SECTION 22 16 00 - FACILITY NATURAL-GAS PIPING

ALL LIBRARIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping and tubing joining materials.
3. Valves.
4. Seismic Valves.
5. Pressure Regulators.
6. Mechanical sleeve seals.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. PE: Polyethylene – Gas piping suitable for underground installations.

E. CSST: Corrugated Stainless Steel Tubing – Suitable for noted interior equipment connections.

1.4 PERFORMANCE REQUIREMENTS

A. Operating-Pressure Ratings:

1. Operating Pressure downstream of Building Service Meter/Regulator Assembly: 2 psig
2. Piping: ranges from 2 psig to 0.5 psig
3. Valves: Refer to valve schedule on plans
4. Equipment Pressure Regulators: Refer to plans

B. Natural-Gas System Pressure within Buildings: Two pressure ranges. Primary pressure is 0.5 psig but not more than 2 psig and is reduced to a secondary pressure of 0.5 psig or less

C. Delegated-Design Submittal: For natural-gas piping and equipment indicated to comply with performance requirements and design criteria including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of seismic restraints.
2. Design calculations: Calculate requirements for selecting seismic restraints.

1.5 SUBMITTALS

A. Product Data: For each type of the following:

1. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
2. Pressure regulators. Indicate pressure ratings, capacities and vent connection sizes.
3. Service meters. Indicate pressure ratings and capacities. Include bypass fittings and meter bars and supports.
4. Dielectric fittings.
5. Mechanical sleeve seals.
6. Seismic Valves.
7. CSST.

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1. Shop Drawing Scale: 1/4 inch per foot.

C. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other trade installations, using input from installers of the items involved.

D. Welding certificates.

E. Field quality-control reports.

F. Operation and Maintenance Data: For equipment pressure regulators to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture. All piping, prior to installation, shall be cleaned of all dirt, debris and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

1.8 PROJECT CONDITIONS

A. Prior to trenching perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:

1. Notify Construction Manager or Coordinating Contractor and Owner no fewer than ten working days in advance of proposed interruption of natural-gas service.
2. Do not proceed with interruption of natural-gas service without Construction Manager's or Coordinating Contractor’s and Owner's written permission.

1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and

facings:

a. Material Group: 1.1.
b. End Connections: Threaded or butt welding to match pipe.
c. Lapped Face: Not permitted underground.
d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE sleeve material.

a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

6. Mechanical Couplings:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Dresser Piping Specialties; Division of Dresser, Inc.
2) Smith-Blair, Inc.

b. Steel flanges and tube with epoxy finish.
c. Buna-nitrile seals.
d. Stainless-steel bolts, washers, and nuts.
e. Couplings shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe and steel pipe to steel pipe.
f. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

B. Underground PE Pipe: ASTM D 2513, SDR 11.

1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
3. Anodeless Service-Line Risers: Factory fabricated and leak tested.

a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
b. Casing: Steel pipe complying with ASTM A 53/A 53M. Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering.
c. Aboveground Portion: PE transition fitting.
d. Outlet shall be threaded or flanged or suitable for welded connection.
e. Tracer wire connection.
f. Ultraviolet shield.
g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

C. Corrugated Stainless Steel Tubing (CSST): NPS 2 and smaller, ASTM E84, ANSI LC1/CSA, ANSI Z223.1 Stainless steel conforming to ASTM A240 rated for 5 and 25 psi, cold formed and

not annealed

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include:

   a. Dormont.
   b. Tracpipe

2. Tubing shall be coated with chemical resistant polymer. Coating shall be yellow.

3. Fittings shall be yellow brass tested and listed with CSA International for concealed use. All joints shall be metal-to-metal flare seal with no gaskets and made with stainless steel pilot insert.

4. All pipe shall be marked with pressure rating, approving agencies marks and manufacturer's name.

5. Installer shall meet the applicable State and local requirements and shall be successfully trained and certified through the manufacturer's installation program.

6. Electrical bonding shall be in accordance with the National Electrical Code NFPA 70 Article 250.104 and National Fuel Gas Code including any State and local ordinances. CSST pipe shall NOT be used as a bonding attachment,

D. Plastic mechanical Couplings, NPS 1-1/2 and smaller: Capable of joining PE pipe to PE pipe.

1. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include the following:

   a. Lyall, R.W. & Company, Inc.
   b. Mueller Co., Gas Products Div.
   c. Perfection Corporation; a subsidiary of American Meter Company.

2. PE body with molded-in, stainless-steel support ring.
3. Buna-nitrile seals.
4. Acetal collets.
5. Electro-zinc-plated steel stiffener.

E. Plastic mechanical Couplings, NPS 2 and larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

1. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include the following:

   a. Lyall, R.W. & Company, Inc.
   b. Mueller Co., Gas Products Div.
   c. Perfection Corporation; a subsidiary of American Meter Company.

