon any of the following soil types, as defined in *Tunnelman's Ground Classification for Soils*: Firm, Slow Raveling, Fast Raveling, Cohesive Running, Running.

**Excerpts from Tunnelman's Ground Classification for Soils (after Heuer, 1974)**

Classification		Behavior	Typical Soil Types
Firm		Heading can be advanced without initial support and final lining can be constructed before ground starts to move.	Loess above water table; hard clay, marl, cemented sand, and gravel when not highly overstressed.
Raveling	Slow Raveling	Chunks or flakes of material begin to drop out of the arch or walls some time after the ground has been exposed, due to loosening or to overstress and brittle fracture. In fast raveling ground, the process starts within a few minutes; otherwise the ground is slow raveling.	Residual soils or sand with small amounts of binder may be fast raveling below the water table; slow raveling above. Stiff fissure clays may be slow or fast raveling depending upon degree of overstress.
	Fast Raveling		
Squeezing		Ground squeezes or extrudes plastically into tunnel, without visible fracturing or loss of continuity, and without perceptible increase in water content. Ductile, plastic yield and flow due to overstress.	Ground with low frictional strength. Rate of squeeze depends on degree of overstress. Occurs at shallow to medium depth in clay or very soft to medium consistency. Stiff to hard clay under high cover may move in combination of raveling at execution surface and squeezing at depth behind surface.
Running	Cohesive Running	Granular materials without cohesion are unstable at a slope greater than their angle of repose (30-35 degrees). When exposed at steeper slopes they run like granulated sugar or dune sand until the slope flattens to the angle of repose.	Clean, dry granular materials. Apparent cohesion in moist sand or weak cementation in any granular soil may allow the material to stand for a brief period of raveling, before it breaks down and runs. Such behavior is cohesive-running.
	Running		

3. Dewatering of bore pits shall be included in the contract unit price for Bore Entry Pit or Exit Pit regardless of inflow rate or volume unless specified otherwise in the bid item for Bore Entry Pit or Exit Pit.

B. Jacking & Boring:

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1. In addition to work described in A. above, include full compensation for encasement pipe, tunnel lining, manufactured spacers required for carrying, separating, and sliding pipe and conduit within encasement pipe.
  - 1) Encasement pipe dimensions may be chosen by contractor, in accordance with other requirements of these specifications, as required to contain pre-insulated pipe of sizes indicated, along with two 4" communications conduits.
  - 1) Construct in accordance with standard City of Austin specification section 505S Concrete Encasement and Encasement Pipe, and with standard Austin Energy Detail R11 "Typical Casing Spacer Detail". Provide Casing Spacers for chilled water piping and conduits.

C. Tunnel excavation and primary liner:

1. In addition to work described in A. above, include full compensation for underground hand excavation, liner, pipe within tunnel, instrumentation and surface settlement monitoring.
2. Tunnel dimensions: Tunnel dimension are to be determined by contractor based upon specified equipment/materials installation requirements.

B. Payment, when included as a Contract pay item, will be made under one of the following.

<b>Pay Items SP</b>	<b>Description</b>	<b>Units</b>
SP501S-ROCK-08	Underground excavation via tunnel or jack & bore method. Length 10 feet to 100 feet. Depth 8 feet to 16 feet cover above top of excavation, in rock. Includes 8 inch CHWS & CHWR pipes, two 4 inch conduits(innerduct and fiber) per standard detail #R1, pressure grout backfill. Includes camera inspection of pipe.	PER LINEAR FOOT
SP-501S-SOIL-08	Underground excavation via tunnel or jack & bore method. Length 10 feet to 100 feet. Depth 8 feet to 16 feet cover above top of excavation, in soil. Includes 8 inch CHWS & CHWR pipes, two 4 inch conduits(innerduct and fiber) per standard detail #R1, pressure grout backfill. Includes camera inspection of pipe.	PER LINEAR FOOT
SP501S-ROCK-10	Underground excavation via tunnel or jack & bore method. Length 10 feet to 100 feet. Depth 8 feet to 16 feet cover above top of excavation, in rock. Includes 10 inch CHWS & CHWR pipes, two 4 inch conduits(innerduct and fiber) per standard detail #R1, pressure grout backfill. Includes camera inspection of pipe.	PER LINEAR FOOT

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SP-501S- SOIL-10	Underground excavation via tunnel or jack & bore method. Length 10 feet to 100 feet. Depth 8 feet to 16 feet cover above top of excavation, in soil. Includes 10 inch CHWS & CHWR pipes, two 4 inch conduits(innerduct and fiber) per standard detail #R1, pressure grout backfill. Includes camera inspection of pipe.	PER LINEAR FOOT
SP501S- ROCK-I2	Underground excavation via tunnel or jack & bore method. Length 10 feet to 100 feet. Depth 8 feet to 16 feet cover above top of excavation, in rock. Includes 12 inch CHWS & CHWR pipes, two 4 inch conduits(innerduct and fiber) per standard detail #R1, pressure grout backfill. Includes camera inspection of pipe.	PER LINEAR FOOT
SP-501S- SOIL-12	Underground excavation via tunnel or jack & bore method. Length 10 feet to 100 feet. Depth 8 feet to 16 feet cover above top of excavation, in soil. Includes 12 inch CHWS & CHWR pipes, two 4 inch conduits(innerduct and fiber) per standard detail #R1, pressure grout backfill. Includes camera inspection of pipe.	PER LINEAR FOOT
SP501S- ROCK-18	Underground excavation via tunnel or jack & bore method. Length 10 feet to 100 feet. Depth 8 feet to 16 feet cover above top of excavation, in rock. Includes 18 inch CHWS & CHWR pipes, two 4 inch conduits(innerduct and fiber) per standard detail #R1, pressure grout backfill. Includes camera inspection of pipe.	PER LINEAR FOOT
SP-501S- SOIL-18	Underground excavation via tunnel or jack & bore method. Length 10 feet to 100 feet. Depth 8 feet to 16 feet cover above top of excavation, in soil. Includes 18 inch CHWS & CHWR pipes, two 4 inch conduits(innerduct and fiber) per standard detail #R1, pressure grout backfill. Includes camera inspection of pipe.	PER LINEAR FOOT
SP-501S- ROCK-24	Underground excavation via tunnel or jack & bore method. Length 10 feet to 100 feet. Depth 8 feet to 16 feet cover above top of excavation, in rock. Includes 24 inch CHWS & CHWR pipes, two 4 inch conduits(innerduct and fiber) per standard detail #R1, pressure grout backfill. Includes camera inspection of pipe.	PER LINEAR FOOT
SP-501S- SOIL-24	Underground excavation via tunnel or jack & bore method. Length 10 feet to 100 feet. Depth 8 feet to 16 feet cover above top of excavation, in soil. Includes 24 inch CHWS & CHWR pipes, two 4 inch conduits(innerduct and fiber) per standard detail #R1, pressure grout backfill. Includes camera inspection of pipe.	PER LINEAR FOOT

**SPECIAL PROVISION  
JACKING OR BORING PIPE  
SP 501S**

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SP-501S-ROCK-PIT-A	Four sided pit for tunnel or jack & bore &/or access to existing CHW pipe for hot tap, in rock. Width 6 feet by 6 feet to 12 feet by 12 feet. Depth 6 feet to 12 feet deep, including excavation, debris spoils haul off, CLSM backfill. Excludes street repair of excavation area.	PER CUBIC YARD
SP-501S-SOIL-PIT-A	Four sided pit for tunnel or jack & bore &/or access to existing CHW pipe for hot tap, in soil. Width 6 feet by 6 feet to 12 feet by 12 feet. Depth 6 feet to 12 feet deep, including excavation, debris spoils haul off, CLSM backfill. Excludes street repair of excavation area.	PER CUBIC YARD
SP-501S-ROCK-PIT-B	Four sided pit for tunnel or jack & bore &/or access to existing CHW pipe for hot tap, in rock. Width 6 feet by 6 feet to 12 feet by 12 feet. Depth 13 feet to 20 feet deep, including excavation, debris spoils haul off, CLSM backfill. Excludes street repair of excavation area.	PER CUBIC YARD
SP-501S-SOIL-PIT-B	Four sided pit for tunnel or jack & bore &/or access to existing CHW pipe for hot tap, in soil. Width 6 feet by 6 feet to 12 feet by 12 feet. Depth 13 feet to 20 feet deep, including excavation, debris spoils haul off, CLSM backfill. Excludes street repair of excavation area.	PER CUBIC YARD
SP-501S-ROCK-PIT-C	Four sided pit for tunnel or jack & bore &/or access to existing CHW pipe for hot tap, in rock. Width 6 feet by 6 feet to 12 feet by 12 feet. Depth 20 feet to 35 feet deep, including excavation, debris spoils haul off, CLSM backfill. Excludes street repair of excavation area.	PER CUBIC YARD
SP-501S-SOIL-PIT-C	Four sided pit for tunnel or jack & bore &/or access to existing CHW pipe for hot tap, in soil. Width 6 feet by 6 feet to 12 feet by 12 feet. Depth 20 feet to 35 feet deep, including excavation, debris spoils haul off, CLSM backfill. Excludes street repair of excavation area.	PER CUBIC YARD

End

**SPECIAL PROVISION To  
Standard Specification Item 506 (Version 2-2-21)  
MANHOLES**

For this project, Item No. 506 Manholes, dated 2-22-21, of the City of Austin Standard Technical Specifications is hereby amended with respect to the clauses cited below. No other clauses or requirements of this Section of the City of Austin Standard Specifications are waived or changed.

**506.1 Description**

**INSERT** the following as first paragraph:

Specification includes communications manhole, per Austin Energy Standard Detail R3 COMMUNICATION VAULT.

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**506.2 Qualifications**

**DELETE** the entire section.

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**506.4 Materials**

**DELETE** the following sections entirely.

- D. Reinforcement**
  - G. Bulkheads**
  - N. High Density Polyethylene Grade Rings**
  - O. Controlled Low Strength Material**
  - P. Cement Stabilized Sand**
  - Q. Waterproofing Joint Materials**
  - R. Interior Surface Coatings for Wastewater Manholes**
  - S. Structural Lining Systems for Wastewater Manholes**
- 

**506.5 Construction**

**DELETE** the following sections entirely.

- A. General**
  - E. Pipe Connections to Manholes and Junctions Boxes**
  - F. Pipe Connections to Existing Manholes and Junction Boxes**
  - G. Waterproofing**
  - J. Interior Coatings of Wastewater Manholes and Junction Boxes**
  - K. Structural Linings of Existing Wastewater Manholes**
  - L. Abandonment of Existing Manholes**
- 

**506.6 Acceptance Testing of Wastewater Manholes**

**DELETE** the entire section.

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**506.7 Measurement**

**REPLACE** the entire section with the following:

A "Communication Vault" or "Communications Manhole" will be measured by each structure of the indicated size. AE Detail R3 and R3A.

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**506.8 Payment**

**SPECIAL PROVISION  
MANHOLES  
SP 506**

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**REPLACE** the entire section with the following:

Payment for completed "Communication Vault" or "Communications Manhole" of the type indicated on the Drawings shall be made at the appropriate unit bid price. The unit bid price shall include all labor, equipment, materials, (including but not limited to frames and grates, rings and covers, bases, concrete, reinforcing steel, non-shrink grout, mortar, wall hook for fiber optic cable), hot mix asphalt and road base required for street repair, time and incidentals necessary to complete the work.

It is expected that, in most instances, any required excavation for a communications manhole will already have been performed as a part of work required for hand excavation, jacking & boring, or open trenching, as priced in items 501S-ROCK-PIT- \_\_\_ or 501S-SOIL-PIT- \_\_\_. Therefore, excavation specifically for communications manhole is listed as a separate line item for those instances where manhole will *not* be installed in the excavated pit covered in 501S-ROCK-PIT- \_\_\_ or 501S-SOIL-PIT- \_\_\_.

---

Payment, when included as a Contract pay item, will be made under the following.

<b>Pay Items SP</b>	<b>Description</b>	<b>units</b>
<b>Pay Item No. SP506S:</b>	Communications manhole, per Austin Energy Standard Detail R3 "COMMUNICATION VAULT".	Per Each.

**End**

**SPECIAL PROVISION To  
Standard Specification 509S (Version 09/26/2012)  
Excavation Safety Systems**

For this project Item 509S Excavation Safety Systems of the City of Austin Standard Technical Specifications is hereby amended with respect to the clauses cited below. No other clauses or requirements of this Section of the City of Austin Standard Specifications are waived or changed.

**509S.1 Description**

Add the following paragraph after the second paragraph.

Furnish, install, maintain, and remove Special Shoring to hold the surrounding earth out of the work area.”

**509S.9 Measurement**

Add the following paragraph after the last paragraph.

When listed as a pay item, Special Shoring will be measured by the square foot of surface area of a vertical plane at the face of the shoring between the top of the ground being supported and the minimum protection grade line shown on the plans. If no minimum protection grade is shown on the plans, the lowest required excavated elevation will be used. Shoring projection above the level of the ground being supported will not be measured. When excavation techniques (e.g. sloped cuts or benching) are used to provide the necessary protection, the surface area for payment will be calculated based on the area described by a vertical plane adjacent to the structure.”

**509S.10 Payment**

Add the following pay item.

<b>“Pay Items SP509S-2</b>	<b>Special Shoring</b>	<b>Per Square Foot”</b>
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**SPECIAL PROVISION  
TO  
ITEM NO. 510 PIPE**

For this Project, Item No. 510, "Pipe" 12/08/18, of the Standard Specifications is hereby amended with respect to the clauses cited below and no other clauses or requirements of this section are waived or changed hereby.

**510.2 Materials  
(8) Pipe**

**REPLACE** the entire section with the following:

All pre-insulated chilled water pipe materials shall be per "Pre-Insulated Chilled Water Piping SS 232114" Specification. All non pre-insulated chilled water pipe materials shall be per specification "SS 232113 Hydronic Piping".

**510.3 Construction Methods  
(5) Trench Width**

**INSERT** the following as first paragraph:

Trenches for pre-insulated chilled water piping shall have a clear width on each side beyond the outside of the pipe of 12 to 16 inches per Austin Energy Standard Trench Detail R1.

**(26) Quality Testing for Installed Pipe**

**REPLACE** the entire section with the following:

All pre-insulated chilled water pipe shall be tested per "Pre-Insulated Chilled Water Piping – SS 232114" Specification. All non pre-insulated chilled water pipe materials shall be tested per specification "SS 232113 Hydronic Piping".

**510.5 Payment**

**REPLACE** the entire section with the following:

- A. Trench installed with pre-insulated chilled water pipe
1. Payment for pipe, measured as prescribed above, will be made at the Unit Price bid per linear foot for the specified sizes of pipe, of lengths and in soils types indicated, installed within trench as per AE Standard Trench Detail R1 to include full compensation for furnishing, preparing, hauling and installing required materials, safety provisions, clearing, pumping for dewatering, shoring of trenches, particle migration measures, temporary pavement repairs and maintenance, backfill and compaction, hot mix asphalt and road base required for street repair, and for labor, tools, equipment and incidentals necessary to complete work, including excavation, bedding, and disposal of surplus material, **chilled water supply and return pipe of sizes indicated (in accordance with specifications SS 232114 PRE-INSULATED CHILLED WATER PIPING for piping 24" diameter or less or SS 232113 HYDRONIC PIPING for piping greater than 24" diameter), and two 4" communications conduits (in accordance with specifications SS 260533 RACEWAYS AND BOXES).**

**SPECIAL PROVISION  
PIPE  
SP 510**

- a. Soil Conditions: Base Unit Price upon any of the soil types A and B, as defined in OSHA's "Classification of Soils for Excavations" (A-tights soils, B-sandy clays).
- Type A means cohesive soils with an unconfined, compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:
    - a. The soil is fissured; or
    - b. The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or
    - c. The soil has been previously disturbed; or
    - d. The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or
    - e. The material is subject to other factors that would require it to be classified as a less stable material.
  - Type B means:
    - a. Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or
    - b. Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.
    - c. Previously disturbed soils except those which would otherwise be classed as Type C soil.
    - d. Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or
    - e. Dry rock that is not stable; or
    - f. Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.
- b. Payment for dewatering a trench with ground water inflow exceeding 350 gpm of sustained flow shall be agreed by change order.
- c. Depth of Cover is as measured from ground surface to top of pipe insulation.
- B. Payment, when included as a Contract pay item, will be made under one of the following.

<b>Pay Items SP</b>	<b>Description</b>	<b>Units</b>
SP-510-ROCK-8-A	Open trench excavation for new CHW lines. Length 10 feet to 100 feet. Depth 4 feet to 12 feet total depth, <b>in rock</b> . Install 8 inch CHWS & CHWR pipes (Includes camera inspection of pipe), two 4 inch conduits (innerduct and fiber) per standard detail #R1. Includes excavation, bedding, compaction backfill. Excludes street repair of trench zone.	PER LINEAR FOOT
SP-510-SOIL-8-A	Open trench excavation for new CHW lines. Length 10 feet to 100 feet. Depth 4 feet to 12 feet total depth, <b>in soil</b> . Install 8 inch CHWS & CHWR pipes (Includes camera inspection of pipe), two 4 inch conduits (innerduct and fiber) per standard detail #R1. Includes excavation, bedding, compaction backfill. Excludes street repair of trench zone.	PER LINEAR FOOT

**SPECIAL PROVISION  
PIPE  
SP 510**

SP-510-ROCK-10-A	Open trench excavation for new CHW lines. Length 10 feet to 100 feet. Depth 4 feet to 12 feet total depth, <b>in rock</b> . Install 10 inch CHWS & CHWR pipes (Includes camera inspection of pipe), two 4 inch conduits (innerduct and fiber) per standard detail #R1. Includes excavation, bedding, compaction backfill. Excludes street repair of trench zone.	PER LINEAR FOOT
SP-510-SOIL-10-A	Open trench excavation for new CHW lines. Length 10 feet to 100 feet. Depth 4 feet to 12 feet total depth, <b>in soil</b> . Install 10 inch CHWS & CHWR pipes (Includes camera inspection of pipe), two 4 inch conduits (innerduct and fiber) per standard detail #R1. Includes excavation, bedding, compaction backfill. Excludes street repair of trench zone.	PER LINEAR FOOT
SP-510-ROCK-12-A	Open trench excavation for new CHW lines. Length 10 feet to 100 feet. Depth 4 feet to 12 feet total depth, <b>in rock</b> . Install 12 inch CHWS & CHWR pipes (Includes camera inspection of pipe), two 4 inch conduits (innerduct and fiber) per standard detail #R1. Includes excavation, bedding, compaction backfill. Excludes street repair of trench zone.	PER LINEAR FOOT
SP-510-SOIL-12-A	Open trench excavation for new CHW lines. Length 10 feet to 100 feet. Depth 4 feet to 12 feet total depth, <b>in soil</b> . Install 12 inch CHWS & CHWR pipes (Includes camera inspection of pipe), two 4 inch conduits (innerduct and fiber) per standard detail #R1. Includes excavation, bedding, compaction backfill. Excludes street repair of trench zone.	PER LINEAR FOOT
SP-510-ROCK-18-A	Open trench excavation for new CHW lines. Length 10 feet to 100 feet. Depth 4 feet to 12 feet total depth, <b>in rock</b> . Install 18 inch CHWS & CHWR pipes (Includes camera inspection of pipe), two 4 inch conduits (innerduct and fiber) per standard detail #R1. Includes excavation, bedding, compaction backfill. Excludes street repair of trench zone.	PER LINEAR FOOT
SP-510-SOIL-18-A	Open trench excavation for new CHW lines. Length 10 feet to 100 feet. Depth 4 feet to 12 feet total depth, <b>in soil</b> . Install 18 inch CHWS & CHWR pipes (Includes camera inspection of pipe), two 4 inch conduits (innerduct and fiber) per standard detail #R1. Includes excavation, bedding, compaction backfill. Excludes street repair of trench zone.	PER LINEAR FOOT
SP-510-ROCK-24-A	Open trench excavation for new CHW lines. Length 10 feet to 100 feet. Depth 4 feet to 12 feet total depth, <b>in rock</b> . Install 24 inch CHWS & CHWR pipes (Includes camera inspection of pipe), two 4 inch conduits (innerduct and fiber) per standard detail #R1. Includes excavation, bedding, compaction backfill. Excludes street repair of trench zone.	PER LINEAR FOOT
SP-510-SOIL-24-A	Open trench excavation for new CHW lines. Length 10 feet to 100 feet. Depth 4 feet to 12 feet total depth, <b>in soil</b> . Install 24 inch CHWS & CHWR pipes (Includes camera inspection of pipe), two 4 inch conduits (innerduct and fiber) per standard detail #R1. Includes excavation, bedding, compaction backfill. Excludes street repair of trench zone.	PER LINEAR FOOT

**End**

**SPECIAL PROVISION  
BARRICADES, SIGNS AND TRAFFIC HANDLING  
SP 803S**

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**SPECIAL PROVISION To  
Standard Specification Item 803S (Version 1-15-11)  
BARRICADES, SIGNS AND TRAFFIC HANDLING**

For this project, Item No. 803S Barricades, Signs and Traffic Handling, dated 1-15-11, of the City of Austin Standard Technical Specifications is hereby amended with respect to the clauses cited below. No other clauses or requirements of this Section of the City of Austin Standard Specifications are waived or changed.

