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COMPLIANCE IS MANDATORY

John C. Stennis Space Center
PVC and HDPE Piping
for Potable Water Service Underground

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1.0 PURPOSE

This John C. Stennis Space Center (SSC) standard (SSTD) specifies the materials and procedures for the construction of polyvinyl chloride (PVC) and high-density polyethylene (HDPE) potable water piping systems at SSC. This SSTD is for installation below ground surface only.

2.0 APPLICABILITY

a. This SSTD shall be used for specifying materials and components to be incorporated into the PVC and HDPE potable water piping systems as designated on the SSC Site-wide Operational and Repair Documentation (SORD) Drawing System.

b. Existing piping systems, piping system sections, and pipe spools that are modified, repaired, tested, or in operational service prior to the issue date of this SSTD are exempt from requirements of this SSTD. However, these existing piping systems, piping system sections, and pipe spools shall conform to this SSTD at specific locations where modifications and repairs are made and where new pipe and pipe fittings are installed into or joined to lines and components of these existing systems after the issue date of this SSTD.

3.0 REFERENCES AND APPLICABLE DOCUMENTS

All references are assumed to be the latest version unless otherwise indicated.

AASHTO H-20, *American Association of State Highway Transportation Officials*
ANSI/AWWA C110/A21.10, *Ductile-Iron and Gray-Iron Fittings*
ANSI/AWWA C111/A21.11, *Rubber-Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings*
ANSI/AWWA C116/A21.16*, Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings*
ANSI/AWWA C213, *Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings*
ANSI/AWWA C508, *Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS*
ANSI/AWWA C509, *Resilient-Seated Gate Valves for Water Supply Service*
ANSI/AWWA C600, *Installation of Ductile Iron Mains and their Appurtenances*
ANSI/AWWA C512, *Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service*
ANSI/AWWA C515, *Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service*
ANSI/AWWA C600, *Installation of Ductile-Iron Mains and Their Appurtenances*
ANSI/AWWA C605, *Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings*

ANSI/AWWA C651, *Disinfecting Water Mains*
ANSI/AWWA C655, *Field Dechlorination*
ANSI/AWWA C900, *Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings 4 In. Through 60 In. (100 mm Through 300 mm), for Water Transmission and Distribution*
ANSI/AWWA C906, *Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm through 1,650 mm) for Waterworks*
ANSI/AWWA M23, *PVC Pipe – Design and Installation*
ANSI/AWWA M51, *Air Valves: Air-Release, Air/Vacuum and Combination*
ANSI/AWWA M55, *PE Pipe – Design and Installation*
ASTM C302, *Standard Test Method for Density and Dimensions of Preformed Pipe-Covering-Type Thermal Insulation*
ASTM C585, *Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing*
ASTM C1423, *Standard Guide for Selecting Jacketing Materials for Thermal Insulation*
ASTM C1879, *Standard Practice for Installation of Aluminum and Stainless Steel Jacketing over Thermal Insulation on Pipe and Rigid Tubing*
ASTM D2774, *Standard Practice for Underground Installation of Thermoplastic Pressure Piping*
ASTM D3139, *Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals*
ASTM D3261, *Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing*
ASTM D3350, *Standard Specification for Polyethylene Plastics Pipe and Fittings Materials*
ASTM F477, *Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe*
ASTM F1668, *Standard Guide for Construction Procedures for Buried Plastic Pipe*
ASTM F2164, *Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure*
ASTM F2206, *Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE)*
ASTM F2620, *Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings*
ASTM F3190, *Standard Practice for Heat Fusion Equipment (HFE) Operator Qualification on Polyethylene (PE) and Polyamide (PA) Pipe and Fittings*
Mississippi Department of Health Recommended (MDH) Minimum Design Criteria for Mississippi Public Water Systems
NFPA 24, *Installation of Private Fire Service Mains and Their Appurtenances*
NFPA 25, *Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*
SPR 1440.1, *SSC Records Management Program Requirements*
SSTD-8070-0005-CONFIG, *SSC Preparation, Review, Approval, and Release of SSC Standards*
UL 789, *Standard for Safety Indicator Posts for Fire-Protection Service*

4.0 RESPONSIBILITIES

a. Users of this SSTD shall comply with its requirements, ensure use of the correct version of this SSTD and the documents it references, and inform the appropriate organization of needed changes in accordance with SSTD-8070-0005-CONFIG.

b. Responsibilities for the use and control of this SSTD and for the review and approval of revisions or cancellation of this SSTD shall be as specified in SSTD-8070-0005-CONFIG and the applicable documents referenced therein.

