



Alliant Energy - Gas Service Manual

Chapter 5 – Customer Gas Piping and Equipment

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A. GENERAL REQUIREMENTS

1. The Company assumes no responsibility for the installation, maintenance or operation of the customer gas piping and equipment beyond the meter outlet.
2. The Customer shall, at their own expense, furnish, install, and maintain all building gas piping and gas utilization equipment beyond the Company's metering facility.
3. Customer gas piping and equipment shall be installed and maintained at all times in accordance with the Company's GSM and with all applicable codes and regulations. Refer to GSM Chapter 1 "General Information" for applicable codes.
4. Customer piping and equipment shall be securely supported. Spacing of gas piping supports shall not exceed NFPA 54, Table 7.2.6.2.
5. Spacing of supports of CSST shall be in accordance with the applicable CSST manufacturer's instructions.
6. Customer piping and equipment shall be located where it will be protected from external forces. Examples of such forces include, but are not limited to, motor vehicles, excessive vibration, falling and/or an accumulation of ice or snow, and pedestrian traffic.

B. CUSTOMER GAS PIPING – MATERIALS

1. Customer piping materials shall be in accordance with NFPA 54, Chapter 5.
2. Cast iron piping shall not be used (NFPA 5.6.2.1).



3. Steel, Stainless Steel, and Wrought Iron Pipe shall be at least Schedule 10 and shall comply with the dimensional standards of ANSI/ASME B36.10M, *Welded and Seamless Wrought Steel Pipe*, and with one of the following industry standards (NFPA 54, 5.6.2.2):
 - a) ASTM A53, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless*
 - b) ASTM A106, *Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service*
 - c) ASTM A312, *Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes*
4. Steel tubing shall comply with the following industry standard (NFPA 54, Section 5.6.3.2):
 - a) ASTM A254, *Standard Specification for Copper-Brazed Steel Tubing*
5. Stainless Steel tubing shall comply with one of the following industry standards (NFPA 54 Section, 5.6.3.3):
 - a) ASTM A268, *Standard Specification for Seamless and Welded Ferritic and Martensitic Stainless Steel Tubing for General Service*
 - b) ASTM A269, *Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service*
6. Copper tubing shall comply with one of the following industry standards (NFPA 54, Section 5.6.3.4):
 - a) ASTM B 88, *Specification for Seamless Copper Water Tube*
 - b) ASTM B 280, *Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service*

Copper tubing shall be Type K or Type L. Type M copper tubing shall not be used. Copper tubing shall be permanently marked in accordance with its governing specification. Copper tubing markings are color coded as follow:

- a) Type K is green
- b) Type L is blue
- c) Type M is red



7. Aluminum alloy pipe shall comply with the following industry standard (NFPA 54, Section 5.6.2.5):

- a) ASTM B241, *Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.*

Aluminum alloy 5456 shall not be used.

Aluminum alloy pipe shall be coated to protect against external corrosion where it is in contact with masonry, plaster, or insulation or is subject to repeated wettings by such liquids as water, detergent, or sewage (NFPA 54, Section 5.6.2.5).

8. Aluminum alloy tubing shall not be used in exterior locations or underground (NFPA 54, Section 5.6.2.6).

Aluminum alloy tubing shall comply with one of the following industry standards (NFPA 54, Section):

- a) ASTM B210, *Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes*
- b) ASTM B241, *Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube*

Aluminum alloy tubing shall be coated to protect against external corrosion where it is in contact with masonry, plaster, or insulation or is subject to repeated wettings by such liquids as water, detergent, or sewage (NFPA 54, Section 5.6.3.5).

Aluminum alloy tubing shall not be used in exterior locations or underground (NFPA 54, Section 5.6.3.6).

9. Corrugated stainless steel tubing (CSST) shall be listed in accordance with the following industry standard (NFPA 54, 5.6.3.6):

- a) ANSI LC 1/CSA 6.26, *Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing*

For additional CSST specific requirements, see Part A, Part J, and Part K of this GSM Chapter.



10. Polyethylene plastic pipe, tubing, and fittings used to supply fuel gas shall conform to the following industry standard:

- a) ASTM D 2513, *Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings*.

Polyethylene piping shall be marked “gas” and “ASTM D 2513” (NFPA 54, Section 5.6.4.1.1)

11. Polyamide pipe, tubing, and fittings shall be identified in and conform to the following industry standard:

- a) ASTM F2945, *Standard Specification for Polyamide 11 Gas Pressure Pipe, Tubing, and Fittings*.

