



भारतीय मानक ब्यूरो BUREAU OF INDIAN STANDARDS

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व्यापक परिचालन मसौदा

हमारा संदर्भ : सीईडी 46/टी-21

15 नवंबर 2015

तकनीकी समिति :राष्ट्रीय भवन निर्माण संहिता विषय समिति.सीईडी 46

प्राप्तकर्ता :

- 1 सिविल इंजीनियरी विभाग परिषद् के सभी सदस्य
- 2 राष्ट्रीय भवन निर्माण संहिता विषय समिति, सीईडी 46 व
नल-साजी सेवाओं के लिए पैनल, सीईडी 46:P17 के सभी सदस्य
- 3 रुचि रखने वाले अन्य निकाय ।

महोदय/महोदया,

निम्नलिखित मसौदा संलग्न है:

प्रलेख संख्या	शीर्षक
सीईडी 46(8061)WC	राष्ट्रीय भवन निर्माण संहिता का मसौदा: भाग 9 नल-साजी सेवाएं, अनुभाग 4 गैस आपूर्ति [SP7(भाग9/अनुभाग 4)]

कृपया इस मसौदे का अवलोकन करें और अपनी सम्मतियाँ यह बताते हुए भेजें कि यदि यह मसौदा भारत की राष्ट्रीय भवन निर्माण संहिता के भाग के रूप में प्रकाशित हो तो इस पर अमल करने में आपके व्यवसाय अथवा कारोबार में क्या कठिनाइयाँ आ सकती हैं ।

सम्मतियाँ भेजने की अंतिम तिथि :**15 दिसंबर2015**

यदि कोई सम्मति हो तो कृपया अधोहस्ताक्षरी को उपरिलिखित पते पर संलग्न फॉर्मेट में भेजें । हो सके तो कृपया अपनी सम्मतियाँ ई-मेल द्वारा sanjaypant@bis.org.in पर भेजें ।

यदि कोई सम्मति प्राप्त नहीं होती है अथवा सम्मति में केवल भाषा सम्बन्धी त्रुटि हुई तो उपरोक्त प्रलेखों को यथावत अंतिम रूप दे दिया जाएगा । यदि सम्मति तकनीकी प्रकृति की हुई तो विषय समितिके अध्यक्ष के परामर्श से अथवा उनकी इच्छा पर आगे की कार्यवाही के लिए विषय समिति को भेजे जाने के बाद प्रलेख को अंतिम रूप दे दिया जाएगा ।

यह प्रलेख भारतीय मानक ब्यूरो की वेबसाइट www.bis.org.in पर भी उपलब्ध है ।

धन्यवाद ।

भवदीय,

ह0

(बी.के. सिन्हा)

प्रमुख (सिविल इंजीनियरी)

संलग्न: उपरिलिखित

**भारतीय मानक ब्यूरो**
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DRAFT IN WIDE CIRCULATION**DOCUMENT DESPATCH ADVICE**

Reference	Date
CED 46/T-21	15 November 2015

TECHNICAL COMMITTEE:**NATIONAL BUILDING CODE SECTIONAL COMMITTEE, CED 46****ADDRESSED TO:**

1. All Members of Civil Engineering Division Council, CEDC
2. All Members of National Building Code Sectional Committee, CED 46 and Panel for Plumbing Services, CED 46:P17
3. All other interests.

Dear Sir/Madam,

Please find enclosed the following draft:

Doc. No.	Title
CED 46 (8061)WC	Draft National Building Code of India: Part 9 Plumbing Services, Section 4 Gas Supply [SP 7(Part 9/Section 4)]

Kindly examine the draft and forward your views stating any difficulties which you are likely to experience in your business or profession if this is finally adopted as Part of the National Building Code of India.

Last Date for comments: **15 December 2015.**

Comments if any, may please be made in the format as attached, and mailed to the undersigned at the above address. You are requested to send your comments preferably through e-mail to **sanjaypant@bis.org.in**.