5.0 DESIGN CONDITIONS

Service	Working Pressure	Hydrostatic Test Pressure	Temperature Range	Maximum Reoccurring / Normal Velocity	Maximum Occasional / Emergency Velocity
Potable Water	80 psig*	120 psig	+35°F - +80°	6 ft/sec (HDPE) 4 ft/sec (PVC)**	12 ft/sec (HDPE) 12 ft/sec (PVC)

***** Working pressure as listed in the table above and throughout this standard is considered equivalent to the Design Pressure as defined by ASME.

******PVC maximum reoccurring / normal flow rate limited to 4 ft/sec based on fatigue failure limitations associated with a typical 50 year life span.

NOTE: Listed maximum flow rates represent conservative design parameters assuming instantaneous valve closure for the Dimension Ratios (DRs) selected in this SSTD. Flow rates in excess of these values may be acceptable provided an engineering analysis is performed and prior approval is obtained from the Authority Having Jurisdiction (AHJ). Refer to ANSI/AWWA M23 and M55 for more information.

6.0 REQUIREMENTS

6.1 General

a. All materials, components, and their interconnections shall be in compliance with the Mississippi Department of Health (MDH) Minimum Design Criteria for Mississippi Public Water Systems.

b. Pipe for underground potable water distribution and transmission systems shall be designed to the following requirements:

1. Required pipe pressure rating or class shall incorporate calculation of dynamic / transient reoccurring and occasional surges that may occur during operation during

service life. Typical maximum recurring surge pressure of 150 pounds per square inch (psig) shall be used for design considerations. Refer to ANSI/AWWA M23 and M55 for more information.

2. Temperature Range, +35°F to +80°F, with nominal operating temperature at 73.4°F. Piping pressure rating or class shall also consider the temperature derating factors associated with operation above nominal temperature as described in ANSI/AWWA M23 and M55.

   NOTE: This SSTD does not apply to any systems intended to transport or distribute heated or hot water at temperatures exceeding 80°F.

3. Pipe Size, 4" - 24"

   A. A maximum pipe size of 24" is assumed to account for future growth. Maximum existing pipe size is 16".

   B. A minimum pipe size of 4" per MDH Minimum Design Criteria.

   C. Other pipe sizes require case by case consideration.

c. Installation methods applying critical stresses affecting pipe design shall be considered, such as placement via open excavation and various trenchless techniques, such as horizontal directional drilling (HDD).

d. System design shall include installation of combination type air release and air and vacuum valves for release of entrapped air and prevention of vacuum creation at high points in the system.

6.2 Installation, Inspection, and Test Requirements

6.2.1 High-Density Polyethylene (HDPE) Potable Water Piping Systems

All HDPE potable water piping systems shall be installed, inspected, and tested in accordance with ANSI/AWWA M55.

Size	4" through 24"
Pipe Materials / Details	ANSI/AWWA C906 HDPE resin shall be PE4710 in accordance with ASTM D3350, with a minimum cell classification of 45474 C, containing zero recycled content. Pipe pressure class shall be a minimum of Class 125 (Dimension Ratio [DR] 17) with requirements for increased wall thickness to be determined by installation method and location and calculated system surge / transient pressures. Refer to ANSI/AWWA M55.
Fitting Material	Same as pipe
Fitting Details	**HDPE-to-HDPE Connections:** HDPE-to-HDPE connections shall be butt fusion welded with procedures in accordance with ASTM F2620, Procedure 2. Sizes 4" through 12": • Molded fittings in accordance with ASTM D3261, or • Fabricated fittings in accordance with ANSI/AWWA C906 and ASTM F2206 Sizes 14" through 24": • Fabricated fittings in accordance with ANSI/AWWA C906 and ASTM F2206 **NOTE:** Field fabricated elbows do not comply with the listed standards and may not be used for pressure service. HDPE fittings shall be of the same material as the pipe. HDPE shall be of an equal pressure rating to the pipe (typically one DR thicker than the pipe). Example: DR 11 pipe shall utilize DR 9 fittings. **HDPE Pipe to Unlike Materials:** For connection of HDPE pipe to unlike materials, restrained material transition couplings shall be utilized. Couplings shall be specific for the two materials to be joined. Couplings shall be constructed of steel or ductile iron and coated with fusion bonded epoxy in accordance with ANSI/AWWA C213 or ANSI/AWWA C116 respectively. Gaskets and bolting accessories shall be in accordance with ANSI/AWWA C111. Type 304 stainless steel stiffener shall be provided.

