PART 1 GENERAL

1.1 DESCRIPTION

- A. The requirements of this section apply to the fuel gas distribution systems for the facility.
- B. Related Work: The requirements of Section 23 0500, Common HVAC Materials and Methods, also apply to this section.

1.2 CODES AND STANDARDS

- A. Comply with the provisions of the following referenced codes, standards and specifications:
 - 1. National Fire Protection Association (NFPA)
 - 2. Underwriters Laboratories, Inc. (UL)
 - 3. Factory Mutual (FM)
 - 4. National Fuel Gas Code (NFPA 54)
 - 5. Liquefied Petroleum Gas Code (NFPA 58)
 - 6. International Mechanical Code (IMC) with State and Local Amendments
 - 7. American Society for Testing and Materials (ASTM)
 - 8. International Fire Code (IFC) with State and Local Amendments
 - 9. American Gas Association (AGA)

1.3 SUBMITTALS

A. Required for all items.

PART 2 PRODUCTS

2.1 PIPING MATERIALS

- A. Black Steel Pipe:
 - 1. Applications: Indoors or underground.
 - a. Natural Gas.
 - b. LP gas (Propane).
 - 2. Pipe: Systems 10" or smaller, operating below 400 psi, schedule 40, standard black steel pipe ASTM A-106, A-53 or ASME B36.10, 10M.
 - 3. Underground Piping: Coated with a minimum of ten mils of factory applied 100% thermosetting epoxy resin.
 - 4. Threaded Fittings: For above ground installations only. Banded class 150 malleable iron fittings, ANSI B16.3 to 150 psi.
 - 5. Welding Fittings: Standard weight, seamless steel, beveled end fittings, ANSI B16.9.
 - 6. Flanged Fittings: For above ground installations only.
 - a. Class 150 steel welding neck flanges, ANSI B16.9 to 150 psi.
 - b. Facing and Gasketing: Selected for service pressures and temperatures. Raised face for steel flanges.
- B. Galvanized Steel Pipe:
 - 1. Applications: Above ground only.
 - a. Natural gas, outdoors.
 - 2. Pipe: Schedule 40, standard galvanized steel pipe, ASTM A-53 or A-106.
 - 3. Fittings: Banded class 150 galvanized malleable iron threaded fittings, ANSI B16.3.
- C. Flexible Fuel Gas Piping (CSST):
 - 1. Application: 2 psi or less:

- a. Natural gas
- 2. Pipe: Corrugated 300 series stainless steel tubing with yellow polyethylene jacketing.
- 3. Fittings: Fittings shall be yellow brass and provide a self-flaring connection to the tubing. Systems incorporating gaskets or o-rings are not acceptable.
- 4. Underground Installations: CSST pre-sleeved with heavy wall internally ribbed polyethylene secondary venting conduit with end seals and vent connection fittings.
- 5. Approvals: System shall be listed with ANSI LC/1 and approved for use by the local code officials. TracPipe, Gastite, or approved.
- D. Copper Pipe and Tube:
 - 1. Application:
 - a. LPG (Propane gas)
 - b. Regulator vents.
 - 2. Pipe: ASTM B88.
 - a. Above Ground: Type L hard temper copper with brazed joints.
 - b. Underground: Type L soft annealed with no joints or type K hard tempered copper with brazed joints.
 - 3. Fittings: Wrought copper solder-joint fittings, ANSI B16.22.

