

Combined Heat and Power (CHP) and New Steam Generation System
Atlanta VA Medical Center, Decatur, Georgia
Issued for Bid - 18 April 2014 (Updated - 6 June 2014)

ADDENDUM 03

TO ALL DOCUMENT HOLDERS:

Subject: Combined Heat & Power Plant and New Steam Generation System, Atlanta VA
Medical Center, DeKalb, GA

VA Task Order: VA701-13-R-0054

URS Job No.: 15290200

Enclosed herewith is Addendum No. 3 covering URS' response to a question
submitted Tuesday, August 12, 2014. Addendum No. 3 includes this document as
well as the below noted specification.

Sincerely,

URS Group, Inc.



Jeffrey F Rouleau, P.E.
Project Manager

Attachments:

Specification:

33 63 00 STEAM ENERGY DISTRIBUTION

ADDENDUM TO THE BIDDING DOCUMENTS FOR
COMBINED HEAT AND POWER PLANT (CHP) AND NEW STEAM GENERATION SYSTEM
ATLANTA VA MEDICAL CENTER, DECATUR, GEORGIA

1.1 GENERAL

- A. This Bulletin covers changes to the Documents and in closing the Contract will become a part thereof. Each Bidder shall include these items to the extent they affect his Bid.
- B. These items modify only the portion of the Documents specifically noted. All other wording and Drawings remain in effect.

1.2 PROJECT MANUAL

- A. SECTION 00 01 10, TABLE OF CONTENTS
 - 1. ADD Section 33 63 00 STEAM ENERGY DISTRIBUTION

--- END OF ADDENDUM NO. 3 ----

SECTION 33 63 00
STEAM ENERGY DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies materials and procedures for construction of underground steam distribution and condensate return piping system, including manholes, outside the buildings. System shall be: pre-engineered direct-buried water-spread-limiting (WSL).

1.2 RELATED WORK:

- A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING.
- B. Concrete Work, Reinforcing, Placement and Finishing: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- C. Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- D. Erosion and Sediment Controls: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

1.3 DEFINITIONS:

- A. System: The complete underground steam and condensate distribution system including all components such as carrier piping, pipe supports, insulation, protective enclosures, anchors, corrosion protection and accessories.
- B. Pre-Engineered Direct-Buried System: The factory-fabricated system.
- C. Carrier Pipe: Pipe carrying the steam or condensate.
- D. Encasement Pipe: Outer protective pipe on any main line pipe. Carrier pipe and insulation are within the casing.
- E. HP Systems: High-pressure piping operating at more than 15 psi (104 kPa) as required by ASME B31.1.
- F. LP Systems: Low-pressure piping operating at 15 psi (104 kPa) or less as required by ASME B31.9.

1.4 ABBREVIATIONS:

A. WOG: water, oil and gas

1.5 DELIVERY, STORAGE AND HANDLING:

A. The Contractor is solely responsible for the protection of equipment and material against damage. Protect piping systems against the entry of water, mud or other foreign substances by installing watertight covers on open ends at all times. Protect direct-buried system coatings from

ultraviolet light (sunlight). Existing equipment worked on by the Contractor or in the Contractor's working area shall be considered to be in the custody and responsibility of the Contractor.

- B. All insulated piping systems exposed to water must be replaced prior to installation.

1.6 COORDINATION:

- A. Coordinate exterior steam lines and connections to building services up to the actual extent of building wall.

1.7 QUALITY ASSURANCE:

A. Products Criteria:

1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

- B. Contractor shall restore damaged items to as-new operating condition or replace damaged items as directed by the Contracting Officer's Representative, at no additional cost to the Government.

C. Welding Qualifications: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with provisions in ASME B31.9, Building Services Piping.
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. ASME Compliance: Comply with ASME B31.9, Building Services Piping for materials, products, and installation.

E. ASME Compliance: Safety valves and pressure vessels shall bear appropriate ASME labels.

1.8 SUBMITTALS:

- A. Manufacturers' Literature and Data shall be submitted, as one package, for pipes, fittings and appurtenances, including jointing materials, insulation, hangars and other miscellaneous items.

1.9 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred in the text by basic designation only.