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Size	4" through 24"
Fusion Welding	HDPE fusion shall be completed in accordance with the requirements contained in ASTM F2620. Operator training and field practices shall also follow ASTM F3190. As part of all HDPE implementations, a HDPE fusion joint procedure, operating qualification welds, and fusion quality control plan is required. Procedures and plans shall be detailed in all aspects of the work, as detailed by ASTM F2620 and ASTM F3190, and shall be reviewed by the engineer prior to implementation. Prior to any production work, each certified fusion equipment operator shall perform a fusion joint following the Fusion Joint Procedure. The joint shall be visually and destructively examined to ensure an acceptable weld has been produced. An operator who cannot produce an acceptable joint, the second time, will not be allowed to operate the fusion equipment.
Valves	**Sectionalization:** Resilient-seated gate valves shall be utilized for line sectionalization. Gate valves shall be in accordance with ANSI/AWWA C509 or C515. Valves shall be non-rising stem type for buried service. All buried valves shall include a 2" operator nut for on grade valve operation. Valves shall be rated for a minimum of 200 psig working pressure. The end connections shall be mechanical joint with dimensions complying to ANSI/AWWA C-111/A21.11. HDPE pipe shall be fitted with a mechanical joint adapter of equal pressure rating as the pipe, dimensioned in accordance with ASTM D3261. Mechanical joints shall include a stainless steel stiffener sleeve. **Vacuum and Air Release:** Combination type air release and air vacuum valves shall be designed, supplied, and installed in accordance with ANSI/AWWA C512 and ANSI/AWWA M51. Combination air vacuum valves shall have a minimum working pressure equal or greater than the system's maximum calculated occasional surge pressure as determined using the methods described in ANSI/AWWA M55. Isolation valves installed on the inlet or outlet shall have a means of being locked open so as to prevent inadvertent and/or unauthorized closure. Combination air vacuum

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Size	4" through 24"
Valves ***(Cont.)***	valves shall be treated as safety devices and may only be circumvented when absolutely necessary and with prior approval from the AHJ. **Check:** As required for backflow prevention, swing check in accordance with ANSI/AWWA C508. Locate in accordance with MDH requirements.
Installation Methods	All pipe shall have a minimum cover of 30". Open trench installation shall be in accordance with ASTM D2774 and ASTM F1668. Pipe embedment materials shall be Class II or Class III as described by ASTM D2774. HDD shall be designed specific to the individual application, accounting for soil type, hole diameter, length of drill, bending radii of both drill rod and pipe, and pulling forces. A minimum of DR11 HDPE shall be required for all HDD installations.
Flushing / Disinfection / Dechlorination	Flushing and disinfection shall be completed in accordance with ANSI/AWWA C651 and MDH regulations. For verification / acceptance of disinfection, two consecutive satisfactory bacteriological samples analyzed by a State of Mississippi certified laboratory must be attained. Satisfactory is defined as "No Coliform Present". Samples must be collected in accordance with MDH regulations. Prior to discharge of disinfection water, perform dechlorination in accordance with ANSI/AWWA C655.
Pressure and Leak Test	A pressure test shall be performed on all new installations in accordance with ASTM F2164 and ANSI/AWWA M55. Prior to testing, pipe shall be adequately anchored and restrained against movement. All valves and fire hydrants shall have been permanently installed and, if practical, the trench partially backfilled, leaving the joints exposed for examination. Pipe shall also be flushed and vented prior to testing to remove any foreign material and entrapped air from the pipeline. **NOTE:** Testing of HDPE pipe requires a soaking / equalization period of 24 hours to minimize influence of pipe expansion (due to flexible nature of material) on testing results.

