

**SECTION 23 11 23  
FACILITY NATURAL-GAS PIPING**

SPEC WRITER NOTES:

1. Delete between // // if not applicable to project. Also delete any other item or paragraph not applicable in the Section and renumber the paragraphs.
2. Where the scope of work includes installation of a gas meter, ensure tie-in with the building metering system, if any, at the VA facility. Use Section 25 10 10, ADVANCED UTILITY METERING SYSTEM for guidance.
3. Provide the year of latest edition to each publication listed in Article 1.3 APPLICABLE PUBLICATIONS

**1.1 DESCRIPTION**

- A. Fuel gas systems, including piping, equipment and all necessary accessories as designated in this section. Fuel gas piping for central boiler plants is not included.
- B. A complete listing of common acronyms and abbreviations are included in //Section 23 05 10, COMMON WORK RESULTS FOR BOILER PLANT AND STEAM GENERATION// //Section 23 05 11, COMMON WORK RESULTS FOR HVAC// //Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING//.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- D. //Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.//
- E. Section 07 84 00, FIRESTOPPING.
- F. Section 07 92 00, JOINT SEALANTS.
- G. Section 09 91 00, PAINTING.
- H. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- I. Section 22 05 23, GENERAL DUTY VALVES FOR PLUMBING PIPING.
- J. //Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.//
- K. Section 23 09 11, INSTRUMENTATION AND CONTROL FOR BOILER PLANT.
- L. Section 23 21 11, BOILER PLANT PIPING SYSTEMS.
- M. //Section 25 10 10, ADVANCED UTILITY METERING SYSTEM.//

**1.3 APPLICABLE PUBLICATIONS**

SPEC WRITER NOTE:

1. Make material requirements agree with requirements specified in the referenced Applicable Publications. Verify and

update the publication list to that which applies to the project, unless the reference applies to all mechanical systems. Publications that apply to all mechanical systems may not be specifically referenced in the body of the specification, but, shall form a part of this specification.

2. Insert the year of approved latest edition of the publications between the brackets //---// and delete the brackets if applicable to this project.

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern.
- B. American Society of Mechanical Engineers (ASME):
- B16.3-//2019//.....Malleable Iron Threaded Fittings: Classes 150  
and 300
- B16.9-//2018//.....Factory Made Wrought Buttwelding Fittings
- B16.11-//2011//.....Forged Fittings, Socket-Welding and Threaded
- B16.15-//2018//.....Cast Copper Alloy Threaded Fittings: Classes  
125 and 250
- B16.40-//2019//.....Manually Operated Thermoplastic Gas Shutoffs  
and Valves in Distribution Systems
- B31.8-//2018//.....Gas Transmission and Distribution Piping  
Systems
- C. American Society for Testing and Materials (ASTM):
- A47/A47M-//2018//.....Standard Specification for Ferritic Malleable  
Iron Castings
- A53/A53M-//2018//.....Standard Specification for Pipe, Steel, Black  
and Hot-Dipped, Zinc-Coated, Welded and  
Seamless
- A536-//2019//.....Standard Specification for Ductile Iron  
Castings
- A733-//2016//.....Standard Specification for Welded and Seamless  
Carbon Steel and Austenitic Stainless-Steel  
Pipe Nipples
- B43-//2015//.....Standard Specification for Seamless Red Brass  
Pipe, Standard Sizes

- B687-//2016//.....Standard Specification for Brass, Copper, and Chromium-Plated Pipe Nipples
- D2513-//2019//.....Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings
- D2683-//2014//.....Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
- D3261-//2016//.....Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
- D. American Water Works Association (AWWA):
- C203-//2015//.....Coal-Tar Protective Coatings and Linings for Steel Water Pipes
- E. International Code Council (ICC):
- IFGC-//2018//.....International Fuel Gas Code
- IPC-//2018//.....International Plumbing Code
- F. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):
- SP-72-//2010a//.....Ball Valves with Flanged or Butt-Welding for General Service
- SP-110-//2010//.....Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
- G. NACE International (NACE):
- SP0274-//2011//.....High-Voltage Electrical Inspection of Pipeline Coatings
- SP0490-//2007//.....Holiday Detection of Fusion-Bonded Epoxy External Pipeline Coating of 250 to 760  $\mu\text{m}$  (10 to 30 mil)
- H. National Fire Protection Association (NFPA):
- 54-//2018// .....National Fuel Gas Code

#### 1.4 SUBMITTALS

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 11 23, FACILITY NATURAL-GAS PIPING", with applicable paragraph identification.