1. 803S.7, Payment: **ADD** the following text and Pay Items:

“Due to the nature of the Work, Barricades, Signs and Traffic Handling will vary from Work Assignment to Work Assignment. **Pay Item 803S-CD, Barricades, Signs and Traffic Handling, Pay Item 803S-WD, Barricades, Signs and Traffic Handling, Pay Item 803S-MO, Barricades, Signs and Traffic Handling** are intended to pay for implementation of a basic traffic control plan, not included as a separate bid item below, containing a reasonable number of Type III barricades (e.g., up to six barricades), cones, sidewalk closure barricades, and other necessary signage.

<b>Pay Items SP</b>	<b>Description</b>	<b>units</b>
<b>Pay Item No. SP803S-D-RS:</b>	Temporary reflective stripping.	Per Linear Foot.
<b>Pay Item No. SP803S-D-PM:</b>	Remove existing pavement marking.	Per Linear Foot.
<b>Pay Item No. SP803S-R-PM:</b>	Replace pavement markings.	Per Linear Foot.
<b>Pay Item No. SP803S-D-TB-WK:</b>	Temporary traffic water barriers	Per Linear Foot.
<b>Pay Item No. SP803S-D-TB-MO:</b>	Temporary traffic water barriers	Per Linear Foot.
<b>Pay Item No. SP803S-D-MB-WK:</b>	Temporary message board.	Each
<b>Pay Item No. SP803S-D-MB-MO:</b>	Temporary message board.	Each
<b>Pay Item No. SP803S-A1L-WK:</b>	Arterial one lane closure per COA standards, per week, daytime only, short term. Includes daily setup and removal. (804S-1, 1 of 9)	Each
<b>Pay Item No. SP803S-A1L-MO:</b>	Arterial one lane closure per COA standards, per month, daytime only, short term. Includes daily setup and removal. (804S-1, 1 of 9)	Each
<b>Pay Item No. SP803S-A2L-WK:</b>	One way arterial two lane closure per COA standards, per week, daytime only, short term. Includes daily setup and removal. (804S-1, 2 of	Each

**SPECIAL PROVISION**  
**BARRICADES, SIGNS AND TRAFFIC HANDLING**  
**SP 803S**

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9)

**Pay Item No. SP803S-A2L-MO:** One way arterial two lane closure per COA standards, per month, daytime only, short term. Includes daily setup and removal. (804S-1, 2 of 9) Each

**Pay Item No. SP803S-WC-WK:** Sidewalk bypass or closure per COA standards, per week, daytime only, short term. Includes daily setup and removal. (804S-1, 4 of 9) Each

**Pay Item No. SP803S-WC-MO:** Sidewalk bypass or closure per COA standards, per month, daytime only, short term. Includes daily setup and removal. (804S-1, 4 of 9) Each

**Pay Item No. SP803S-SP-WK:** Steel plating of trench per COA standard, length 8 feet, per week. Includes setup and removal. (804S-4, 5 thru 9 of 9) Each

**Pay Item No. SP803S-SP-MO:** Steel plating of trench per COA standard, length 8 feet, per month. Includes setup and removal. (804S-4, 5 thru 9 of 9) Each

**End**

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## PART 1 - GENERAL

### 1.1 SUMMARY

- A. Low density cellular grout for filling annular space, by pumping, between chilled water pipe and primary tunnel liner, casing, or ground, or significant voids surrounding jack & bore casing.

### 1.2 SUBMITTALS

- A. Conform to requirements of Submittal Procedures.
- B. Product Data: Submit grout mix design report, including:
  - 1. Grout type and designation.
  - 2. Grout mix constituents and proportions, including materials by weight and volume.
  - 3. Grout densities and viscosities, including wet density at point of placement.
  - 4. Initial set time of grout.
  - 5. Bleeding, shrinkage/expansion.
  - 6. Compressive strength.
  - 7. Detailed description of grout pressure limiting equipment.
  - 8. For annular space grouting, buoyant force calculations and bulkhead designs.
  - 9. Volumetric calculation for vacant space to be filled with grout.
- C. Report shall detail amount of grout used versus calculated amount to be used. Report shall include notification that all voids and gaps are filled inside and outside (if applicable) casing.

## PART 2 - PRODUCTS

### 2.1 LOW DENSITY CELLULAR GROUT

- A. Description:
  - 1. Manufacturer: Pacific International Grout Company - LDB 662 annular backfill.
  - 2. Mix number: 65.0-500C
  - 3. Cement, ASTM C150, Type I/II
  - 4. Slurry Density, ASTM C138, 104.3 pcf
  - 5. Insitu Density, ASTM C138: 55.00 pcf
  - 6. Flow, ASTM C939: 20 seconds
  - 7. Shrinkage, ASTM: <I %
  - 8. Bleeding, ASTM C232: No Bleed
  - 9. Set Time, ASTM C403: 3-6 hours (depending upon temperature and site conditions)
  - 10. Compressive Strength, ASTM C495: @ 28 Days 150 PSI Minimum

- 
- B. Submit description of materials, grout mix, equipment and operational procedures to accomplish grouting operation. Description may include sketches as appropriate, indicating type and location of mixing equipment, pumps, injection points, venting method, flow lines, pressure measurement, volume measurement, grouting sequence, schedule, and stage volumes. Tests and certifications shall have been performed within last 12 months prior to date of submittal.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install in strict accordance with manufacturer's instructions.
- B. Grout mix is to be mixed on site to meet requirements of particular installation.
- C. Fill tunnels with low density cellular grout after installation of pipes and conduits. Fill air voids within tunnel.
  - 1. PVC conduit or other materials subject to damage from heat of hydration produced by grout curing must be protected from such damage. Circulate water within conduit at rate required to maintain surface temperature well below the melting point of the PVC installed. Water utilized by this circulation shall be drained into the sanitary sewer. Contractor to coordinate with Austin Water for sanitary sewer discharge permit. Circulation water shall not be drained in the storm drain.
- D. Fill significant voids surrounding jack and bore casing.
- E. Verify all voids and gaps inside and outside (if applicable) casing are filled by comparing volumetric quantity of grout used versus volumetric calculation of vacant space to be filled. If quantity of grout used is less than the volumetric calculation of vacant space, Contractor to determine means of completely filling the voids and gaps.

### 3.2 PAYMENT

- A. Grout:
  - 1. Work performed under this Section will not be paid as a separate line item. Provision of grout will be paid for under unit pricing as described in Section 501S JACKING OR BORING PIPE.

END OF SECTION

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## **PART 1 - GENERAL**

### **1.01 SUMMARY**

- A. It is the intent of this project that the Contractor may provide either a fusion-bonded epoxy dual coating system or a polyurethane coating system. This coating is intended for buried pipe and pipe located in a conditioned environment. It is not intended for pipe in direct sunlight or outdoors. This Section includes the following:
  - 1. Factory surface preparation and application of fusion-bonded epoxy dual coating system on the exterior of pipe and fittings. Dual coating system means fusion-bonded epoxy base coating system with abrasion resistant overlay top coat.
  - 2. Factory surface preparation and application of polyurethane coating system on the exterior of pipe and fittings.
  - 3. Minimum coating thicknesses are specified in the Coating Schedule contained within this Section.
  - 4. Requirements for repair of damaged coating.
- B. Related Work Described Elsewhere.
  - 1. Hydronic Piping, SS 232113

### **1.02 DEFINITIONS**

- A. DFT: Dry-film thickness.
- B. Min.: Minimum

### **1.03 REFERENCES**

- A. American Society for Testing and Materials (ASTM) Publications:
  - 1. D2240: Standard Test Method for Rubber Property—Durometer Hardness
  - 2. D4060: Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
  - 3. D4541: Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
  - 4. G14: Standard Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test)
- B. American Water Works Association (AWWA):

- 
1. C213: Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
  2. C222: Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings
- C. NACE International (Formerly The National Association of Corrosion Engineers) (NACE):
1. Standard RP0490-95 Standard Recommended Practice - Holiday Detection of Fusion-Bonded Epoxy External Pipeline Coatings of 250 to 760 um (10 to 30 mils)
- D. The Society for Protective Coatings (SSPC):
1. PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.
  2. SP 1: Solvent Cleaning
  3. SP 10: Near White Metal Blast

#### 1.04 SUBMITTALS

A. Manufacturer Data:

1. Product data for each coating system specified.
  - a. Provide the manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each material proposed for use.
  - b. Certification from the manufacturer that products supplied meet the specifications referenced within this Section.
  - c. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

B. Quality Assurance/Control Submittals

1. Manufacturer's certified statements of compliance that products supplied meet the specifications referenced within this Section
  - a. Include documentation of inspection and testing of all pipe and fittings as required by referenced standards.
  - b. Include a copy of the manufacturer's quality management program to be implemented during manufacture and application, all references to the applicable standard that will govern the inspection or test, and the applicable acceptance criteria of the standard.

- 
2. Results of all dimensional, thickness, and visual inspections and measurements conducted during the application process.

#### 1.05 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has successfully completed coating system applications similar in material and extent to those specified within this Section.
- B. Certified test reports that the line pipe sections pass the electrical holiday tests specified in Paragraph 3.02.

#### 1.06 STORAGE AND HANDLING

- A. Coating materials shall be plainly and permanently marked, stored, and applied in accordance with the manufacturer's recommendations.
- B. Fusion-bonded epoxy powder shall be no more than six months old and shall be protected from any moisture contamination and stored at a temperature between 50° and 80°F.
- C. The coated pipe sections shall be handled with proper equipment, including slings at least eight inches wide, to prevent distortion or damage to the pipe, and to prevent damage to the pipe coating. The pipe shall not be stacked more than four units high, and shall be supported with suitable cradles to prevent chaffing and damage.

### **PART 2 - PRODUCTS**

#### 2.01 MATERIALS

- A. Fusion-Bonded Epoxy Dual Coating System: The fusion-bonded epoxy dual coating system shall meet the requirements of AWWA C213 and shall be by a single manufacturer. The use of reclaimed and reconditioned fusion-bonded epoxy or abrasion resistant overlay powder is not permitted.
  1. The fusion-bonded epoxy dual coating system shall be Skotchkote 6352 as manufactured by 3M, or Engineer approved equal.
- B. Polyurethane Coating System: The polyurethane coating system shall meet the requirements of AWWA C222 and shall be by a single manufacturer.
  1. The polyurethane coating system shall be Durashield 210, as manufactured by Lifelast, or Engineer approved equal.

#### 2.02 EQUIPMENT

- A. Compressed Air System: The compressed air system for blasting shall be equipped with adequate separators and traps and the compressed air shall be free of water and oil. Forty to eighty mesh silica abrasive shall be discharged from a blast nozzle at no less than 100 psi pressure.

- 
- B. Powder Application Equipment: All powder application equipment shall be inspected and approved by the Coating Applicator prior to coating application. An operative moisture trap and desiccator shall be provided between the air supply and fluidized bed. Water shall be bled frequently from the trap.

## **PART 3 - EXECUTION**

### **3.01 SURFACE PREPARATION**

- A. Fusion-Bonded Epoxy Dual Coating System or Polyurethane Coating System: The exterior of the steel pipe and fittings shall be prepared prior to application of coating in accordance with the surface preparation requirements contained in AWWA C213, Section 4.4.2 for Fusion-Bonded Epoxy or AWWA C222 Section 4.4.2 for Polyurethane Coating, as applicable, and manufacturer requirements.
1. All weld splatter, rough welds, burns, and sharp steel surfaces shall be ground smooth prior to blasting.
  2. Prior to blast cleaning, surfaces shall be inspected and pre-cleaned according to SSPC-SP1 to remove oil, grease, and loosely adhering deposits. Visible oil and grease spots shall be removed by solvent wiping. Only approved safety solvents, which do not leave a residue, shall be used.
  3. Blast cleaning operations shall not be conducted on surfaces that are less than 5°F above dew point, or when the relative humidity of the air is greater than 80%. Coating Applicator shall ensure that the blasted surfaces remain dry and clean after blasting and before coating.
  4. The nozzle distance from the steel should be no more than 10 inches. Air source shall provide a minimum of 200 CFM per blast nozzle.
  5. The exterior pipe surface shall be blast cleaned to NACE No. 2/ SSPC-SP10 near-white metal blast cleaning using steel grit or steel grit-shot mixture after pre-heating of pipe to sufficient temperature to remove all moisture. Near-white finish is interpreted to mean that all metal surfaces shall be blasted to remove all dirt, mill scale, rust, corrosion products, oxides, paint and other foreign matter. Very light shadows, very slight streaks or slight discoloration shall be acceptable; however, at least 95% of the surface shall have the uniform gray appearance of a white-metal blast cleaned surface. The surface, when viewed without magnification, should be found free of visible rust, corrosion products or stains, paint, or foreign matter.
  6. The cleaning media shall be selected to achieve an anchor pattern profile of not less than 1.5 mils (40 μm) or more than 4 mils (100μm.). A 3 mil minimum profile is required for the polyurethane coating system. The contractor shall make available standards for comparison. For consistent surface finish, a stabilized working mix of the cleaning media shall be maintained by frequent small additions of new grit or shot commensurate with consumption; infrequent large additions shall be avoided. The cleaning media working mix shall be maintained

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clean of contaminants by continuous and effective operation of blasting machine scalping and air wash separators.

7. Any raised slivers, scabs, laminations or bristles of steel remaining on the newly cleaned surface shall be removed using abrasive grinders or by hand filing. This cleaning operation shall not burnish or destroy the anchor pattern.
8. All blasting residue shall be removed by brush, air blast, or vacuum cleaner prior to applying coating. The cleaned pipe shall be inspected to ensure that all cleaning steps have been adequately performed. Presence of contaminants indicates a malfunction of the cleaning equipment, which shall be corrected immediately.
9. The prepared surfaces shall be kept free of any contaminants such as high humidity, surface moisture, water, mud, or tire marks (e.g., from support carriages for heating and coating application equipment). The pipe surface shall not be allowed to flash rust before coating. Blasted surfaces which become contaminated shall be re-cleaned as stated in this Section.

### 3.02 COATING APPLICATION

- A. Fusion-Bonded Epoxy Dual Coating System: The exterior of the steel pipe and fittings shall be coated in accordance with the coating application requirements contained in AWWA C213, Section 4.4.3 for Fusion-Bonded Epoxy. The application of the coating to the exterior of the pipe shall be as follows:
  1. Clean pipe shall be preheated so the pipe temperature at the entrance to the base coating station is between 405°F - 490°F (207°C - 254°C). The heat source shall not leave a residue or contaminant on the pipe surface. Blueing of the steel during preheating shall not be acceptable. If blueing occurs, the pipe shall be cooled to room temperature and re-cleaned. Graduated Tempilstik crayons may be used to measure the temperature. Only a small spot of pipe shall be touched with the Tempilstik. Optical pyrometers or infrared sensing devices may be used in addition to, or in lieu of, Tempilstik. The calibration of the optical pyrometer shall be checked at least twice daily.
  2. Infrared sensing devices shall be used to monitor temperature of the applied coating. Do not use on uncoated/bare steel. IR temperature measurements on coating are usually 20°F - 30°F cooler than actual steel temperature. Check temperature variance with Tempilstik.
  3. Apply base per instruction, then apply top coat before base coat has cured.
  4. Following application of Dual Coating System 6352 epoxy top coating, follow cure guide for time before force cooling.
  5. During the period of coating and curing, the pipe shall be handled so as to avoid damage to the coating. After the coating has cured, it shall be cooled with air or water spray prior to inspection and repair.

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6. Pipe Ends

- a. Coating shall be held back a minimum of 2.5 inches +/- 0.5 inches from the ends of pipe sections to be joined by welding. Contractor is responsible for selecting holdback to avoid damage to the coating system during welding. Coating material on the bevel or holdback is not acceptable.

B. Polyurethane Coating System: The exterior of the steel pipe and fittings shall be coated in accordance with the coating application requirements contained in AWWA C222, Section 4.4.3 for Polyurethane Coating. The application of the coating to the exterior of the pipe shall be as follows:

- 1. Thinning is not allowed.
- 2. The coating thickness shall be as specified in this Section. The applicator shall measure and record coating thickness using a thickness gauge that is acceptable to the Owner.
- 3. The relative humidity, dew point and steel surface temperature shall conform to the recommended parameters outlined in the DuraShield 210 and DuraShield 210-61 Technical Data Sheets (or approved equal manufacturer data sheets). Ensure that the resin (Part A) and activator (Part B) components are within the recommended product Application Temperatures for the chosen application method as listed on the respective Technical Data Sheet. The applicator shall use a contact thermometer, a psychrometer and psychrometric charts, or equipment that provides equivalent accuracy, to monitor these environmental requirements.
- 4. Apply the coating in strict conformance to the manufacturer's requirements. Application shall be done in a professional manner, mitigating runs and sags and providing complete coverage on all surfaces, including difficult to spray areas like welds, seams and angles. Application shall be accomplished in a manner that achieves as smooth and uniform of a coat as possible.