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Size	4" through 24"
Pressure and Leak Test ***(Cont.)***	Testing pressure shall be 120 psig as measured at the lowest elevation in the test section. Test duration (excluding pipe soaking / equalization period) shall not exceed two (2) hours. Zero leakage allowance is permitted for HDPE pipe, fused joints, and sleeve type mechanical joints. Other connection / joint allowances shall be calculated as appropriate. **NOTE:** In no case may the test pressure exceed the pressure rating of the pipe or any appurtenance connected to the test section. A leak test at the system operating pressure may be performed in lieu of a hydrostatic pressure test when a pressure test is deemed impractical due to the nature of the installation or when the test pressure may cause damage to the existing system or any connected appurtenance. Leak tests shall be performed for a period not less than 24 hours. Any leaks observed will be repaired. Prior approval from the AHJ must be obtained before waiving the pressure test requirement and performing the leak test.
Code Compliance	Design per ANSI/AWWA M55.

6.2.2 Polyvinyl Chloride (PVC) Potable Water Piping Systems

All PVC potable water piping systems shall be installed, inspected, and tested in accordance with ANSI/AWWA M23 and ANSI/AWWA C605.

Size	4" through 24"
Pipe Materials / Details	4" through 24": ANSI/AWWA C900 Pipe pressure class shall be a minimum of Class 235 (DR 18).
Fitting Material	Pipe-to-pipe joints shall be bell in spigot type in accordance with ASTM D3139. Fittings for changes in direction or branch attachment, fittings shall be ductile iron in accordance with ANSI/AWWA C110/A21.10.
Fitting Details	ANSI/AWWA C110/A21.10 ductile iron fitting shall be mechanical-joint as described in ANSI/AWWA C111/A21.11. Where thrust is developed, pipe fittings must be restrained by use of joint restraints and/or thrust blocking to prevent joint separation. Thrust restraint requirements are to be calculated on a case by case basis in accordance with ANSI/AWWA M23. For connection of PVC pipe to unlike materials, restrained material transition couplings shall be utilized. Couplings shall be specific for the two materials to be joined. Couplings shall be constructed of steel or ductile iron and coated with fusion bonded epoxy in accordance with ANSI/AWWA C213 or ANSI/AWWA C116 respectively. Gaskets and bolting accessories shall be in accordance with ANSI/AWWA C111/A21.11.
Gasket	Gaskets shall be elastomeric in accordance with ASTM F477.

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Size	4" through 24"
Valves	**Sectionalization:** Resilient-seated gate valves shall be utilized for line sectionalization. Gate valves shall be in accordance with ANSI/AWWA C509 or ANSI/AWWA C515. Valves shall be non-rising stem type for buried service. All buried valves shall include a 2" operator nut for on grade valve operation. Valves shall be rated for a minimum of 200 psig working pressure. The end connections shall be mechanical joint with dimensions complying to ANSI/AWWA C111/A21.11. **Vacuum and Air Release:** Combination type air release and air vacuum valves shall be designed, supplied, and installed in accordance with ANSI/AWWA C512 and ANSI/AWWA M51. Combination air vacuum valves shall have a minimum working pressure equal or greater than the system's maximum calculated occasional surge pressure as determined using the methods described in ANSI/AWWA M23. Isolation valves installed on the inlet or outlet shall have a means of being locked open so as to prevent inadvertent and/or unauthorized closure. Combination air vacuum valves shall be treated as safety devices and may only be circumvented when absolutely necessary and with prior approval from the AHJ. **Check:** As required for backflow prevention, swing check in accordance with ANSI/AWWA C508. Locate in accordance with MDH requirements.
Installation Methods	All pipe shall have a minimum cover of 30". Open trench installation shall be in accordance with ANSI/AWWA C605. Pipe embedment shall utilize Type 2 or higher to ensure an adequately supported piping system. ASTM D2774 and ASTM F1668 provide additional guidance for installation of plastic pipe systems. **NOTE:** Horizontal directional drilling for PVC pipe installations requires special joint restraints and techniques. Although possible, this method is not preferred for this material.