- C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
  - 1. Pipe & Fittings.
  - 2. Valves.
  - 3. Strainers.
  - 4. All items listed in Part 2 - Products.
- D. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane.
- E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
  - 1. Include complete list indicating all components of the systems.
  - 2. Include complete diagrams of the internal wiring for each item of equipment.
  - 3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.
- F. //Completed System Readiness Checklist provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.//
- G. //Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.//

#### **1.5 AS-BUILT DOCUMENTATION**

SPEC WRITER NOTE: Coordinate O&M Manual requirements with Section 01 00 00, GENERAL REQUIREMENTS. O&M manuals shall be submitted for content review as part of the close-out documents.

- A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- B. Submit operation and maintenance data updated to include submittal review comments, VA approved substitutions and construction revisions shall be //in electronic version on CD or DVD// inserted into a three-ring binder. All aspects of system operation and maintenance procedures, including applicable piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic,

and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

SPEC WRITER NOTE: Select and edit one of the bracketed options after the paragraph below to indicate the format in which the contractor must provide record drawing files. Select the hand-marked option only when the designer has been separately contracted to provide the record drawings from the contractor's mark-ups. Select the BIM option only when a BIM model will be generated, which is typically only performed by the designer on some Design-Bid-Build projects or by the contractor on some Design-Build projects.

- C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement. Provide record drawings as follows:
1. //Red-lined, hand-marked drawings are to be provided, with one paper copy and a scanned PDF version of the hand-marked drawings provided on CD or DVD.//
  2. //As-built drawings are to be provided, with a copy of them on AutoCAD version // // provided on CD or DVD. The CAD drawings shall use multiple line layers with a separate individual layer for each system.//
  3. //As-built drawings are to be provided, with a copy of them in three-dimensional Building Information Modeling (BIM) software version // // provided on CD or DVD.//
- D. The as-built drawings shall indicate the location and type of all lockout/tagout points for all energy sources for all equipment and pumps to include breaker location and numbers, valve tag numbers, etc.

Coordinate lockout/tagout procedures and practices with local VA requirements.

- E. Certification documentation shall be provided to COR 21 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and provide documentation/certification that all results of tests were within limits specified. Test results shall contain written sequence of test procedure with written test results annotated at each step along with the expected outcome or setpoint. The results shall include all readings, including but not limited to data on device (make, model and performance characteristics), normal pressures, switch ranges, trip points, amp readings, and calibration data to include equipment serial numbers or individual identifications, etc.

SPEC WRITE NOTE: Coordinate pressures with Government requirements.

#### **1.6 SYSTEM PRESSURE**

- A. Natural gas systems //unless otherwise noted// are designed and materials and equipment selected to prevent failure under gas pressure of //    // kPa (//    // psig) //entering government property //    // kPa (//    // psig) at downstream side of pressure regulator//.

### **PART 2 - PRODUCTS**

#### **2.1 FUEL GAS SERVICE CONNECTIONS TO BUILDING**

- A. From inside face of exterior wall to a distance of approximately 1500 mm (5 feet) outside of building.
- B. Pipe: Black steel, ASTM A53/A53M, Schedule 40. Shop-applied pipe coating shall be one of the following types:
1. Coal Tar Enamel Coating: Exterior of pipe and fittings shall be cleaned, primed with Type B primer and coated with hot-applied coal tar enamel with bonded layer of felt wrap in accordance with AWWA C203. Asbestos felt shall not be used; felt material shall be fibrous glass mat in accordance with AWWA C203.
- C. Holiday Inspections: Procedure for holiday inspection: Holiday Inspection shall be conducted on all coatings to determine the presence and number of discontinuities in those coatings using a Tinker & Rasor model AP/W Holiday Detector or equal. Holiday inspection shall be performed in a manner spelled out in the Tinker & Rasor operating

instructions and at a voltage level recommended by the coating manufacturer or applicable NACE standard such as SP0274 or SP0490 in the case thermosetting epoxy coating. Holiday Detectors shall be calibrated and supplied with a certificate of calibration from the factory. A calibration of the Holiday Detector shall be performed once every 6 months to verify output voltages are true and correct.