B. Federal Specifications (Fed. Spec.):

A-A-60005 NOT 1.....Frames, Covers, Grating, Steps, Sump and Catch Basin, Manhole

L-S-125.....Screening, Insect, Nonmetallic

C. Military Specifications (Mil. Spec.):

MIL-S-901.....Shock Tests H.I. (High Impact) Shipboard Machinery, Equipment and Systems

D. American Society for Testing and Materials (ASTM):

A36/A36M-08.....Carbon Structural Steel

A47/A47M-99(2009).....Ferritic Malleable Iron Castings

A53/A53M-10.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

A105/A105M-10a.....Carbon Steel Forgings for Piping Applications

A106/A106M-10.....Seamless Carbon Steel Pipe for High-Temperature Service

A126-04(2009).....Gray Iron Castings for Valves, Flanges, and Pipe Fittings

A139/A139M-04(2010).....Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)

A167-99(2009).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

A193/A193M-10a.....Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications

A194/A194M-10a.....Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both

A197/A197M-00(2006)Cupola Malleable Iron

- A234/A234M-10b.....Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
- A240/A240M-10b.....Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
- A307-10.....Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
- A666-10.....Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
- A733-03(2009).....Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
- B61-08.....Steam or Valve Bronze Castings
- C177-10.....Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
- C411-05.....Hot-Surface Performance of High-Temperature Thermal Insulation
- C449-07.....Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
- C450-08.....Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging
- C533-09.....Calcium Silicate Block and Pipe Thermal Insulation
- C547-07.....Mineral Fiber Pipe Insulation
- C552-07.....Cellular Glass Thermal Insulation
- C585-10.....Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing
- C591-09.....Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

- C655-09.....Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe
- C920-10.....Elastomeric Joint Sealants
- C1126-10a.....Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation
- C1136-10.....Flexible, Low Permeance Vapor Retarders for Thermal Insulation
- D2996-01(2007).....Filament-Wound Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
- D4024-05.....Machine Made Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) Flanges
- E84-10b.....Surface Burning Characteristics of Building Materials
- E. American Society of Mechanical Engineers (ASME):
 - B1.20.1-2006.....Pipe Threads, General Purpose (Inch)
 - B16.3-2006.....Malleable Iron Threaded Fittings: Classes 150 and 300
 - B16.4-2006.....Gray Iron Threaded Fittings: (Classes 125 and 250)
 - B16-5-2009.....Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard
 - B16.9-2007.....Factory-Made Wrought Butt-welding Fittings
 - B16.11-2009.....Forged Fittings, Socket-Welding and Threaded
 - B16.21-2005.....Nonmetallic Flat Gaskets for Pipe Flanges
 - B18.2.1-2010.....Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)
 - B31.1-2010.....Power Piping
 - B31.9-2008.....Building Services Piping
 - B40.1000-2009.....Pressure Gauges and Gauge Attachments

F. American Welding Society (AWS):

B2.1-B2.1M-BMG-2009.....Base Metal Grouping for Welding Procedures and
Performance Qualification

D10.12/D10.12M-2000.....Guide for welding Mild Steel Pipe

G. American Association of State Highway and Transportation Officials
(AASHTO):

M300-03.....Inorganic Zinc-Rich Primer

H. Manufacturer's Standardization Society (MSS):

MSS SP 58.....Pipe Hangers and Supports-Materials, Design,
Manufacture, Selection, Application and
Installation

I. NACE International (NACE):

SP0169-2007.....Control of External Corrosion on Underground or
Submerged Metallic Piping Systems

J. National Fire Protection Agency (NFPA):

255-2006 Ed.....Test Burning Characteristics of Building
Materials

1.10 WARRANTY

A. The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting there from within a period of one year from final acceptance. Further, the Contractor will provide all manufacturer's and supplier's written guarantees and warranties covering materials and equipment furnished under this Contract.

PART 2 - PRODUCTS

2.1 STEEL PIPES AND FITTINGS

A. Steel Pipe: ASTM A53, Type E, Grade A, wall thickness as indicated in "Piping Application" Article; black with plain ends.

B. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
 2. End Connections: Butt welding.
 3. Facings: Raised face.
- C. Steel Welding Fittings: ASME B16.9 and ASTM A234, seamless or welded.
1. Welding Filler Metals shall comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- D. Nipples: ASTM A733, Standard Weight, seamless, carbon-steel pipe.
- E. Pipe-Flange Gasket Materials: ASME B16.21, suitable for chemical and thermal conditions of piping system contents, nonmetallic, flat, asbestos free, 1/8 inch (3.2 mm) maximum thickness unless thickness or specific material is indicated.
1. For flat-face, Class 125, cast-iron and cast-bronze flanges.
 2. For raised-face, Class 250, cast-iron and steel flanges.
- F. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

