

# Chapter 8

## FUEL GAS SUPPLY

### 8.1 GENERAL

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#### 8.1.1 Scope

- 8.1.1.1 This Chapter provides the requirements aimed at safeguarding life and property in nonindustrial gas piping systems for use with fuel gases such as natural gas (NG) and liquefied petroleum gas (LPG) in the vapour phase used for fuel or lighting purposes in consumers' premises.
- 8.1.1.2 This Chapter does not cover the safety requirements and rules for gas burning appliances. The requirements of National Fuel Gas Code - 2009 edition (NFPA-54/ANSI Z223.1) and NFPA 58-2008 edition and International Fuel Gas Code-2009 of the USA shall apply for such appliances.
- 8.1.1.3 The requirements of this Chapter do not apply to gas piping systems for industrial installation and applications.
- 8.1.1.4 This Chapter covers the aspects of design, fabrication, installation, test, operation, inspection and maintenance of gas piping systems from the point of delivery to the connections with each utilization device. The point of delivery is defined in this Chapter as the outlet of the service regulator or the service shutoff valve where there is no meter.
- 8.1.1.5 Piping systems covered here are limited to a maximum operating pressure of 3.45 kPa (14 inches of water column or ½ psig).
- 8.1.1.6 While applying the provisions of this Chapter, reference should also be made to the manufacturers' instructions, gas supply company's regulations and other applicable codes and standards listed in this Chapter or required by the authority having jurisdiction.

#### 8.1.2 Terminology

This section provides definitions of terms used in this Chapter of the Code. Where terms are not defined in this Chapter, they shall be defined using their ordinarily accepted meanings such as the context implies. The definitions in the Chapter are the same as used in National Fuel Gas Code-2009 edition (NFPA-54/ANSI Z223.1), International Fuel Gas Code-2009 and Liquefied Petroleum Gas Code-2008 (NFPA-58) and National Building Code of India-2005.

**Appliance:** Any device that utilizes gas as a fuel or *raw material* to produce light, heat, power, refrigeration, or air conditioning.

**Appliance Valve:** A device that will shut off the gas supply to burners(s)

**Approved:** Acceptable to the authority having jurisdiction

**Authority Having Jurisdiction (AHJ):** An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, and installation, or a procedure.

**Branch Line:** Gas piping that conveys gas from a supply line to the appliance

**Burner/Cookers:** A device for the final conveyance of gas, or a mixture of gas and air, to the combustion zone.

**Concealed Gas Piping:** Gas piping that, when in place in a finished building, would require removal of permanent construction to gain access to the piping.

**Consumer's/Customer's Connection:** Piping tapped on the riser to supply gas to individual customer/consumer

**Cylinder:** A portable container designed, fabricated, tested and marked (or stamped) in accordance with a recognized standard/code such as ASME, or the regulations of the US Department of Transportation (DOT) used for transporting or storing LPG. The maximum size permitted inside the building is 320 kg water capacity.

**Diversity Factor:** Ratio of the maximum probable demand to the maximum possible demand.

**Drip:** The container placed at a low point in a system of piping to collect condensate and from which it may be removed.

**Equivalent:** Nothing in this code is intended to prevent the use of system, methods or device of equivalent or superior quality, strength, fire resistance, effectiveness, durability and safety over those prescribed by this code. However, technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency; and the proposed method, system or device shall be approved for the intended use by the same authority.

**Fuel Gas:** A natural gas, manufactured gas, liquefied petroleum gas or mixtures of the gases (This chapter only recognizes natural gas and LPG as fuel gas).

**Gases:** Include natural gas, manufactured gas, liquefied petroleum (LP) gas in the vapor phase, liquefied petroleum gas-air mixtures and mixtures of these gases, plus gas-air mixtures within the flammable range, with the fuel gas or the flammable component of a mixture being a commercially distributed product.

**Gas Fitter:** An employee of the gas supplying company

**Gas Manifold:** The conduit of an appliance that supplies gas to the individual burner(s).

**Labeled:** Equipment or materials to which has been attached a label, symbol or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

**Liquefied Petroleum Gas (LPG):** Liquefied petroleum gas composed predominantly of propane, propylene, butanes or butylenes or mixtures thereof that is gaseous under normal atmospheric conditions but is capable of being liquefied under moderate pressure at normal temperatures.

**Listed:** Equipment, materials or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states either that the equipment, materials, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

**Meter:** An instrument installed to measure the volume of gas delivered through it.

**Outlet:** The point at which gas-fired appliance connects to the gas piping system.

**Pilot:** A small flame that is utilized to ignite the gas at the main burner or burners.

**Pipe:** Rigid conduit of iron, steel, copper, brass, aluminum, or plastic.

**Piping System:** All piping, valves and fittings from the outlet of the point of delivery from the supplier to the outlets of the equipment shutoff valves.

**Pressure Regulator:** Equipment placed in a gas line for reducing, controlling, and maintaining the pressure in that portion of the piping system downstream of the equipment.

**Pressure Test:** An operation performed to verify the gastight integrity of gas piping following its installation or modification.

**Purge:** To free a gas conduit of air or gas, or a mixture of gas and air.

**Qualified Agency:** An individual, firm, corporation, or company that either in person or through a representative is engaged in and is responsible for (a) the installation, testing, or replacement of gas piping or (b) the connection, installation, testing, repair, or servicing of appliances and equipment; that is experienced in such work; that is familiar with all precautions required; and that has complied with all the requirements of the authority having jurisdiction.

**Riser:** A vertical pipe supplying fuel gas

**Safety Shutoff Device:** A device that will shut off the gas supply to the controlled burner(s) in the event the source of ignition fails. This device may interrupt the flow of gas to main burner(s) only or to pilot (s) and main burner (s) under its supervision.