C. COATING SCHEDULE

- 1. The following schedule contains the minimum dry film thickness requirements for the coatings specified in this Section:

Surface	Coating	Min. DFT (mils)
Exterior Surface of Steel Pipe	Fusion-Bonded Epoxy	16
Exterior Surface of Steel Pipe	Abrasion Resistant Overlay	30
Exterior Surface of Steel Pipe	Polyurethane	40

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### 3.03 INSPECTION

- A. General: All work done under this Section shall be inspected by the Coating Applicator's Quality Control inspector and shall be subject to inspection and acceptance by the Owner. All parts of Coating Applicator's facilities associated with this work shall be accessible to the Owner. The Coating Applicator shall correct work which is found defective under this Section or within the obvious intent of this specification.
- B. The Coating Applicator's quality control inspector shall advise the Applicator's foreman when conditions exist which adversely affect the coating operation with respect to cleaning, application, or material performance, so that immediate corrective measures can be taken.
- C. The fusion-bonded epoxy shall be subjected to the following inspection:
  - 1. Coating thickness checks shall be made at ambient temperature with a magnetic pull-off film thickness gauge which has been calibrated within the previous 24 hours, using a U.S. Bureau of Standards certified coating calibration standard. The thickness of the calibration standard shall be within 20% of the minimum required coating thickness. Thickness measurements shall be made in accordance with SSPC-PA2, Section 2. The thickness measurements shall be made at the 12 o'clock, 3 o'clock, 6 o'clock, and 9 o'clock position.
  - 2. Prior to storage, the coating shall be inspected for continuity utilizing the voltage calculation methodology of NACE Standard RP0490-95. Use approximately 4000 volts. The search electrode shall be steel spring or conductive rubber.
  - 3. Coating shall meet the following requirements:
    - a. The cured lining and coating shall be smooth and glossy, with no graininess or roughness. The lining and coating shall have no blisters, cracks, bubbles, underfilm voids, mechanical damage, discontinuities, or holidays.
- D. The polyurethane coating shall be subjected to the following inspection:
  - 1. Visual
    - a. Coating shall be uniform in color. The coating shall be visually inspected and found to be free of blisters, cracks, pinholes, missed areas and excessive roughness.
    - b. Sags and runs shall be kept to a minimum. Excessive runs can be sanded smooth and overcoated with a layer of DuraShield 210 or DuraShield 310 (or approved equal manufacturer recommended product).

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## 2. Coating Thickness

- a. During continuous spray operations, the coating thickness shall be measured using a wet film thickness gage whenever feasible. The dry film coating thickness shall be tested using a properly calibrated magnetic pull off or eddy current equipment after completion of each pipe. In either measure, if the thickness of the coating is below the minimum specified millage anywhere along the length of the pipe, then adjustments must be made to the spray system to account for this.

## 3. Holiday Testing

- a. Holiday testing will be conducted on the completed coating after cure or 24 hours, whichever is less, using a high voltage spark test in accordance with NACE Standard RP-0188.
- b. Coating shall be at 75% or greater of its fully cured hardness value prior to holiday testing.
- c. Coating thickness used for holiday detection shall be the minimum specified coating thickness.
- d. All holidays shall be plainly marked immediately after detection and shall be repaired according to this Section.
- e. Holiday testing will be performed in such a way as to mitigate possible damage to the coating by performing as few of passes as required over the coating.

### 3.04 REPAIRS

- A. All damage detected by the holiday detector or visual inspection shall be repaired by the Applicator.
- B. Scars, dents, damaged areas, and large holidays shall be cleaned by removing all rust, scale, dirt, or other foreign material and loose coating by using hand- or power-driven wire brushes. The area to be patched (holiday plus at least 3/4 inch of surrounding coating) shall be suitably roughened before patching (preferably by 120 grit "wet" or "dry" sandpaper). Files may not be used. Dust generated by the sanding is to be removed with a clean, dry cloth or brush prior to patching.
- C. Areas not meeting hardness requirements shall be removed using a method that will not damage the primary coating or pipe.
- D. Products used for repair in coating systems shall match the properties of the original coating system and shall be recommended by the manufacturer for use in repairs. Repairs shall be made in accordance with manufacturer requirements.

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- E. Coating Manufacturer approved melt sticks shall be used for patching holidays and damaged areas of the epoxy coating. The surface to be patched shall be heated with a small torch until the patch stick just starts to melt; then the stick shall be rubbed over the heated surface, building up a small puddle of patching compound over the area. The patches shall overlap the surrounding undamaged coating by a minimum of 3/4 inch. The repair shall be re-jeeped in accordance with the requirement of this section.

### 3.05 STORAGE, HANDLING, AND SHIPPING

- A. Pipe shall be handled and stored in a manner to prevent damage to pipe walls, beveled ends and coating. Pipe or coating damaged in handling or other operations shall be satisfactorily repaired.
- B. Stacking in the yard shall be in accordance with good safety practices or in accordance with Purchaser's specifications. Sufficient spacers and padding shall be used to prevent damage to coating.
- C. Pipe shall be shipped using sufficient dunnage to adequately protect the pipe and its external coating. Chains or wire rope shall not be used without sufficient padding to prevent damage to the coating.

## **PART 4 - MEASUREMENT AND PAYMENT**

### 4.01 Measurement and Payment

- A. Work required in this section shall not be measured separately for payment, but shall be considered subsidiary to the cost of the pay item to which it relates.

**End**

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## **1.0 GENERAL**

This specification covers the internal inspection of Piping System through the use of visual records.

## **2.0 SUBMITTALS**

Contractor shall submit to Owner the following:

2.1 Compact Disc (CD) or Digital Video Disc (DVD) of recording of chilled water piping.

A. Three (3) copies shall be given to Austin Energy Project Manager.

## **3.0 EXECUTION**

### **3.1 Video Recording of Installed Chilled Water Piping**

Contractor shall provide all labor, equipment, material and supplies and perform all operations required to conduct internal closed-circuit television and video recording of all chilled water piping. Video recording of each chilled water piping section shall be completed and submitted to Owner **prior to completion** of backfill of chilled water piping. Contractor shall not place backfill until Owner has reviewed the video and agrees that there are no defects in the chilled water pipe welding and pipe is clean of debris. Placement of backfill prior to Owner review of video and agreement of no defects in the chilled water piping installation shall be at the Contractor's risk. Any defects observed through the video inspection shall be corrected at the Contractor's expense and new video submitted to the Owner prior to acceptance of the pipe. Third (3<sup>rd</sup>) party weld inspector shall review and approve all weld roots shown in video conform to B31.1.

All video work shall be performed under the direct full-time supervision of operator qualified to operate the televising equipment and provide a quality video for review by the Owner.

Closed circuit television shall produce a color CD or DVD.

Camera shall produce a video using a pan-and-tilt, radial viewing, conduit inspection camera that pans plus/minus 275 degrees and rotates 360 degrees. The television camera shall be specifically designed and constructed for such use. The camera shall be operative in 100% humidity conditions. Camera shall have an accurate footage counter that displays on the monitor the exact distance of the camera (to the nearest tenth of a foot) from the centerline of the starting point.

Camera shall have the capability of traversing bends and elbows up to 180 degrees of bends. Camera must be capable of a forty five (45) degree angled elevation change.

Camera shall have height adjustment so that the camera lens is always centered within plus/minus 10% of the center axis of the conduit being videoed. Camera shall provide a minimum of 460 lines of horizontal resolution and 400 lines of vertical resolution. Camera shall be equipped with a remote iris to control the illumination range for an acceptable picture. Geometrical distortion of the image shall not exceed one percent (1%). The video image produced by each camera shall be calibrated using a Marconi Resolution Chart No. 1 or equivalent.

Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the conduit without loss of contrast, flare out of picture or shadowing. A reflector in front of the camera may be

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required to enhance lighting in dark or large size conduit. The video camera shall be capable of showing on the digital display the Owner's name, Project name, Contractor name, date, line size and material, conduit identification, and ongoing footage counter. The camera, television monitor, and other components of the video system shall be capable of producing picture quality to the satisfaction of the Owner that is a clear, accurate, in-focus color recording of the chilled water piping's internal condition. If picture quality is unsatisfactory, equipment shall be removed and replaced with adequate equipment.

If during video of the chilled water piping section, water is encountered inside the pipe, the pipe must be dewatered. The chilled water piping section must be dry. Video performed while floating the camera is not acceptable.

Computer printed location records shall be kept by the Contractor and shall clearly show the location and amounts of any debris, materials, or equipment left in the pipe. A copy of all records shall be supplied to the Owner. Noted defects shall be documented as color digital files and color hard copy print-outs. Photo logs shall accompany each photo submitted.

The video recording shall supply a visual and audio record of the chilled water piping that may be replayed. Video recordings shall include an audio track recorded by the video technician during the actual video work describing the parameters of the chilled water piping being videoed (i.e. location, depth, diameter, pipe material), as well as describing connections, defects and unusual conditions observed during the video work. Video recording playback shall be at the same speed that it was recorded. Slow motion or stop-motion playback features may be supplied at the option of the Contractor. Once videoed, the CDs/DVDs shall be labeled and become the property of the Owner. The Contractor shall have all video and necessary playback equipment readily accessible for review by the Owner during the project.

#### **4.0 Measurement**

Accepted work performed as prescribed by this item will be the complete recording of all chilled water pipe installed per the plans and specifications.

Measurement for this item will be made as lump sum payment.

#### **5.0 Measurement and Payment**

- A. Work required in this section shall not be measured separately for payment, but shall be considered subsidiary to the cost of the pay item to which it relates.

**End**

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## PART 1 - GENERAL

### 1.1 DESCRIPTION:

This item shall govern the valves furnished and installed as indicated on the Drawings. Unless otherwise indicated on the Drawings, all butterfly valves 4 inches (102 mm) and larger shall be bi-directional, bubble-tight resilient seated butterfly type valves of suitable design and fully equipped for service in chilled water systems, without need for further modification; all ball valves shall be lead free full port stainless steel valves of suitable design and fully equipped for service in chilled water systems, without need for further modification.

### 1.2 QUALITY ASSURANCE

- A. MSS Compliance: Comply with the various MSS Standard Practice documents referenced.
- B. ASME Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping, ASME B1.20.1 Pipe Threads, General Purpose and ASME B31.3 for Process piping.
- C. Coating applicator qualifications: Engage an experienced applicator who has successfully completed coating system applications similar in material and extent to those specified within this Section. Contractor shall submit a certificate that personnel have been trained in coating system application procedure. Certificate shall come from manufacturer of product. An AE representative shall be notified of coating system application at least 48 hours prior to installation.

### 1.3 SUBMITTALS

- A. Product Data: For each type of valve indicated.
  - 1. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
  - 2. Include valve diagram cut sheet: Cut sheet shall include item number, quantity, description, materials, reorder part number.
- B. Torque setting table: For each type of valve indicated.
  - 1. Table shall include for each valve: the manufacturer's recommended torque adjustment range for bolt tightening and the actual torque Contractor tightened the bolts to on the valves.

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## 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set angle, gate, and globe valves closed to prevent rattling.
  - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
  - 5. Set butterfly valves closed or slightly open.
  - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use hand wheels or stems as lifting or rigging points.

## PART 2 - PRODUCTS

### 2.1 BASIC, COMMON FEATURES

- A. Pressure and Temperature Ratings: As required to suit system pressures and temperatures.
- B. Sizes: Same size as upstream pipe, unless otherwise indicated.
- C. Gear Operators: For quarter-turn butterfly valves, with 2" square nut on shaft of gear operator to fit socket connection of extension stem. If gear operator is in a direct burial application, the gear operator shall be rated for ground burial, and shall not have any moving parts such as an indicator except for shaft unless prior AE approval is granted. Gear operators shall only have a single shaft component and be able to withstand at a minimum of 8000 in-lbs output torque. Multiple shaft components are not allowed for gear operator unless prior AE approval is granted.
- D. Extension Stems: Galvanized steel or stainless steel, female socket end at bottom, 2" square nut at top, of length required as per AE Standard Detail R6 'VALVE BOX DETAIL'.
- E. Extension Hubs: Carbon steel, galvanized steel or stainless steel, connection shall seamlessly fit to gear operator, shall be manufactured by valve manufacturer to length as specified in approved shop drawings, where applicable.
- F. Bypass and Drain Connections: Comply with MSS SP-45 bypass and drain connections.
- G. Threads: ASME B1.20.1.

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## 2.2 BUTTERFLY VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by:

1. Bray Controls; a division of Bray International. Series 31H or 36H valves.

B. Description:

1. Standard: MSS SP-67.
2. CWP Rating:
  - a. For Valves 20" and below: 250 psig at 100 deg F.
  - b. For Valves greater than 20": 232 psig at 100 deg F.
3. Body Design: polyester coated ductile iron lug type body, flange size for 150 lb companion flanges; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
4. Seat: Resilient, EPDM.
5. Stem: 316 or 416 stainless steel.
6. Disc: Aluminum-bronze or stainless steel.
7. Service: Bidirectional.
8. Gear operator: Permanently lubricated, self locking carbon steel worm and stainless steel gear input shaft, coated cast iron gear housing, meeting NEMA 4, 4x and IP 65 specifications, Teflon bushing, FKM O-Ring body seal, vertical shaft from gear operator with 2" square nut on shaft to fit socket connection of extension stem. Operator shaft must be of sufficient length to accommodate connection to the valve riser. Gear input shaft shall be a keyed connection throughout, pins are not acceptable. For direct burial of gear operator, Diamond Gear Company or AE OSER approved equal. For gear operator located in vault, valve manufacturer's gear operator is acceptable.

## 2.3 BALL VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Conbraco Industries, Inc.; Apollo Valves, 76F-100A series.
2. Nibco Inc.; Nibco T-585-S6 Series.

B. Description:

1. Threaded, 1000 psig cold non-shock, stainless steel body, full port.
2. 316 SS ball and stem.
3. RPTFE Seats and stuffing box ring.
4. Adjustable packing gland.
5. Investment cast components.
6. Reinforced seats.
7. Blow-out-proof stem design.
8. Stem bearing: RPTFE.
9. Stem packing: MPTFE.
10. Adjustable packing gland.
11. Two (2) piece construction.
12. 304 or 316 stainless steel lever with vinyl grip, stainless steel lever nut.

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13. Federal Specification: WW-V-35C, Type: II, Composition: SS, Style: 3.

#### 2.4 AUTOMATIC AIR VENT VALVES

A. Manufacturers:

1. ITT Hoffman or AE OSER Approved equal.

B. Description:

1. Model 792
2. Body: Cast iron.
3. Internal Parts: Stainless steel.
4. 3/4" NPT inlet and 1/2" NPT outlet.
5. Minimum operating pressure rating: 250 psi.
6. 10 CFM air discharge capacity at 100 psig water pressure.

#### 2.5 VALVE BOXES AND RISERS

A. Valve Stem Extension Assembly: Construct per AE Standard Details R5, R6, R6A, R16 and R16A for valve box, valve box cover, valve box riser, and valve operator extension.

B. Operator and Boot Assembly Description:

1. Manufactured assembly, round, East Jordan 8555 24B or AE approved equal. Material: Cast Iron Per ASTM A48 Class 30B.
2. Min. 5-1/4" riser inner clear opening.
3. Min. 10" inner diameter base.
4. Centering guide within riser to ensure riser stays centered over valve or valve operator.
5. 2" diameter stainless steel shaft extension length as required.
6. 3" and 4" PVC pipe length as required.
7. If Valve Riser shaft is fabricated by the valve manufacturer, refer to AE Detail R16.
8. If Valve Riser shaft is fabricated by Contractor, refer to AE Detail R16A.

C. Provide "Debris Cap" by SW Services, 800-462-2773, [www.debriscaps.com](http://www.debriscaps.com), at top of each valve box riser.

D. Provide Quality Water Products' "Box-Seat" at stems of all direct buried valves.

E. Valve Riser and Cover Assembly Description:

1. Ductile iron pipe for elevation adjustment per AE Detail R6
2. Round flat lid, traffic rated.
3. Approved Manufacturers: East Jordan #70 valve box frame and cover or AE OSER approved equal
4. Valve wrench extension stem, constructed of 1-1/4" schedule 40 galvanized steel pipe, with 2" nut socket on lower end and 2" nut on upper.

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## 2.6 BURIED VALVE AND FLANGE COATING

- A. Buried valves and flanges shall be covered with the STAC Coating System products including STACprime, STACfill, STACwrap and STACguard. Coating materials shall be plainly and permanently marked, stored, and applied in accordance with the manufacturer's recommendations.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Alignment Fit-Up of pipe and flanges to valves shall abide by B31.3 335.1.1 "Alignment and B31.3 Appendix F. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves from fully open to fully closed positions. Examine guides and seats made accessible by such operation.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.
- G. All material shall be able to be inspected by AE OSER inspectors before installation at job site. 48 hour notice shall be given to AE Project manager for inspection of items.

### 3.2 VALVE INSTALLATION

- A. Install valves as indicated, according to manufacturer's written instructions.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in a position to allow full stem movement.
  - 1. **Ball valves must be installed within air release valve assembly boxes such that valve opens to flow with handle pulled UP.** Installation where handle is pushed down to open will not be accepted.

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2. Gear operator shaft must be long enough to allow base of valve box to fit completely over square nut operator without adjacent pipe / butterfly valve obstructing. Provide gear operator shaft extension piece if/as required to meet this requirement.
  3. Provide extension hub if/as required to meet valve riser requirements. Extension hub shall be welded to operator in such a manner that there are no visible holes or gaps. Each face of the extension hub shall be sealed with a gasket or silicon sealant.
  4. If support of extension hub is necessary, review and follow manufacturers' support guidelines and requirements.
  5. Apply STACprime, STACfill, STACwrap and STACguard to all direct buried valves. Install in strict accordance with manufacturer's instructions. Contractor shall submit a certificate that personnel have been trained in STAC wrap procedure. Certificate shall come from manufacturer of product. An AE representative shall be notified of installation of STAC wrap at least 48 hours prior to installation.

### 3.3 VALVE BOX INSTALLATION

- A. Install in accordance to AE Detail R6 and following manufacturer's recommendations.
- B. Coordinate top riser dimensions with Austin Energy to verify proper fit of AE-provided lid. [Note: Height of valve box street-level lids (reference AE Standard Details R7 and R8) is 2.5".]
- C. Coordinate length of gate wrench extension stem with elevation requirements of site such that top nut is 12 -20 inches below street surface.
- D. Provide centering guide within riser, attached to valve or valve operator shaft, to ensure riser stays centered over valve or valve operator.
  1. Provide "Box-Seat" by Quality Water Products at stems of all direct buried valves. Box Seat may serve as centering guide.
- E. Provide "Debris Cap" by SW Services, 800-462-2773, [www.debriscaps.com](http://www.debriscaps.com), at top of each valve box riser above underground valves.
- F. Verify risers are installed perfectly vertically, centered on valve or gear nut. Do not backfill around riser until inspected and approved by representative of AE and/or Engineer.
- G. Contractor shall check that the valve riser is plumb once project is at final completion. If not plumb, Contractor shall adjust riser and verify it is plumb. AE OSER inspector shall witness that the valve riser is adjusted appropriately.