2.2 LOOSE-FILL INSULATION:

- A. Granular, loose-fill insulation: Inorganic, nontoxic, nonflammable, sodium potassium aluminum silicate with calcium carbonate filler. Include chemical treatment that renders insulation hydrophobic.
1. Thermal Conductivity (k-Value): 0.60 at 175 deg F (0.087 at 79 deg C) and 0.65 at 300 deg F (0.094 at 149 deg C).
 2. Application Temperature Range: 35 to 800 deg F (2 to 426 deg C).
 3. Dry Density: 40 to 42 lb./cu. ft. (640 to 672 kg/cu. m).
 4. Strength: 12,000 lb./sq. ft. (58,600 kg/sq. m).
- B. Powder, loose-fill insulation: Inert, nontoxic, nonflammable, calcium carbonate particles. Include chemical treatment that renders insulation hydrophobic.
1. Thermal Conductivity (k-Value): ASTM C177, 0.58 at 100 deg F (0.084 at 37 deg C) and 0.68 at 300 deg F (0.098 at 149 deg C).
 2. Application Temperature Range: Minus 273 to plus 480 deg F (Minus 169 to plus 250 deg C).
 3. Dry Density: Approximately 60 lb./cu. ft. (960 kg/cu.).
 4. Strength: 12,000 lb./sq. ft. (58,600 kg/sq. m).

2.3 STEAM CARRIER PIPING:

A. Pipe: ASTM A53, steel, seamless, Grade B or ASTM A106, Grade B, electric resistance welded. Standard weight permitted for pipe sizes 12 inches (300 mm) and above. Grade F, furnace butt-welded pipe, is not permitted.

B. Joints:

1. In trenches and direct-buried systems: Butt-weld; socket weld for pipe sizes 2 inches (DN 50) and below. Manufacturer's standard sliding gasketed joints are permitted between sections of WSL pre-engineered direct-buried systems. No joints are allowed in factory-fabricated straight sections of pre-engineered direct-buried systems. Factory-fabricated direct-buried piping sections that are a portion of an expansion loop or bend shall have all welded joints 100% radiograph inspected. All radiographs shall be reviewed and interpreted by an American Society for Non-Destructive Testing (ASNT) Certified Level III radiographer, employed by the testing firm, who shall sign the reading report. Dye penetrant testing may be utilized for pipe sizes 2 inches (50 mm) and below.

2. In tunnels, manholes and open areas: Butt weld pipe sizes 2-1/2 inches (65 mm) and above; thread or socket weld pipe sized 2 inches (50 mm) and below.

C. Fittings:

1. Butt welded joints: ASTM A234 or ASME B16.9, steel, Grade B, same schedule as adjoining pipe. All elbows shall be long radius unless otherwise indicated. Tees shall be full size or reducing as required, having interior surfaces smoothly contoured.

2. Threaded joints: ASTM A47 or ASTM A197 or ASME B16.3, malleable iron, 300 pound (2050 kPa) class.

3. Socket welded joints: ASME B16.11, forged steel, 2000 psi (13,800 kPa) class.

D. Flanges and bolts: ASME B16.5, weld neck, forged steel or ASTM A105, pressure class 150 psi (1025 kPa). Bolts shall be high strength ASTM A193, Class 2, Grade B8. Nuts shall be ASTM A194.

E. Unions: Pipe 2 inches (50 mm) and smaller shall be threaded, malleable

2.4 EXPANSION LOOPS AND BENDS:

A. Stresses: Less than the maximum allowable stress in the Power Piping Code (ASME B31.1). Submit shop drawings and stress and anchor force calculations for all loops and bends. Show locations of all anchors,

guides and supports. Base calculations on 150 psi (1000 kPa) and 366 deg F (185 deg C) for steam line loops and bends and 50 psi (345 kPa) and 310 deg F (154 deg C) for condensate return line loops and bends. Base calculations on actual pressures and temperatures if they are higher than those listed above.

- B. Low pressure steam systems 15 psi (100 kPa) and less: ASME B31.9, base calculations for steam and condensate on 15 psi (100 kPa) and 250 deg F (121 deg C).

2.5 PIPE HANGERS AND SUPPORTS:

- A. Requirements: MSS SP 58 and ASME B31.1.
- B. Applies to all piping not in factory-fabricated direct-buried system. All systems shall be completely supported. Arrange supports so that all loads due to weight, thermal expansion, seismic shock (if applicable), and pressure are transferred from the support system to the structure. The design and location of supports shall at all times prevent excessive forces, moments, and stresses from being imposed on the equipment, structure, supported system, and supports. Heated systems generally require resilient or roller/slide supports.
- C. Manufacturer Certification: Factory built products of a manufacturer whose principle business is pipe supports for 10 years. All components must have published load ratings. For concrete trenches, non-factory built products that comply with details may be utilized.
- D. Drawings:
 - 1. Types, sizes, locations, and spacing of all hangers and supports.
 - 2. Roller or slider supports for all horizontal steam and condensate piping.
 - 3. Special supports including anchors, guides and braces.
 - 4. If equipment and piping arrangement differs from that shown on the drawings, support locations and types shall be revised at no cost to the government.
 - 5. Spring hangers on all systems subject to vertical movement.
 - 6. Roller hangers and sliding supports on all systems subject to horizontal movement.
 - 7. If vertical angle of hanger rod exceeds four degrees, rollers or sliders are required.
 - 8. Vertical deflection: Shall not exceed 0.1 inch (2.5 mm) between supports when system is filled with fluid normally carried.