Polyamide piping shall be marked “gas” and “ASTM F2945” (NFPA 54, Section 5.6.4.1.2).

12. Polyvinyl chloride (PVC) and chlorinated polyvinyl chloride (CPVC) plastic pipe, tubing and fittings shall not be used to supply fuel gas (NFPA 54, Section 5.6.4.1.3).

13. Within the customer piping system, plastic pipe and fittings used to connect regulator vents on to remote vent terminations shall be PVC conforming to the following industry standard:

- a) ANSI/UL 651, *Schedule 40 and 80 Rigid PVC Conduit and Fittings*

PVC vent piping shall not be installed indoors (NFPA 54, Section 5.6.4.2).

14. An electrically continuous corrosion-resistant tracer shall be buried with plastic customer gas piping to facilitate locating (NFPA 54, Section 7.1.7.3).

15. Polyethylene piping shall be installed outdoors and underground except in the following circumstances (NFPA 54, Section 7.1.7.1):

- a) Plastic Piping may terminate above-ground where an anodeless riser is used.
- b) Plastic Piping may terminate with a wall head adapter aboveground in buildings, including basements, where the plastic piping is inserted in a piping material permitted for use in buildings.



C. CUSTOMER GAS PIPING – JOINING

1. Customer pipe joints shall be made in accordance with the technique or techniques appropriate for the piping material, as listed in NFPA 54, Chapter 5.
2. Schedule 40 and heavier metallic pipe joints shall be threaded, flanged, brazed, welded or assembled with press connect fittings. Metallic piping lighter than Schedule 40 shall be connected using press connect fittings, flanges, brazing or welding (NFPA 54, Section 5.6.7.1).
3. The Company shall not provide a delivery pressure greater than 5 psig unless the customer piping system meets one or more of the following conditions (NFPA 5.5.4):
 - a) The piping joints are welded or brazed.
 - b) The piping joints are flanged and all pipe-to-flange connections are made by welding or brazing.
 - c) The piping is located in a ventilated chase or otherwise enclosed for protection against accidental gas accumulation.
 - d) The piping is located inside buildings or separate areas of buildings used exclusively for one of the following:
 - 1) Industrial processing or heating
 - 2) Research
 - 3) Warehousing
 - 4) Boiler or mechanical rooms
 - e) The piping is a temporary installation for buildings under construction.
 - f) The piping serves appliances or equipment used for agricultural purposes.

D. BACK PRESSURE PROTECTION

1. Back pressure protection must be installed when gas utilization equipment is connected in such a way that air, oxygen, stand-by gases, or fuels could be forced into the Company's gas supply system. Suitable protective devices shall be installed as close to the utilization equipment as practicable (NFPA 54, Section 5.10.1.1).



2. Gas and air combustion mixers incorporating double diaphragm “zero” or “atmosphere” governors or regulators require no further protection unless connected directly to compressed air or oxygen at pressures of 5 psig or more (NFPA 54, Section 5.10.1.2).
3. In order to prevent flow back into the Company’s meter when liquefied petroleum gas or other supplementary gas is used as a standby fuel source by the customer, a three-way valve may be substituted for a check valve, if desired, in order to admit the standby gas supply while shutting off the natural gas supply (NFPA 54, Section 5.3.2).
4. Natural gas compressors shall be connected to the Company’s system through a check valve capable of withstanding the outlet pressure of the compressor.

E. LOW-PRESSURE AND VACUUM PROTECTION

1. A suitable protective device shall be installed between the meter and the gas utilization equipment if the operation of the equipment may produce a vacuum or a dangerous reduction in gas pressure at the meter. Appliances that can produce these conditions include, but are not limited to, gas compressors (NFPA 54, Section 5.11).

Such devices include, but are not limited to, mechanical, diaphragm-operated, or electrically operated low-pressure shut-off valves (NFPA 54, Section A.5.11).