2. Fiber-reinforced plastic body.
3. PE body tube.

4. Buna-nitrile seals.
5. Acetal collets.
6. Stainless-steel bolts, nuts, and washers.

F. Plastic Mechanical Couplings, NPS 2 and larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

1. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include the following:

a. Lyall, R.W. & Company, Inc.
b. Mueller Co., Gas Products Div.
c. Perfection Corporation; a subsidiary of American Meter Company.

2. Fiber-reinforced plastic body.
3. PE body tube.
4. Buna-nitrile seals.
5. Acetal collets.
6. Stainless-steel bolts, nuts, and washers.

G. Steel Mechanical Couplings, Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

1. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Dresser Piping Specialties; Division or Dresser, Inc.
b. Smith-Blair, Inc.
c. Mueller Co., Gas Products Div.

2. Stainless-steel Flanges and tube with epoxy finish.
3. Buna-nitrile seals.
4. Stainless-steel bolts, nuts, and washers.
5. Factory-installed anode for steel body couplings installed underground.

2.2 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 MANUAL GAS SHUTOFF VALVES

A. General Requirements:

1. Two-piece bronze body, full-port chrome-plated ball, brass stem, corrosion resistant retainer and gland screws. Comply with CSA/ANSI Z21.15, CGA9.1. Service Mark Initials ½ psi 5G shall be permanently marked on valve body for valves up to 1-1/2

inches. Valves 2-inches and above shall have the initials “WOG” permanently marked on valve body.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Conbraco Industries, Inc.; Apollo Div.
   b. BrassCraft Manufacturing Co.; A Masco Company.
   c. McDonald, A.Y. Mfg. Co.

B. See plans for “Gas Shutoff Valve Schedule" where each valve type is applied in various services.

C. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ANSI Z21.15, ASME B16.33, B16.44 and CSA requirement 3-88.

   1. OWP Rating: 600 psig.
   2. Threaded Ends: Comply with ASME B1.16.44
   3. Tamperproof Feature: Locking feature for valves indicated in "Gas Shutoff Valve Schedule" Articles.

D. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

   1. OWP Rating: 600 psig
   2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
   3. Tamperproof Feature: Locking feature for valves indicated in “Gas Shutoff Valve Schedule" Articles.

2.4 SOLENOID GAS VALVES

A. Electrically Operated Valves: Comply with UL 429.

   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

      a. ASCO Power Technologies, LP; Division of Emerson.
      b. Dungs, Karl, Inc.
      c. Eclipse Combustion, Inc.
      d. Goyen Valve Corp.; Tyco Environmental Systems.
      e. Magnatrol Valve Corporation.
      f. Parker Hannifin Corporation; Climate & Industrial Controls Group; Skinner Valve Div.
      g. Watts Regulator Co.; Division of Watts Water Technologies, Inc.

   2. Pilot operated.
   3. Body: Brass or aluminum.
   4. Seats and Disc: Nitrile rubber.

5. Springs and Valve Trim: Stainless steel.
6. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
7. NEMA ICS 6, Type 4, coil enclosure.
8. Normally closed.
9. Visual position indicator.

2.5 EARTHQUAKE VALVES

A. Earthquake Valves: Comply with ASC 25.

1. Manufacturers: Subject to compliance with available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Vanguard Valves, Inc.
   b. Pacific Seismic Products, Inc.
   c. Northridge

2. Listing: Listed and labeled by an NRTL acceptable to the authorities having jurisdiction.
3. Maximum Operating Pressure: 2 psig
4. Cast-aluminum body with nickel-plated chrome steel internal parts and stainless steel ball for horizontal installation.
5. Nitrile-rubber, reset-stem, o-ring seal.
6. Composition valve seat with clapper held by spring or magnet locking mechanism.
7. Level indicator.
8. End Connections: Threaded for valves NPS 2 and smaller; flanges for valves NPS 2-1/2 and larger.
9. Manual reset
10. Operation set point; Magnitude 5.0 on the Richter scale.
11. Stabilizer bracket assembly with rigid building connection.

2.6 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. American Meter Company.
   b. Fisher Control Valves and Regulators; Division of Emerson Process Management.
   c. Maxitrol Company.
   d. Actaris.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 2 psig

2.7 DIELECTRIC FITTINGS

A. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Hart Industries International, Inc.
   b. McDonald, A. Y. Mfg. Co.
   c. Watts Regulator Co.; Division of Watts Water Technologies, Inc.

2. Minimum Operating-Pressure Rating: 2 psig
3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

B. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Watts Regulator Co.; Division of Watts Water Technologies, Inc.

2. Minimum Operating-Pressure Rating: 150 psig.
3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

C. Dielectric-Flange Kits:

1. Manufacturers: Subject to compliance with requirements, available manufacturers

offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Advance Products & Systems, Inc.
b. Calpico Inc.
c. Pipeline Seal and Insulator, Inc.