### 3.4 THREADED CONNECTIONS

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- A. Note the internal length of threads in valve ends and proximity of valve internal seat or wall to determine how far pipe should be threaded into valve. Industry standards shall be followed.
  - B. Align threads at point of assembly.
  - C. Apply appropriate tape or thread compound to the external pipe threads, except where dry seal threading is specified.
  - D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded. Tighten in accordance to manufacturers' or industry standard.

### 3.5 AIR RELEASE VALVE ASSEMBLIES

- A. Install air release valve assemblies, complete with all components such as shutoff valves, air release valves, nipples, tubing, concrete ground box, AASHTO-20 rated lid, etc, in accordance with AE Standard Detail R2 "Air Release Valve Assembly".

### 3.6 APPLICATION SCHEDULE

- A. General Application: Use ball valves for shutoff duty and for throttling duty.
- B. Refer to drawings for valve type required in particular locations.

### 3.7 ADJUSTING

- A. Valve bolts shall be tightened in accordance to manufacturers' or industry standard in the proper bolt sequence.
- B. If adjustment of packing is needed, valve shall be replaced. No adjustment shall be required unless indicated by manufacturer in writing. Adjust or replace packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves if leak persists.

### 3.8 MEASUREMENT

- A. Accepted work performed as prescribed by this item will be measured per each by each unit installed by plans and specifications.

### 3.9 PAYMENT

- A. Butterfly Valves:
  - 1. Valves will be paid for at the unit bid price for the size and type direct-buried valve installed, including valve, thrust blocking, valve insulation/wrap, all flanges, unions, and fittings required along with related bolts, valve insulation, gear operator and gear operator stem top nut, valve boxes referencing stand-

ard Austin Energy Details, and other appurtenances necessary for proper operation.

- a. Unit pricing assumes top nut of valve or valve gear operator is not more than 8 feet below grade.

B. Air release valve assembly:

- 1. Air release valve assembly will be paid for at the unit bid price for an entire assembly, per AE Standard Detail R2 "Air Release Valve Assembly", including underground box and lid, 2" pipe risers, tubing and all pipe fittings, ball valves, pipe and valve insulation, and air release valve. Riser pipe to include all lengths up to 20 feet, measured from main chilled water line tap to ball valve.

C. Payment, when included as a Contract pay item, will be made under one of the following:

<b>Pay Items SP</b>	<b>Description</b>	<b>Units</b>
SS-230524-BFV-8	Single butterfly isolation valve, per standard detail #R6 "valve box" & #R16A "valve box base gear operator", 8 inch pipe size. Includes two weld-on flange pipe connections, valve insulation & P.C. concrete supports. Excludes excavation & backfill.	PER EACH
SS-230524-BFV-10	Single butterfly isolation valve, per standard detail #R6 "valve box" & #R16A "valve box base gear operator", 10 inch pipe size. Includes two weld-on flange pipe connections, valve insulation & P.C. concrete supports. Excludes excavation & backfill.	PER EACH
SS-230524-BFV-12	Single butterfly isolation valve, per standard detail #R6 "valve box" & #R16A "valve box base gear operator", 12 inch pipe size. Includes two weld-on flange pipe connections, valve insulation & P.C. concrete supports. Excludes excavation & backfill.	PER EACH
SS-230524-BFV-18	Single butterfly isolation valve, per standard detail #R6 "valve box" & #R16A "valve box base gear operator", 18 inch pipe size. Includes two weld-on flange pipe connections, valve insulation & P.C. concrete supports. Excludes excavation & backfill.	PER EACH
SS-230524-BFV-24	Single butterfly isolation valve, per standard detail #R6 "valve box" & #R16A "valve box base gear operator", 24 inch pipe size. Includes two weld-on flange pipe connections, valve insulation & P.C. concrete supports. Excludes excavation & backfill.	PER EACH
SS-230524-AIR	Air release assembly per standard detail #R2. Excludes excavation & backfill.	PER EACH

END

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## PART 1 - GENERAL

### 1.1 SUMMARY

- A. This Specification includes pipe and fitting materials and joining methods for the following:
  - 1. Chilled water transmission piping larger than 24” in diameter.
  - 2. Short lengths of hydronic piping, 2” and less, for miscellaneous items such as fittings in air release pipe riser, outlet and inlet piping from air releases, etc.
  - 3. Refer to Pre-insulated Chilled Water Piping specification SS232114 for pipe 24” diameter and smaller.

### 1.2 REFERENCES

- A. Design, drawings, welding details, fabrication, non destructive examinations and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. ASME B31.1 – Power Piping edition, ASME B31.3 – Process Piping
- C. ASME Section IX – Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operations.
- D. ASME B1.20.1 – Pipe Threads, General Purpose, Inch
- E. ASME B16.3 – Malleable Iron Threaded Fittings Class 150 and 300.
- F. ASME B16.47 - Large Diameter Steel Flanges: NPS 26 through NPS 60 Metric/Inch Standard
- G. ASME B16.5 – Pipe Flanges and Flanged Fittings
- H. ASME B16.9 – Factory Made Wrought Steel Buttwelding Fittings
- I. ASME B16.21 – Non Metallic Flat Gaskets for Pipe Flanges
- J. ASME B18.2.1 - Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)
- K. ASTM A53 – Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- L. ASTM A105 – Carbon Steel Forgings for Piping Applications

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- M. ASTM A106 – Seamless Carbon Steel Pipe for High Temperature Service
  - N. ASTM 193 - Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
  - O. ASTM 194 - Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
  - P. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
  - Q. ASTM A312 – Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
  - R. ASNT TC-1A - Personnel Qualification and Certification in Nondestructive Testing
  - S. PFI ES-03 – Pipe Fabricators Institute – Fabricating Tolerances

#### SUBMITTALS

##### A. Product Data:

For each type of the following, provide manufacturer's catalog and additional supporting information as required to show compliance with specifications and standards.

1. Pressure-seal fittings
2. Air control devices
3. Pipe Material and Fittings – Additionally, include certified copies of mill tests and, in catalog data, mark specific model, type, sizes, etc. as applicable.
4. Pipe supports or pipe rollers utilized for temporary pipe support while placing pipe in tunnel, if applicable.
5. Pipe spool drawings showing weld location. All welds to have unique number.
6. Casing and Casing spacers, if applicable.
7. Pipe and Fittings Insulation.
8. Coatings, if applicable.

##### B. Welding Procedures:

1. Welding procedure specifications (WPS) and procedure qualification records (PQR), including lab test data, complying with Section IX of the ASME Boiler and Pressure Vessel Code as referenced in B31.1 specific to the project and prepared by a Senior Certified Weld Inspector per WPS's and PQR's must be supplied by the Contractor for review and approval by City personnel before commencing any welding work. If Contractor is intending to use the SMAW welding process, Contractor shall utilize the low hydrogen rods for the fill and cap.

##### C. Welding Performance:

1. Welders' Performance Qualifications (WPQ), including lab test data and certification of compliance with ASME Section IX of the ASME Boiler and Pressure Vessel Code as referenced in B31.1 specific to the project. **City will not accept welder's performance qualifications from welders performing welding on other projects under different WPS's and PQR's from other Employers. Welding certificates shall be no more**

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**than six (6) months old or Welder has been approved by AE OSER within the last year.**

- D. Load Calculations:
1. Provide load calculations signed and sealed by an engineer licensed in the state of Texas showing that the proposed pipe support and conveyance system is adequate to handle the dead loads from the pipe and water and live loads caused by conveyance of pipe into tunnel.
- E. Conveyance of Pipe in Tunnels:
1. Submit documentation illustrating how the pipe will be conveyed into the tunnel and supported/blocked during grouting operations. Submittal shall be in accordance with this Section. Submittal should take into account protection of the pipe coating, spacing of supports to prevent stress on pipe from exceeding ASME B31.1 allowable stress, access for AE personnel to all joints during leakage test, and maintenance of alignment of pipes as shown in the Drawings. Calculations for support/conveyance structure shall be signed and sealed by an engineer licensed in the state of Texas and shall show that the support/conveyance system is adequate to handle the anticipated dead and live loads for installation and hydrostatic testing.
- F. Shop Drawings:
1. Detail at 1/2" scale or larger, indicating piping layout, fabrication, weld map. All shop drawing shall be isometric unless prior AE approval is given. Also show:
    - a. Pipe supports and conveyance system for placing pipe in tunnel from launch shaft.
    - b. System to prevent flotation of conduits and piping during grouting of tunnel.
- G. Field quality-control test reports.
- H. Welding test reports:
- Including, but not limited to: ultrasonic, mag. particle, x-ray test reports with pictures and/or films as applicable. Reports shall be received no later than 48 hours prior to any operation or procedure rendering the weld location inaccessible.
- I. Operation and Maintenance Data:
1. For air control devices, hydronic specialties, and special-duty valves to include emergency, operation, and maintenance manuals.

#### QUALITY ASSURANCE

- A. Contractor shall provide their own quality assurance inspector on site to assure compliance with ASME B31.1.
- B. Welding:
1. Contractor shall maintain qualified welding procedures and welders according to ASME Section IX Boiler and Pressure Vessel Code.
  2. Comply with provisions set forth in ASME B31.1 Pressure Piping Code.
  3. Certify that each welder has passed ASME Section IX qualification tests for welding processes and positions, and that certification is current.

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4. City will provide an independent inspector to perform both visual inspections and volumetric testing in accordance with ASME B31.1 and this contract. Nondestructive testing personnel, methods, and procedures will be qualified to ASNT-TC1A latest revision. Inspectors shall be certified to AWS – CWI with a valid AWS certification number. Independent inspectors shall not have contracts for services with the Contractor for the Project.
  5. The City shall provide an independent ASNT-TC-1A Level III Inspector to review and approve all inspection and test reports.
  6. In cases where Contractor is under contract with a Developer and not the City to complete construction on the City’s behalf, the Developer shall provide independent inspection services. City shall review inspector’s qualifications and procedures to assure compliance with applicable codes.
- C. Coating applicator qualifications:
1. Engage an experienced applicator who has successfully completed coating system applications similar in material and extent to those specified within this Section. Representative for coating manufacturer shall be on site for two days, minimum, to instruct Contractor in application of product and ensure manufacturer’s installation specifications are being met.

## PART 2 - PRODUCTS

### 2.1 PIPE

- A. Steel Pipe, up to and including 10”; ASTM A53, Type S, seamless, Grade B or ASTM A106, Grade B; Schedule 40 Weight; and plain ends, unless otherwise indicated
- B. Steel Pipe, larger than 10” to 26”; ASTM A53, Type S, seamless, Grade B or ASTM A106, Grade B; Standard Weight; and plain ends, unless otherwise indicated
- C. Steel Pipe, 26” to 40”: ASTM A106, Grade B; Standard Weight; and plain ends, unless otherwise indicated.
- D. Steel Pipe, larger than 40”: API5L, PSL2, spiral submerged arc welded; Grade B. Standard Weight; and plain ends, unless otherwise indicated.
- E. Steel Pipe, 2”: ASTM A53, seamless, Schedule 80.
- F. Stainless Steel Pipe: 0.5” to 2”, ASTM A 312, Type 304 or 316 stainless steel, Schedule 80, NPT threaded.
- G. All pipe shall be domestic unless prior approval from AE OSER Project Manager is received for any import pipe. Documentation shall be received stating the necessity of utilizing import pipe.

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## 2.2 PIPE FITTINGS

- A. Steel Flanges: ASTM A105, ASME B16.5, steel Class 150, or ASME B16.47 Grade A, Class 150; butt welded end connection raised face.
  - 1. Bolts: ASTM A193/A193M, Grade B7. Extend minimum of two full threads beyond nut with bolts tightened to required torque.
  - 2. Nuts: ASTM A194/194M, Grade 7, with Teflon coated threads.
  - 3. Washers: Stainless steel flat circular washers under bolt heads and nuts.
- B. Steel Welding Fittings: ASTM A234, forged wrought steel. Tees, reducers and elbows (long radius only) unless prior approval by Austin Energy personnel. Fittings shall have the same weight schedule as pipe. Field modified fittings shall not be acceptable without prior AE approval.
- C. Socket Weld Fittings: ASTM A105 Grade II, forged steel, Class 300 for use with Schedule 80 pipe.
- D. Socket Outlet Fittings: ASTM A105/ASME 16.9 – Class 300 forged steel. Use for drain and vent connections to main only as indicated on drawings.
- E. All pipe fittings shall be domestic unless prior approval from AE OSER Project Manager is received for any import pipe fittings. Documentation shall be received stating the necessity of utilizing import pipe fittings.

## 2.3 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents, and type suitable for fluid to be handled and working temperatures and pressures.
  - 1. ASME B16.21, ASTM F36, nonmetallic, flat, asbestos free, 3/32-inch minimum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face or raised, Class 150,
    - b. Factory cut gaskets shall be used unless noted otherwise.
    - c. Manufacturers:
      - 1) Klinger Company
      - 2) Garlock
      - 3) or AE OSER approved equal
- B. Flange Bolts and Nuts: ASTM A193 B7 and ASME B18.2.1, carbon steel, conform to 2.3.A.1 and 2.2.A.2 unless otherwise indicated.
- C. Welding Filler Metals: Comply with AWS and ASME Section IX classifications for welding materials.

## 2.4 STEEL PIPE COATING

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- A. Provide coating system per requirements of Section 09900 COATINGS FOR CARBON STEEL PIPE AND FITTINGS.
  - B. Uncoated pipe shall be coated with STAC Coating System including STACprime, STACfill, STACwrap, and STACguard. Coating materials shall be plainly and permanently marked, stored, and applied in accordance with the manufacturer's recommendations.

## 2.5 RNC CONDUIT

- A. Rigid non metallic conduit shall be per Section 260533 RACEWAYS AND BOXES for all underground routings.
- B. Rigid galvanized conduit shall be per Section 260533 RACEWAYS AND BOXES for all aboveground routings.

## 2.6 BURIED WARNING AND IDENTIFICATION TAPE

- A. Provide detectable warning tape from those listed in the City Standard Product list. Tape shall have solid aluminum core laminated with protective clear film on both sides to protect graphics from underground moisture, acids and alkalis. Tape shall follow APWA uniform color code. Tape shall include continuously repeated graphics reading "Caution AE Chilled Water Line" (blue). See Standard Detail R1.

## 2.7 FILTER FABRIC

- A. Description:
  - 1. 16 oz. Non-woven Geotextile fabric
  - 2. Non-biodegradable
  - 3. UV resistance 70%/500 hours ASTM-D-4355
  - 4. Tensile Strength 380lbs, ASTM-D-4632
  - 5. Permeability 0.22 cm/s, ASTM-D-4491
  - 6. Water Flow Rate 50 gpm/ft
  - 7. US Sieve size (AOS) 100 Sieve, ASTM-D-4751
- B. Manufacturers:
  - 1. Granite Environmental or approved equal

## PART 3 - EXECUTION

### 3.1 EXCAVATION, BACKFILLING AND PAVING

- A. Excavation, backfilling and paving shall be in conformance with City of Austin Standard Specification Item No. 510 "Pipe".

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### 3.2 PIPING APPLICATIONS

- A. Air release riser piping from main chilled water pipe takeoffs to shutoff ball valves within air release assembly boxes: 2", ASTM A53, seamless, carbon steel pipe, Schedule 80, socket weld fittings.
- B. Within air release assembly boxes, all piping above shutoff ball valves: 316 stainless steel, Schedule 80, NPT threaded. See detail Air Release Valve Assembly R2.

### 3.3 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved by Engineer.
- B. Provide factory coated pipe per requirements of Section 09900 COATINGS FOR CARBON STEEL PIPE AND FITTINGS for buried, non-insulated pipe larger than 24".
- C. Install piping straight and true to bear on sand bedding material where indicated and as detailed on drawings for piping in trenches. Install piping on supports as detailed in box tunnels.
- D. Install piping at a uniform grade of 0.2 percent, or as indicated in drawings.
- E. Install piping free of sags and bends.
- F. Welding of steel piping including qualification of welders shall be in accordance with ASME B31.1 and ASME Section IX, metallic arc process. Contractor shall adhere to table B31.1 Table 127.4.2 when reinforcement of welds is required.
- G. Install air release piping and water air release valve where shown and as detailed on drawings
- H. Install fittings for changes in direction and branch connections.
- I. Apply STAC Coating System to un-coated steel pipe in welded main pipe sections, air vent riser piping, branch pipe welds, valves and flanges in accordance with manufacturer's instructions. Contractor shall submit a certificate that personnel have been trained in STAC wrap procedure. Certificate shall come from manufacturer of product. An AE representative shall be notified of installation of STAC wrap at least 48 hours prior to installation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- M. Install valves according to Section 230523 GENERAL-DUTY VALVES FOR HVAC PIPING.

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- N. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
  - O. Utilize standard weight or schedule 40 (match pipe weight) seamless welding fittings including long radius elbows, tees, reducing tees and reducers.
  - P. Provide detectable warning tape above pipe in direct buried applications per standard detail.
  - Q. Backfill per details in the drawings.
  - R. Support pipe in tunnel per contractor's approved submittal until grouting operations are complete.
  - S. For pipe greater than 40", install horizontal positioned seamed pipe with seam located on the top center of pipe.
  - T. All material shall be able to be inspected by AE OSER inspectors before installation at job site. 48 hour notice shall be given to AE Project manager for inspection of items.

#### PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves with thread compound.
- D. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Welded Joints: Comply with ASME B31.1 and ASME Boiler and Pressure Vessel Code, Section IX, using qualified processes and welding operators according to welding codes.
- F. Apply heat shrink sleeve or coating (subject to Owner approval) at each joint upon completion of welding and testing, per insulation manufacturers' written recommendations.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- H. All flange bolts shall be torqued to recommended tightening pattern and applied torque recommendation per B31.1 and B31.3. Threaded connections shall follow recommendation and ASME B1.20.1 for applied torque requirements. Contractor shall record for each flange the torque applied. If applied torque is greater than torque range of valve, Contractor shall at Contractor's expense verify flange is not damaged. If flange shows signs that damage has been done, Contractor shall replace damaged flange at Contractor's expense.