F. OVERPRESSURE PROTECTION

1. Within the customer piping system, the customer shall provide, install, and maintain overpressure protection as required by NFPA 54, Section 5.9.
2. Pressure relieving or pressure limiting devices shall be one of the following (NFPA 54, Section 5.9.3.1):
 - a) Pressure relief valve.
 - b) Monitoring regulator.
 - c) Series regulator installed upstream from the line regulator and set to continuously limit the pressure on the inlet of the line regulator to the maximum values specified by equipment manufacturer’s installation instructions or less.
 - d) Automatic shutoff device installed in series with the line pressure regulator and set to shut off when the pressure on the downstream piping system reaches the maximum values specified by equipment manufacturer’s installation instructions or less. This device shall be designed so that it will remain closed until manually reset.



3. Pressure relieving or pressure limiting devices shall be constructed of materials so that the operation of the device is not impaired by corrosion of external parts by the atmosphere or internal parts by the gas (NFPA 54 5.9.4).
4. Pressure relieving or pressure limiting devices shall be designed and installed so they can be operated to determine whether the valve is free (NFPA 54 5.9.4).
5. Pressure relieving or pressure limiting devices shall be designed and installed so they can be tested to determine the pressure at which they operate and be examined for leakage when in the closed position (NFPA 54 5.9.4).
6. The customer gas piping system shall be designed so that failure of any primary pressure control device within the customer gas piping system is detectable (NFPA 54, Section 5.9.2.4).
7. External control piping shall be designed and installed so that damage to the control piping of one device does not render both the regulator and the overpressure protective device inoperative (NFPA 54, Section 5.9.5).
8. Where unauthorized operation of any shutoff valve could render a pressure relieving valve or pressure limiting device inoperative, the customer shall ensure that one of the following conditions exists (NFPA 54, Section 5.9.7):
 - a) The valve shall be locked in the open position. Instruct authorized personnel in the importance of leaving the shutoff valve open and of being present while the shutoff valve is closed so that it can be locked in the open position before leaving the premises.
 - b) Duplicate relief valves shall be installed, each having adequate capacity to protect the system. Arrange the isolating valves or three-way valve so that only one relief valve can be rendered in operative at a time.
9. The discharge stacks, vents or outlet parts of all pressure relieving and pressure limiting devices shall be located so that gas is safely discharged to the outdoors. Discharge stacks or vents shall be designed to prevent the entry of water, insects or other foreign material that could cause blockage (NFPA 5.9.8.1).
10. The discharge stack or vent line shall be at least the same size as the outlet of the pressure relieving device (NFPA 5.9.8.2).



G. PRESSURE TESTING OF CUSTOMER GAS PIPING

1. Prior to the Company providing permanent gas service, customer gas piping shall be visually inspected and pressure tested to meet the requirements of NFPA 54 Section, 8.1
2. Minimum acceptable test pressures based on the customer's delivery pressure can be found in Table 1 below. Exceptions must receive prior approval from the Company.

Table 1: Minimum Test Pressure for Customer Piping

Delivery Pressure	Minimum Test Pressure
7" w.c.	3 psig
2 psig	5 psig
5 psig	15 psig
10 psig	20 psig
15 psig	25 psig
60 psig	90 psig

3. Pressure test duration on customer gas piping shall follow the requirements outlined in NFPA 54 Section, 8.1.4:
 - a) The minimum test duration for single-family residences and for customer piping systems with a piping volume less than 10 ft³ shall be 10 minutes.
 - b) For all other systems, the minimum test duration shall be 30 minutes for each 500 ft³ of pipe volume or fraction thereof.
4. Customer piping shall have a pressure rating that meets or exceeds the required test pressure.
5. Materials that do not have a maximum working pressure or a maximum operating pressure rating that meets or exceeds the required test pressure are acceptable if they meet both of the following conditions:
 - a) The material has a maximum test pressure rating that meets or exceeds the required test pressure, and
 - b) The material has a maximum working pressure or a maximum operating pressure rating that meets or exceeds the delivery pressure.