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Size	4" through 24"
Flushing / Disinfection / Dechlorination	Flushing and disinfection shall be completed in accordance with ANSI/AWWA C651 and MDH regulations. For verification / acceptance of disinfection, two consecutive satisfactory bacteriological samples analyzed by a State of Mississippi certified laboratory must be attained. Satisfactory is defined as "No Coliform Present". Samples must be collected in accordance with MDH regulations. Prior to discharge of disinfection water, perform dechlorination in accordance with ANSI/AWWA C655.
Pressure and Leak Test	A pressure test shall be performed on all new installations in accordance with ANSI/AWWA M23. Prior to pipe testing, all valves and fire hydrants shall have been permanently installed and, if practical, the trench partially backfilled, leaving the joints exposed for examination. Pipe shall also be flushed and vented prior to testing to remove any foreign material and entrapped air from the pipeline. All thrust blocking shall be installed and allowed to reach design strength prior to testing. The pipe shall be filled and hydrostatically pressure tested for a minimum of two (2) hours at 120 psig as measured at the lowest elevation in the test section. The design engineer should examine this test pressure to assure it is appropriate for the installation. All valves shall be operable, and visible leaks repaired. In the case that repairs are required, the test shall be repeated until acceptable results are attained. The maximum allowable leakage shall be calculated in accordance with ANSI/AWWA M23. **NOTE:** In no case may the test pressure exceed the pressure rating of the pipe or any appurtenance connected to the test section. A leak test at the system operating pressure may be performed in lieu of a hydrostatic pressure test when a pressure test is deemed impractical due to the nature of the installation or when the test pressure may cause damage to the existing system or any connected appurtenance. Leak tests shall be performed for a period not less than 24 hours. Any leaks

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Size	4" through 24"
Pressure and Leak Test ***(Cont.)***	observed shall be repaired. Prior approval from the AHJ shall be obtained before waiving the pressure test requirement and performing the leak test.
Code Compliance	ANSI/AWWA M23

6.2.3 Connection to Existing System

a. Testing and disinfection of new lines shall be completed as described in the respective piping material sections. These sections should be tested and disinfected independent of existing systems, which may not meet the specification of the new materials.

b. Short sections of pipe and/or fittings may be required to make connections to existing systems. These pipe sections and final make-up fittings are typically not hydrostatically tested, as existing systems may not be capable of withstanding hydrostatic test stresses. In order to ensure proper installation, these sections shall be leak tested under standard operating pressure for a period not less than 24 hours. Any leaks observed shall be repaired.

c. Disinfection of small sections of lines and fittings shall be in accordance with previously referenced standards which provide methods for use of disinfecting sprays and wipes.

6.2.4 Location of Water Lines

a. Water lines shall be located in accordance with MDH Minimum Design Criteria for Mississippi Public Water Systems.

b. Do not lay water line closer horizontally than 10 feet from any sewer line. Lay water lines which cross sewer force mains and inverted siphons at least 2 feet above these sewer lines; when joints in the sewer line are closer than 3 feet horizontally from the water line, encase these joints in concrete.

1. Water Piping Installation Parallel with Sewer Piping

A. Normal Conditions: Lay water piping at least 10 feet horizontally and 18" vertically from a sewer or sewer manhole whenever possible. Measure the distance edge-to-edge.

B. Unusual Conditions: When local conditions prevent a horizontal separation of 10 feet, the water piping may be laid closer to a sewer or sewer manhole provided that:

i. The bottom (invert) of the water piping shall be at least 18" above the top (crown) of the sewer piping.
ii. Where this vertical separation cannot be obtained, the sewer piping shall be constructed of ANSI/AWWA-approved water pipe and pressure tested in place without leakage prior to backfilling. Approved wastewater disposal method shall be utilized.
iii. The sewer manhole shall be of watertight construction and tested in place.

2. Installation of Water Piping Crossing Sewer Piping

A. Normal Conditions: Water piping crossing above sewer piping shall be laid to provide a separation of at least 18" between the bottom of the water piping and the top of the sewer piping.

B. Unusual Conditions: When local conditions prevent a vertical separation described above, the engineer shall provide special design to meet the intended separation requirements provided by MDH.

