

5.23.10 – FACILITY FUEL SYSTEMS

DESIGN AND CONSTRUCTION STANDARD

PART 1: GENERAL

1.01 Purpose:

This standard is intended to provide useful information to the Professional Service Provider (PSP) to establish a basis of design. The responsibility of the engineer is to apply the principles of this section such that the University may achieve a level of quality and consistency in the design and construction of their facilities. Deviations from these guidelines must be justified through LCC analysis and submitted to the University for approval.

1.02 References:

A. Codes and Standards that are Standard at the University:

1. AGA Compliance: LC 1-91 – Interior Fuel Gas Piping Systems
2. ANSI Compliance: Fabricate and install natural gas piping in accordance with ANSI Z223.1 "National Fuel Gas Code", Z21.15 "Gas Valves", Z21.18 "Pressure Regulators", Z21.21 "Automatic Valves for Gas Appliances", Z21.80 "Line Pressure Regulators", B109.1 and B109.2 "Meters" and ANSI 144 "Boilers".
4. NFPA Compliance: Fabricate and install natural gas systems in accordance with NFPA 54 "Natural Fuel Gas Code" and NFPA 30 "Flammable and Combustible Liquids".
6. Utility Compliance: Design and install natural gas systems in accordance with local gas utility company.
8. Code Compliance: Design and install natural gas systems in accordance with International Fuel Gas Code requirements as well as all local amendments.
9. FM Global and IRI Compliance: Factory Mutual Insurance and Industrial Risk Insurers.

1.03 Requirements:

- ###### A.
- Design system to achieve a minimum pressure drop of .05 inches w.c., with a minimum pressure down stream of the meter at 7 inches w.c. to 14 inches w.c. and a maximum operating pressure of 5 psig pressure downstream of the meter. Higher operating pressure requires pre approval from U.T. Facilities Services.

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- B. Design shall include all information required by the Authority Having Jurisdiction and UT Facilities Services and Utilities departments.
- C. Design shall include piping layout indicating total equivalent length pipe and all connected equipment, total friction loss in piping system and equipment demand capacities (total connected load) throughout piping system.
- D. Indicate minimum pressure requirements at outlet of meter, extent of work to be completed by utility company, meter location, work required by owner to allow meter assembly to be installed, all site information including building location, gas service location (utility supply mains), any low pressure cutoff requirements, equipment with pilot lights and all future equipment and capacities.
- E. Provide sleeved pipe runs through enclosed spaces, plenums and above corridor ceilings. Ventilate sleeve on both ends to exterior of building. Route piping exposed in ventilated spaces where possible.
- F. Base pressure ratings on natural gas piping system maximum design pressures.
- G. Provide pipe identification complying with ANSI A13.1 Scheme for Identification of Piping Systems in accordance with the following:
 - 1. Building Distribution Piping: Plastic pipe markers
 - 2. Gas Service: Underground type plastic line markers
 - 3. Gas Valves: Plastic valve tags
- H. Gas piping entering a building shall first rise above grade exterior to the building and be provided with a wrench operated shutoff valve in the horizontal portion of the exterior piping.
- I. It shall be the Contractor's responsibility to make all arrangements and pay for all services, fees, and material which are required to have the gas company extend its gas main to the property line and to install the regulator and/or meter required for the project.
- J. Verify and coordinate, with the actual various users on the site, all the times and timing involved with modification, additions to, or alterations thereof, of gas piping serving these users
- K. The gas regulator bypass globe valve shall be sized to provide a pressure drop equal to the regulator when fully open. It shall include provision for locking shut with a large padlock.
- L. Provide a wrench operated plug cock valve at the inlet and discharge side of the

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gas meter and pressure regulators and at building entrance.

- M. Provide zone valves on each floor accessible to occupants for shutting off areas of the building under emergency conditions. Gas piping shall be welded up to these zone valves.
- N. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- O. Route piping in orderly manner to conserve building space and not to interfere with use of space. Maintain gradient and group piping wherever practical at common elevations.
- P. Design piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- Q. Route piping parallel to other piping. Maintain a minimum of 12" clearance between gas piping and steam or hydronic piping above 200 degrees F.
- R. Provide shutoff gas cock and drip leg at each gas-fired equipment connection. Comply with equipment manufacturer's instructions.
- S. Provide gas shutoff outside building, upstream of meter, at pipe entry to building in adjustable gas service valve box with cover set flush to finish grade.
- T. Provide access where valves and fittings are not exposed. Coordinate access door location with architectural features.
- U. Establish elevations of buried piping outside the building to ensure a minimum of cover.
- V. Provide protective bollards for gas meter installations, horizontally spaced no more than four feet apart and 36" high. Bollards should be constructed of galvanized steel, 6" diameter, with a minimum 0.25" wall thickness, or 4" diameter concrete-filled, schedule 40 galvanized steel pipe. Bollards should be permanent-type, epoxy primed and painted, and anchored to 18" X 42" concrete foundation with ASTM 3/4" x 12" ASTM - A36 galvanized L hook anchor bolts.

PART 2 PRODUCTS

2.01 Pipe and pipe fittings:

- A. All pipe used for the fabrication of gas piping systems shall be Schedule 40 black steel pipe ASTM A-53.