H. CORROSION PROTECTION OF CUSTOMER PIPING SYSTEMS

1. The Company's gas piping system must be electrically isolated from all customer piping, wiring, and grounding systems. Gas piping shall never be used as a ground for electrical systems.
2. The customer shall protect susceptible piping from corrosion (NFPA 54, Section 7.1.3).
3. All above ground metallic customer gas piping shall be coated with a corrosion resistant material to protect against atmospheric corrosion (NFPA 54, Section 7.2.2).
4. All above ground piping that partially or completely penetrates through an exterior wall shall be protected against corrosion using one of the methods below. Wall penetration protection must extend beyond the penetration so that it is visible.
 - a) The piping may be coated with an inert coating material. The manufacturer's surface preparation and coating application instructions must be followed. The piping shall be sealed around its circumference at the point of the exterior penetration to prevent the entry of water, insects and rodents.
 - 1) Galvanizing is not considered an inert coating. Galvanized piping shall have an inert coating or an inert wrap applied to the sections of piping partially or completely penetrating a wall. Due to the difficulty of getting coatings to adhere to galvanized surfaces, it is recommended that a wrap or tape be used.
 - 2) Fusion bonded epoxy (FBE) is an acceptable wall penetration coating, but the non-penetrating portions of the FBE must be painted for UV resistance.
 - 3) Typical household and aerosol ("spray can") paints are not suitable for exterior piping and wall penetrations. Acceptable coatings and paints must be rated for exterior use and they must have a high abrasion resistance.
 - 4) A typical two coating system that meets these requirements is an epoxy base coat with a urethane top coat. These types of coating systems can be found at specialty paint stores and may be listed under coatings suitable for industrial, piping, oil and gas, or marine applications.



- b) The piping may be wrapped with an inert wrap or tape material. The piping shall be sealed around its circumference at the point of the exterior penetration to prevent the entry of water, insects and rodents.
- 1) The Company recommends an all-weather corrosion protectant pipe wrap or tape with a thickness of 10 to 20 mil (thousandths of an inch), and a PVC backing for impact and abrasion resistance. Wrap or tape should be installed with using at least a 50% overlap, resulting in an overall application of twice the base wrap or tape thickness.
 - 2) Such products include 3M™ Scotchrap™ Tapes 50 and 51, which should both be used with 3M™ Scotchrap™ Pipe Primer.

Suggested places to purchase:

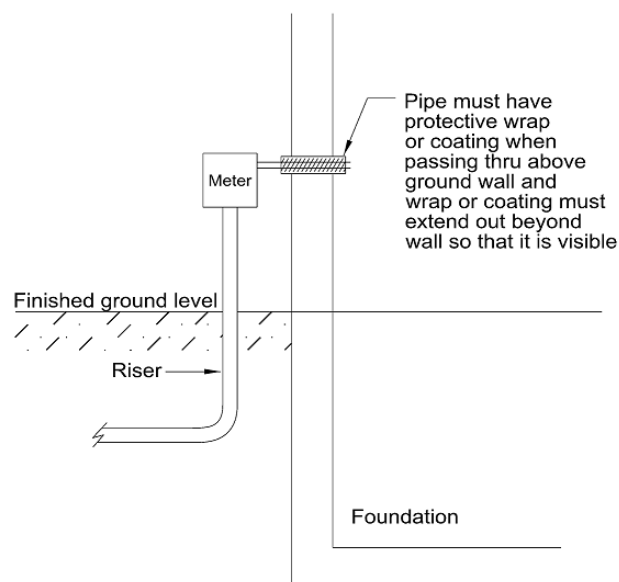
Amazon.com – use hyperlink or search “3M Scotchrap Tape”

Shop3M.com – use hyperlink or search “3M Scotchrap Tape”

HomeDepot.com – use hyperlink or search “2 in. x 50 ft. 20 Mil Pipe Wrap Tape”

- c) The piping may be coated with an inert material or wrapped with an inert wrapping or tape, and then also protected with a sleeve through the exterior wall. Where piping is encased in a protective pipe sleeve, the annular spaces between the gas piping and the sleeve, and between the sleeve and the wall opening, shall be sealed.