**Service Meter Assembly:** The piping and fittings installed by the serving gas supplier to connect the inlet side of the meter to the gas service and to connect the outlet side of the meter to the customer's house or yard piping.

**Service Regulator:** A pressure regulator installed by the serving gas supplier to reduce and limit the service line gas pressure to delivery pressure.

**Service Shutoff Valve:** A valve, installed by the serving gas supplier between the service meter or source of supply and the customer piping system, to shut of the entire piping system.

**Shall:** Indicates a mandatory requirement

**Tubing:** Semi rigid conduit of copper, steel, aluminum, CSST (corrugated stainless steels tubing) or plastic

**Valve:** A device used in piping to control the gas supply to any section of a system of piping or to an appliance.

**Vent:** A passageway used to convey flue gases from appliances or their vent connectors to the outdoors.

**Water Heater:** An appliance for supply hot water for domestic or commercial purpose.

### 8.1.3 General Precautions

8.1.3.1 **Turn Gas Off:** All gas piping work or gas appliance installation shall be performed with the gas turned off to eliminate hazards from leakage of gas.

8.1.3.2 **Notification of Interrupted Service:** It shall be the responsibility of the installing agency, when if the gas supply is to be turned off, to notify all affected consumers.

8.1.3.3 **Before Turning Gas Off:** Before turning off the gas to premises for the purpose of installation, repair, test, inspection, replacement or maintenance of gas piping or appliances, all burners shall be turned off. When two or more consumers are served from the same supply system, precautions shall be taken to ensure that only supply to the concerned consumer is turned off.

8.1.3.4 **Checking for Gas Leaks:** Soap and water solution or other material approved for the purpose, shall be used in locating gas leakage. Use of matches, candles, flames or other sources of ignition shall be prohibited for this purpose.

8.1.3.5 **Use of Lights:** Artificial illumination used in connection with a search for gas leakage shall be restricted to battery operated flashlights (preferably of the safety type) or approved safety lamps. In searching for leaks, electric switches should not be operated. If electric lights are already turned on, they should not be turned off.

8.1.3.6 **Working Alone:** An individual shall not work alone in any situation where working practice desires that two or more persons are necessary to carry out the work safely.

8.1.3.7 **Handling Liquid from Drips:** Liquid which is removed from a drip in an existing gas piping shall be handled with proper precautions, and shall not be left on the consumers' premises.

8.1.3.8 **No Smoking:** When working on piping which contains or has contained gas, smoking shall be prohibited.

8.1.3.9 **Handling of Flammable Liquids:** Flammable liquids used by the installer shall be handled with proper precautions and shall not be left within the premises from the end of one working day to the beginning of the next.

8.1.3.10 **Work Interruption:** When interruptions in work occur, the system shall be left in a safe and satisfactory condition.

8.1.3.11 Certain requirements related to work on the gas supply system are listed in Appendix A.

#### 8.1.4 Notification of Completion

- 8.1.4.1 When regulations so require, the completion of installation shall be notified to the gas supply company or the Authority.

### 8.2 GAS PIPING INSTALLATION

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#### 8.2.1 Piping Plan and Approval

- 8.2.1.1 Plans for installation of gas piping system and gas appliances shall be prepared in accordance with requirements of the gas supply company and the Authority. Necessary approvals shall be obtained from the gas supply company and the Authority before installation of the gas piping system and the appliances. (See Appendix B).
- 8.2.1.2 The plan shall include proposed location of the piping, layout and sketch of the piping system, sizes of different branches, and present and future gas demands.
- 8.2.1.3 Approved plans shall bear the authorized seal and signatures of the gas supply company and the Authority.

#### 8.2.2 Size of Piping to Gas Appliances

- 8.2.2.1 Gas piping shall be of such size and so installed to ensure adequate supply of gas to meet the maximum demand without undue pressure drop between the meter, or service regulator when there is no meter, and the appliance or appliances.
- 8.2.2.2 The size of gas piping depends upon the following factors:
- (a) Allowable pressure drop from meter or service regulator, when there is no meter, to appliance
  - (b) Maximum gas consumption to be provided
  - (c) Length of piping and number of fittings
  - (d) Specific gravity of the gas
  - (e) Diversity factor
- 8.2.2.3 The size of each gas piping system shall be determined by standard engineering methods acceptable to the gas supply company and the Authority.
- 8.2.2.4 Gas pipes smaller than 12 mm in diameter shall not be used.
- 8.2.2.5 Straight lengths of piping shall be used as far as practicable. Where there are bends in the pipeline, or as approved by the gas supply company. The inside radius of a bend shall be not less than 6 times the outside diameter of the pipe.

#### 8.2.3 Acceptable Piping Materials

- 8.2.3.1 Piping material shall be one of the materials listed in Table 8.8.1 conforming to the corresponding standards, or other materials as may be approved by the gas supply company or the Authority. Cast iron pipe shall not be used.

**Table 8.8.1 Fuel Gas Pipe Materials**

<b>Material</b>	<b>Standards</b>
Black steel pipe*	ASTM A106
Galvanized steel pipe*	ASTM A53
Wrought steel and wrought iron pipe*	ANSI B36.10 M
Corrugated stainless steel tubing	ANSI LCI/CSA 6.26
Copper or copper-alloy tubing (Type K or L)	ASTM B88; ASTM B280
Aluminium pipe and tubing	ASTM B210; ASTM B 241
Plastic pipe and tubing	ASTM D2513

\* Minimum Schedule 40

- 8.2.3.2 Fittings shall be of an approved type and material for gas piping systems accepted to the gas supply company. Bushings shall not be employed.
- 8.2.3.3 All joints and connections shall be of an approved type and material for gas piping system acceptable to the gas supply company. Joints and connections shall be gas tight at the test pressure. (see Sec 8.2.9.3 and 8.2.9.4)
- 8.2.3.4 Flexible metal pipes or heavy rubber pressure tubing accepted to the gas supply company may be used only for direct connections to burners.