In case no comments are received or comments received are of editorial nature, you may kindly permit us to presume your approval for the above document as finalized. However, in case of comments of technical nature are received then it may be finalized either in consultation with the Chairman, Sectional Committee or referred to the Sectional Committee for further necessary action if so desired by the Chairman, Sectional Committee.

This document is also hosted on BIS website **www.bis.org.in**.

Thanking you,

Yours faithfully,

Sd/-

(B. K. Sinha)
Head (Civil Engg)

Encl: as above

FORMAT FOR SENDING COMMENTS ON THE DOCUMENT

[Please use A4 size sheet of paper only and type within fields indicated. Comments on each clause/sub-clause/ table/figure, etc, be stated on a fresh row. Information/comments should include reasons for comments, technical references and suggestions for modified wordings of the clause. **Comments through e-mail in MS WORD format to sanjaypant@bis.org.in shall be appreciated.**]

Doc. No.: CED 46(8061)WC **BIS Letter Ref:** CED 46/T-21 **Dated:** 15 November 2015

Title: NATIONAL BUILDING CODE OF INDIA: Part 9 'Plumbing Services, Section 4 Gas Supply' [SP 7 (Part 9/Sec 4)]

Name of the Commentator or Organization: _____

Clause No. with Para No. or Table No. or Figure No. commented (as applicable)	Comments/Modified Wordings	Justification for the Proposed Change

Draft NATIONAL BUILDING CODE OF INDIA

PART 9 PLUMBING SERVICES (INCLUDING SOLID WASTE MANAGEMENT)

Section 4 Gas Supply

[SP 7 (Part 9/ Section 4)]

BUREAU OF INDIAN STANDARDS

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LIST OF STANDARDS

IMPORTANT EXPLANTORY NOTE FOR USERS OF THE CODE

In this Part of the Code, where reference is made to 'good practice' in relation to design, constructional procedures or other related information, and where reference is made to 'accepted standard' in relation to material specification, testing, or other related information, the Indian Standards listed at the end of this Part may be used as a guide to the interpretation.

At the time of publication, the editions indicated in the standards were valid. All standards are subject to revision and parties to agreements based on this Part are encouraged to investigate the possibility of applying the most recent editions of the standards.

In the list of standards given at the end of this part, the number appearing in the first column indicates the number of the reference in this Part. For example:

- a) Accepted standard [9-4(5)] refers to the Indian Standard given at serial number (5) of the above list given at the end of this Section 4 of Part 9, that is IS 15683: 2006 'Portable Fire Extinguishers–Performance and Construction–Specification '.
- b) Good practice [9-4(8)] refers to the Indian Standard given at serial number (8) of the above list given at the end of this Section 4 of Part 9, that is IS 6044 (Part 2): 2001 'Code of practice for liquefied petroleum gas storage installations : Part 2 Commercial, industrial and domestic bulk storage installations (first revision)'.

BUREAU OF INDIAN STANDARDS

DRAFT FOR COMMENTS ONLY

(Not to be reproduced without the permission of BIS or used as an Indian Standard)

***Draft* NATIONAL BUILDING CODE OF INDIA:**

PART 9 PLUMBING SERVICES (INCLUDING SOLID WASTE MANAGEMENT)

Section 4 Gas Supply

[SP 7(Part 9/Sec 4)]

ICS: 01.120; 91.040.01

**National Building Code
Sectional Committee, CED 46**

**Last Date for Comments:
15 December 2015**

National Building Code Sectional Committee, CED 46

FOREWORD

This Section covers the safe use of gas for fuel or lighting purposes in buildings.

The use of gas for fuel and lighting purposes in buildings has begun in some parts of the country and with the advent of new petroleum complexes, community gas supply is bound to become one of the important services like electricity and water supply in buildings.

The use of liquefied petroleum gas supplied in containers and cylinders is already quite popular. On release of pressure, by opening the valve, they readily convert into the gaseous phase. In this state they present a hazard comparable to any inflammable natural or manufactured gas, except that being heavier than air, low level ventilation is necessary to avoid inflammable concentration of gas.

A minimum set of safety regulations are, therefore, laid down to safeguard the gas piping installation and the mode of operation in the interest of public safety.