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- I. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance. Alignment Fit-Up of pipe and flanges to valves and connecting flanges shall abide by PFI ES-03. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.5 PIPING SUPPORTS

- A. Piping support must account for expansion and contraction, vibration, dead load of piping and its contents, and seismic-bracing requirements.
- B. Support devices will be required only for piping installed within tunnels, used to assist insertion of pipe in tunnel without damaging pipe insulation cover, and to keep pipe off floor of tunnel. Any acceptable means, as approved by Project, may be used.
- C. Comply with the following requirements for maximum spacing of supports.
  1. NPS 6: Maximum span, 17 feet.
  2. NPS 8: Maximum span, 19 feet.
  3. NPS 10: Maximum span, 20 feet.
  4. NPS 12: Maximum span, 23 feet.
  5. NPS 14: Maximum span, 25 feet.
  6. NPS 16: Maximum span, 27 feet.
  7. NPS 18: Maximum span, 28 feet.
  8. NPS 20 and larger: Maximum span, 30 feet.

### 3.6 FIELD QUALITY CONTROL

- A. Owner shall provide for inspections and testing of welds.
  1. Hydronic Piping:
    - a. Third part testing firm shall have an American Welding Society-Certified Welding Inspector (CWI) to provide visual inspections (VT) per B31.1 on staff or included as a sub-contractor.
    - b. Third party testing firm shall have an American Society of Nondestructive Testing (ASNT-TC-1A) Level III Inspector certified for the type of additional NDE selected for the project (i.e.; magnetic testing, radiographic, and ultrasonic testing methods) on staff or included as a sub-contractor.
    - c. Inspectors performing field tests shall be certified at a minimum as an AWS-CWI to perform B31.1 visual inspections (VT) and as an ASNT-TC-1A Level II inspector for the type of NDE selected for the project. It is preferred to have one inspector with both certifications, but it may be necessary to have two inspectors if an inspector cannot be hired with both qualifications.
    - d. A QA/QC or CWI Inspector working for the third-party testing firm shall review and approve Contractor's WPS, PQR and WPQ submittals. The qualified inspector shall also confirm that the PQR's include the tensile testing results and that the testing laboratory has specific lab identification numbers assigned to the test results and traceable to the WPS's and the PQR's. **AE OSER will not accept welder's performance qualifications from welders performing welding on other projects under different WPS's and PQR's from other Employers.**

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- e. Per ASME B31.1, the CWI certified third party inspector will perform VT on 100% of the **completed** welds.
  - f. In-process VT as defined by ASME B31.1 is optional. The CWI will perform in-process VT on the initial two (2) welds. This shall be done for each welder and each welding process on the project. If the weld passes the in-process and final VT as well as following volumetric testing, typically recordable UT, no additional in-process welds will be performed with two exceptions:
    - 1) A weld fails the completed weld VT or volumetric testing, in which case, AE shall increase volumetric testing and may also require additional in-process VT, and
    - 2) When contractor's welder has successfully welded without any failed welds to the same welding procedure on a previous AE project within the last 3 months, no in-process VT will be performed until such point as the welder fails inspection.
  - g. AE OSER will perform enhanced volumetric inspections using ASME B31.1 standards.
    - 1) 10% of the welds passing visual examination will be examined using ultrasonic (UT) with recordable equipment. This allows for permanent records of the examinations and follow-up QA/QC. These records will serve as documentation within the final reports and verification of compliance with ASME B31.1.
    - 2) Austin Energy's preference is use of phased array ultrasonic testing. Inspector may submit to use another form of ultrasonic testing and will be approved on a case by case basis. Documentation of the substituted form of ultrasonic testing shall be provided indicating compliance to B31.1. There will be no blanket approval any types ultrasonic testing except for phased array.
    - 3) The ultrasonic examination shall be capable of detecting the following imperfections: crack – surface, crack – internal, slag inclusion, lack of fusion and incomplete penetration.
    - 4) When in-process VT is performed on the initial four (4) welds, the completed welds shall be included in the 10% UT examination.
    - 5) The UT frequency shall be increased to 100% in portions of the pipe that will be inaccessible after completion of construction, tunneling, jack and bore or any pipe that will be covered before hydro is performed and on a case by case basis, with approval from the project manager.
    - 6) On a case by case basis, radiography or X-rays (RT) can be used as an alternative to UT in which case; the radiographic films serve as the permanent examination record.
    - 7) Should any of the 10% welds tested fail, 20% of all remaining welds will be tested.
    - 8) Should any of the 20% tested welds fail, 100% of all remaining welds will be tested.
    - 9) Owner's independent inspectors will document and approve in writing the visual and NDE UT/RT examinations.
    - 10) Testing shall be done prior to pressure testing and field application of sleeve or coating at joints.

2. Cost of testing

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- a. Owner will arrange for independent testing company to inspect, test, and approve welds. Coordinate and cooperate with Owner and Owner's testing representatives in all aspects of testing procedures. Give adequate advance notice that work is ready for inspections, tests or approvals (48 hour minimum). Testing company will provide written and photographic report of results to Owner and Engineer. Do not fill system with water nor pressure test until Owner and Engineer have approved results of welding tests.
  - b. Failed tests, Hydronic Piping:
    - 1) Should any joint fail the test, Contractor shall correct the deficiency using qualified processes and procedures per ASME Boiler and Pressure Vessel Code, Section IX. Cost for correction of deficiency shall be borne by Contractor at no additional cost to Owner.
    - 2) Any and all additional testing required due to failure(s) in initial testing will be borne by Contractor, at no additional cost to Owner. Owner will deduct testing expenses from Contractor's payment.
- B. Contractor shall pressure test the hydronic piping to current ASME B31.1 as follows:
1. Prepare hydronic piping as follows:
    - a. Leave joints, including welds, uncoated and uninsulated and exposed for examination and testing prior to shrink sleeve or insulation being applied.
    - b. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
    - c. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
    - d. Fill system with clean ambient temperature water.
    - e. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
    - f. Install safety valve, set at a pressure no more than lowest component's rated pressure, to protect against damage by expanding liquid or other source of overpressure during test.
  2. Contractor shall adhere to the following sequence for pressure testing installed pipe.
    - a. Contractor shall make joints accessible for inspection by Owner. Contractor shall install and remove necessary caps, bulkheads, blow-offs, or closure pieces to accomplish specified testing. Contractor shall test against welded caps or closure pieces. Flanges shall not be installed in the piping for purposes of testing except at locations called for in the Drawings.
    - b. For trenchless piping installation methods, install piping in tunnel and pressure test prior to construction of riser pipes in shafts. Field welded joints in elbows and tees shown in Drawings at bottom of work shafts shall be visible during pressure tests. Section of piping shall pass pressure test prior to grouting the tunnel.
    - c. Install riser pipes in shafts. It is Owner's preference that field welded joints in riser pipes remain visible during hydrostatic and pressure test, but not required.
    - d. Install and pressure test elbows and tees shown in Drawings at top of work shafts. Field welded joints in pipe and fittings shall remain visible pressure testing. Section of piping shall pass pressure test as indicated in this section prior to placing backfill.

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3. Perform pressure testing per ASME B31.1:

Hydraulic Pressure Testing:

- a. Notify Owner a minimum of two business days prior to testing. Owner will have access to pipe during pressure test.
- b. The piping system shall be subjected to pressure test of 225 psig for 15 minutes, followed by 150 psig for 24 hours.
- c. After pressure test pressure has been applied for 10 minutes, accessible piping, joints, and connections shall be examined and inspected for leakage. Maintain a chart of pressure and temperature on the test section. Pressure and temperature readings shall be taken prior to the start of the test and upon completion of the 24 hour test period. Leaks shall be eliminated by tightening, repairing or replacing components as appropriate and the pressure test shall be repeated until there are no leaks.
- d. Coordinate with owner to witness initial pressurization and final verification of pressure records.
- e. Contractor shall provide and install a test pressure gauge in piping for hydraulic pressure test.
- f. Contractor shall provide a means to record the outside air temperature.
- g. If a pressure test failure occurs, Contractor to repeat process.
- h. Provide Engineer and Owner with a written report of test results.

Pneumatic Pressure Testing: (Prior AE Approval shall be given for this procedure to be utilized)

- a. Pneumatic testing shall not be implemented as a standard without prior approval by AE OSER personnel. This method shall only be implemented in cases where hydrostatically testing the pipe is not feasible or if the pipe will be without circulating water for longer than 3 weeks.
- b. Notify Owner a minimum of two business days prior to testing. Owner will have access to pipe during pressure test.
- c. The piping system shall be subjected to air pressure test of 25 psig to check for major leaks. Using Snoop soap solution each weld, flange, flange nut, and threaded fitting connection shall be checked. The system will not be depressurized until all flanges, nuts and welds are leak checked or if a component leaks air.
- d. If a component leaks during the major leak process, the major leak process will be implemented repeatedly until all major leaks are resolved.
- e. The air pressure shall be increased in tenths to 50 psig pressure and maintained for eight (8) hours.
- f. Contractor shall perform leak checks. Using Snoop soap solution each weld, flange, flange nut, and threaded fitting connection shall be checked. The system will not be depressurized until all flanges, nuts and welds are leak checked or if a component leaks air.
- g. If a component leaks during the minor leak process, the minor leak process will be implemented until all minor leaks are resolved.
- h. Leaks shall be eliminated by tightening, repairing or replacing components as appropriate and the pressure test shall be repeated until there are no leaks.
- i. Contractor shall provide and install a test pressure gauge in piping for hydraulic pressure test.
- j. Contractor shall provide a means to record the outside air temperature.

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- k. Demonstrate test pressure is maintained for a minimum of 8 hours. Coordinate with owner to witness initial pressurization and final verification of pressure records.
  - l. If a pressure test failure occurs, Contractor to repeat process.
  - m. Contractor to record on a pressure test report the initial and final pressures and temperatures for verification of passing pneumatic pressure test.
  - n. Provide Engineer and Owner with a written report of test results.

C. Camera Inspection – Contractor shall inspect chilled water lines for debris per SS230190.

### 3.7 CLEANING

- A. Refer to specifications section 232500 CHILLED WATER FLUSH AND CHEMICAL TREATMENT.

## PART 4 - MEASUREMENT AND PAYMENT

### 4.1 MEASUREMENT

- A. Refer to SP 510 - Special Provision to Item No. 510 Pipe for measurement of chilled water pipe and related appurtenances installed via open cut.
- B. Refer to SP 501S - Special Provision to Item No. 501S Jacking and Boring Pipe for measurement of chilled water pipe and related appurtenances installed in tunnel or shaft.

### 4.2 PAYMENT

- A. Refer to SP 510 - Special Provision to Item No. 510 Pipe for payment of chilled water pipe and related appurtenances installed via open cut.
- B. Refer to SP 501S - Special Provision to Item No. 501S Jacking and Boring Pipe for payment of chilled water pipe and related appurtenances installed in tunnel or shaft.

**End**

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. This Section governs piping for hydronic distribution systems located outside a building. Piping as defined in this item shall include pre-insulated steel piping systems for 24" diameter and smaller piping and associated fittings, valves, insulation, and specialties.

### 1.2 REFERENCES

- A. Design, drawings, welding details, fabrication, non destructive examinations and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. ASME B31.1 – Power Piping edition, ASME M31.3 - Process Piping
- C. ASME Section IX – Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operations.
- D. ASME B1.20.1 – Pipe Threads, General Purpose, Inch
- E. ASME B16.3 – Malleable Iron Threaded Fittings Class 150 and 300.
- F. ASME B16.5 – Pipe Flanges and Flanged Fittings
- G. ASME B16.9 – Factory Made Wrought Steel Buttwelding Fittings
- H. ASME B16.21 – Non Metallic Flat Gaskets for Pipe Flanges
- I. ASME B18.2.1 - Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)
- J. ASTM A53 – Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- K. ASTM A105 – Carbon Steel Forgings for Piping Applications
- L. ASTM A106 – Seamless Carbon Steel Pipe for High Temperature Service
- M. ASTM 193 - Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
- N. ASTM 194 - Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
- O. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service

- P. ASTM A312 – Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
- Q. ASNT TC-1A - Personnel Qualification and Certification in Nondestructive Testing
- R. PFI ES-03 – Pipe Fabrication Institute- Fabricating Tolerances

#### SUBMITTALS

##### A. Product Data:

For each type of the following, provide manufacturer’s catalog and additional supporting information as required to show compliance with specifications and standards.

- a. Pressure-seal fittings
- b. Air control devices
- c. Pipe Material and Fittings – Additionally, include certified copies of mill tests and, in catalog data, mark specific model, type, sizes, etc. as applicable.
- d. Pipe supports or pipe rollers utilized for temporary pipe support while placing pipe in tunnel, if applicable.
- e. Pipe spool drawings showing weld location. All welds to have unique number.
- f. Casing and Casing spacers, if applicable.
- g. Pipe and Fittings Insulation.
- h. Coatings, if applicable.

##### B. Welding Procedures:

- 1. Welding procedure specifications (WPS) and procedure qualification records (PQR), including lab test data, complying with Section IX of the ASME Boiler and Pressure Vessel Code as referenced in B31.1 specific to the project and prepared by a Senior Certified Weld Inspector per WPS’s and PQR’s must be supplied by the Contractor for review and approval by City personnel before commencing any welding work. If Contractor is intending to use the SMAW welding process, Contractor shall utilize the low hydrogen rods for the fill and cap.

##### C. Welding Performance:

Welders’ Performance Qualifications (WPQ), including lab test data and certification of compliance with ASME Section IX of the ASME Boiler and Pressure Vessel Code as referenced in B31.1 specific to the project. **City will not accept welder’s performance qualifications from welders performing welding on other projects under different WPS’s and PQR’s from other Employers. Welding certificates shall be no more than six (6) months old or Welder has been approved by AE OSER within the last year.**

##### D. Load Calculations:

Provide load calculations signed and sealed by an engineer licensed in the state of Texas showing that the proposed pipe support and conveyance system is adequate to handle the dead loads from the pipe and water and live loads caused by conveyance of pipe into tunnel.

E. Conveyance of Pipe in Tunnels

Submit documentation illustrating how the pipe will be conveyed into the tunnel and supported/blocked during grouting operations. Submittal shall be in accordance with this Section. Submittal should take into account protection of the pipe coating, spacing of supports to prevent stress on pipe from exceeding ASME B31.1 allowable stress, access for AE personnel to all joints during leakage test, and maintenance of alignment of pipes as shown in the Drawings. Calculations for support/conveyance structure shall be signed and sealed by an engineer licensed in the state of Texas and shall show that the support/conveyance system is adequate to handle the anticipated dead and live loads for installation and hydrostatic testing.

F. Shop Drawings:

Detail at 1/2" scale or larger, indicating piping layout, fabrication, weld map. All shop drawing shall be isometric unless prior AE approval is given. Also show:

- a. Pipe supports and conveyance system for placing pipe in tunnel from launch shaft.
- b. System to prevent flotation of conduits and piping during grouting of tunnel.

G. Field quality-control test reports.

H. Welding test reports,:

Including, but not limited to: ultrasonic, mag. particle, x-ray test reports with pictures and/or films as applicable. Reports shall be received no later than 48 hours prior to any operation or procedure rendering the weld location inaccessible.

I. Operation and Maintenance Data:

For air control devices, hydronic specialties, and special-duty valves shall include emergency, operation, and maintenance manuals.

## QUALITY ASSURANCE

A. Contractor shall provide their own quality assurance inspector on site to assure compliance with ASME B31.1.

B. Welding:

1. Contractor shall maintain qualified welding procedures and welders according to ASME Section IX Boiler and Pressure Vessel Code.
2. Comply with provisions set forth in ASME B31.1 Pressure Piping Code.
3. Certify that each welder has passed ASME Section IX qualification tests for welding processes and positions, and that certification is current.
4. City will provide an independent inspector to perform both visual inspections and volumetric testing in accordance with ASME B31.1 and this contract. Nondestructive testing personnel, methods, and procedures will be qualified to ASNT-TC1A latest revision. Inspectors shall be certified to AWS – CWI with a valid AWS certification number. Independent inspectors shall not have contracts for services with the Contractor for the Project.

5. The City shall provide ASNT-TC-1A Level III Inspector to review and approve all inspection and test reports.
6. In cases where Contractor is under contract with a Developer and not the City to complete construction on the City's behalf, the Developer shall provide independent inspection services. City shall review inspector's qualifications and procedures to assure compliance with applicable codes.

C. Coating applicator qualifications:

Engage an experienced applicator who has successfully completed coating system applications similar in material and extent to those specified within this Section. Representative for coating manufacturer shall be on site for two days, minimum, to instruct Contractor in application of product and ensure manufacturer's installation specifications are being met.

## PART 2 - PRODUCTS

### BURIED PRE-INSULATED CHILLED WATER PIPING

- A. Subject to compliance with requirements, products shall be provided by one of the following for all piping sizes 24" and smaller.
  1. Insul-Pipe Systems, Inc.
  2. Perma-Pipe, Inc.
  3. Thermacor Process, Inc.
- B. Casing: Seamless high density polyethylene (HDPE) 150 mil minimum thickness. Size the casing to provide nominal 2" thick insulation between pipe and casing.
- C. Insulation: Foamed in place cellular polyurethane: ASTM C168.
  1. Thermal Conductivity (k-value): 0.16 at 75 deg. F. per ASTM C-518.
  2. Service Temperature: 32 to 100 deg. F.
  3. Moisture Absorption: ASTM D2842, maximum 0.054 percent by volume.
  4. Water-Vapor Transmission: ASTM E96, 1.26 perm inches.
  5. Compressive Strength: 30 psi.
  6. Density: 2.0 lbs. per cubic foot minimum.
- D. End Seals: Factory applied waterproof mastic or heat shrink seal covering the urethane insulation at each end of each joint of pipe and bonded to the carrier pipe and casing.
- E. Fitting Insulation: Provide molded HDPE 150 mil minimum thickness fitting cover kit with field applied polyurethane foam insulation to provide nominal 2 inch thick insulation.
- F. All pipe fittings shall be pre-insulated to match pipe insulation.
- G. A pre-insulated pipe repair kit shall be used for repair of minor and short segments. Match existing type and kind of insulation on pipe

## 2.2 PIPE AND TUBES

- A. Steel Pipe, up to and including 10"; ASTM A53, Type S, seamless, Grade B or ASTM A106, Grade B; Schedule 40 Weight; and plain ends, unless otherwise indicated
- B. Steel Pipe, greater than 10" to 24"; ASTM A53, Type S, seamless, Grade B or ASTM A106, Grade B; Standard Weight; and plain ends, unless otherwise indicated
- C. Steel Pipe 2": ASTM A53, seamless, Schedule 80.
- D. Pipe 0.5" to less than 2": Stainless Steel Sch 80, threaded.
- E. All pipe shall be domestic unless prior approval from AE OSER Project Manager is received for any import pipe. Documentation shall be received stating the necessity of utilizing import pipe.

## 2.3 PIPE FITTINGS

- A. Steel Flanges: ASTM A105, ASME B16.5, steel Class 150; butt welded end connection raised face.
  - 1. Bolts: ASTM A193/A193M, Grade B7. Extend minimum of two full threads beyond nut with bolts tightened to required torque.
  - 2. Nuts: ASTM A194/194M, Grade 7, with Teflon coated threads.
  - 3. Washers: Stainless steel flat circular washers under bolt heads and nuts.
- B. Steel Welding Fittings: ASTM A234, wrought steel. Tees, reducers and elbows (long radius only) unless prior approval by Austin Energy personnel. Fittings shall have the same weight schedule as pipe. Field modified fittings shall not be acceptable without prior AE approval.
- C. Socket Weld Fittings: ASTM A105 Grade II, forged steel, Class 3000 for use with Schedule 80 pipe.
- D. All pipe fittings shall be domestic unless prior approval from AE OSER Project Manager is received for any import pipe fittings. Documentation shall be received stating the necessity of utilizing import pipe fittings.