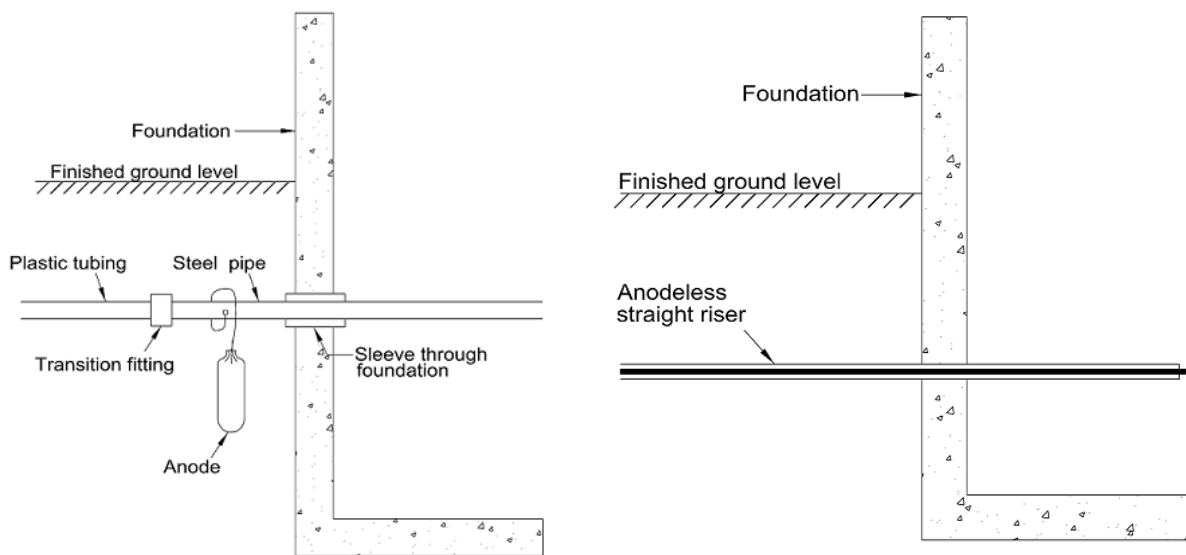
The drawing below illustrates the above ground wall penetration protection requirements.





- Underground piping, where installed through the outer foundation or basement wall of the building, shall be encased in a protective sleeve or protected by an approved device or method, such as an anodeless riser (NFPA 54, Section 5.6.4.3). The space between the gas piping and the sleeve, and between the sleeve and the wall, shall be sealed to prevent the entry of gas, water, insects, or rodents (NFPA 54, Section 7.1.5).

The drawing and pictures below illustrate the underground wall penetration protection requirements.



I. ELECTRICAL GROUNDING AND BONDING FOR PIPE AND TUBING OTHER THAN CORRUGATED STAINLESS STEEL TUBING (CSST)

- Each above-ground portion of a gas piping system, other than corrugated stainless steel tubing (CSST), that is upstream from the equipment shut-off valve and is likely to become energized shall be electrically continuous and bonded to an effective ground-fault current path (NFPA 54, Section 7.12.1).
- Gas piping, other than CSST, shall be considered to be bonded when it is connected to appliances that are connected to the appliance grounding conductor of the circuit supplying that appliance (NFPA 54, Section 7.12.1).
- The Company's gas piping system must be electrically isolated from all customer piping, wiring and grounding systems. Gas piping shall never be used as a ground for electrical system (NFPA 54, Section 7.12.5).



J. CORRUGATED STAINLESS STEEL TUBING (CSST) GAS PIPING

1. CSST gas piping shall be installed in accordance with the code and manufacturer's installation instructions (NFPA 54, Section 7.1.8).
2. CSST gas piping systems or gas piping systems that contain one or more segments of CSST shall be electrically continuous and bonded to the electrical service grounding system or, where provided, a lightning protection grounding electrode system (NFPA 54, Section 7.12.2).
3. The required bonding connection may be made from the piping to one of the following:
 - a) The electrical service equipment enclosure (breaker panel);
 - b) The grounded conductor at the electrical service;
 - c) The grounding electrode conductor (where of sufficient size); or
 - d) Directly to the grounding electrode.

The bond may also be made to a lightning protection system grounding electrode (but not to down conductors) if the resulting length of the bonding conductor is shorter.

4. The bonding jumper shall connect to any metallic fitting within the CSST piping system as long as the bonding jumper does not exceed 75 ft. in length. Listed clamps are manufactured to facilitate attachment of the bonding conductor to either a segment of rigid pipe or to a CSST-copper alloy fitting. The bonding conductor and/or the bonding clamp shall not be attached directly to the corrugated portion of the CSST.

Any additional grounding electrodes installed to limit the CSST bonding jumper length to 75 feet or less must be bonded to the electrical service grounding electrode system or, where provided, the lightning protection grounding electrode system.

Additional grounding electrodes and bonding shall be installed according to NFPA 70, *National Electric Code*.

5. The bonding jumper shall not be smaller than 6 American Wire Gauge (AWG) copper wire or equivalent, as defined in NFPA 54, Section 7.12.2.