#### 8.2.4 Fabrication of Piping for Installation

- 8.2.4.1 Gas pipe or tubing and fittings shall be clean and free from cutting burrs and defects in structure or threading and shall be thoroughly brushed with chips and scale blown. Defects in pipe or tubing or fittings shall not be repaired when defective pipe, tubing or fittings have been identified. The defective material shall be replaced.
- 8.2.4.2 Pipe, tubing, fittings and valves removed from any existing installation shall not be used again until they have been thoroughly cleaned, inspected and ascertained to be equivalent to new material.
- 8.2.4.3 Metallic pipes with threads which are damaged or defective shall not be used.
- 8.2.4.4 Metallic pipes shall be threaded in accordance with approved standard acceptable to supply company.
- 8.2.4.5 When used in a corrosive environment, metallic pipes and fittings shall be protected with corrosion resistant coating.
- 8.2.4.6 For any thread joint proper sealant shall be used on the made threads only.
- 8.2.4.7 Joints and joining compounds if used in LPG installation shall be resistant to the action of liquid petroleum gas.

#### 8.2.5 Installation of Gas Pipes

- 8.2.5.1 Installation, repair and replacement of gas piping or appliances shall be performed only by a qualified installing agency or gas fitter.
- 8.2.5.2 Protection of Piping: Piping shall be buried to a minimum depth of 1 m covered in a manner so as to protect the piping from physical damage. It shall be protected from physical damage when it passes through flower beds, shrub beds and other such cultivated areas.

- 8.2.5.3 Protection against Corrosion: Gas piping in contact with earth or other materials which will corrode the piping shall be protected against corrosion in an approved manner. When dissimilar metals are joined underground, an insulating coupling or fitting shall be used. Piping shall not be laid in contact with cinder or ash.
- 8.2.5.4 All the piping within the premises where it has to run on the wall shall be exposed and should not be in contact with wall to ensure that no corrosion takes place. Epoxy sealant or polyethylene conduit shall be used to ensure no contact of pipe with the wall in the situation of pipe crossing the wall. Uncoated threaded or socket welded joints shall not be used in piping in contact with soil or where internal or external crevice corrosion is known to occur.
- 8.2.5.5 Piping Through Foundation Wall: Underground gas piping, when installed below grade through the outer foundation or basement wall of a building, shall be either encased in a protective sleeve or protected by an approved device or method. The piping or sleeve shall be sealed at the foundation or basement wall to prevent entry of gas or water.
- 8.2.5.6 Piping Underground beneath Buildings: If the laying of gas piping underground beneath buildings cannot be avoided, the piping shall be encased in an approved conduit designed to withstand super imposed load. The conduit shall extend into a normally accessible portion of the building and, at the point where the conduit terminates in the building, the space between the conduit and the gas piping shall be sealed to prevent the entrance of gas from any possible leakage. The conduit shall extend at least 100 mm outside the building, be vented outdoors above finished ground level and be installed in such a way as to prevent the entrance of water and insects.
- 8.2.5.7 Building Structure: The building shall not be weakened by the installation of any gas piping. Existing beams or joists shall not be cut or notched.
- 8.2.5.8 Piping Supports: Gas piping in buildings, shall be supported with pipe hooks, metal pipe straps, bond or hangers of an approved type and material suitable for the size of piping, and of adequate strength and quality and located at specified intervals so that the piping cannot be moved accidentally from the installed position. Gas piping shall not be supported by other piping.
- 8.2.5.9 Piping Entrance to Buildings: When gas pipe enters a building through a wall or floor of masonry or concrete, it shall be sealed against the entrance of water, moisture or gas.
- 8.2.5.10 Piping in Floors: Piping in solid floors, such as concrete, shall be laid in channels in the floor suitably covered to provide access to the piping with a minimum damage to the building.
- 8.2.5.11 Single pipe without joints shall be used for wall crossing in any building.
- 8.2.5.12 Changes in direction of gas pipe shall be made by the use of approved fittings, factory bends or field bends. Field bends shall be made by employing approved procedures and equipment.
- 8.2.5.13 Gas piping inside any building shall not be run in or through an air duct, chimney or gas vent, ventilating duct or elevator shaft. Gas piping shall not be taken through inaccessible or concealed areas where its condition cannot be inspected and accumulation of gas due to undetected leakage may create a dangerous condition.
- 8.2.5.14 Provide Drips where Necessary: A drip shall be provided at any point in the line of pipe where condensate may collect. When condensation is excessive, a drip should be provided at the outlet of the meter where required by the authority or the gas supply company. This drip shall be so installed as to constitute a trap wherein an accumulation of condensate will shut off the flow of gas before it will run

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back into the meter. All drips installed shall be readily accessible to permit cleaning, inspection or emptying.