## 2.4 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents, and type suitable for fluid to be handled and working temperatures and pressures.
  - 1. ASME B16.21, ASTM F36, nonmetallic, flat, asbestos free, 3/32-inch minimum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face or raised-face, Class 150,
    - b. Factory cut gaskets shall be used unless noted otherwise.
    - c. Manufacturers:
      - 1) Klinger Company

- 2) Garlock
  - 3) or AE OSER approved equal
- B. Flange Bolts and Nuts: ASTM A193 B7 and ASME B18.2.1, carbon steel, conform to 2.3.A.1 and 2.3.A.2 unless otherwise indicated.
- C. Welding Filler Metals: Comply with AWS and ASME Section IX classifications for welding materials.

## 2.5 STEEL PIPE COATING

- A. For bolted connections which are not pre-insulated or which have been exposed due to removal of insulation: cover with STAC Coating System products including STACprime, STACfill, STACwrap and STACguard. Coating materials shall be plainly and permanently marked, stored, and applied in accordance with the manufacturer's recommendations.

## 2.6 CONDUIT

- A. Rigid non metallic conduit shall be per Section 260533 RACEWAYS AND BOXES for all underground routings.
- B. Rigid galvanized conduit shall be per Section 260533 RACEWAYS AND BOXES for all aboveground routings.

## 2.7 BURIED WARNING AND IDENTIFICATION TAPE

- A. Provide detectable warning tape from those listed in the City Standard Product list. Tape shall have solid aluminum core laminated with protective clear film on both sides to protect graphics from underground moisture, acids and alkalis. Tape shall follow APWA uniform color code. Tape shall include continuously repeated graphics reading "Caution AE Chilled Water Line" (blue). See Standard Detail R1.

## 2.8 FILTER FABRIC

- A. Description:
- 1. 16 oz. Non-woven Geotextile fabric
  - 2. Non-biodegradable
  - 3. UV resistance 70%/500 hours ASTM-D-4355
  - 4. Tensile Strength 380lbs, ASTM-D-4632
  - 5. Permeability 0.22 cm/s, ASTM-D-4491
  - 6. Water Flow Rate 50 gpm/ft
  - 7. US Sieve size (AOS) 100 Sieve, ASTM-D-4751
- B. Manufacturers:
- 1. Granite Environmental or approved Equal

## PART 3 - EXECUTION

### EXCAVATION, BACKFILLING AND PAVING

- A. Excavation, backfilling and paving shall be in conformance with City of Austin Standard Specification Item No. 510 "Pipe".

### 3.2 PIPING APPLICATIONS

- A. Air release riser piping from main chilled water pipe takeoffs to shutoff ball valves within air release assembly boxes: 2", ASTM A53, seamless, carbon steel pipe, Schedule 80, socket weld fittings.
- B. Within air release assembly boxes, all piping above shutoff ball valves: 316 stainless steel, Schedule 80, NPT threaded. See detail Air Release Valve Assembly R2.

### 3.3 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved by Engineer.
- B. Pre-insulated piping shall be handled in accordance with manufacturer's handling instructions.
- C. Select system components with pressure rating equal to or greater than system operating pressure.
- D. Install piping straight and true to bear on sand bedding material where indicated and as detailed on drawings for piping in trenches. Install piping on supports as detailed in box tunnels.
- E. Install piping at a uniform grade of 0.2 percent or as indicated in drawings.
- F. Install piping free of sags and bends.
- G. Welding of steel piping including qualification of welders shall be in accordance with ASME B31.1 and ASME Section IX, metallic arc process. Contractor shall adhere to table B31.1 Table 127.4.2 when reinforcement of welds is required.
- H. Install air release piping and water air release valve where shown and as detailed on drawings
- I. Install fittings for changes in direction and branch connections.
- J. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

- K. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- L. Install valves according to Section 230523 GENERAL-DUTY VALVES FOR HVAC PIPING.
- M. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- N. Utilize standard weight seamless welding fittings including long radius elbows, tees, reducing tees and reducers.
- O. Apply STAC Coating System to un-coated steel pipe in welded main pipe sections, bolted connections, air vent riser piping, branch pipe welds, valves and flanges in accordance with manufacturer's instructions. Contractor shall submit a certificate that personnel have been trained in STAC wrap procedure. Certificate shall come from manufacturer of product. An AE representative shall be notified of installation of STAC wrap at least 48 hours prior to installation.
- P. Provide detectable warning tape above pipe in direct buried applications per standard detail.
- Q. Backfill per details in the drawings.
- R. Support pipe in tunnel per contractor's approved submittal until grouting operations are complete.
- S. All material shall be able to be inspected by AE OSER inspectors before installation at job site. 48 hour notice shall be given to AE Project manager for inspection of items.

#### PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves with thread compound.
- D. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Welded Joints: Comply with ASME B31.1 and ASME Boiler and Pressure Vessel Code, Section IX, using qualified processes and welding operators according to welding codes.
- F. Apply heat shrink sleeve or coating (subject to Owner approval) at each joint upon completion of welding and testing, per insulation manufacturer's recommendation.

- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- H. All flange bolts shall be torqued to recommended tightening pattern and applied torque recommendation per B31.1 and B31.3. Threaded connections shall follow recommendation and ASME B1.20.1 for applied torque requirements. Contractor shall record for each flange the torque applied. If applied torque is greater than torque range of valve, Contractor shall at Contractor's expense verify flange is not damaged. If flange shows signs that damage has been done, Contractor shall replace damaged flange at Contractor's expense.
- I. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance. Alignment Fit-Up of pipe and flanges to valves and connecting flanges shall abide by PFI ES-03. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.5 PIPING SUPPORTS

- A. Piping support must account for expansion and contraction, vibration, dead load of piping and its contents, and seismic-bracing requirements.
- B. Support devices will be required only for piping installed within tunnels, used to assist insertion of pipe in tunnel without damaging pipe insulation cover, and to keep pipe off floor of tunnel. Any acceptable means, as approved by Project, may be used.
- C. Comply with the following requirements for maximum spacing of supports.
  - 1. NPS 6: Maximum span, 17 feet.
  - 2. NPS 8: Maximum span, 19 feet.
  - 3. NPS 10: Maximum span, 20 feet.
  - 4. NPS 12: Maximum span, 23 feet.
  - 5. NPS 14: Maximum span, 25 feet.
  - 6. NPS 16: Maximum span, 27 feet.
  - 7. NPS 18: Maximum span, 28 feet.
  - 8. NPS 20 and larger: Maximum span, 30 feet.

### 3.6 FIELD QUALITY CONTROL

- A. Owner shall provide for inspections and testing of welds.
  - 1. Hydronic Piping:
    - a. Third part testing firm shall have an American Welding Society-Certified Welding Inspector (CWI) to provide visual inspections (VT) per B31.1 on staff or included as a sub-contractor.
    - b. Third party testing firm shall have an American Society of Nondestructive Testing (ASNT-TC-1A) Level III Inspector certified for the type of additional NDE selected for the project (i.e.; magnetic testing, radiographic, and ultrasonic testing methods) on staff or included as a sub-contractor.
    - c. Inspectors performing field tests shall be certified at a minimum as an AWS-CWI to perform B31.1 visual inspections (VT) and as an ASNT-TC-1A Level II

inspector for the type of NDE selected for the project. It is preferred to have one inspector with both certifications, but it may be necessary to have two inspectors if an inspector cannot be hired with both qualifications.

- d. A QA/QC or CWI Inspector working for the third-party testing firm shall review and approve Contractor's WPS, PQR and WPQ submittals. The qualified inspector shall also confirm that the PQR's include the tensile testing results and that the testing laboratory has specific lab identification numbers assigned to the test results and traceable to the WPS's and the PQR's. **AE OSER will not accept welder's performance qualifications from welders performing welding on other projects under different WPS's and PQR's from other Employers.**
- e. Per ASME B31.1, the CWI certified third party inspector will perform VT on 100% of the **completed** welds.
- f. In-process VT as defined by ASME B31.1 is optional. The CWI will perform in-process VT on the initial two (2) welds. This shall be done for each welder and each welding process on the project. If the weld passes the in-process and final VT as well as following volumetric testing, typically recordable UT, no additional in-process welds will be performed with two exceptions:
  - 1) A weld fails the completed weld VT or volumetric testing, in which case, AE shall increase volumetric testing and may also require additional in-process VT, and
  - 2) When contractor's welder has successfully welded without any failed welds to the same welding procedure on a previous AE project within the last 3 months, no in-process VT will be performed until such point as the welder fails inspection.
- g. AE OSER will perform enhanced volumetric inspections using ASME B31.1 standards.
  - 1) 10% of the welds passing visual examination will be examined using ultrasonic (UT) with recordable equipment. This allows for permanent records of the examinations and follow-up QA/QC. These records will serve as documentation within the final reports and verification of compliance with ASME B31.1.
  - 2) Austin Energy's preference is use of phased array ultrasonic testing. Inspector may submit to use another form of ultrasonic testing and will be approved on a case by case basis. Documentation of the substituted form of ultrasonic testing shall be provided indicating compliance to B31.1. There will be no blanket approval any types ultrasonic testing except for phased array.
  - 3) The ultrasonic examination shall be capable of detecting the following imperfections: crack – surface, crack – internal, slag inclusion, lack of fusion and incomplete penetration.
  - 4) When in-process VT is performed on the initial four (4) welds, the completed welds shall be included in the 10% UT examination.
  - 5) The UT frequency shall be increased to 100% in portions of the pipe that will be inaccessible after completion of construction, tunneling, jack and bore or any pipe that will be covered before hydro is performed and on a case by case basis, with approval from the project manager.
  - 6) On a case by case basis, radiography or X-rays (RT) can be used as an alternative to UT in which case; the radiographic films serve as the permanent examination record.

- 7) Should any of the 10% welds tested fail, 20% of all remaining welds will be tested.
  - 8) Should any of the 20% tested welds fail, 100% of all remaining welds will be tested.
  - 9) Owner's independent inspectors will document and approve in writing the visual and NDE UT/RT examinations.
  - 10) Testing shall be done prior to pressure testing and field application of sleeve or coating at joints.
2. Cost of testing
    - a. Owner will arrange for independent testing company to inspect, test, and approve welds. Coordinate and cooperate with Owner and Owner's testing representatives in all aspects of testing procedures. Give adequate advance notice that work is ready for inspections, tests or approvals (48 hour minimum). Testing company will provide written and photographic report of results to Owner and Engineer. Do not fill system with water nor pressure test until Owner and Engineer have approved results of welding tests.
    - b. Failed tests, Hydronic Piping:
      - 1) Should any joint fail the test, Contractor shall correct the deficiency using qualified processes and procedures per ASME Boiler and Pressure Vessel Code, Section IX. Cost for correction of deficiency shall be borne by Contractor at no additional cost to Owner.
      - 2) Any and all additional testing required due to failure(s) in initial testing will be borne by Contractor, at no additional cost to Owner. Owner will deduct testing expenses from Contractor's payment.
  3. Hot tap piping: Reference specifications section SS 232115 HYDRONIC PIP HOT TAPS for testing requirements.
- B. Contractor shall pressure test the hydronic piping to current ASME B31.1 as follows:
1. Prepare hydronic piping as follows:
    - a. Leave joints, including welds, uncoated and uninsulated and exposed for examination and testing prior to shrink sleeve or insulation being applied.
    - b. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
    - c. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
    - d. Fill system with clean ambient temperature water.
    - e. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
    - f. Install safety valve, set at a pressure no more than lowest component's rated pressure, to protect against damage by expanding liquid or other source of overpressure during test.
  2. Contractor shall adhere to the following sequence for pressure testing installed pipe.

- a. Contractor shall make joints accessible for inspection by Owner. Contractor shall install and remove necessary caps, bulkheads, blowoffs, or closure pieces to accomplish specified testing. Contractor shall test against welded caps or closure pieces. Flanges shall not be installed in the piping for purposes of testing except at locations called for in the Drawings.
  - b. For trenchless piping installation methods, install piping in tunnel and pressure test prior to construction of riser pipes in shafts. Field welded joints in elbows and tees shown in Drawings at bottom of work shafts shall be visible during pressure tests. Section of piping shall pass pressure test prior to grouting the tunnel.
  - c. Install riser pipes in shafts. It is Owner's preference that field welded joints in riser pipes remain visible during hydrostatic and pressure test, but not required.
  - d. Install and pressure test elbows and tees shown in Drawings at top of work shafts. Field welded joints in pipe and fittings shall remain visible at time of pressure testing. Section of piping shall pass pressure test as indicated in this section prior to placing backfill.
3. Perform pressure testing per ASME B31.1:

Hydraulic Pressure Testing:

- a. Notify Owner a minimum of two business days prior to testing. Owner will have access to pipe during pressure test.
- b. The piping system shall be subjected to pressure test of 225 psig for 15 minutes, followed by 150 psig for 24 hours.
- c. After pressure test pressure has been applied for 10 minutes, accessible piping, joints, and connections shall be examined/inspected for leakage. Maintain a chart of pressure and temperature on the test section. Pressure and temperature readings shall be taken prior to the start of the test and upon completion of the 24 hour test period. Leaks shall be eliminated by tightening, repairing or replacing components as appropriate and the pressure test shall be repeated until there are no leaks.
- d. Coordinate with owner to witness initial pressurization and final verification of pressure records.
- e. Contractor shall provide and install a test pressure gauge in piping for hydraulic pressure test.
- f. Contractor shall provide a means to record the outside air temperature.
- g. If a pressure test failure occurs, Contractor to repeat process.
- h. Provide Engineer and Owner with a written report of test results.

Pneumatic Pressure Testing: (AE approved only)

- a. Pneumatic testing shall not be implemented as a standard without prior approval by AE OSER personnel. This method shall only be implemented in cases where hydrostatically testing the pipe is not feasible or if the pipe will be without circulating water for longer than 3 weeks.
- b. Notify Owner a minimum of two business days prior to testing. Owner will have access to pipe during pressure test.
- c. The piping system shall be subjected to air pressure test of 25 psig to check for major leaks. Using Snoop soap solution each weld, flange, flange nut, and

threaded fitting connection shall be checked. The system will not be depressurized until all flanges, nuts and welds are leak checked or if a component leaks air.

- d. If a component leaks during the major leak process, the major leak process will be implemented until all major leaks are resolved.
  - e. The air pressure shall be increased in tenths to 50 psig pressure and maintained for eight (8) hours.
  - f. Contractor shall perform leak checks. Using Snoop soap solution each weld, flange, flange nut, and threaded fitting connection shall be checked. The system will not be depressurized until all flanges, nuts and welds are leak checked or if a component leaks air.
  - g. If a component leaks during the minor leak process, the minor leak process will be implemented until all minor leaks are resolved.
  - h. Leaks shall be eliminated by tightening, repairing or replacing components as appropriate and the pressure test shall be repeated until there are no leaks.
  - i. Contractor shall provide and install a test pressure gauge in piping for hydraulic pressure test.
  - j. Contractor shall provide a means to record the outside air temperature.
  - k. Demonstrate test pressure is maintained for a minimum of 8 hours. Coordinate with owner to witness initial pressurization and final verification of pressure records.
  - l. If a pressure test failure occurs, Contractor to repeat process.
  - m. Contractor to record on a pressure test report the initial and final pressures and temperatures for verification of passing pneumatic pressure test.
  - n. Provide Engineer and Owner with a written report of test results.
- C. Camera Inspection – Contractor shall inspect chilled water lines for debris per specification SS 230190 PIPE INSPECTIONS INTERNAL.

### 3.7 CLEANING

- A. Refer to specifications SS 232500 CHILLED WATER FLUSH AND CHEMICAL TREATMENT.

## PART 4 - MEASUREMENT AND PAYMENT

### 4.1 MEASUREMENT

- A. Refer to SP 510 - Special Provision to Item No. 510 Pipe for measurement of chilled water pipe and related appurtenances installed via open cut.
- B. Refer to SP 501S - Special Provision to Item No. 501S Jacking and Boring Pipe for measurement of chilled water pipe and related appurtenances installed in tunnel or shaft.

## 4.2 PAYMENT

- A. Refer to SP 510 - Special Provision to Item No. 510 Pipe for payment of chilled water pipe and related appurtenances installed via open cut.
- B. Refer to SP 501S - Special Provision to Item No. 501S Jacking and Boring Pipe for payment of chilled water pipe and related appurtenances installed in tunnel or shaft.
- C. Payment, when included as a Contract pay item, will be made under one of the following.

<b>Pay Items SP</b>	<b>Description</b>	<b>Units</b>
SS-232114-UG-22-BEND-8	Single 8 inch 22-1/2 degree bend welded pipe fitting. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-22-BEND-10	Single 10 inch 22-1/2 degree bend welded pipe fitting. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-22-BEND-12	Single 12 inch 22-1/2 degree bend welded pipe fitting. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-22-BEND-18	Single 18 inch 22-1/2 degree bend welded pipe fitting. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-45-BEND-8	Single 8 inch 45 degree bend welded pipe fitting. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-45-BEND-10	Single 10 inch 45 degree bend welded pipe fitting. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-45-BEND-12	Single 12 inch 45 degree bend welded pipe fitting. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-45-BEND-18	Single 18 inch 45 degree bend welded pipe fitting. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-90-BEND-8	Single 8 inch 90 degree bend welded pipe fitting. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-90-BEND-10	Single 10 inch 90 degree bend welded pipe fitting. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-90-BEND-12	Single 12 inch 90 degree bend welded pipe fitting. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-90-BEND-18	Single 18 inch 90 degree bend welded pipe fitting. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-TEE-8-8	Single tee for 8 inch steel pipe, branch outlet 8 inch. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-TEE-10-8	Single tee for 10 inch steel pipe, branch outlet 8 inch. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-TEE-12-8	Single tee for 12 inch steel pipe, branch outlet 8 inch. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-TEE-18-8	Single tee for 18 inch steel pipe, branch outlet 8 inch. Includes fitting insulation. Excludes excavation & backfill.	PER EACH

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SS-232114-UG-TEE-10-10	Single tee for 10 inch steel pipe, branch outlet 10 inch. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-TEE-12-10	Single tee for 12 inch steel pipe, branch outlet 10 inch. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-TEE-18-10	Single tee for 18 inch steel pipe, branch outlet 10 inch. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-TEE-12-12	Single tee for 12 inch steel pipe, branch outlet 12 inch. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-TEE-18-12	Single tee for 18 inch steel pipe, branch outlet 12 inch. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-TEE-18-18	Single tee for 18 inch steel pipe, branch outlet 18 inch. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-RED-10-8	Single reducer fitting for 10 inch steel pipe, outlet 8 inch. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-RED-12-8	Single reducer fitting for 12 inch steel pipe, outlet 8 inch. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-RED-12-10	Single reducer fitting for 12 inch steel pipe, outlet 10 inch. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-RED-18-10	Single reducer fitting for 18 inch steel pipe, outlet 10 inch. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-RED-18-12	Single reducer fitting for 18 inch steel pipe, outlet 12 inch. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-CAP-8	Single weld cap fitting for 8 inch steel pipe. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-CAP-10	Single weld cap fitting for 10 inch steel pipe. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-CAP-12	Single weld cap fitting for 12 inch steel pipe. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232114-UG-CAP-18	Single weld cap fitting for 18 inch steel pipe. Includes fitting insulation. Excludes excavation & backfill.	PER EACH

**End**

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## PART 1 - GENERAL

### 1.1 SUMMARY

- A. This Specification includes pipe, fitting materials, and installation methods for hot taps used in hydronic piping systems.