6. Arc-Resistant jacketed CSST shall be considered to be bonded when it is connected to appliances that are connected to the appliance grounding conductor of the circuit that supplies that appliance (NFPA 54, Section 7.12.3).

NOTE: Arc-Resistant jacketed CSST installed **only** to an appliance that does not have grounding conductor (three-prong plug) must be bonded and grounded according to manufacturer's instructions. Examples of this are water heaters and fireplaces.

NOTE: Manufacturer installation instructions must be carefully followed when cutting and stripping the jacket layers on arc-resistant jacketed CSST to ensure the jacket has an electrically continuous path to the piping and appliances to which it is connected. Yellow jacketed, non-arc resistant CSST must still be bonded and grounded per NFPA 54, Section 7.12.2.

7. All electrical connections between wiring and electrically operated control devices in a piping system shall conform to the requirements of NFPA 70, *National Electric Code* (NFPA 54, Section 7.14.1).

K. TRANSITION TO PIPING MATERIAL OTHER THAN STEEL

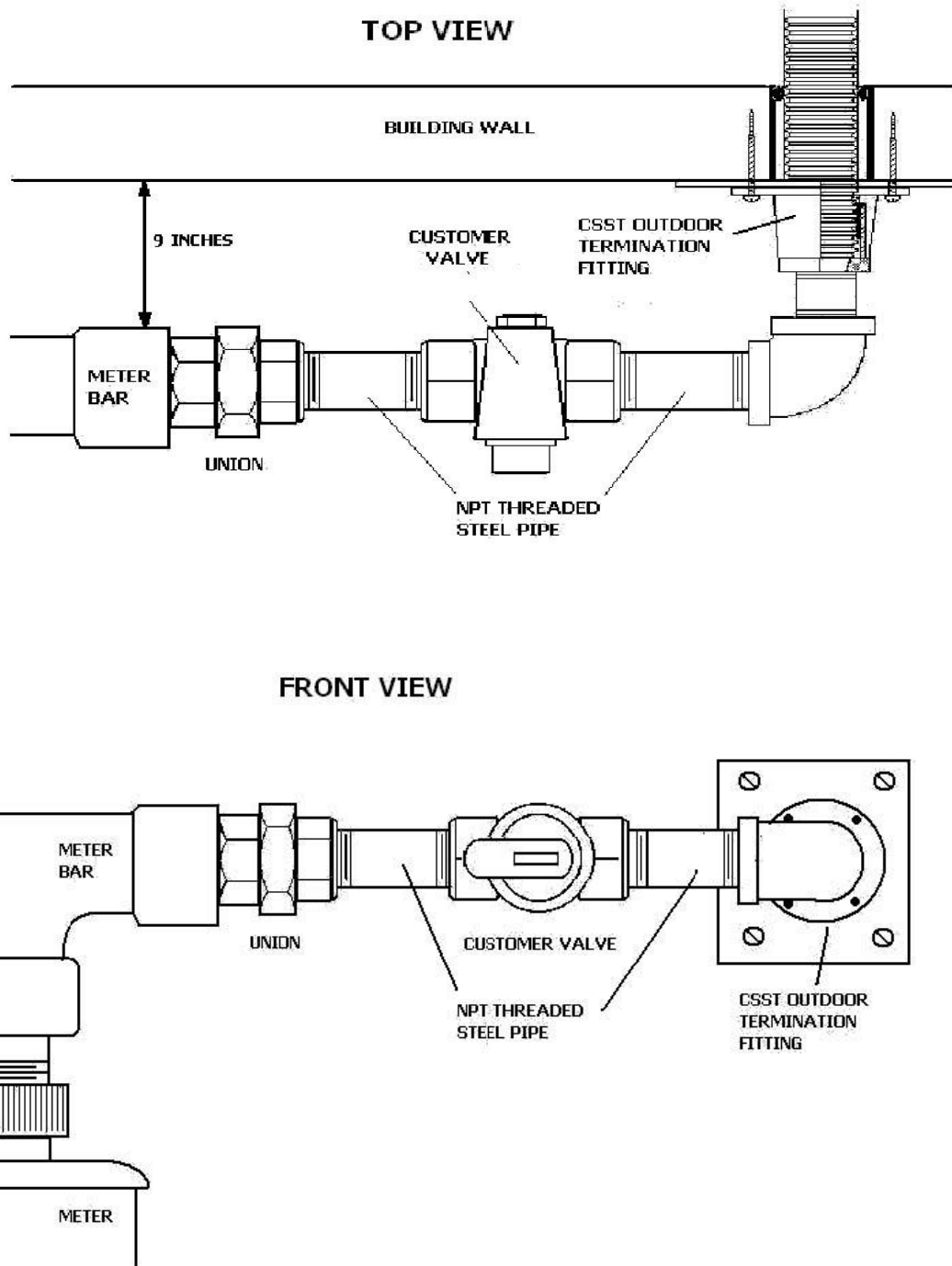
1. When a material other than steel is used for customer piping, steel pipe shall be used from the outlet of the Company's metering facility to a transition point inside the building. The transition shall be made using a joint method approved in NFPA 54, Section 5.6.
2. In the rare event building design elements or construction features prevent the transition from occurring inside the building, the transition may be made on the external side of the building as close as possible to the point of entrance to the building and be rigidly supported or securely fastened to the building wall.