9. Individual drawing for each hanger assembly showing all components, sizes, calculated loadings. Provide identification tags, on each hanger part, keyed to the layout drawings.
- E. Wall brackets: MSS SP 58, Type 31, 32, or 33.
- F. Pipe stands: MSS SP 58, Type 38.
- G. Riser clamp: MSS SP 58, Type 42.
- H. Alignment guides: Welded steel as shown to restrain movement perpendicular to the long axis of the piping. If not welded, provide steel spider clamped to pipe, enclosed within steel sleeve that is bolted or welded to structural support. Must provide lateral force equal to minimum of 15 percent of anchor loading.
- I. Trapeze supports: MSS SP 58, may be used where pipes are close together and parallel, structural steel channels or angles. Bolt roller supports to steel to support piping subject to horizontal thermal expansion. Attach other piping with "U" bolts.
- J. Pipe covering protection saddles: MSS SP 58, Type 39. Provide at all support points on insulated pipe except where Type 3 pipe clamp is provided.
- K. Sliding supports: MSS SP 58, Type 35. Welded steel attachments to pipe and structure with Teflon or graphite sliding surfaces bonded to the attachments. Provide steel guides, except at expansion bends, to prevent lateral movement of the pipe.
- L. Pipe racks and miscellaneous supports: ASTM A36, structural steel shapes. Manufactured strut systems are acceptable if they have the required load carrying ability.
- M. Supports, including all structural steel, in trenches and manholes: Hot-dip galvanized.
- N. Calcium Silicate Insulation:
1. Preformed piping insulation: ASTM C533, Type I.
 2. Blocks: ASTM C533, Type I.
 3. Fitting Insulation: ASTM C533, with polyvinyl chloride, Type II Grade GU, and Type III, premolded fitted covering 0.020 inches (0.5 mm) thick.
- O. Fiberglass Insulation:
1. Preformed piping insulation: ASTM C547, 450 deg F (230 deg C).

2. Fitting insulation: ASTM C547, 450 deg F (230 deg C), with polyvinyl chloride, Type II Grade GU, and Type III, premolded fitted covering 0.020 inches (0.5 mm) thick.
- P. Rigid closed cell phenolic foam: ASTM C1126, Type III, Grade 1, 250 deg F (121 deg C).
- Q. Cellular glass insulation: ASTM C552.
- R. Insulating and finishing cements: ASTM C449, as recommended by the manufacturer for the type of insulation system and service conditions.
- S. Insulation bands: ASTM A167, minimum of 1/2 inch (12 mm) wide by 0.015 inch (0.4 mm) thick stainless steel.
- T. Aluminum jackets: Minimum of 0.016 inch (0.4 mm) thick aluminum, 3003 alloy, H-14 temper, with locking longitudinal joints. Jackets for elbows, tees and other fittings shall be factory fabricated to match material and construction of the straight run jackets. Factory fabricated stainless steel bands shall be furnished and installed on all circumferential joints. Bands shall be 0.75 inch (20 mm) wide on 18 inch (450 mm) centers. Bands shall be applied with manufacturers recommended sealant. Entire system shall be watertight.
- U. Service jackets: ASTM C1136, white kraft bonded to 0.001 inch (0.025 mm) thick aluminum foil, fiberglass reinforced, pressure sensitive adhesive closure, beach puncture tested to 50 units, suitable for painting without sizing. Jackets shall have a minimum 1-1/2 inch (40 mm) lap on longitudinal joints and not less than 4 inch (100 mm) butt strips on end joints. Butt strip material shall be same as the jacket. Lap and butt strips may be self-sealing type with factory-applied pressure sensitive adhesive.
- V. Glass cloth jacket: A minimum 7.8 ounces per square yard (0.24 kg per square meter), 300 psi (2000 kPa) bursting strength, weathertight for outside service. Beach puncture test to 50 units.
- W. Pipe covering protection saddles: MSS SP 58, Type 39 at all hanger points except where Type 3 pipe clamps are provided.
- X. Fire and smoke ratings of assembled insulation systems: ASTM C411 and NFPA 255, flame spread (25) and smoke developed (50) ratings.