3. Sewer Piping or Sewer Manholes: No water piping shall pass through or come in contact with any part of a sewer manhole.

6.2.5 Buried Warning and Identification Tape

a. Polyethylene (PE) plastic and metallic core warning tape manufactured specifically for warning and identification of buried utility lines shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

b. Provide tape on rolls, 3-inch minimum width, blue in color, with warning and identification imprinted in bold black letters continuously over the entire tape length.

1. Warning and identification to read, "CAUTION, BURIED POTABLE WATER LINE BELOW", or similar wording.

2. Color and printing shall be permanent, unaffected by moisture or soil.

3. Minimum thickness of the tape shall be 0.004".

4. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise.

5. Install buried warning and identification tape above pipe.

   A. Bury tape 12" below grade in open areas.

   B. Bury tape 6" below top of subgrade beneath pavements and slabs.

6.2.6 Tracer Wire

a. Install detection wire with all non-metallic pipe installations. Detection wire shall be insulated single strand, solid copper with a minimum of 12 American Wire Gauge (AWG).

b. Bury detection wire directly above non-metallic piping at a distance not to exceed 3" above the top of pipe.

   1. The wire shall extend continuously and unbroken, from valve to valve.

   2. The ends of the wire shall terminate inside the valve box at each end of the pipe, with a minimum of 3 feet of wire, coiled, remaining accessible.

   3. The wire shall remain insulated over its entire length.

      NOTE: This requirement applies to all new pipe installation regardless of installation method.

6.2.7 Valve Boxes

a. All buried gate valves shall be installed with a valve box or position indicator post as appropriate for the application.

b. Valve boxes shall be cast iron with an adjustable shaft, sized appropriately for the valve which the box is to be installed.

   1. Shaft shall be a minimum of 5¼" in diameter.

2. Box shall have a round head and cast iron lid with the word “WATER” cast into the lid.

3. Cast iron box shall have a heavy coat of bituminous paint for corrosion protection.

4. All valve boxes shall be rated for traffic rated service (minimum of American Association of State Highway Transportation Officials [AASHTO] H-20).

5. Valve boxes shall be supported on bricks or concrete block to prevent transmission of on grade loads to the valve.

c. All valve boxes shall be installed with a concrete collar around the top of the valve box to protect the valve box. Collar may be precast or cast in place.

d. Post indicators shall conform to the requirements of UL 789, with barrels constructed of centrifugally cast ductile iron.

NOTE: Post indicators must be painted red with a high performance enamel intended for corrosion protection, both above and below grade.

6.2.8 Valve Tags

a. Tag new valves with new valve size and valve numbers.

1. Numbers shall be attained by providing a list of the valves to Central Engineering Files (CEF) to include the make, model, size, and location of the new valve.

2. CEF will assign numbers for each valve.

b. Tags shall be 2”-by-4” by 1/16th” stainless steel (Type 304, or 316). Engrave or stamp valve number using "sanserif" font with letters ½” tall. Include holes on each 2” side to enable installation, 0.375” +/-.

c. Tags shall be installed to label on/below grade valves and above grade valves.

1. For below grade valves: Affix tags to concrete within 6” of valve box using stainless steel wedge anchors (Type 304 or 316), 0.25” by 1.75” or approved equal.

2. Above grade valves: Hang tags on valves using #6 beaded stainless steel chain (Type 304 or 316).

6.2.9 Documentation of As-Built Condition

As-built drawings of installed lines shall document the actual location, kinds and sizes of all sub-surface utility lines. As-built documentation shall include newly installed utilities and existing utilities that are either crossed or modified by the work. Location shall be performed while the pipe is still exposed in the trench; no approximations shall be accepted. Documentation shall include all horizontal and vertical changes in piping direction, recorded by northing, easting and elevation. Horizontal and vertical tolerances shall be plus or minus 0.1 feet and shall be referenced to certified National Geodetic Survey benchmarks. Coordinates systems shall reference North American Vertical Datum 88 (NAVD88) and North American Datum 83 (NAD83). Drill logs for directionally drilled piping shall be logged to the accuracy requirements herein. As-builts shall be prepared by a Mississippi licensed Professional Land Surveyor, in good standing, to locate and certify the location and elevation of all subgrade utilities affected by the project.