- 8.2.5.15 **Cap All Outlets:** Each outlet, including a valve or cock outlet, shall be firmly closed gas tight with a threaded plug or cap immediately after installation and shall be left closed until an appliance is connected thereto. Similarly, when an appliance is disconnected from an outlet and the outlet is not to be used again immediately, it shall be capped or plugged gas-tight. The outlet shall not be closed with tin caps, wooden plugs, corks or by other improvised means or objects. Use of a listed quick disconnect device is acceptable.
- 8.2.5.16 **Prohibited Devices:** No device shall be placed inside the gas pipe or fittings that will reduce the cross-sectional area or otherwise obstruct the free flow of gas.
- 8.2.5.17 **Branch Pipe Connection:** All branch pipe connections and outlets shall be taken from the top or sides of horizontal lines and not from the bottom.
- 8.2.5.18 **Electrical Bonding and Grounding:** The gas piping shall be electrically continuous throughout its length and properly earthed except in stretches where cathodic protection system is used for protection against corrosion. The piping shall not be used to ground any electrical equipment.
- 8.2.5.19 **Distance from Electrical Wiring:** The distance between the gas piping and electrical wiring system shall be at least 60 mm. They shall be securely fixed to prevent contact due to movement. The gas piping should be installed below the electrical wiring for heavier gas like LPG and for natural gas the piping should be above the electrical wiring.
- 8.2.5.20 **Distance from Steam Piping:** The gas piping and steam piping, if installed parallel, shall be at least 150 mm apart. The gas piping should preferably be installed below the steam piping.
- 8.2.5.21 **Gas Piping to be Graded:** All gas piping shall be graded not less than 1 in 750 to prevent accumulation of condensate or liquids in the line. All horizontal lines shall grade to risers, and from the risers to the meter, or service regulator when there is no meter, or to the appliance.
- 8.2.5.22 The gas piping shall be painted red in order to differentiate it from other piping. Where the piping is exposed to sun rays, it shall be painted silver gray.
- 8.2.5.23 Documentation shall be maintained for all gas supply installations. (See Appendix B).

## 8.2.6 Pressure Regulators

- 8.2.6.1 Where the pressure of gas supplied to domestic installation or other low pressure gas piping systems in buildings is in excess of 3.45 kPa, a gas pressure regulator of approved type and size shall be installed in the service pipe of each such system to prevent pressure in excess of 3.45 kPa from being introduced into such a building piping. If the building pipe is of welded construction the pressure regulator may be located upstream of the gas meter in each consumer's premises. In these cases, the gas pressure in the piping downstream of the gas pressure regulator shall not exceed 3.45 kPa.
- 8.2.6.2 If installed inside a building, the regulator shall comply with the following:
- (a) If any of the diaphragms of the regulator ruptures, the gas shall be directed to an outlet vent pipe made of brass or plastic in order to vent the gas out of the building. The vent pipe shall be installed about 1m above the topmost story of the building in open air. Means shall be employed to prevent water from entering the pipe and also to prevent blocking it by insects or other foreign bodies.

(b) If the gas pressure at the outlet of the regulator falls below 50 per cent of the operating gas pressure or rises above twice the operating pressure, the gas supply to the pressure regulator shall shut off.

(c) In the event of malfunctioning of this safety device, a supplementary device shall connect the low pressure circuit to the vent pipe as soon as the exit pressure reaches *6.90 kPa*.

8.2.6.3 The gas supply company shall ensure that the heating value and supply pressure of gas shall not exceed the stated values for the type of gas being supplied.

### 8.2.7 Service Shutoff Valves

8.2.7.1 Service shutoff valves shall be provided on all new services including replacements and shall be installed in a readily accessible location.

8.2.7.2 Service shutoff valves shall be located upstream of the meter if there is no regulator or upstream of the regulator if there is one.

8.2.7.3 All gas services installation operating at pressure greater than 3.45 kPa shall be equipped and with shutoff valve of approved type installed on the service pipe outside the building.

8.2.7.4 Underground shutoff valves shall be located in a covered durable kerb box, manhole, vault, or stand pipe which is designed to permit ready operation of the valve. The covers so provided shall be clearly marked "GAS".

8.2.7.5 Every gas outlet shall have an individual shutoff valve. The shutoff valve shall be accessible and adjacent to the appliance.

### 8.2.8 Existing Work

8.2.8.1 Nothing herein shall prohibit the continued use of an existing gas piping system without further inspection or test unless the Authority has reason to believe that defects which make the system dangerous to life or property exist.

### 8.2.9 Inspection of Services

8.2.9.1 No person shall use or permit the use of a new system or an extension of an old system of gas piping in a building or structure before the same has been inspected and tested to ensure that the system is safe and a certificate has been issued by the Authority. (See Appendix B).

8.2.9.2 Test of Piping for Tightness: Before any system of gas piping is finally put in service, it shall be carefully tested to ensure that it is gas tight and safe. Where any part of the system is to be enclosed or concealed, this test should precede the work of closing in. The test medium shall be air, nitrogen, carbon dioxide or an inert gas. OXYGEN SHALL NEVER BE USED.

8.2.9.3 Before appliances are connected, the piping systems shall be tested at a pressure of at least 159-mm mercury for a period not less than 10 minutes without showing any pressure drop. The source of pressure shall be isolated before the pressure tests are performed.

8.2.9.4 The Authority shall, within a reasonable time after being requested to do so, inspect and test the gas piping system that is ready for such inspection and test. If the system is found to comply with the requirements of inspection and test as laid down, it shall issue the certificate.



8.2.9.5 It shall be unlawful to supply gas in a building before the required certificate has been issued (see Sec 8.2.9.4 above), except that the Authority may give temporary permission for a limited time to supply and use gas before such an installation has been fully completed and the certificate issued.

### 8.2.10 Check of Leakage

8.2.10.1 Close All Gas Outlets: Before turning gas under pressure into any piping, all openings and outlets from which gas can escape shall be closed.

8.2.10.2 Check for Leakage: No matches, flames or other sources of ignition shall be used to check for gas leakage from meters, piping or appliance. Checking for gas leakage with soap and water solution shall be recommended (see Sec 8.1.3.4 and 8.1.3.5 also).