In the first version of the Code formulated in 1970, three separate Sections of Part 9 Plumbing services, were brought out, namely, Section 1 Water supply, Section 2 Drainage and sanitation, and Section 3 Gas supply. These Sections were subsequently revised in 1983.

In the first revision, in 1983, the safe distance between gas piping and electrical wiring system was modified as well as between gas piping and steam piping was incorporated. Additional information regarding the handling, use, storage and

transportation of LPG in cylinders exceeding 500 ml water capacity were included. Provisions relating to LPG cylinders, installations regarding some aspects, such as jointing compound used at joints, painting of gas piping, details of fire extinguishers, total quantity of LPG at stationary and portable installations in proportion to the floor area were added. Also, some provisions of LPG bulk storage installations were introduced.

In the second revision in 2005, the Part 9 was renamed as 'Plumbing Services (Including Solid Waste Management)' and provisions on solid waste management were included for the first time under Section 1 which contained in it, Water Supply, Drainage & Sanitation. Gas Supply was addressed in Section 2 of Part 9. In this second revision, provisions with regard to pressure regulations were modified; in the provision of service shut-off valves, number of additional shut-off valves were specified; in the provision of installation of gas pipe, new materials for pipes were mentioned; the minimum diameter for gas pipe was reduced to 8 mm; the colour for pipe line for supplying natural gas was specified; the provisions regarding protection against the corrosion were modified; the process of installation of meters were clarified; and additional method for detection of leakage of gas was recommended.

In this third revision of the Code, to comprehensively address the various and distinct features related to the plumbing aspects, this Part 9 Plumbing Services has been rearranged as follows:

- Section 1 Water Supply
- Section 2 Drainage and Sanitation
- Section 3 Solid Waste Management
- Section 4 Gas Supply

Based on the experience gained in the use of this Section, the provisions have been modified in this revision. The significant changes incorporated in this revision include:

- a) Certain terminologies have been included/updated;
- b) References to Indian Standards on details regarding medical gas pipeline systems have been included.
- c) Provision of use of fire stops/sleeves at openings has been included.
- d) The clause on use of use of liquefied petroleum gas has been completely revised.
- e) Cross-referred standards have been updated.

Further modifications shall be done based on the comments and suggestions received as a result of this wide-circulation of the document for public comments.

It may also be noted that the following Indian Standards have also been formulated on design and installation of natural gas pipelines:

- | | |
|-----------------------|--|
| IS 15663(Part 1):2006 | Code of practice for design and installation of natural gas pipelines: Part 1 Laying of pipelines |
| IS 15663(Part 2):2006 | Code of practice for design and installation of natural gas pipelines: Part 2 Laying of pipelines in crossings |

IS 15663(Part 3):2006 Code of practice for design and installation of natural gas pipelines: Part 3 Pre-commissioning and commissioning of pipelines

While implementing this standard, compliance with statutory regulations shall be ensured.

The information regarding the use of liquefied petroleum gas has been largely based on the following Indian Standards:

IS 6044 (Part 1):2013 Liquefied petroleum gas storage installations — Code of practice: Part 1 Residential, commercial and industrial cylinder installations (*second revision*)
IS 6044 (Part 2):2001 Code of practice for liquefied petroleum gas storage installations: Part 2 Commercial, industrial and domestic bulk storage installations (*first revision*)

All standards, whether given herein above or cross-referred to in the main text of this section, are subject to revision. The parties to agreement based on this section are encouraged to investigate the possibility of applying the most recent editions of the standards.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2:1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this Section.

BUREAU OF INDIAN STANDARDS**DRAFT FOR COMMENTS ONLY**

(Not to be reproduced without the permission of BIS or used as an Indian Standard)

Draft* NATIONAL BUILDING CODE OF INDIA:*PART 9 PLUMBING SERVICES (INCLUDING SOLID WASTE MANAGEMENT)****Section 4 Gas Supply**

[SP 7(Part 9/Sec 4)]

ICS: 01.120; 91.040.01

**National Building Code
Sectional Committee, CED 46**

**Last Date for Comments:
15 December 2015**

1 SCOPE

1.1 This Section covers the requirements regarding the safety of persons and property for all piping uses and for all types of gases used for fuel or lighting purposes in buildings.