2.6 BURIED UTILITY WARNING TAPE:

- A. Tape: 0.004 inch (0.1 mm) thick, 6 inches (150 mm) wide, yellow polyethylene with a ferrous metallic core, acid and alkali-resistant and shall have a minimum strength of 1750 psi (12,000 kPa) lengthwise and

1500 psi (10,300 kPa) crosswise with an elongation factor of 350 percent. Provide bold black letters on the tape identifying the type of system. Tape color and lettering shall be unaffected by moisture and other substances contained in the backfill material.

PART 3 - EXECUTION

3.1 GENERAL:

- A. Connect new work to existing work in a neat and workmanlike manner. Where an existing structure must be cut or existing utilities interfere, such obstruction shall be bypassed, removed, replaced or relocated, patched and repaired. Piping connections shall be made only in manholes, tunnels or buildings.
- B. Coordinate the location of all items of equipment and work of all trades. Maintain operability and maintainability of the equipment and systems. The contractor at his cost shall perform any relocation of equipment or systems to comply with the requirement of operability and maintainability.
- C. Unless otherwise shown on drawings, steam lines shall be graded downward not less than 2 inches in 40 feet (50 mm in 12 meters) in direction of the flow. Provide eccentric reducing fittings on steam mains and branches, (except on vertical piping). Install said fittings to maintain continuity of grade in bottom of pipeline. Provide risers with drip pockets and steam traps on steam lines where space restrictions prevent continuous grading. All steam traps must be located in manholes or tunnels.

3.2 DEMOLITION:

- A. Perform work in accordance with requirements for phasing and the Drawings.
- B. Completely remove all pipe, valves, fittings, insulation, and all hangers including the connection to the structure and any fastenings.
- C. Seal all openings in manhole or building walls after removal of piping.
- D. All material and equipment removed shall become the property of the Contractor and shall be removed from Government property and shall not be stored in operating areas.

E. All flame cutting shall be performed with adequate fire protection facilities available as required by safety codes and Contracting Officer's Representative.

3.3 PIPING APPLICATION:

A. HP Steam Piping:

1. NPS 2-1/2 through NPS 12 (DN 65 through DN 300): Schedule 80, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
2. Piping with granular or powder, loose-fill insulation.

3.4 PIPING INSTALLATION:

- A. Drawings indicate general location and arrangement of piping systems. Install piping insulation as indicated.
- B. Standing water in the bottom of trench: Remove all water.
- C. Pipe Bedding: Minimum 6 inch (150 mm) layer of sand.
- D. Clearance: Minimum 6 inch (150 mm) clearance between the pipes.
- E. Testing: Do not insulate piping or backfill piping trench until field quality-control testing has been completed and results approved.
- F. Grade:
 1. Install condensate piping at uniform grade of 0.4 percent downward in direction of flow.
 2. Install piping at uniform grade of 0.2 percent downward in direction of flow or as indicated on the Drawings.
- G. Drain Valves and Air Vents: In conduits, install at low points and air vents at high points.
- H. Install components with pressure rating equal to or greater than system operating pressure.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Secure anchors with concrete thrust blocks.
- L. Connect to steam and condensate piping where it passes through the building wall.

3.5 DIRECT-BURIED SYSTEM INSTALLATION:

- A. The Contractor shall oversee the deliver, store, install and test the system as per manufacturer's recommendations. All work shall be in strict accordance with the requirements specified by the manufacturer. Printed instructions must be available on site prior to delivery of system components. Any changes required to the design and layout of the

system due to site conditions must be approved in writing by the Contracting Officer's Representative. All branch piping connections, valves and drip traps must be located within manholes.