8.2.10.3 Checking for Leakage with Meter: Immediately after turning gas into the piping, the system shall be checked to ascertain that no gas is escaping. This may be checked by carefully watching the test dial of the meter to determine whether the gas is flowing through the meter. Under no circumstances shall a leakage test be made using a gas meter unless immediately prior to such test it has been determined that the meter is in operating condition.

8.2.10.4 Checking of Leakage not using a Meter: This may be performed by attaching to an appliance orifice, a manometer or equivalent device (gauge) so that it can be read in increments of 2.5 mm water column and momentarily turning on the gas supply and observing the gauging device for pressure drop with gas supply shutoff. No drop in pressure shall occur during a period of 3 minutes.

8.2.10.5 When Leakage is Indicated: If the meter test hand moves or a pressure drop on the gauge occurs, all appliances or outlets supplied through the systems shall be checked to ensure that they are shut off and do not leak. If they are shut off firmly there is a leak in the piping system. The gas supply shall be shut off until the necessary repairs have been made, after which the test specified in Sec 8.2.10.3 or 8.2.10.4 above shall be repeated.

### 8.2.11 Purging

8.2.11.1 Purging All Gas Piping: After piping has been checked, all gas piping shall be fully purged. Piping shall not be purged into the combustion chamber of an appliance. A suggested method for purging the gas piping to an appliance is to disconnect the pilot piping at the outlet of the pilot valve.

8.2.11.2 Lighting Pilots: After the gas piping has been fully purged, all appliances shall be purged and the pilots lighted. The installing agency shall satisfy itself that all piping and appliances are fully purged and safe for use before leaving the premises.

### 8.2.12 Rules for Turning Gas On

8.2.12.1 A person, who is an employee of the gas supply company and authorized by the gas supply company, shall turn on the gas at a service shutoff valve or at any valve that controls the supply of gas to more than one consumer.

8.2.12.2 Gas shall not be turned on at any meter valve without specific permission from the gas supply company or the Authority if any of the following conditions are found:

- (a) If the gas piping, appliances or meter supply through the meter valve are known to leak or otherwise be defective;
- (b) If required inspection of the piping or appliance has not been performed;

- (c) If the gas supply company or the Authority has requested that the gas be left turned off;
- (d) If the meter valve is found shutoff for some reason not known to the gas fitter.

8.2.12.3 The gas shall not be turned on in the event of fire.

8.2.12.4 Gas shall not be turned on at any branch line valve if any of the conditions listed in Sec 8.2.12.2 above are found. Where a branch line valve is found closed, a gas fitter shall again turn the gas on at such valve only. If proper precautions to prevent leakage are taken and no other unsafe conditions are created thereby.

8.2.12.5 Gas shall not be turned on at either the meter valve or the service line unless all gas keys/ cocks or valves installed on all outlets in the piping system are closed or all outlets in the piping system are capped or plugged.

### 8.2.13 Rules for Shutting Off the Gas

8.2.13.1 The gas fitter shall put the gas off to any appliance, pipe or piping system and shall leave the gas turned off, until the cause for interruption of supply has been removed in any one the following cases:

- (a) If ordered to do so by the Authority;
- (b) If leakage of gas is found, which appears to be sufficient to cause fire, explosion or asphyxiation;
- (c) If an installation is found to be such as to seriously endanger life and property;
- (d) If any condition exists which threatens interruption of gas supply that may cause burner failure or otherwise lead to dangerous conditions.

8.2.13.2 Before turning off the gas at the meter, for the purpose of installation, repair, replacement, test, inspection or maintenance of piping or appliances, all burners and pilot valves on the premises supplied with gas through the meter shall be turned off and the meter test hand observed for a sufficient length of time to ascertain that there is no flow of gas through the meter. Where there is more than one meter on the premises, precautions shall be exercised to ensure that the concerned meter is turned off.

### 8.2.14 Provision for Meter Location

8.2.14.1 The meter location shall be such that the meter can be easily read and the connections are readily accessible for servicing. Location, space requirements, dimensions and type of installation shall be acceptable to the gas supply company and be approved by the same.

8.2.14.2 Meters shall be installed in such a way that there shall be no load transfer from the pipeline to the inlet/outlet of the meter.

8.2.14.3 Gas piping at multiple meter installations shall be clearly marked by a metal tag or other permanent means provided by the installing agency, designating the building or the part of the building being supplied.

## 8.3 USE OF LIQUEFIED PETROLEUM GAS (LPG)

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- (a) The cylinders used for the storage and transportation of liquefied petroleum gas (LPG) shall conform to the accepted standards approved by the Authority.

- (b) The handling, use, storage and transportation of liquefied petroleum gas in cylinders exceeding 500 ml of water capacity shall be done in accordance with *the good practice* approved by the Authority and the guidelines of the gas supply company.
- (c) The cylinders shall be marked as provided in the regulations, rules or code under which they are fabricated.

### 8.3.1 LPG Cylinder Installation

The following recommendations apply to installations in residential, commercial, industrial, educational and institutional premises.

- 8.3.1.1 Personnel engaged and responsible for the installation of cylinders, equipment and piping should understand the characteristics of LPG and be trained in good practice of handling, installing, inspection, test and maintenance of installation.
- 8.3.1.2 The joining compounds used in the piping system shall be resistant to the action of liquefied petroleum gas and shall be decided by the Qualified Installation Agency. Hemp and similar materials shall not be used at the joint. In any joint in which the thread provides a gas tight seal, joining compound shall be used on the male thread.
- 8.3.1.3 Fire extinguishers of dry power or carbon dioxide type conforming to accepted standards shall be provided in places where LPG cylinder installations are situated and shall be located near such installations. Two buckets filled with sand and two with water shall also be installed nearby. The guidelines of the LPG supply company and the Authority shall be followed in this respect. The number, type and size of the fire extinguishers shall be as follows:

For installation with LPG	Number	Type	Capacity
40 kg to 200 kg	2	Dry powder	10 kg
more than 200 kg upto 320 kg	2	Dry powder	10 kg

- 8.3.1.4 Liquefied petroleum gas shall not be transferred from the cylinders in which it is supplied to any other container.