D. Steel Fittings:

1. Butt weld fittings, wrought steel, ASME B16.9.
2. Socket weld and threaded fittings forged steel, ASME B16.11.
3. Grooved End: Ductile iron (ASTM A536, Grade 65-45-12), malleable iron (ASTM A47/A47M, Grade 32510), or steel (ASTM A53/A53M, Type F or Type E or S, Grade B).

E. Steel Joints: Welded, ASME B31.8.

SPEC WRITER NOTE: Earthquake sensor may be provided on EGSSO valve in lieu of providing separate earthquake valve. Earthquake valves or EGSSO valves with earthquake sensors are required where seismicity is "Moderate-High" or greater (Refer to VA Handbook H-18-8).

**2.2 EMERGENCY GAS SAFETY SHUT-OFF VALVE //WITH EARTHQUAKE SENSOR//**

- A. Permits remote shut-off of fuel gas flow to boiler plant.
- B. Type: Manually opened, electrically held open, automatic closing upon power interruption. Pneumatic operator is prohibited.
- C. Performance: Shall shut bubble tight within one second after power interruption. Refer to the drawings for pressure, flow, and valve size requirements.
- D. Service: Natural gas and LP gas.
- E. Construction: UL listed, FM approved, rated for 861 kPa (125 psig) ASME flanged ends for pipe sizes above 50 mm (2 inches), threaded ends for pipe sizes 50 mm (2 inches) and under. Cast iron, cast steel or bronze body, open and shut indicator. Valves for LP gas service shall be rated at 1725 kPa (250 psig).
- F. Control Switch: Mounted //on Boiler Plant Instrumentation Panel// //in Control Room// //at exterior doorways (multiple switches)//. Switch shall also cut the power to the fuel oil pump set. Refer to Section 23 09 11, INSTRUMENTATION AND CONTROL FOR BOILER PLANT. Provide auxiliary switch to //operate annunciator on Boiler Plant Instrumentation Panel// //provide signal to Computer Work Station//.

G. //Earthquake Sensor: Mechanical device which automatically breaks 120-volt electrical circuit to safety shut off valve when earthquake occurs allowing valve to automatically close. UL listed and shall comply with State of California Standard Codes (Part 12 Title 24 CAC). Valve shall close within 5 seconds after sensor is subjected to horizontal sinusoidal oscillation having a peak acceleration of  $2.94 \text{ m/sec}^2$  (0.3g) and a period of 0.4 seconds. The valve shall not shut off when the sensor is subjected for 5 seconds to horizontal, sinusoidal oscillations having: a peak acceleration of  $3.92 \text{ m/sec}^2$  (0.4g) with a period of 0.1 second; a peak acceleration of  $0.78 \text{ m/sec}^2$  (0.08g) with a period of 0.4 second; peak acceleration of  $0.78 \text{ m/sec}^2$  (0.08g) with a period of 1.0 second. Sensor shall be corrosion-resistant for outside location. Manufacturer: Quake-Defense or equal.//

### **2.3 FUEL GAS PIPING ABOVE GROUND**

- A. Pipe: Black steel, ASTM A53/A53M, Schedule 40.
- B. Nipples: Steel, ASTM A733, Schedule 40.
- C. Fittings:
  - 1. Sizes 50 mm (2 inch) under ASME B16.3 threaded malleable iron.
  - 2. Over 50 mm (2 inch) and up to 100 mm (4 inch) ASME B16.11 socket welded.
  - 3. Over 100 mm (4 inch) ASME B16.9 butt welded.
- D. Joints: Provide welded or threaded joints.
- E. Threaded Metallic Joints: Threaded joints in metallic pipe shall have tapered threads evenly cut. Metal screwed pipe joints shall be made leak-tight by applying Rector Seal No. 5 pipe thread sealant to all threaded joints. Care must be taken to prevent the pipe dope compound from getting inside the internal pipeline. Teflon tape type sealant is prohibited.