2.2 PIPING ACCESSORIES

- A. Fuel Gas Valves: UL listed or AGA approved valves.
 - 1. Manually operated shut-off valves for use in gas piping systems up to 1/2 psig shall comply with ANSI Z21.15.
 - 2. Manually operated metallic gas valves for use in gas piping systems up to 125 psig (sizes 1/2 inch through 2 inch) shall comply with ASME B16.33.
 - 3. Manually operated metallic gas valves for use in aboveground gas piping systems up to 5 psig shall comply with ASME B16.44.
 - 4. 10 psig or Less:
 - a. Ball: NIBCO bronze body T/S 585-70-UL, brass body FP-600.
- B. Strainers: Threaded bronze or iron body for 175 working pressure, Y pattern with [40] [60] mesh start-up strainer and stainless steel perforated screen basket with 50 percent free area.
- C. Gas Pressure Regulators: Size based on pressures indicated on the drawings and for 1.5 times connected load. Style and model as approved by Northwest Natural Gas Co. / serving utility. Maxitrol, Rockwell, Fisher, Reliance, or approved substitute.
 - 1. Line gas pressure regulator shall be in listed as complying with ANSI Z21.80.
- D. Gas Appliance Connectors: For low pressure gas connection to indoor or outdoor rigidly mounted stationary appliances, AGA approved corrugated stainless steel tubing with zinc plated steel end fittings. Brasscraft or approved substitute.
 - 1. Appliance gas pressure regulator shall be listed as complying with ANSI Z21.18
- E. Gas Connection Hose: For low pressure gas connection to moveable appliances including cooking equipment, flexible hose consisting of inner tube, stainless steel braid, and outer protective jacket with swivel steel threaded end fittings. T & S Brass HG series, or approved substitute.
 - 1. Outdoor gas appliance flexible connectors shall be listed and labeled as complying with ANSI Z21.75/CSA 6.27.
 - 2. Indoor fixed gas appliance flexible connectors shall be listed and labeled as complying with ANSI Z21.24.

- F. Gas Meter: Diaphragm style positive displacement meter in primed and painted weather resistant cast aluminum case. Delivery pressure rating, flow, and fuel gas as indicated on the drawings. Maximum allowable operating pressure rating of 2 psi or greater. Temperature compensated style where installed outdoors. ANSI B109.1 compliant. Accuracy of +/- 0.5% over rated flow range. Pointer style cubic foot register with security seals. Provide with meter mounting bar and shutoff valve. American Meter, Equimeter, or approved.
- G. Solenoid Gas Shutoff Valve: Normally closed solenoid valve, ASCO or approved.
- H. Seismic Gas Shutoff Valve.

2.3 EXPANSION JOINTS AND LOOPS

A. Flexible Expansion/Seismic Loop: Factory fabricated assembly consisting of two elbows and return bend or three elbows, and two lengths of flexible hose to allow free movement in three axis. Return bend or elbow shall include a drain/vent fitting. Hose shall be corrugated metal style with metal overbraid compatible with the piping materials. Connections to match piping system except connection 2" and larger shall be flanged style. Listed for fuel gas use. Metraflex "Metraloop" or Unisource "Uni-loops".

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Locating and Positioning Equipment: Observe all Codes and Regulations and good common practice in locating and installing mechanical equipment and material so that complete installation presents the least possible hazard. Maintain adequate clearances for repair and service to all equipment. Installation of any equipment with less than minimum clearances shall not be accepted.
- B. Anchorage: Anchor and/or brace mechanical equipment and piping to resist displacement due to seismic action.
- C. Gas Pressure Regulators: Install with drip leg at regulator inlet and capped test tees at inlet and outlet piping connections.
 - 1. Provide shutoff valve upstream of the pressure regulator.
 - 2. Vent to exterior in accordance with code requirements except where vent limiting devices are installed.
 - a. Vent piping shall be not smaller than the vent connection on the pressure regulating device.
 - b. Provide a weatherproof vent cap at vent discharge with corrosion resistant wire screen. The free area of the vent cap shall be equal to the cross-sectional area of the connecting vent pipe.
- D. Provide gas shutoff valve and union upstream of the appliance. Install in the same room within 6 feet of the appliance.
- E. Sediment trap: Provide a tee fitting with capped nipple installed vertically in the bottom tee opening. Install sediment trap downstream of the shutoff valve and close to the appliance.
- F. Provide shutoff valve upstream of the gas meter.
- G. Provide an emergency gas shutoff valve outside of each building.
- H. Provide maintenance access and service clearance to shutoff valves and pressure regulators.