NOTE: For manufactured home piping transition requirements, see GSM Chapter 6.

3. When CSST is used inside a building, external transitions to company owned steel piping must be made with a manufacturer approved flange mount termination plate.
4. If CSST piping is to be connected to customer owned steel piping to serve outdoor equipment, a manufacturer approved fitting must be used at the point of transition.
5. The two figures on the following page depict the configuration of an outdoor transition to indoor CSST piping using a flange mounted termination plate.



CSST Flange Mounted Transition Plate Drawings





L. MULTIPLE METER INSTALLATIONS

1. For multiple meter installations, all meters served by one service pipe shall be installed at the same location.
2. Gas piping at multiple meter installations shall be plainly marked by a metal tag, or other permanent means attached by the customer piping installer. The markings shall designate the building or the part of the building being supplied by each meter (NFPA 54, Section 5.7.5). Writing directly on the piping does not comply with this requirement.
3. For multiple meter installation specifications refer to GSM Chapter 4.

M. ODOR FADE

1. Although Alliant Energy adds a distinctive odor to natural gas as a safety precaution to assist in the detection of leaks, you should not rely solely on your sense of smell to determine if natural gas is present. Some people may not be able to detect the odorant because they have a diminished sense of smell, because they have smelled the same odor for too long, or because the odor is being masked by other odors in the area. There are also certain conditions that may cause the odor to “fade” or be stripped out of the gas, to the point that it is no longer readily detectable. Individuals with a known inability to smell are especially at risk. A natural gas detector provides a secondary level of detection. Look for the Underwriters Laboratories Standard 1484 (UL) stamp on the box or in the product description and carefully follow the manufacturer’s directions for operation, placement, and maintenance.
2. Odor fade, or loss of odorant, occurs when the odorant in the gas is diminished because of physical and chemical processes. These processes include adsorption, absorption and oxidation. Adsorption occurs when an extremely thin layer of gas molecules adheres to a solid surface. This occurs predominately in new pipe installations, rather than in existing pipe, and is more pronounced in steel pipe, although it can also occur in plastic pipe. The longer and larger the piping system, the more likely it is that odor fade will occur.
3. If a natural gas leak occurs underground, the surrounding soil may cause odor fade or the odorant to be stripped out. Other factors that may cause odor fade include, but are not limited to the construction and configuration of the customer’s gas facilities; the presence of rust, moisture, liquids or other substances in the pipe; and gas composition, pressure and/or flow. Intermittent, little or no gas flow over an extended period of time may also result in the loss of odorant until gas flow increases or becomes more frequent.



4. There are some important safety precautions you should take when working with natural gas piping systems:
 - DO NOT purge the contents of a gas line into an enclosed space. Any purging of a gas line should be done in a well ventilated area or by venting the contents to the outside atmosphere away from potential ignition sources.
 - Always use gas detection equipment (combustible gas detector) during purging operations or when otherwise working on or around gas piping systems.
 - DO NOT rely on your sense of smell alone to detect the presence of natural gas.
 - Consult the National Fuel Gas Code (NFPA 54, Chapter 8) or your local building codes for additional purging requirements.
 - When installing gas appliances or equipment, the manufacturer's instruction manual should be followed in accordance with the applicable national, state, or local codes.