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- B. Unless otherwise specifically required, all steel pipe provided for gas piping systems shall be provided with plain ends and assembled with weld fittings on all pipe 1-1/4" and larger and 3/4" and larger if before the emergency shut off valve. No pipe smaller than 3/4", except as detailed for laboratory furniture, shall be used. From the emergency shutoff valve to the outlets, the pipe shall be assembled with threaded fittings provided all joints are exposed or within the confines of the laboratory furniture.
- C. Machine wrap pipe using 50% overlap wrap, with polyvinyl chloride tape. Hand wrap fittings using 100% overlap wrap extending 6" beyond fitting onto wrapped pipe. Comply with tape manufacturer's installation instructions. Installation standards and procedures of the utility company shall be strictly followed. At a point 6' from the building and the final riser to meter or building entrance point shall be wrapped steel.
- D. Unless otherwise specifically shown or called for, gas piping systems installed throughout the building shall be fabricated by a fusion welding process making use of welding fittings. These fittings shall be fittings as specified in other Sections. In no case shall the wall thickness of a fitting incorporated in a gas piping system be less than that of the pipe to which it is jointed.

2.02 Valves:

- A. Gas Cocks 2" and smaller shall be AGA approved 150 PSI non-shock WOG, bronze straightway cock, flat or square head with threaded ends.
- B. Gas cocks 2-1/2" and larger shall be AGA approved 125 PSI non-shock WOG, iron body bronze mounted, straightway cock, square head with flanged ends.
- C. Master control valve shall be packless, single seat, bronze body, explosion-proof solenoid operated. It shall be normally closed, UL approved, 120 volt, with automatic reset.
- D. Control station shall be pushbutton station mounted in 2-gang box, one normally open key operated contact, and one normally closed pushbutton operated contact. Faceplate shall be inscribed with "Gas Valve Control" on top, "Open" over keyhole, and "Closed" over pushbutton.
- E. Pressure regulating valves shall be single stage, steel jacketed, corrosion-resistant gas pressure regulator. Provide with elevation compensator and atmospheric vent routed to outdoors, full size of outlet, and terminated in weather proof hood. Provide with threaded ends for 2" and smaller, flanged ends for 2-1/2" and larger. Size for required inlet and outlet gas pressures, specific gravity and volume flow. Provide gas shutoff valve upstream of each pressure regulating valve.

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- F. Provide AGA plug valves for shut-off and to isolate equipment, part of systems, and vertical risers.

2.03 Flanges:

- A. In all instances in which flanges are required for the installation of flanged fittings for gas lines, the Contractor shall provide Crane or Walworth weld neck pattern, Class 150 forged steel flanges

2.04 Drip Pipes:

- A. Drip pipes shall be provided throughout the gas piping systems for the purpose of accumulating moisture and condensate. They shall be sized no smaller than the gas piping to which they are connected in each instance. These drip pipes shall be U-shaped providing an effective water seal of no less than twelve inches (12") of water. The extremity of each U-shaped drip pipe shall be threaded and capped with a suitably sized, screwed pattern, black, standard weight, malleable iron cap.
- B. All drip pipes shall be located in an accessible position so that the condensate may either be pumped from the system or so that a water seal shall be provided in the event that the water forming the seal evaporates.

J. **HEADERS:**

- A. The gas distribution header installed by this Contractor in the building shall be fabricated of Schedule 40 steel pipe. The pipe and welding materials for this header shall be carefully selected, and the welding operations shall be carefully supervised.
- B. Welding nipples neatly aligned shall be provided for the outlets of the header. After the header has been completely fabricated, it shall be temporarily sealed and subjected to a pneumatic test pressure of 100 pounds per square inch. While the header is subjected to this pressure, all welded joints shall be given an application of soapy water for the purpose of detecting minute leaks which might not otherwise be observed. These leaks shall not be repaired by any peening operations. Such leaks shall be remedied by chipping and re-welding until the header is devoid of leaks at that pressure. The header shall then be subjected to a hydrostatic test pressure of 200 pounds per square inch. Under these circumstances, the test pressure of the water confined in the header shall not decrease in a four hour period of observation. If leaks are encountered, they shall be repaired and re-tested until proven tight.
- C. The header shall be provided with a one-half inch (1/2") drain connection "taken off" the bottom of the header and terminated in a suitable stop cock. This

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one-half inch (1/2") drain connection shall have its origin in a 2" x 1/2" welding reducer having its two inch (2") end so welded to the header as to completely drain that member. Each outgoing branch from the header shall be provided with a gas stop valve or gas cock. The nature of the outgoing welding nipples shall be such that these cocks shall be aligned in a neat horizontal line.

2.05 COCKS:

- A. Near the point at which each outgoing line leaves the gas header, the Contractor shall install a AGA gas stop valve or gas cock. These wrench operated valves shall each be provided with an appropriate wrench. Cocks of the same type shall, moreover, be installed at each other point indicated on the Drawings.

2.06 PROTECTIVE COATING:

- A. Gas piping systems installed underground shall utilize pipe which has been factory coated with Scotchkote protective resin No. 212. All materials, surface preparation, application and testing shall conform to Federal Specification L-C-530 B-Type 2, dated June 4, 1970. This coating shall be applied by A&A Coating Company, Lone Star, Texas.
- B. Underground welded joints and fittings shall be coated with Scotchkote No. 306 epoxy resin and taped with vinyl Scotchwrap-50 brand tape. Flanged joints shall be given two coats of Koppers Company No. 300M Catalyzed Coal Tar Epoxy. Flanged joints will not be allowed under ground.
- C. Under no circumstances shall any backfilling operations be begun until these pipe protection operations have been completed.

PART 3 EXECUTION

3.01 TESTING:

- A. Natural gas piping shall be tested in accordance with International Fuel Gas Code requirements. Refer to Appendix 6.01.06 for further information.

END OF STANDARD