### **2.4 EXPOSED FUEL GAS PIPING**

- A. Finished Room: Use full iron pipe size chrome plated brass piping for exposed fuel gas piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Government or specified in other sections.
  - 1. Pipe: ASTM B43, standard weight.
  - 2. Fittings: ASME B16.15 cast bronze threaded fittings with chrome finish, (125 and 250).
  - 3. Nipples: ASTM B687, Chromium-plated.

4. Unions: 50 mm (2 inches) and smaller MSS SP-72, MSS SP-110, brass or bronze threaded with chrome finish. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.
  5. Valves: MSS SP-72, MSS SP-110, brass or bronze with chrome finish.
- B. Unfinished Rooms, Mechanical Rooms and Kitchens: Chrome-plated brass piping is not required. Paint piping systems as specified in Section 09 91 00, PAINTING.

## **2.5 VALVES**

- A. Ball Valve: Bronze body, rated for 1034 kPa at 185 degrees C (150 psig at 365 degrees F), 1723 kPa at 121 degrees C (250 psig at 250 degrees F), reinforced TFE seat, stem seal and thrust washer; end entry, threaded ends, UL-listed for natural or LP gas shut off service when used on those services.
- B. Gas Vent Cocks: Type 701: Bronze body, tee handle, rated for 207 kPa at 38 degrees C (30 psig at 100 degrees F), ground plug, rated for tight shut-off on fuel gas service.

## **2.6 WATERPROOFING**

- A. Provide at points where pipes pass through membrane waterproofed floors or walls in contact with earth.
- B. Floors: Provide cast iron stack sleeve with flashing device and a underdeck clamp. After stack is passed through sleeve, provide a waterproofed caulked joint at top hub.
- C. Walls: See detail shown on drawings.

## **2.7 STRAINERS**

- A. Provide on high pressure side of pressure reducing valves, on inlet side of indicating and control instruments and equipment subject to sediment damage and where shown on drawings. Strainer element shall be removable without disconnection of piping.
- B. Gas Lines: "Y" type with removable mesh lined brass strainer sleeve.
- C. Body: Smaller than 75 mm (3 inches), brass or bronze; 75 mm (3 inches) and larger, cast iron or semi-steel.

## **2.8 DIELECTRIC FITTINGS**

- A. Provide dielectric couplings or unions between ferrous and non-ferrous pipe.

## **2.9 GAS EQUIPMENT CONNECTORS**

- A. Flexible connectors with Teflon core, interlocked galvanized steel protective casing, AGA certified design.

## 2.10 FUEL GAS PIPING BELOW GROUND

- A. Thermoplastic (Polyethylene - PE): PE pipe and heat fusion fittings shall conform to ASTM D2513, SDR 11 and manufactured for 861 kPa (125 psig) working pressure. Pipe and fittings shall have heat fusion joints PE pipe and fitting materials for heat fusion shall be compatible to ensure uniform melting and a proper bond.
- B. Fittings:
  - 1. Socket Fusion Fittings: ASTM D2683.
  - 2. Butt Fusion Fittings: ASTM D3261, molded and matching pipe dimensions.
- C. Risers: Manufacturer's standard anodeless type riser, transition from plastic to steel pipe with fusion bonded epoxy coating. Inlet connection socket or butt weld or swaged gas-tight construction with O-ring seals, metal insert, and protective sleeve. Outlet or above ground connection end shall be threaded or flanged. Riser shall comply with ASTM A53/A53M, Type F and E, Grade A, Schedule 40.
- D. Polyethylene ball valves, ASME B16.40 shall be manufactured and rated for underground gas service. Operating pressure to 861 kPa (125 psig) (SDR 9.3). Valve shall be maintenance and corrosion free. Polyethylene valves shall be full port opening type. Valves shall be wrench operated. Wrench operated valves shall have a 50 mm (2 inch) square adaptor securely fastened to the valve stem. Polyethylene valves shall be installed by butt fusion method.