### 8.3.2 Cylinder Location

#### 8.3.2.1 Stationary Installations

- (a) Stationary installation not exceeding 40 kg of LPG may be installed indoors on any floor. Recommended minimum floor area per installation is 5 m<sup>2</sup>.
- (b) Stationary installations each not exceeding 40 kg of LPG may be installed indoors on any floor within the same workspace provided the minimum distance between two such installations is 3 m. Recommended minimum floor area per installation is 5 m<sup>2</sup> and the *aggregate* of all such installations should not exceed 200 kg.
- (c) Stationary installation not exceeding 80 kg of LPG may be installed indoors on any floor provided the floor area per installation is not less than 12 m<sup>2</sup>.
- (d) Stationary installations each not exceeding 80 kg of LPG may be installed indoors on any floor and within the same workspace provided the minimum distance between two such installations is 3 m. Recommended floor area per installation is 12 m<sup>2</sup> and the *aggregate* quantity of all such installations should not exceed 200 kg.

- (e) Stationary installation not exceeding 320 kg of LPG may be installed indoors in an enclosed section of a building or a room reserved exclusively for this purpose and ventilated at low level directly to the outside air.
- (f) Stationary installation above 320 kg (200 kg in case provision as in (e) above is not possible) but not exceeding 1000 kg shall be installed outdoors on the ground level only. A minimum distance of 3 m shall be maintained between such an installation and any building, public place, roadways and other surroundings. The installation shall be protected against weathering by sun, rain, etc. and from tampering by unauthorized persons. A suitable shade of approved type and material may be provided for the purpose. Adequate ventilation at ground level to the outside air shall be provided. The distance between any two such installations shall be 3 m unless separated by a solid wall of fire resistant material up to at least 1 m above the height of the manifold valve.
- (g) The position of the cylinders shall facilitate: changing and quick removal of any cylinder in case of necessity, and access to cylinder valve connections and regulating devices
- (h) Cylinders shall be placed upright with the valve uppermost.
- (i) Cylinders shall be placed on a firm and dry base such as concrete or brick floor. For outdoor installations the base shall be elevated.
- (j) Cylinders shall not be placed close to steam pipes or any other source of heat and shall be protected from the weather and direct sun. Cylinders shall be placed at a distance of 3 m from any other source of heat which is likely to raise the temperature of cylinders above the room temperature unless separated by metal sheet or masonry partition.
- (k) When cylinders are being connected or disconnected, there shall be no open flame or any source of ignition nearby and smoking shall be prohibited.
- (l) Cylinders shall not be installed below ground level and shall be at least 1 m away from drains, culverts or entrances and openings leading to cellars and other depressions in which gas might accumulate.
- (m) Cylinders shall not be installed at a place where they are likely to cause an obstruction, to be damaged or to be exposed to conditions likely to affect their safety.
- (n) Cylinders which have safety relief valve or similar devices incorporated in them shall be so positioned that if the relief devices operates, escaping gas is not hazardous.

#### 8.3.2.2 Portable Installations

When portability of cylinders is desired, the following requirements shall be met:

- (a) The sum total capacity of the cylinders connected to each manifold shall not exceed 80 kg of LPG. The total quantity of gas thus installed in a workspace shall not exceed 200 kg.
- (b) The regulator shall be connected directly to the cylinder valve or to a manifold which shall be connected to the cylinder valve by means of rigid connections to have the regulator firmly secured.
- (c) At any time the total quantity of gas at portable installations shall not exceed the limits in proportion to the floor area specified in Sec 8-3.2.1 (a) to (f).

- (d) If cylinders are mounted on a trolley shall be stable, where necessary the cylinders shall be secured to prevent them from falling.

### 8.3.3 Manifolds and Pressure Regulators

- 8.3.3.1 If pressure regulators, manifold headers, automatic change over devices, etc. are connected to cylinders by flexible or semi-flexible connectors, they shall be rigidly secured. Copper tube pigtailed and reinforced high pressure hoses are considered to be flexible or semi-flexible connectors for this application.
- 8.3.3.2 Pressure regulator fitted with a safety valve shall be either:
- (a) Installed in the open air or
  - (b) Vented to the open air by means of a metal vent pipe connected to the safety valve discharge line.
- 8.3.3.3 Precautions shall be taken that safety valve outlets do not get blocked with dust or other substances.
- 8.3.3.4 Suitable line shutoff valves shall be provided with each appliance or burner when more than one appliance is connected to the gas supply. Both ends of the connection to portable appliances shall be firmly attached with clips. Hose shall be resistant to the action of LPG.
- 8.3.3.5 The manifold headers which do not have to be taken off in normal use should be brazed or welded using material conforming to approved standards and having a melting point not less than 540o C.
- 8.3.3.6 All materials, fittings, etc. used in cylinder manifold system shall comply with the distributing company's stipulations.
- 8.3.3.7 The individual component parts of manifolds, that is, piping, fittings, pigtailed, etc, which are subject to cylinder pressure shall be capable of withstanding a test pressure without bursting of 2.5 N/mm<sup>2</sup> or one and half times the maximum pressure corresponding in the maximum assessed temperature of the cylinder, whichever is more.
- 8.3.3.8 Where cylinder installations are made up with service and reserve batteries of cylinders, suitable change-over devices or valves shall be incorporated in the manifold header to prevent undue escape of the gas when cylinders are changed.
- 8.3.3.9 It is recommended that joints in manifold headers which do not have to be taken in normal use should be welded or brazed using a material and which shall have melting point of at least 540oC.
- 8.3.3.10 All joints between manifold headers and cylinder connectors shall be readily accessible.
- 8.3.3.11 Pressure regulators and other devices used to control the gas shall comply with the distributing company's stipulations and accepted standards.
- 8.3.3.12 Care shall be taken that safety of a metal vent pipe connected to the safety valve outlets do not become choked with dust or other foreign matter.
- 8.3.3.13 If the regulator is fitted with a relief valve, care should be taken in positioning the regulator to avoid unnecessary hazards if the relief valve functions.
- 8.3.3.14 Pressure regulators and other control devices shall be adequately supported.
- 8.3.3.15 Instructions to Consumers: Necessary instructions dealing with the following aspects shall be supplied by the LPG supply company to each consumer in the form of a manual:

- (a) Operation of the whole system;
- (b) How to recognize and detect gas leakage;
- (c) Action to be taken in case of leakage;
- (d) Action to be taken in case of fire; and
- (e) Action to be taken in case of damage to, or failure of any part of the installation.

8.3.3.16 For detailed information regarding installation of LPG cylinders in commercial, educational and institutional premises, the LPG supply company shall be consulted.

## **8.4 LPG Bulk Storage Installations**

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NFPA 58: Liquefied Petroleum Gas Code-2008 edition shall be followed along with approval of the gas supply company and the Authority having jurisdiction for LPG for bulk storage installations where storage tanks over 450 liters water capacity are used for domestic consumers' premises.

The maximum capacity an individual tank and groups of tanks at domestic premises shall be as follows:

Maximum water capacity of an individual tank	20,000 litre
Maximum water capacity of group of tanks	80,000 litre

The LPG Bulk Storage Installations shall strictly adhere to the provisions laid down in NFPA 58: Liquefied Petroleum Gas Code-2008 edition or its equivalent for the followings:

Location and spacing of storage tanks

- (a) Bunding
- (b) Protection and Safety
- (c) Good house keeping
- (d) Warning Signs
- (e) Fire protection and fire extinguishers
- (f) Water supply
- (g) Sound engineering practice for design, layout and operation of the entire installations
- (h) Training of personnel on both operations and on action to be taken in an emergency
- (i) The gas supply company and the Authority having jurisdiction shall approve every item mentioned above and can add anything more that will improve safety of the installation and people living around it.

## **8.5 INSTALLATION OF SPECIFIC APPLIANCES**

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### **8.5.1 General**

8.5.1.1 Gas appliances, accessories, and equipment shall be "Approved". Listed and labeled appliances shall be installed in accordance with the manufacturer's installation instruction.

8.5.1.2 It shall be determined whether the appliance has been designed for use with the gas to which it will be connected. No attempt shall be made to convert the appliance from the gas specified on the rating plate for use with a different gas without consulting the gas supply company or the appliance manufacturer for complete instructions.

8.5.1.3 Safety shutoff devices of the complete shutoff type shall be installed on manually controlled water heaters and automatically controlled appliances, except domestic ranges.

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- 8.5.1.4 Gas appliances shall not be installed in any location where flammable vapours are likely to be present or accumulate, unless the design, operation and installation are such as to eliminate the possibility of ignition of the flammable vapours.
- 8.5.1.5 Appliances shall be vented in accordance with the instructions of their manufacturers or the procedures of the gas supply company.
- 8.5.1.6 Gas appliances shall be firmly supported. They shall not exert undue strain on the connected piping and connections.
- 8.5.1.7 The installing agency shall conform with the appliance manufacturer's specific recommendations in completing an installation that will provide satisfactory performance and serviceability. The installing agency shall also leave the manufacturer's installation, operating and maintenance instructions in a readily accessible location on the premises for reference and guidance of the Authority, servicemen, and the consumer or operator.
- 8.5.1.8 All appliances shall be located with respect to building construction and other equipment so as to permit ready access to the appliance. Sufficient clearance shall be maintained to permit cleaning of heating surfaces, replacement of parts, adjustment, cleaning of burners and pilots and maintenance.
- 8.5.1.9 Connecting Appliances and Equipment: Appliances and equipment shall be connected to the building piping system by one of the following:
- (a) Rigid metallic pipe and fittings
  - (b) Semi-rigid metallic tubing and metallic fittings. Aluminum-alloy tubing shall not be used in exterior locations.
  - (c) Listed appliance connectors and only one connector shall be used per appliance
  - (d) Semi-rigid tubing in lengths up to 2 m that are in the same room as the appliance
  - (e) Listed gas hose connectors to be used as approved.
  - (f) The connector or tubing shall be protected against physical and thermal damages.
  - (g) Aluminum-alloy tubing and connectors shall be factory coated to protect against external corrosion where they are in contact with masonry, plaster or insulation or are subject to frequent wettings by such liquids as water (except rain water), detergents or sewage.
- 8.5.1.10 Any appliance connected to a piping system shall have an accessible approved manual shutoff valve with a displaceable valve member or a listed gas convenience outlet and shall be located within 2 m of the appliance it serves except as permitted by the Authority.
- 8.5.1.11 Appliance connectors may be connected to the building piping by means of a listed quick disconnect device, and when installed indoors, a manual shutoff valve shall be installed upstream of the quick disconnect device.
- 8.5.1.12 Electrical connection between gas appliances and the building wiring shall conform to the approved electrical code.
- 8.5.1.13 No devices using or dependent upon electricity shall be used to control or ignite a gas supply if of such type that failure of the electricity would result in the escape of unburned gas, or in failure to reduce the supply of gas under conditions which would normally result in its reduction, unless other means are provided to prevent the creation of dangerous temperatures, pressures or the release of gas.
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## 8.5.2 Cookers/Burners