- B. Excavation, Trenching, and Backfilling: Perform all excavation, trenching, and backfilling as required by the system manufacturer's design. Beach sand or any sand with large amounts of chlorides is not permitted. Place system on a 6 inch (150 mm) thick sand bed and backfill on all sides with 6 inch (150 mm) thick sand as measured from outside the carrier pipe/insulation. Foundation for system must be firm and stable. Foundation and backfill must be free from rocks. Concrete anchor and thrust blocks must be installed in undisturbed earth. Backfilling must not commence until elevations have been surveyed and accepted and system has been satisfactorily pressure tested including hydrostatic testing of carrier pipes and air testing of casings.
- C. Maintain constant slope of carrier pipes as shown or specified. Prior to backfilling over the top of the casing, but after removal of temporary supports, Contractor shall measure and record elevations of top of casing in the trench. Elevations shall be taken at every field joint, 1/3 points along each pipe section, and at tops of elbows. These measurements shall be checked against contract drawings and shall confirm that the conduit system has been installed to the elevations shown on the contract drawings unless approved by the Contracting Officer's Representative. Slope shall be uniform within 0.1 percent. Measurements shall be recorded by the Contractor, included in the direct buried system manufacturer representative's daily report, and given to the Contracting Officer's Representative prior to covering the top of the casing with backfill.
- D. Remove all dirt, scale, and other foreign matter from inside the piping by use of a pipe swab or pipe "pig" before connecting pipe sections, valves, or fittings.
- E. Sections of system that have been fully or partially submerged in water must be replaced. Moisture content of insulation during installation shall not exceed five percent by weight.
- F. At each casing termination (end plate) in buildings and manholes, plug the casing drain openings with brass plugs and extend 1 inch pipe size galvanized vent pipes (ASTM A53) from the casing vents through the tops

of the manholes or 1 foot (300 mm) above the conduit in buildings.
Terminate the outside vents in 180-degree bends.

- G. Provide reports to the Contracting Officer's Representative that include:
1. Daily written report: Prepared daily and signed by the Contractor. Submit the original report to the Contracting Officer's Representative on the same day it is prepared. Provide one set of field pictures of work daily.
 2. Report Contents: State whether or not the condition and quality of the materials used and the delivery, storage, installation and testing of the system are in accordance with the manufacturer's recommendations, changes to drawings and specifications, any corrective action that was taken of the system, identify any conditions that could result in an unsatisfactory installation.
 3. Report Certification: Daily reports are to be reviewed, signed and sealed by the Professional Engineer responsible for the system installation.
 4. Report Submittals and Stop Order: Daily reports shall be submitted with the payment requests. All work must stop if daily reports are not furnished and requests for payments shall be denied if the daily reports are not furnished.
 5. Certification of Compliance: Upon completion of the work and 30 days prior to final acceptance, deliver to Contracting Officer's Representative a notarized Certificate of Compliance signed by principal officers of Contractor, stating that the installation is satisfactory and in accordance with plans, specifications, and manufacturer's instructions.
 6. The Contractor shall retain copies of all the daily reports and the Certificate of Compliance for 5 years after final acceptance of the system by the Government.
- H. Sections of system that have been fully or partially submerged in water must be replaced. Moisture content of insulation during installation shall not exceed five percent by weight.
- I. At each casing termination (end plate) in buildings and manholes, plug the casing drain openings with brass plugs and extend 1 inch pipe size ASTM A53 galvanized vent pipes from the casing vents through the tops of

the manholes or 1 foot (300 mm) above the conduit in buildings.

Terminate the outside vents in 180-degree bends.

3.6 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: ASME B1.20.1, tapered pipe threads. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified. Joints made with oil and graphite pipe joint compound shall have compound applied to male threads only.
 - 2. 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.
 - 3. Pipe threads shall be cut to give proper engagement in threaded fittings. Clean pipe and fittings before installation and ream pipe after cutting threads. Threaded pipe shall have clean-cut threads; dull or damaged pipe dies shall not be used.
- D. Construct welded joints: AWS D10.12, using qualified processes and welding operators according to "Quality Assurance" Article. Branch connections shall be made with either welding tees or welding outlet fittings. Welding outlet fittings shall be forged, integrally reinforced to provide 100 percent pipe strength, beveled for full penetration welding and funneled at inlet for full fluid flow.
- E. Flanged joints: Select gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Gaskets and bolting shall be applied in accordance with the recommendations of the gasket manufacturer and bolting standards of ASME B31.1. Strains shall be evenly applied without overstress of bolts. Gaskets shall cover entire area of mating faces of flanges.
- F. Location, spacing and cold set of ball joints: Conform to layout drawings approved by manufacturer of ball joints. Representative of manufacturer shall visit site and verify that installation is proper. Locate to allow access to all packing injection devices, when provided.

G. Expansion Joints (Bellows And Slip Type):

1. Type, quantity and spacing of anchors and guides as recommended by manufacturer of expansion joint and as shown. A professional engineer shall verify in writing that anchors and guides are properly designed for forces and moments that will be imposed.
2. Cold setting of joint travel at installation as recommended by the manufacturer for the ambient temperature during the installation.
3. Prepare for service by cleaning all sliding surfaces, add packing as necessary. Remove all apparatus provided to restrain joint during shipping or installation.
4. Expansion joints must be located in readily accessible manhole or in walk-through tunnel. Locate joints to permit access without removing piping or other devices. Allow clear space to permit replacement of joints and to permit access to devices for inspection of all surfaces and for adding packing.