## 2.11 VALVE BOXES

- A. Provide each valve on buried piping with a plastic or cast iron valve box of a size suitable for the valve. Valve box shall have a round cover with the word "Gas" cast on it. A metal tag or label shall be installed on top or inside of each valve box lid. The tag shall designate the appropriate location number, valve size, and other pertinent information. Each cast iron box shall be given a heavy coat of bituminous paint. Provide adjustable box extensions of length required for depth of buried valve.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Comply with the ICC IFGC, ICC IPC and the following:
  - 1. Install branch piping for fuel gas and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.

2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, shall be reamed to full size after cutting.
3. All pipe runs shall be laid out to avoid interference with other work.
4. Install valves with stem in horizontal position whenever possible. All valves shall be easily accessible.
5. Install union and shut-off valve on pressure piping at connections to equipment.
6. Pipe Hangers, Supports and Accessories:
  - a. All piping shall be supported per the ICC IFGC.
  - b. Shop Painting and Plating: Hangers, supports, rods, inserts and accessories used for Pipe supports shall be shop coated with red lead or zinc Chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
  - c. Floor, Wall and Ceiling Plates, Supports, Hangers:
    - 1) Solid or split unplated cast iron, chrome plated in finished areas.
    - 2) All plates shall be provided with set screws.
    - 3) Pipe Hangers: Height adjustable clevis type.
    - 4) Adjustable Floor Rests and Base Flanges: Steel.
    - 5) Concrete Inserts: "Universal" or continuous slotted type.
    - 6) Hanger Rods: Mild, low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
    - 7) Riser Clamps: Malleable iron or steel.
    - 8) Rollers: Cast iron.
    - 9) Self-drilling type expansion shields shall be "Phillips" type, with case hardened steel expander plugs.
    - 10) Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories.
7. Install cast chrome plated escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
8. Penetrations:
  - a. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke

and gases as specified in Section 07 84 00, FIRESTOPPING.

Completely fill and seal clearances between piping and openings with the fire stopping materials.

- b. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.

B. Fuel gas piping shall conform to the following:

- 1. Entire fuel gas piping installation shall be in accordance with requirements of NFPA 54.
- 2. Provide fuel gas piping with plugged drip pockets at low points.

SPEC WRITER NOTE: Use the following paragraph only for projects with Seismic Design Categories C, D, E, and F.

- 3. //Seismic Data: Refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS. Install automatic shutoff valve (earthquake valve) on discharge side of meter. Valve shall positively shut off supply of gas in case of pressure failure, remain shut off until manually reopened, and be provided with outside adjustment for reset.//

C. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

### **3.2 CLEANING OF SYSTEM AFTER INSTALLATION**

- A. Clean all piping systems to remove all dirt, coatings and debris.  
//Remove all valves, controls etc., and reinstall after piping system has been cleaned.//

### **3.3 TESTS**

- A. General: Test system either in its entirety or in sections after system is installed or cleaned.
- B. Test shall be made in accordance with Section 406 of the International Fuel Gas Code. The system shall be tested at //a minimum of 1.5 times maximum working pressure, but not less than 3 psig (21 kPa) gauge)//  
//100 psig (690 kPa)//.
- C. System Purging: After completing pressure tests, and before testing a gas-contaminated line, purge line with nitrogen at junction with main line to remove all air and gas. Clear completed line by attaching a test pilot fixture at capped stub-in line at building location and let

gas flow until test pilot ignites. Procedures shall conform to NFPA 54 and ASME B31.8.

### **3.4 STARTUP AND TESTING**

- A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.
- C. //The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with COR and Commissioning Agent. Provide a minimum notice of 10 working days prior to startup and testing.//

### **3.5 //COMMISSIONING**

- A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.
- B. Components provided under this section of the specification will be tested as part of a larger system.//

### **3.6 DEMONSTRATION AND TRAINING**

- A. Provide services of manufacturer's technical representative for //4//  
// // hour//s// to instruct each VA personnel responsible in operation and maintenance of the system.
- B. //Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.//

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