- 8.5.2.1 Domestic cooking appliances shall be installed be listed and labeled as household type appliances for domestic use. These are installed in accordance with its listing and the manufacturer's instruction.
- 8.5.2.2 Listed cookers/burners when installed on combustibile floors shall be set on their own bases or legs firmly and shall be installed in accordance with their listing and the manufacturer's instructions. In absence of clearance information the appliances shall be installed in consultation with the gas supply company. The clearances shall not interfere with the flow of combustion air, accessibility for operation and servicing.
- 8.5.2.3 Unlisted appliances when acceptable with the authority shall be installed with at least a 150 mm clearance at the back and sides to combustibile material. Combustibile floors under unlisted appliances shall be protected in an approved manner. Guidelines of the Authority shall be followed.
- 8.5.2.4 Appliances shall have a vertical clearance above the cooking top of not less than 750 mm to combustibile material or metal cabinets.
- 8.5.2.5 Appliances shall be installed so that the top or oven racks are level.

## 8.5.3 Illuminating Appliances

- 8.5.3.1 Listed (labeled) illuminating appliances shall be installed in accordance with their listing and manufacturer's instructions.
- 8.5.3.2 Unlisted illuminating appliances may be used when acceptable to the Authority and they shall be installed in accordance with the guidelines of the Authority.
- 8.5.3.3 Illuminating appliances designed for wall or ceiling mounting shall be firmly attached to substantial structures in such a manner that they are not dependent on the gas piping for support.
- 8.5.3.4 Illuminating appliance designed for post mounting shall be firmly attached to a post which has proper strength and rigidity. Posts shall be rigidly erected.

## 8.5.4 Water Heaters

- 8.5.4.1 Water heater installation in bedrooms and bathrooms shall comply with one of the following:
- (a) Water heaters shall be installed in a closet equipped with a weather-stripped door with no openings and with a self-closing device. All combustion air shall be obtained from the outdoors through one or two permanent openings having cross-sectional area  $1 \text{ in}^2/3000 \text{ Btu/hr}$  ( $700 \text{ mm}^2/\text{kW}$ ). The minimum dimension of air opening shall not be less than 3 in (80 mm).
  - (b) Water heater shall be of direct vent type
- 8.5.4.2 Listed (labeled) water heaters shall be installed in accordance with their listing and manufacturer's instructions. The clearances shall not be such as to interfere with combustion air, draft hood clearance and relief, and accessibility for servicing.
- 8.5.4.3 Unlisted water heaters shall be installed with a clearance of 300 mm on all sides and rear and they shall be installed with the approval of the authority following its guidelines.
- 8.5.4.4 Water heaters shall be connected in a manner to permit observation, inspection, maintenance and servicing.



8.5.4.5 Water heaters shall be fitted with limiting switches for pressure and temperature and also with temperature, pressure and vacuum relief devices in accordance with nationally recognized standards for such devices.

### 8.5.5 Stationery Gas Engine Generators

Stationary gas engine generators for generating power to meet emergency needs during power outage shall be installed in accordance with the manufacturer's installation instructions and shall meet the requirements of UL 2200-04 (Standard for Stationary Engine Generator Assemblies-2004) of USA or equivalent.

The Equipment powered by internal combustion engines and turbines shall not be rigidly connected to the gas supply piping.

Installation of stationary gas engine generators in the building shall be approved by the Authority and the gas supply company; and all their regulations applicable shall be complied with for installation, testing, operation and maintenance.

## 8.6 List of Codes and Standards

The list includes those codes and standards that are acceptable as "good practice" and "accepted codes and standards" for complying with the requirements of this code. The latest version of a code or standard shall be used. The list may be used by the authority as a guide to fulfill the requirements mentioned in this code.

National Fuel Gas Code-2009 edition (NFPA 54/ANSI Z223-1)

Liquefied Petroleum Gas Code-2008 edition (NFPA 58)

International Fuel Gas Code-2009

National Building Code of India-2005 (Part 9, Section 2, Gas supply)

ASME Boiler and Pressure Vessel Code, Section VIII; 'Rules for the Construction of Unfired Pressure Vessels', 2004

ASTM A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless, 2007

ASTM A106, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Services, 2006a

ASTM A539, Standard Specification for Electric Resistance-Welded Coiled Steel

Tubing for Gas Fuel Oil Lines, 1999

ASTM B 43, Standard Specification for Seamless Red Brass Pipe, Standard sizes

ASTM B88, Standard Specification for Seamless Copper Water Tube, 2003

ASTM B210, Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes, 2004

ASTM B210, Standard Specification for Aluminum and - Aluminum - Alloy Drawn Seamless Tubes, 2004

ASTM B 241, Standard Specification for Aluminum and Aluminum Alloy Seamless Pipe and Seamless Extruded Tube, 2002

ASTM B280, Standard Specification for Seamless Copper Tube Air Conditioning and Refrigeration Field Service, 2008

ASTM D2513, Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings, 2008a

ANSI/ASME B36.10M, Welded and Seamless Wrought Steel Pipe, 2004

ANSI LC 1/CSA 6.26, Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST), 2005

ANSI Z21.1 Household Cooking Gas Appliances, 2005

NFPA 37, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines, 2006 edition

NFPA 10, Standard for Portable Fire Extinguishers, 2007 edition

Title 49, Code of Federal Regulations, Parts 191, 192 and 195, "Transportation of Hazardous Liquids by Pipeline".