### 1.2 REFERENCES

- A. Design, drawings, welding details, fabrication, nondestructive examinations and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. ASME B31.1 – Power Piping
- C. ASME Section IX – Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operations.
- D. ASME B1.20.1 – Pipe Threads, General Purpose, Inch
- E. ASME B16.3 – Malleable Iron Threaded Fittings Class 150 and 300
- F. ASME B16.47 - Large Diameter Steel Flanges: NPS 26 through NPS 60 Metric/Inch Standard
- G. ASME B16.5 – Pipe Flanges and Flanged Fittings
- H. ASME B16.9 – Factory Made Wrought Steel Buttwelding Fittings
- I. ASME B16.21 – Non Metallic Flat Gaskets for Pipe Flanges
- J. ASME B18.2.1 - Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)
- K. ASTM A53 – Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- L. ASTM A105 – Carbon Steel Forgings for Piping Applications
- M. ASTM A106 – Seamless Carbon Steel Pipe for High Temperature Service
- N. ASTM 193 - Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
- O. ASTM 194 - Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both

- P. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
- Q. ASTM A312 – Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
- R. ASNT TC-1A - Personnel Qualification and Certification in Nondestructive Testing

**SUBMITTALS**

- A. Product Data: For each type of the following, provide manufacturer’s catalog and additional supporting information as required to show compliance with specifications and standards.
  - 1. Pressure-seal fittings.
  - 2. Air control devices.
  - 3. Pipe Material and Fittings – Additionally, include certified copies of mill tests reports and, in catalog data, mark specific model, type, sizes, etc. as applicable.
  - 4. Gate valves: data sheets, dimensions, construction materials and features.
    - a. Contractor must verify opening of temporary hot tap gate valve is large enough to permit entry of hot tap machine cutter.
    - b. Standard hot tap cutter sizes (outer diameter) are assumed to be:

Nominal	Cutter	Nominal	Cutter
<u>Tap Size</u>	<u>O.D.</u>	<u>Tap Size</u>	<u>O.D.</u>
1”	3/4”	18”	15-1/16”
2”	1-3/4”	20”	17”
3”	2-1/2”	22”	19”
4”	2-7/32”	24”	21”
6”	5-15/32”	26”	23”
8”	7-5/16”	28”	25”
10”	9-1/2”	30”	27”
12”	11-1/2”	32”	29”
14”	12-3/4”	34”	31”
16”	14-9/16”	36”	33”

- 5. Hot tap: Procedures, data sheets, shop drawings, fabrication details, weld maps, and job plans, must be submitted for review and approval by AE personnel.
- 6. Welding procedure specifications (WPS) and procedure qualification records (PQR), including lab test data, complying with Section IX of the ASME Boiler and Pressure Vessel Code as referenced in B31.1 specific to the project and prepared by a Senior Certified Weld Inspector per WPS’s and PQR’s must be supplied by the Contractor for review and approval by City personnel before commencing any welding work. If Contractor is intending to use the SMAW welding process, Contractor shall utilize the low hydrogen rods for the cap.

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- B. Welders' performance qualifications (WPQ), including lab test data and certification of compliance with ASME Section IX of the ASME Boiler and Pressure Vessel Code as referenced in B31.1 specific to the project. **City will not accept welder's performance qualifications from welders performing welding on other projects under different WPS's and PQR's from other Employers. Welding certificates shall be no more than six (6) months old or Welder has been approved by AE OSER within the last year.**
  - C. Shop Drawings: Detail at 1/2" scale or larger, indicating piping layout, fabrication, hot tap fittings, hot tap tee, pipe supports and conveyance system for placing hot tap and pipe.
  - D. Field quality-control test reports.
  - E. Welding test reports, including, but not limited to: ultrasonic, mag. particle, x-ray test reports with pictures and/or films as applicable. Reports shall be received no later than 48 hours prior to any operation or procedure rendering the weld location inaccessible.
  - F. Operation and Maintenance Data: For valves to include emergency, operation, and maintenance manuals.

#### QUALITY ASSURANCE

- A. Contractor shall provide their own quality assurance inspector on site during the Hot Tap Operation.
- B. Contractor shall provide certification from the Hot Tap Machine Manufacturer for the applicable hot tap size.
- C. Welding:
  - 1. Contractor shall maintain qualified welding procedures and welders according to ASME Section IX Boiler and Pressure Vessel Code.
  - 2. Comply with provisions set forth in ASME B31.1 Pressure Piping Code.
  - 3. Certify that each welder has passed ASME Section IX qualification tests for welding processes and positions, and that certification is current.
  - 4. City will provide an independent inspector to perform both visual inspections and volumetric testing in accordance with ASME B31.1 and this contract. Nondestructive testing personnel, methods, and procedures will be qualified to ASNT-TC1A latest revision. Inspectors shall be certified to AWS – CWI with a valid AWS certification number. Independent inspectors shall not have contracts for services with the Contractor for the Project.
  - 5. The City shall provide an independent ASNT-TC-1A Level III Inspector to review and approve all inspection and test reports.
  - 6. In cases where Contractor is under contract with a Developer and not the City to complete construction on the City's behalf, the Developer shall provide independent inspection services. City shall review inspector's qualifications and procedures to assure compliance with applicable codes.
- D. Coating applicator qualifications: Engage an experienced applicator who has successfully completed coating system applications similar in material and extent to those specified

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within this Section. Representative for coating manufacturer shall be on site for two days, minimum, to instruct Contractor in application of product and ensure manufacturer's installation specifications are being met.

## PART 2 - PRODUCTS

### 2.1 PIPE

- A. Steel Pipe, up to and including 10"; ASTM A53, Type S, seamless, Grade B or ASTM A106, Grade B; Schedule 40 Weight; and plain ends, unless otherwise indicated.
- B. Steel Pipe, greater than 10" to 26"; ASTM A53, Type S, seamless, Grade B or ASTM A106, Grade B; Standard Weight; and plain ends, unless otherwise indicated.
- C. Steel Pipe, 26" to 40": ASTM A106, Grade B; Standard Weight; and plain ends, unless otherwise indicated.
- D. Steel Pipe, larger than 40": API5L, PSL2, spiral submerged arc welded; Grade B. Standard Weight and plain ends unless otherwise indicated.
- E. Stainless Steel Pipe: 304 or 316 stainless steel, Schedule 80, NPT threaded.
- F. All pipe shall be domestic unless prior approval from AE OSER Project Manager is received for any import pipe. Documentation shall be received stating the necessity of utilizing import pipe.

### 2.2 PIPE FITTINGS

- A. Steel Flanges: ASTM A105, ASME B16.5, steel Class 150, or ASME B16.47 Grade A, Class 150; butt welded end connection raised face.
  - 1. Bolts: ASTM A193/A193M, Grade B7. Extend minimum of two full threads beyond nut with bolts tightened to required torque.
  - 2. Nuts: ASTM A194/194M, Grade 7, with Teflon coated threads.
  - 3. Washers: Stainless steel flat circular washers under bolt heads and nuts.
- B. Steel Welding Fittings: ASTM A234, forged wrought steel. Tees, reducers and elbows (long radius only) unless prior approval by Austin Energy personnel. Fittings shall have the same weight schedule as pipe. Field modified fittings shall not be acceptable without prior AE approval.
- C. Socket Weld Fittings: ASTM A105 Grade II, forged steel, Class 3000 for use with Schedule 80 pipe.
- D. Socket Outlet Fittings: ASTM A105/ASME 16.9 – Class 300 forged steel. Use for drain and vent connections to main only as indicated on drawings.

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- E. All pipe shall be domestic unless prior approval from AE OSER Project Manager is received for any import pipe. Documentation shall be received stating the necessity of utilizing import pipe.
- F. Hot tap saddles:
1. Hot taps attached to host pipe using reinforcement pads are only allowed when the hot tap branch diameter is less than 50% of the host pipe. A full encirclement, split tee saddle is required when the hot tap branch diameter is 50% or greater of the host pipe diameter.
  2. Reinforcing pad: Construct per AE Standard Detail R14 "HOT TAP SADDLE WELDING" and AE Standard Detail R15 "HOT TAP WITH TAPPING TEE AND GATE VALVE."
    - a. Reinforcing pad is to be round (concentric around nozzle base), and field-formed, rolled, or pre-manufactured such that inside diameter of pad matches outside diameter of main pipe being tapped.
    - b. Bevel interior bottom edge of reinforcing pad to allow room for weld where nozzle is welded to main pipe.
    - c. Provide either one 1/4" NPT threaded weep hole, for one piece reinforcing pad, or two weep holes for split reinforcing pad. The weep hole/holes may be used to pressure test reinforcing pads.
  3. Full Encirclement, Split Tee: Construct per AE Standard Detail R15 "HOT TAP WITH TAPPING TEE AND GATE VALVE", meet steel pipe specifications (Section 2.1), of minimum length required for hot tap machine; flange at top for mounting temporary gate valve, side chilled water outlet; bottom cut to fit main pipe diameter. Contractor shall provide design details sealed by PE in State of Texas for Hot Tap Full Encirclement Saddle.

### 2.3 GATE VALVES

Gate valves will be used only on a temporary basis for purposes of making hot taps unless indicated on engineering drawings. For this reason, no performance or materials specification is included here. Provide gate valve as required to fulfill hot tap requirements with no leakage, and full bore opening to accommodate hot tap machine.

### 2.4 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents, and type suitable for fluid to be handled and working temperatures and pressures.
1. ASME B16.21, nonmetallic, raised, full-face or raised face, Class 150, asbestos free, 3/32-inch minimum thickness unless thickness or specific material is indicated.
    - a. Factory cut gaskets shall be used unless noted otherwise.
    - b. Manufacturers:
      - 1) Klinger Company
      - 2) Garlock

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- 3) Or AE OSER approved equal
  - B. Flange Bolts and Nuts: ASTM A193, B7 and ASME B18.2.1, carbon steel, unless otherwise indicated.
  - C. Welding Filler Metals: Comply with AWS, and ASME Section IX and Section II Part C classifications for welding materials.

## 2.5 STEEL PIPE COATING

- A. The host pipe and hot tap tee shall be coated with STAC Coating System including STACprime, STACfill, STACwrap, and STACguard in areas that cannot be insulated per OSER Standard Details. Coating materials shall be plainly and permanently marked, stored, and applied in accordance with the manufacturer's recommendations.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

- A. This section applies to the installation of hot taps. Procedures for joining pipe are found in specifications SS 232114 HYDRONIC PIPING and SS 232114 PRE-INSULATED CHILLED WATER PIPING
- B. All material shall be able to be inspected by AE OSER inspectors before installation at job site. 48 hour notice shall be given to AE Project manager for inspection of items.

### 3.2 HOT TAP INSTALLATION PROCEDURES

- A. Construct and inspect welded joints according to ASME B31.1 and ASME Section IX, using qualified welding procedures, welders and welding operators according to Part 1 "Quality Assurance" Article.
- B. Verify opening size of tap-valve from supplier, during submittal process, and immediately upon receipt, to ensure hot tap machine cutter fits through valve bore.
- C. Contractor shall test / check Hot Tap machine:
  - 1. Cutter to be dye inspected and sharpness of cutter inspected, including quantity and condition of cutter teeth. (also inspect spare cutter).
  - 2. Pilot drill dye checked and sharpness of drill checked, (also inspect spare drill).
  - 3. Verify type of "U" pins (material, size and spares).
  - 4. Check lube oil PSV setting on hot tap machine.
  - 5. Check travel and turns of hot tap machine. Determine depth of cut and number of turns necessary.
  - 6. Verify the hot tap machine has travel indicator.
  - 7. Strength-test the nozzle and valve by hydrostatic or pneumatic means.

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- D. Checklist of valve and hot tap machine after installed on nozzle.
1. Ensure proper orientation of valve. If the tap is to be performed in the horizontal plane, the valve shall turn horizontal.
  2. Check nozzle, valve and hot tap machine alignment.
  3. Verify diametrical clearance.
- E. Ensure valve will close when cutter is in retracted position. Ensure valve is open prior to initiating tap.
- F. Notify Austin Energy Chilled Water Personnel when the hot tap is ready to begin, and when hot tap is complete.
- G. Document hot tap procedure with photographs per Section 01380 CONSTRUCTION PHOTOGRAPHY & VIDEOS.
- H. Weld hot tap connections:
1. Pre-heat entire weld area as required to maintain minimum 200°F surface temperature **at all times during welding process**. Verify surface temperature using infrared sensing device / digital pyrometer.
  2. Weld hot tap nozzle and saddles to the main chilled water pipe being tapped. Have welds tested per weld test and inspection section. Ensure minimum 200°F surface temperature during welding.
- I. Provide a 1/4" NPT tapped and threaded weep holes where called for use in pressure testing. Inject minimum of 1.2 times design pressure of air into weep hole, and bubble test for leaks. After approval from Owner's representative(s), provide water tight cap in threading of hole.
- J. Replace insulation and coat exposed areas with STAC Coating System in accordance with manufacturer's instructions. Contractor shall submit a certificate that personnel have been trained in STAC wrap procedure. Certificate shall come from manufacturer of product. An AE representative shall be notified of installation of STAC wrap at least 48 hours prior to installation.
- K. After Hot Tap is complete, prepare and submit report on results.

#### FIELD QUALITY CONTROL

- A. Hot tap piping connections:
1. Provide hot tap of chilled water mains per drawings and specifications and in accordance with Austin Energy Standard Detail R14 "HOT TAP REINFORCEMENT PAD WELDING DETAIL" and R15 "HOT TAP WITH TAPPING TEE AND GATE VALVE". For Full-encirclement Tee, Contractor shall complete Hot Tap per the Hot Tap engineer's specifications and drawings.
  2. Leave joints, including welds, uninsulated and exposed for examination and testing prior to insulation being applied.

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B. Welding Tests and Inspections

1. Hot tap piping connections:

- a. Owner's AWS-CWI certified independent inspector will visually examine (VT) 100% of the welds.
- b. Contractor shall not insulate, fill system with water, or otherwise make welds unavailable for examination until Owner's independent inspector has documented and certified results of visual and NDE examinations demonstrating that welds comply with ASME B31.1 and Owner or Owner's representative has approved in writing the visual and NDE examinations.

C. Owner shall provide for inspections and testing of welds.

1. Hydronic Piping:

- a. Third part testing firm shall have an American Welding Society-Certified Welding Inspector (CWI) to provide visual inspections (VT) per B31.1 on staff or included as a sub-contractor.
- b. Third party testing firm shall have an American Society of Nondestructive Testing (ASNT-TC-1A) Level III Inspector certified for the type of additional NDE selected for the project (i.e.; magnetic testing, radiographic, and ultrasonic testing methods) on staff or included as a sub-contractor.
- c. Inspectors performing field tests shall be certified at a minimum as an AWS-CWI to perform B31.1 visual inspections (VT) and as an ASNT-TC-1A Level II inspector for the type of NDE selected for the project. It is preferred to have one inspector with both certifications, but it may be necessary to have two inspectors if an inspector cannot be hired with both qualifications.
- d. A QA/QC or CWI Inspector working for the third-party testing firm shall review and approve Contractor's WPS, PQR and WPQ submittals. The qualified inspector shall also confirm that the PQR's include the tensile testing results and that the testing laboratory has specific lab identification numbers assigned to the test results and traceable to the WPS's and the PQR's. **AE OSER will not accept welder's performance qualifications from welders performing welding on other projects under different WPS's and PQR's from other Employers.**
- e. Per ASME B31.1, the CWI certified third party inspector will perform VT on 100% completed welds.
- f. In-process VT as defined by ASME B31.1 is optional. For hot taps, the CWI will perform in-process VT on 100% of the in-process welds.
- g. Owner's ASNT-TC-1A Level II or Level III certified independent inspector shall examine 100% of the welds, both at nozzle and at reinforcing pad, before insulating and placing pipe in location not open to visual inspection, using following methods:
  - 1) The root welding pass will be tested using dry magnetic particle testing.
  - 2) The following two welding passes will be tested using dry magnetic particle testing.
  - 3) All completed welds as final inspection will be tested using wet fluorescent magnetic particle testing.
  - 4) Full penetration weld joints other than 90 degree Tees or 45 degree laterals or fillet welds will be examined by recordable UT.

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- h. On a case by case basis, radiography or X-rays (RT) can be used as an alternative to UT in which case; the radiographic films serve as the permanent examination record.
  - i. Owner's independent inspectors will document and approve in writing the visual and NDE UT/RT examinations.
  - j. Testing shall be done prior to pressure testing and field application of sleeve or coating at joints.
2. Cost of testing
- a. Owner will arrange for independent testing company to inspect, test, and approve welds. Contractor shall coordinate and cooperate with Owner and Owner's testing representatives in all aspects of testing procedures and give adequate advance notice (a minimum of 48 hours) that work is ready for inspections, tests or approvals. Failed tests, Hot tap piping connections:
    - 1) Should any weld in hot tap connection fail test, Contractor will be required to remedy installation in strict accordance with directions provided by Owner and Owner's testing company.
    - 2) Cost of additional hot tap work required, up to and including redoing the entire hot tap, and cost of all additional hot tap welding tests, will be borne by Contractor, at no additional cost to Owner. Owner will deduct testing expenses from Contractor's payment.

#### PART 4 - MEASUREMENT AND PAYMENT

##### MEASUREMENT

- A. Hot tap:
  - 1. Hot taps will be paid for at the unit bid price for the size and type valve installed, including insulation of tap take off, all testing, and tapping into 24"-30" diameter pipe. Hot taps attached to host pipe using reinforcement pads are only allowed when the hot tap branch diameter is less than 50% or less of the diameter of the host pipe. A full encirclement, split tee saddle is required when the hot tap branch diameter is 50% or greater of the host pipe diameter. Austin Energy Standard Detail R14 "HOT TAP REINFORCEMENT PAD WELDING DETAIL" and R15 "HOT TAP WITH TAPPING TEE AND GATE VALVE". **For Full-encirclement Tee, Contractor shall complete Hot Tap per the Contractor's Hot Tap engineer's specifications and drawings.**
    - a. **Excavation is specifically excluded from hot tap price.** Excavation will be included in the price of hand excavation, jacking & boring, or open trenching, as priced in the items SP-501S-SMALLPIT and SP-501S-LARGE PIT.