2. Minimum Operating-Pressure Rating: 150 psig.
3. Companion-flange assembly for field assembly.
4. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or PE bolt sleeves, phenolic washers, and steel backing washers.
5. Insulating materials suitable for natural gas.
6. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.8 SLEEVES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.9 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Advance Products & Systems, Inc.
b. Calpico Inc.
c. Metraflex Company (The).
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
3. Pressure Plates: Carbon Steel.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.

2.10 ESCUTCHEONS

A. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to fit around pipe or tube, and OD that completely covers opening.

B. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-

plated finish.

C. One-Piece, Cast-Brass Escutcheons: With set screw.

1. Finish: Polished chrome-plated or rough brass.

D. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.

1. Finish: Polished chrome-plated or rough brass.

E. One-Piece, Stamped-Steel Escutcheons: With set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Escutcheons: With concealed hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Escutcheons: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.

2.11 LABELING AND IDENTIFYING

A. Underground Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, PE natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.

C. Install underground PE natural-gas piping according to ASTM D 2774.

D. Gas piping installed across roof surfaces shall be steel pipe and fittings primed and painted.

E. Install fittings for changes in direction and branch connections.

F. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

G. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for minimum 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

H. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

I. Flexible connections to gas fired equipment are prohibited. Unless otherwise noted on drawings.

3.4 INDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation, cleaning and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved in writing by the Engineer.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access and operation.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Install escutcheons at penetrations of interior walls, ceilings, and floors.

1. Piping Escutcheons:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

M. Verify final equipment locations for roughing-in.

N. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

O. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

P. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof and insect proof vent cap. Relief vent lines to be installed with positive slope towards outdoors. Maintain ten foot minimum distance from air intakes, windows, doors and openings.

Q. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

R. Installation: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
2. Prohibited locations: Natural-gas piping shall not be cast in concrete floor or wall slabs. Piping shall not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors Coordinate first subparagraph below with Drawings.
3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
4. In Walls or Partitions: Protect piping installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

5. Prohibited Locations:

    a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    b. Do not install natural-gas piping in solid walls or partitions.

S. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

T. Connect branch piping from top or side of horizontal piping.

U. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

V. Do not use natural-gas piping as grounding electrode.

W. Install strainer on inlet of each line-pressure regulator and automatic operated valve.

X. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

Y. Flexible connections to gas fired equipment are prohibited. Unless otherwise noted on drawings.

3.5 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

3.6 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Piping and Equipment."

B. Comply with requirements for pipe hangers and supports specified in Division 22 Section "Hangers and Supports for Piping and Equipment."

C. Roof gas piping supports shall be as detailed on plans. Piping shall be elevated not less than 3-1/2 inches above finished roof surface and protected from physical damage. Support spacing shall meet the same spans noted for horizontal steel piping hangers.

D. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches: minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 (DN 100) and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.7 CONNECTIONS

A. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

B. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.8 LABELING AND IDENTIFYING

A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.9 PAINTING

A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.

B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint and primer.

1. Alkyd System: MPI EXT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Exterior alkyd enamel (semi-gloss).
d. Color: Yellow

C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.10 FIELD QUALITY CONTROL

A. Arrange for demonstration of building piping system pressure test with Gas Company representative and/or the Authority having jurisdiction. Testing medium shall be compressed air, nitrogen or other inert gas. Minimum test pressure shall be twice the maximum working pressure but not less than 10 psig for a minimum of ½ hour per 500 feet of system piping or fraction thereof. Test gauges shall be in 1 psig increments or less.

B. Tests and Inspections:

1. Conduct pressure test, inspect, and purge natural gas according to the International Fuel Gas Code, NFPA 54 and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare written test and inspection reports. Submit reports to Engineer for review.

3.11 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.12 OUTDOOR PIPING SCHEDULE

A. Aboveground and roof mounted natural-gas piping shall be the following:

1. Steel pipe with wrought-steel fittings and welded joints.

B. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Prime and paint pipe and fitting.

3.13 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, distribution and branch piping NPS 1 and smaller shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

3.14 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND LESS THAN 5 PSIG

A. Aboveground, branch piping NPS 1-1/2 and smaller shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping NPS 2 and larger shall be the following:

1. Steel pipe with steel welding fittings and welded joints.

3.15 ABOVEGROUND MANUAL GAS SHUTOFF VALVES

A. Distribution piping valves for pipe sizes NPS 1-1/2 and smaller shall be one of the following:

1. Two-piece, full-port, bronze ball valves with bronze trim, threaded ends.

B. Distribution piping valves for pipe sizes NPS 2 and larger shall be one of the following:

1. Two-piece, full-port, bronze ball valves with bronze trim, flanged ends.

C. Refer to gas valve schedule on plans.

END OF SECTION 22 16 00