H. Conduit piping joints shall be assembled in sections and finished with pourable or split insulation, exterior jacket sleeve, and apply shrink-wrap seals.

I. All pipe intersections and changes in direction shall be made with factory-built-reinforced fittings. Field-fabricated fittings and miters are not permitted.

3.7 WELDING (ASME B31.1 AND AWA B2.1-B):

A. The Contractor is entirely responsible for the quality of the welding and shall:

1. Conduct tests of the welding procedures used on the project, verify the suitability of the procedures used, verify that the welds made will meet the required tests, and also verify that the welding operators have the ability to make sound welds under standard conditions.
2. Perform all welding operations required for construction and installation of the distribution system.

B. Welder Qualifications: All welders shall be qualified as per ASME B31.1 and AWS B2.1-B2.1M-BMG.

C. Field bevels and shop bevels: Done by mechanical means or by flame cutting. Where beveling is done by flame cutting, surfaces shall be thoroughly cleaned of scale and oxidation just prior to welding. Conform to specified standards.

- D. Utilize split welding rings or approved alternate method for field joints on all carrier pipes above 2 inches (50 mm) to assure proper alignment, complete weld penetration, and prevention of weld spatter reaching the interior of the pipe. Make field joints 2 inches (50 mm) and smaller with welding sockets.
- E. Piping shall not be split, bent, flattened, or otherwise damaged before, during, or after installation. Where the pipe temperature falls to 32 deg F (0 deg C) or lower, the pipe shall be heated to approximately 100 deg F (38 deg C) for a distance of 1 foot (300 mm) on each side of the weld before welding, and the weld shall be finished before the pipe cools to 32 deg F (0 deg C).
- F. Replace and reinspect defective welds. Repairing defective welds by adding weld material over the defect or by peening will not be permitted. Welders responsible for defective welds must be requalified.
- G. Electrodes shall be stored in a dry heated area, and be kept free of moisture and dampness during fabrication operations. Discard electrodes that have lost part of their coating.
- H. An approved independent testing firm regularly engaged in radiographic testing shall perform radiographic examination of all field welds in the carrier piping of the systems, in manholes and in walk-through tunnels, in accordance with ASME B31.1. Furnish a set of films or pictures showing each weld inspected, a report evaluating the quality of each weld, and a location plan showing the physical location where each weld is to be found in the completed project, prior to installing conduit field joints, trench covers, backfilling and hydrostatic testing. All radiographs shall be reviewed and interpreted by an ASNT Certified Level III radiographer, employed by the testing firm, who shall sign the reading report. The Contracting Officer's Representative reserves the right to review all inspection records, and if any welds inspected are found unacceptable they shall be removed, rewelded, and radiographically reexamined at no cost to the Government.

3.8 CLEANING OF PIPING:

- A. Clean pipe and fittings inside and outside before and after assembly. Remove all dirt, scale, and other foreign matter from inside the piping by use of a pipe swab or pipe "pig" before connecting pipe sections, valves, equipment or fittings.

3.9 IDENTIFICATION

- A. Install continuous plastic underground warning tapes during back filling of trenches for underground steam and condensate distribution piping. Locate tapes 12 inches (300 mm) below finished grade, directly over piping.

3.10 IDENTIFICATION SIGNS:

- A. Valves: Provide laminated plastic signs, with engraved lettering not less than 3/16 inch (5 mm) high, on all isolating valves on steam and condensate return system, identifying building or area served. Attach to the valves with corrosion-resistant chains.
- B. Pipes: Label service of all pipes in manholes and walk-thru tunnels.

3.11 FIELD QUALITY CONTROL:

- A. Demonstrate leak-tightness of all piping systems by performing hydrostatic and operational tests. All labor, material and test instruments must be furnished by the Contractor. All instruments must be approved by the Contracting Officer's Representative.
- B. Pressure test direct-buried systems in conformance with requirements stated in this specification and in printed instructions for the system supplied. Tests must include carrier piping and casing.
- C. Holiday testing of direct-buried system steel casings: Test entire surface of casings for faults in coating after installation in trench prior to backfilling. Use test method and voltage recommended by coating manufacturer. Repair any holidays found and retest. System shall not be backfilled until all holidays are eliminated.
- D. Before conducting steam system operating test, remove steam trap elements or use bypass connections around traps; then flush lines with high pressure water until discharge shows no foreign matter to the satisfaction of Contracting Officer's Representative.
- E. Steam and condensate carrier piping shall be tested hydrostatically before insulation is applied at field joints and shall be proved tight at a pressure 1 1/2 times distribution supply pressure for a period not less than 2 hours with no pressure decay.
 - 1. Test piping located in concrete trenches prior to installing trench covers. Test direct-buried systems prior to backfilling.
 - 2. Remove or isolate any elements of the system such as expansion joints, which are not designed for the test pressure.