##### B. PAYMENT

- 1. When included as a Contract pay item, will be made under one of the following:

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<b>Pay Items SP</b>	<b>Description</b>	<b>Units</b>
SS-232115-HT-8-ON-18	Hot tap for 8 inch pipes onto 18 inch pipe, to include both chilled water supply & return connections. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232115-HT-8-ON-24	Hot tap for 8 inch pipes onto 24 inch pipe, to include both chilled water supply & return connections. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232115-HT-10-ON-18	Hot tap for 10 inch pipes onto 18 inch pipe, to include both chilled water supply & return connections. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232115-HT-10-ON-24	Hot tap for 10 inch pipes onto 24 inch pipe, to include both chilled water supply & return connections. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232115-HT-12-ON-18	Hot tap for 12 inch pipes onto 18 inch pipe, to include both chilled water supply & return connections. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232115-HT-12-ON-24	Hot tap for 12 inch pipes onto 24 inch pipe, to include both chilled water supply & return connections. Includes fitting insulation. Excludes excavation & backfill.	PER EACH
SS-232115-HT-18-ON-30	Hot tap for 18 inch pipes onto 30 inch pipe, to include both chilled water supply & return connections. Includes fitting insulation. Excludes excavation & backfill.	PER EACH

END OF SECTION SS 232115

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## PART 1 - GENERAL

### 1.1 DESCRIPTION

- A. This section governs water and chemical circulation for Pre-Operational Cleaning and Flushing activities for chilled water system piping. The design, installation, and operation of a pump circulation system for purposes of flushing and passivation of chilled water lines prior to service shall be the sole responsibility of the contractor.
- B. The contractor shall contract with the Owner's preferred Chemical Treatment Vendor for all items associated with the Chemical Treatment Vendor's scope of work. The contractor shall coordinate circulation pump size and connection details, chemical pump size and connection details, administration of chemicals, testing locations and ports, sample acquisition, and recommendation of water discharge with the Owner's preferred Chemical Treatment Vendor.
- C. The contractor shall demonstrate or employ the services of a vendor who can demonstrate to the Engineer that he specializes in the design and operation of temporary pumping systems. The Contractor or vendor shall provide a minimum of five (5) references of projects of a similar size and complexity as this project performed by his firm within the past three years.

### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.3 SUBMITTALS

- A. Pumping flushing plan including: pump staging location, water source location, water discharge location, pump size and pump sizing calculations, pump capacity, and number of pumps to be on-site.
- B. Pumps shall have cleaning certificate along with serial numbers marked on the pump. Hoses shall be in a bagged, wrapped and sealed package with cleaning certificate. Pumps and hoses must be cleaned of all residues from previous jobs. Owner reserves the right to have all pumps and hoses swabbed for determining their cleanliness.
- C. Calculations of friction losses, discharge, and flow velocity, pump curves, and method of sampling discharge velocity in pumps and/or main piping.
- D. Number, size, material, and connection method of all suction and discharge piping, and suction and discharge manifolds.
- E. Containment plan for isolating circulation system from unauthorized discharges to

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storm sewer.

- F. Capture plan for capturing accidental discharges of flushing water.
- G. Disposal plan for water used in flushing.
- H. Detailed schedule for installation of circulation system.
- I. A schematic drawing or sketch of the piping and the pump connections that will be cleaned, flushed and treated.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT REQUIREMENTS

- A. Engine driven equipment or devices shall be sound attenuated to operate below 70db or current city ordinance db level whichever is lower.
- B. All pumps, piping, hoses, valves, manifolds, connections, and miscellaneous appurtenances in contact with circulation water shall be certified clean by steam cleaning methods prior to mobilization of equipment to the site. Equipment cleaned by methods other than steam will require AE DEC Engineer approval.
- C. All pumps, piping, hoses, valves, manifolds, connections, and miscellaneous appurtenances shall be 100% leak proof. Adequate equipment and materials for capturing spills or releases of any kind shall be on hand and available for immediate use. The use of non-leaking secondary containment for pumps and hose connections shall be used.

### 2.2 CHEMICAL REQUIREMENTS

- A. Utilize Owner's preferred Chemical Treatment Vendor:

NALCO  
Bruce J. Opsahl  
(940) 389-0820

## PART 3 - EXECUTION

### 3.1 GENERAL REQUIREMENTS

- A. Contractor shall schedule and attend an on-site meeting with Owner, Contractor's pump vendor, Owner's preferred Chemical Treatment Vendor, and Owner's engineer to coordinate logistics, piping connections, pump and hose placement, etc.
- B. Inspection of pumps and hoses delivered shall be approved by Owner's appointed Inspector before pumps and hoses are connected and placed into service. If

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pump(s) and/or hose(s) fail inspection and/or flow rate physical measurement, all project delay costs resulting from these failure(s) shall be assessed to the Contractor.

- C. Staging and testing of pumps and hoses shall be completed 24-hours prior to start of cleaning and passivation. Circulation system shall be pressure tested prior to operation to ensure leak-proof construction.
- D. Contractor shall provide on-site 24-hour pump watch for the entirety of the flushing operation.
- E. Pump watch shall obtain a water sample every 4-6 hours in lieu of Owner's preferred Chemical Treatment Vendor. Pump watch shall store samples taken on-site for testing by Owner's preferred Chemical Treatment Vendor.

### 3.2 SYSTEM DESIGN REQUIREMENTS

- A. System shall be capable of circulating water in the largest pipe at a minimum flow rate of 5 feet per second. The design shall include a method of measuring velocity in the system that can be directly related to the velocity in the main piping.
- B. System shall include a chemical pump and connection point for injection of chemicals by the Owner's preferred Chemical Treatment Vendor. Sizing of the chemical pump and injection point shall be coordinated with the Chemical Treatment Vendor.
- C. System shall be 100% leak-proof and shall be hydrostatically tested prior to operation at 1.5 times the system operating pressure. Contractor shall flush hoses prior to connection to chilled water piping system.
- D. System shall feature a containment system to isolate pumps, pipes, hoses, equipment, etc. in the event of an unplanned discharge of circulation water.

### 3.3 SERVICES PERFORMED BY CHEMICAL TREATMENT VENDOR

- A. Chemical treatment will be provided by the Owner's preferred Chemical Treatment Vendor. The Chemical Treatment Vendor will provide the following:
  - 1. Submittals for chemicals and calculation for quantity of chemicals to be used.
  - 2. Chemicals and injection of chemicals after initial flushing and re-filling of pipe by Contractor.
  - 3. Inform Austin Energy Lab Services for the need of sample bottles. Pick sample bottles up from Austin Energy Lab Services and deliver to job site.
  - 4. Tests of the water in sample bottles shall be performed after the initial 48 hour circulation period and at least every 24 hours after the initial 48 hour circulation period. These field test results shall be sent to the Owner's designated representative.

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5. Once the iron levels have stabilized (at least 6 iron readings within 0.2 ppm of each other), at least 48 hours of circulation, and AE representative has given approval for sample to be taken, the water sample shall be sent to an approved testing laboratory. The laboratory shall provide water testing reports.
  6. A recommendation to Austin Energy as to when water used in the flushing operation is safe to discharge to the sanitary sewer.
  7. Addition of post-cleaning and final operational chemicals.
  8. Written documentation of all cleaning and flushing procedures and results.

#### 3.4 SERVICES PERFORMED BY CONTRACTOR

A. Contractor will provide the following:

1. Coordination with Chemical Treatment Vendor.
2. Install piping and valves per contract drawings and specifications in such a manner as to facilitate installation of chemicals by the Chemical Treatment Vendor. Install, delay installation of, or temporarily remove, flanges, valves, fittings, etc. as required to facilitate cleaning and flushing connections and activities.
3. Deployment of equipment or material as needed to contain spills or releases of any kind.
4. A piped source of city water, at local city water pressure, with shutoff valve, meter, and certified backflow preventer in location to allow filling of piping system by contractor.
5. Filling of piping system with water. Circulation of water through pipe for 2-4 hours or longer as needed until water flows clear to remove dirt, sand, silt, gravel, welding slag, construction debris, etc. Flow rate shall be at least 5 ft/s to sufficiently suspend any settled debris to discharge.
6. Discharge of initial circulation water directly to the sanitary sewer at a rate not to exceed that specified by the Owner. No testing is required for discharging of water used in the initial flushing of the facilities.
7. Re-fill pipe with water and coordinate with Chemical Treatment Vendor for injection of initial cleaning chemicals.
8. Circulate water for a minimum of 48-hours and verification iron levels have plateaued before Chemical Treatment Vendor can take a sample for laboratory testing. The 48 hour circulation time duration is defined as the amount of time once the chemicals have been added and before a sample is sent to the lab for analysis. Following the 48-hour circulation period and confirmation from Austin Energy representative that the laboratory results meet City of Austin discharge limits for discharge, discharge water to sanitary

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sewer at a rate not to exceed that specified by the Owner.

9. Before discharge of water to sanitary sewer, Owner shall determine if submitted disposal plan is sufficient for current conditions. If current conditions require an alternative disposal plan, Contractor shall determine best method for disposal and shall present plan for AE approval. Contractor shall implement approved altered disposal plan.
10. Immediately following discharge of cleaning water, fill pipe with water and circulate water for 1-hour. Following 1-hour of circulation, discharge the water to the sanitary sewer. Flow rate shall be sufficient to suspend any settled debris to discharge.
11. Re-fill system with water and coordinate with Chemical Treatment Vendor for injection of final operational chemicals. Circulate for 1-hour.
12. No pumps or hoses shall be removed without the consent of Owner's designated representative.
13. Re-install flanges, valves, piping, etc. that were removed for flushing operation to the final condition as specified in the drawings and specifications.
14. Circulation water temperature shall not exceed 150 F. If circulation temperature reaches above 140, notify Austin Energy's designated representative to determine the course of action to prevent temperature reaching max temperature.

### 3.5 PARAMETERS OF DISCHARGED WATER

- A. Discharge of flushing water to the City's sanitary system is subject to the prohibitions described in Chapter 15-10 of the Austin City Code.
- B. Owner's preferred treatment vendor shall be required to acquire an Austin Water Utility (AWU) permit and shall provide the Owner with a valid permit number to Owner's designated representative.
- C. Discharges must be approved by the Special Services Division prior to any and all discharges related to the flushing operation. The following parameters are required to be analyzed on all samples collected from the activities described herein:

<b>PARAMETER</b>	<b>LIMIT</b>
pH	6.0 – 11.5 std. units
Copper	1.1 mg/L
Lead	0.4 mg/L
Manganese	6.1 mg/L

Zinc	2.3 mg/L
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3.6 PAYMENT

A. Chilled water chemical treatment

- Services included herein will be paid for at the unit bid price for each cleaning, flushing and chemical treatment dependent on the volume of water being treated. Payment shall include compensation for design, installation, maintenance, and operation of the circulation system, as well as all materials, equipment, labor, power, fuel, supervision, maintenance, and coordination with Owner's preferred Chemical Treatment Vendor, etc., for a full and working final installation as per the intent of the drawings and specifications.

Payment, when included as a Contract pay item, will be under the following:

**ROW**

<b>Pay Item No. SS232500-RCHEMa:</b>	Cleaning and flushing process and cleaning and flushing equipment for 12" Pipe and lower	<b>Per 500 Gallons of Treated Water</b>
<b>Pay Item No. SS232500-RCHEMb:</b>	Cleaning and flushing process and cleaning and flushing equipment for 14" to 20" pipe	<b>Per 500 Gallons of Treated Water</b>
<b>Pay Item No. SS232500-RCHEMc:</b>	Cleaning and flushing process and cleaning and flushing equipment for 22" Pipe and up	<b>Per 500 Gallons of Treated Water</b>
<b>Pay Item No. SS232500-RCHEM1:</b>	Pump Watch	<b>Per Hour</b>
<b>Pay Item No. SS232500-RCHEM2:</b>	Chemicals to treat from 0 to 5,000 total gallons of water in pipe	<b>Per 5 Gallon of Chemicals</b>
<b>Pay Item No. SS232500-RCHEM3:</b>	Chemicals to treat from 5,001 to 80,000 total gallons of water in pipe	<b>Per 5 Gallon of Chemicals</b>
<b>Pay Item No. SS232500-RCHEM4:</b>	Alternative Disposal Plan Implementation	<b>Per 500 Gallons of disposed water</b>

**End**

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## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

### 1.2 DEFINITIONS

- A. RNC: Rigid nonmetallic conduit.
- B. RMC: Rigid metallic conduit.

### 1.3 SUBMITTALS

- A. Product Data: For raceways and fittings.

### 1.4 QUALITY ASSURANCE

- A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.
  - 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
- B. Comply with NECA's "Standard of Installation."
- C. Comply with NFPA 70.

### 1.5 COORDINATION

- A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

## PART 2 - PRODUCTS

### 2.1 NONMETALLIC CONDUIT

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. AFC Cable Systems

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2. Calbrite
  3. CANTEX Inc.
  4. Carlon Electrical Products
  5. Electri-Flex Co.
  6. Heritage Plastics
  7. Thomas & Betts
  8. Or AE DEC Engineer approved equal
- B. Rigid Nonmetallic Conduit, RNC: NEMA TC 2, Type EPC-40-PVC, 4.5" outside diameter, unless otherwise indicated.
- C. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

## 2.2 METALLIC CONDUIT

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. AFC Cable Systems
  2. Allied Tube & Conduit
  3. Anixter
  4. Calbrite
  5. Electri-Floex Co.
  6. Graybar Services, Inc.
  7. Wheatland Tube.
  8. Or AE DEC Engineer approved equal.
- B. Rigid Metal Conduit, RMC shall be hot dipped galvanized. NEMA RN2, ANSI C80.1, 4.22" outside diameter unless otherwise indicated
- C. Fittings for RMC shall match to conduit or tubing type and material.

## 2.3 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

- A. Single Raceway Fiber Optic Inner Duct
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Petroflex North America, Ltd.
    - b. Lamson & Sessions; Carlon Electrical Products.
    - c. Endot Industries Inc.
    - d. IPEX Inc.
    - e. Arnco Corporation.
  2. Description:
    - a. Flexible type, approved for general-use installation.

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- b. HDPE, 1" Single Wall Outside Plant Corrugated, 1.00" I.D. min, 1.35" O.D., Fiber Innerduct with pre-installed, color-coded, minimum 900 lb rated pull tape.
  - c. Conduits indelibly labeled.
  - d. Comply with UL 2024 and ASTM D-4216
  - e. Meets material and dimensional requirements of ASTM D3035.
  - f. Material Properties in accordance with ASTM D 4216.
  - g. Tensile Modulus: > 377,000 psi re ASTM D638.
  - h. Tensile strength: > 6500 psi re ASTM D638.
  - i. ASTM D2737-Standard for Polyethylene (PE) Plastic Tubing.
  - j. Duct plugs:
    - 1) Expandable Plug.
    - 2) High-impact plastic components, combined with durable elastic gaskets.
    - 3) Corrosion proof and effective as long-term or temporary seals.
    - 4) Water-tight and gas-tight.
    - 5) Equipped with a rope tie device to allow the securing of pull rope to the plug's back compression plate.
    - 6) Removable and reusable.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine surfaces to receive raceways for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. All material shall be able to be inspected by AE OSER inspectors before installation at job site. 48 hour notice shall be given to AE Project manager for inspection of items.

### 3.2 WIRING METHODS

- A. Communications Raceways:
  - 1. RNC or RMC, minimum 4-inch trade size, with three 1" single raceway fiber optic inner duct.
- B. Raceway Fittings: Compatible with raceways and suitable for use and location.

### 3.3 INSTALLATION

- A. General
  - 1. Install in strict accordance with manufacturer's recommendations.
  - 2. Arrange stub-ups so curved portions of bends are not visible. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

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3. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
  4. Install pull wires or pull tapes in all empty innerduct raceways, including multi-duct systems. Leave at least 12 inches of slack at each end of pull wire.
  5. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

B. Raceways for Optical Fiber and Communications Cable:

1. General

- a. Do not install elbows with turning radius less than 36 inches.
- b. Gasketed fittings are required each time the pipe is terminated seals the system by preventing any foreign material from entering the space between the inner walls of the outer duct and the outer walls of the inner ducts.
- c. Install using manufacturer's recommended practices, using cable pulling lubricants recommended by the innerduct manufacturer and pull ropes
- d. Install in continuous runs between communication pull boxes and splice vaults without splices or joints.
- e. Ends must be smooth to prevent scraping of cables.
- f. Dynamometers must be used to record installation tensions and tension limiting devices must be used to prevent exceeding maximum pulling tensions during installation.
- g. Breakaway devices must be used to limit pulling tensions. One device must be placed in series with every element rated for less than maximum pulling tensions of that element.
- h. Innerducts must not be stressed beyond the minimum-bending radius allowed by the innerduct or fiber optic cable manufacturer.
- i. Tension must be set to the manufacturer's maximum limit. Maximum pulling tension must be recorded for each innerduct run.
- j. Immediately prior to installing cables, innerducts must be blown out with compressed air until foreign material is removed.
- k. Provide Stamped Stainless Steel Tags on fiber cables leaving/entering all innerduct, in each manhole and pull box, and at all termination points. Identify on tag the origin and destination of cable with text on 2" square stainless steel tag. Securely fasten to each cable.

2. Rigid Nonmetallic Conduit:

- a. Minimum 4" size.
- b. Install in all below ground applications
- c. Where PVC raceway will be embedded within grout or other material where heat of hydration may impact integrity of raceway, circulate cool water through raceway until heat of hydration process

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is nearly complete and surrounding material has cooled well below the temperature at which damage to raceway may occur. Conduit shall be pigged and free of water before innerduct is installed in conduit.

3. Rigid Metal Conduit:
  - a. Minimum 4" size
  - b. Hot Dipped Galvanized
  - c. Install in all above ground applications
  
4. Single Raceway Fiber Optic Inner Duct:
  - a. Owner included payment options for both Owner-supplied and Contractor-supplied innerduct.
  - b. Install duct plugs at all duct ends.
  - c. Install three single innerducts per 4" raceway.

#### 3.4 CLEANING

- A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.
  
- B. Each conduit shall have a conduit mandrel pulled through it to determine if any blockages exist. If a single or multiple blockage exist, Contractor at Contractor's expense shall determine and remove any and all blockages from the blocked conduit(s).

#### 3.5 PAYMENT

- A. Conduit: Payment for conduit, whether in above ground, tunnel, open trench, or jack & boring casement, will be included in under specifications section SP 510 "PIPE", or section SP 501S "JACKING OR BORING PIPE".
  
- B. Payment, when included as a Contract pay item, will be made under the following.

<b>Pay Items SP</b>	<b>Description</b>	<b>Units</b>
SS-260533-CAB-B	Customers communications junction box, N250 Type 1.	Per Each

END OF SECTION SS 260533