6.2.10 Underground to Aboveground Transitions

Where underground potable water piping is required to transition from underground to a building's interior or to the exterior's ambient conditions, the following design requirements shall be met:

a. A Schedule 40 steel pipe sleeve shall be installed at the exposed pipe transition point with a minimum of 9" extending into the floor, ground, or wall material. Exposed pipe transitions located outdoors shall also have the pipe sleeve extending a minimum of 9" outward from the ground, wall, or floor.

b. Steel sleeve shall have a mastic coating for corrosion protection and be sized to accommodate full pipe diameter and insulation.

c. Flange, mechanical joint, or other type of material transition coupling shall be located no less than one (1) foot and no greater than four (4) feet from exposed pipe transition point.

d. All piping and appurtenances aboveground shall be protected from Ultraviolet (UV) radiation, weather, and freezing temperatures. Using an insulation field joint, insulation shall start a minimum of 12" extending into the floor, ground or wall material. Insulation shall comply with ASTM C585 and ASTM C302. All-service jacketing shall comply with ASTM C1423. If the piping is located

outdoors, jacketing shall be aluminum or stainless steel. Installation of all-service jacket shall comply with ASTM C1879.

NOTE: This SSTD may not be applied to any sections of pipe extending greater than four (4) feet from the transition aboveground. Potable water piping beyond this point should conform to the applicable governing standards and specifications.

7.0 RECORDS AND FORMS

Records and forms required by the procedures of this SSTD shall be maintained in accordance with SPR 1440.1. All records and forms are assumed to be the latest edition unless otherwise indicated. Forms may be obtained from the SSC Electronic Forms repository or from the National Aeronautics and Space Administration (NASA) SSC Forms Management Officer. Quality Records are identified in the SSC Master Records Index.

8.0 ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
AHJ	Authority Having Jurisdiction
ANSI	American National Standards Institute
ASTM	American Society of Testing and Materials
AWG	American Wire Gauge
AWWA	American Water Works Association
CEF	Central Engineering Files
DR	Dimension Ratio
F	Fahrenheit
HDD	Horizontal Directional Drilling
HDPE	High-Density Polyethylene
”	inch
MDH	Mississippi Department of Health
mm	millimeters
NAD	North American Datum
NASA	National Aeronautics and Space Administration
NAVD	North American Vertical Datum
NFPA	National Fire Protection Agency
PE	Polyethylene
PEX	Crosslinked Polyethylene
psig	pounds per square inch
PVC	Polyvinyl Chloride

PVCO	Molecularly Oriented Polyvinyl Chloride
SORD	Site-wide Operational and Repair Documentation
SPR	Stennis Procedural Requirements
SSC	John C. Stennis Space Center
SSTD	John C. Stennis Space Center Standard
UL	Underwriters Laboratories
UV	Ultraviolet

9.0 DEFINITIONS

Dimension Ratio – The ratio of pipe outer diameter to wall thickness (DR = Outside Diameter/Wall Thickness).

Working Pressure – The maximum anticipated sustained operating pressure excluding any surge events. For the purpose of this standard, working pressure is considered equivalent to the design pressure and maximum operating pressure as defined by ASME.

Occasional Surge Pressure – The pressure surges experienced in excess of the working pressure expected to occur during emergency operation of the system from dynamic/transient system surges. Occasional surge events include, but are not limited to, emergency shut down, fire flow scenarios, and pipe rupture. Reference ANSI/AWWA M23 and M55 for occasional surge pressure allowances. Occasional surge pressures and the system's allowance shall be determined on a case by case basis.

Recurring Surge Pressure – The pressure surges experienced in excess of the working pressure expected to occur during normal operation of the system from dynamic/transient system surges. Recurring surge events include, but are not limited to, normal pump startup/stop and normal valve opening/closing. Reference ANSI/AWWA M23 and M55 for recurring surge pressure allowances. Recurring surge pressures and the system's allowance shall be determined on a case-by-case basis.

Pressure Class / Rating – A numerical classification for the maximum allowed sustained operating pressure excluding any surge events. System pressure class is dependent on the DR, material, and temperature derating factors.