3. Prior to acceptance of installation, Contractor shall subject system to operating tests as may be required by Contracting Officer's Representative to demonstrate satisfactory functional and operating efficiency. These operating tests shall cover a period of not less than six hours for each portion of system tested. Conduct tests at times as the Contracting Officer's Representative may direct.
 4. Provide calibrated instruments, equipment, facilities and labor, at no additional cost to the Government. Test gage shall read in increments not exceeding 0.1 psi (1 kPa).
 5. Repeat tests when failures occur.
 6. After completion of satisfactory test, replace all elements that have been removed prior to testing.
- F. Deficiencies discovered shall be corrected at the Contractor's expense, to satisfaction of Contracting Officer's Representative. Major deficiencies or failure to correct deficiencies, to the satisfaction of the Contracting Officer's Representative, may be considered cause for rejecting the entire installation.
- G. Contractor will engage a qualified testing agency to perform tests and inspections.
- H. Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- I. Tests and Inspections:
1. Steam and condensate piping for testing: ASME B31.1 and ASME B31.9 and as follows:
 - a. Leave joints, including welds, uninsulated and exposed for examination during test.
 - b. Isolate equipment. Do not subject equipment to test pressure.
 - c. Install relief valve set at pressure no more than one-third higher than test pressure.
 - d. Fill system with temperature water. Where there is risk of freezing, air or a safe, compatible liquid may be used.
 - e. Use vents installed at high points to release trapped air while filling system. Use drip legs installed at low points for complete removal of liquid.
 2. Test steam and condensate piping as follows:

- a. Subject steam and condensate piping to hydrostatic test pressure that is not less than 1.5 times the design pressure.
 - b. After hydrostatic test pressure has been applied for 10 minutes, examine joints for leakage. Remake leaking joints using new materials and repeat hydrostatic test until no leaks exist.
3. Test conduit as follows:
- a. Seal vents and drains and subject conduit to 15 psi (105 kPa) for four hours with no loss of pressure. Repair leaks and retest as required.
- J. Prepare test and inspection reports.

3.12 APPENDIX I - CLASSIFICATIONS FOR DIRECT BURIED SYSTEMS:

A. Groundwater conditions:

Site Classification	General Conditions for Such Classifications
A - Severe	1. The water table is expected to be frequently above the bottom of the system and surface water is expected to accumulate and remain for long periods in the soil surrounding the system, or
	2. The water table is expected to be occasionally above the bottom of the system and surface water is expected to accumulate and remain for long periods in the soil surrounding the system.
B - Bad	1. The water table is expected to be occasionally above the bottom of the system and surface water is expected to accumulate and remain for short periods (or not at all) in the soil surrounding the system, or
	2. The water table is expected never to be above the bottom of the system but surface water is expected to accumulate and remain for long periods in the soil surrounding the system.
C - Moderate	The water table is expected never to be above the bottom of the system but surface water is expected to accumulate and remain for short periods in the soil surrounding the system.
D - Mild	The water table is expected never to be above the bottom of the system and surface water is not expected to accumulate or remain in the soil surrounding the system.

- 1. System Temperature Classifications: High 261 to 450 deg F (127 to 232 deg C); Medium 201 to 260 deg F (94 to 126 deg C); Low 200 deg F (93 deg C) or lower.

2. Soil Conditions:

B. Soil Corrosiveness Classification:

- 1. The soil at the site should be classified as corrosive or noncorrosive on the basis of the following criteria:

2. Corrosive: The soil resistivity is less than 30,000 ohm-cm or stray direct currents can be detected underground.
3. Noncorrosive: The soil resistivity is 30,000 ohm-cm or greater and no stray direct currents can be detected underground.
4. The classification should be made by an experienced corrosion engineer based on a field survey of the site carried out in accordance with recognized guidelines for conducting such surveys.

C. Soil pH:

1. If there is any reason to suspect that the soil pH will be less than 5.0 anywhere along the proposed path of the system, pH measurements should be made at pipeline depth at close intervals along the proposed route, and all locations at which the pH is less than 5.0 should be indicated in the contract documents. An experienced soils engineer, preferably the same engineer responsible for other soil engineering work, should determine soil pH.

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