I. Install underground valves in valve boxes.

3.2 PIPE INSTALLATION

- A. General: Install pipe, tube and fittings in accordance with recognized industry practiced for each indicated service without piping failure. Install each run with a minimum of joints and couplings, but with adequate and accessible unions and flanges for disassembly, maintenance and/or replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections.
- B. Ferrous Threaded Piping: Thread pipe in accordance with ANSI 82.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave no more than 3 threads exposed.
- C. Flexible Gas Piping (CSST): Comply with manufacturer's recommendations for system installation. Provide striker plates and supports as required. All penetrations of finished walls, including mechanical room walls, shall be accomplished using surface or recessed termination fittings. Where installed underground below a building, vent the conduit to outdoors per Code.
- D. Changes in Direction: Use fittings for all changes in direction. Run lines parallel with building surfaces.
- E. Unions and Flanges: At all equipment to permit dismantling and elsewhere as consistent with good installation practice.
- F. Expansion: Provide loops, swing joints, anchors, runouts and spring pieces to prevent damage to piping or equipment.
- G. Underground Gas Piping: Standard schedule 40 black steel pipe with welding fittings coated with a minimum of ten mils of 100% thermosetting epoxy resin, Scotchkote No. 203 factory applied per resin manufacturer's recommendations. Wrap all joints with 10 mil polyvinyl chloride pipewrap tape to a total thickness of 40 mils. Provide one 15 pound magnesium anode per each 100' of underground pipe, attached to coupling or other fitting with No. 10 copper wire. No underfloor slab natural gas piping except as provided for by code.
- H. Comply with NFPA 54 for installation, testing, inspection and purging of gas piping systems. Slope piping towards drips no less than 1/4 inches in 15 feet.
- Provide drips in the line of piping where condensate can collect and gas meters outlets.
 Do not install drips where subject to freezing.
- J. Additional gas piping requirements:
 - 1. Install outdoor piping no less than 3-1/2 inches above ground.
 - 2. Install gas piping located on the roof no less than 3-1/2 inches above the roof surface.
 - 3. Install a yellow insulated copper tracer wire (18 AWG) conductor adjacent to underground non-metallic piping.
 - 4. Piping supports:
 - a. Provide pipe hangers and supports in conformance with MSS-SP-58. The installation shall allow free expansion and contraction of the piping.
 - b. Provide seismic restraint devices as required by the building code per ASCE 7.
 - c. Pipe shall be supported at following intervals:

Steel Pipe	Support Spacing
Inches	Feet

1/2	6
3/4 or 1	8
1-1/4 or larger (horizontal)	10
1-1/4 or larger (vertical)	Every floor level
Tubing	Support Spacing
Inches O.D.	Feet
1/2	6
5/8 or 3/4	8
7/8 or 1 (horizontal)	10
1 or larger (vertical)	Every floor level

3.3 GAS SERVICE

A. Contact Northwest Natural Gas Co. service as required and pay all costs involved. Run all gas distribution piping and make final connections to all gas using equipment. Install regulators to deliver proper inlet pressures and vent regulators to outside where required.

3.4 CLEANING

- A. General: Clean all dirt and construction dust and debris from all mechanical piping systems and leave in a new condition. Touch up paint where necessary.
- B. Fuel Piping: Blow clear of debris with nitrogen or oil free air.

3.5 TEST

- A. General: Minimum duration of two hours or longer, as directed for all tests. Furnish report of test observation signed by qualified inspector. Make all tests before applying insulation, backfilling, or otherwise concealing piping or connecting fixtures or equipment. Where part of the system must be tested to avoid concealment before the entire system is complete, test that portion separately, same as for entire system.
- B. Natural Gas Piping: Gas-piping systems under 14 inches water column pressure shall be tested at a pressure of not less than 10 pounds per square inch gauge for a duration of 15 minutes. For welded piping and piping carrying gas at pressures exceeding 14 inches water column pressure the test pressure shall be at least 60 pounds per square inch for not less than 30 minutes or as approved and certified by serving utility.

3.6 MECHANICAL PAINTING

A. Uninsulated Piping: Paint black steel piping in moist equipment rooms, crawl spaces, inside of secondary containment piping, or exposed to weather two (2) coats black rust-inhibiting paint.

END OF SECTION