1.2 This Section does not cover safety rules for gas burning appliances.

2 TERMINOLOGY

2.1 For the purpose of this section, the following definitions shall apply.

2.1.1 *Appliance Valve* – A device that will shut off the gas supply to the burner(s).

2.1.2 *Approved Agency* — Person or agency or a corporate body approved by competent authority or distribution company to execute the job of designing, erection and maintenance of multi cylinder installation.

2.1.3 *Authority Having Jurisdiction* – The Authority which has been created by a statute and which, for the purpose of administering the Code/Part, may authorize a committee or an official to act on its behalf; hereinafter called the ‘Authority’.

2.1.4 *Competent Authority* — The Authority designated or otherwise recognized under *Gas Cylinder Rules, 2004* for approving LPG cylinders, valves and regulators.

2.1.5 *Customer’s/Consumer’s Connection* – Piping tapped on riser to supply each individual customer/consumer.

2.1.6 *Distribution/Distributing Company* — The company which is in the field of marketing LPG and is the owner of cylinders.

2.1.7 Gas Fitter – An employee of the gas supplying organization.

2.1.8 Installation — A designated premises in an establishment where the complete multi-cylinder-system comprising cylinder, piping manifold, vaporizers, etc, is installed.

2.1.9 Manifold — A pipe header provided with several opening to which the cylinders are connected by using suitable pipe fittings.

2.1.10 Pilot – A small flame which is utilized to ignite the gas at the main burner(s).

2.1.11 Pressure Regulator – A device designed to lower the pressure of gas coming from the distribution main and to maintain it practically constants downstream. This normal operation pressure shall be practically in all cases that of the gas appliances used.

2.1.12 Purge – To free a gas conduit of air or gas or a mixture of gas and air.

2.1.13 Qualified Installing Agency – An individual, firm or agency which either in person or through a representative is engaged in and is responsible for the installation or replacement of gas piping on the outlet side of the gas meter, or the connection, installation or repair of gas supply piping and appliances within a building, and who is experienced in such work, familiar with all precautions required, and who has complied with all the requirements as to qualification, registration, licensing, etc, of the Authority.

2.1.14 Riser – Piping usually vertical on most of its length that supplies gas from the service to the various storeys of the building.

2.1.15 Service Pipe – Pipe that runs between the distribution main in the street and the riser in the case of multistoried building or the meter in the case of an individual house.

2.1.16 Service Shut-Off Valve (Isolation Valve) – A device installed outside the premises to cut-off the main supply of gas from pipeline by the supplier.

2.1.17 Vent Pipe – A safety device to which certain regulators are connected to evacuate outside gas that may escape from the normal circuit when some part of system gets damaged or malfunctions or a safety valve is open.

3 PRESSURE REGULATIONS

3.1 Pressure regulation is required to economize the sizing of piping system. Where the pressure of gas supplied to domestic system or other low pressure gas piping system in buildings is in excess of the pressure to be used in the appliance, a gas pressure regulator of suitable specification shall be installed in service pipe of each system to prevent excess pressure reaching the appliance. The pressure regulators to be used can be from 400 kN/m² upstream pressure to 2.1 kN/m² for domestic consumers and 10 kN/m², 30 kN/m², 200 kN/m² for commercial consumers, as the case may be.

3.1.1 In some place the reduction of pressure from main distribution source of 400 kN/m^2 to intermediate pressure (say 7 kN/m^2) and then to operating pressure of 2.1 kN/m^2 is achieved.

3.1.2 Whereas in most of the other places the reduction of pressure from main distribution source of 400 kN/m^2 to directly operating pressure (say 2.1 kN/m^2 , 10 kN/m^2 , 30 kN/m^2 , 200 kN/m^2) is achieved in single stage pressure reduction.

3.2 If located inside a building, the required regulator shall comply with the following:

- a) If any of the diaphragms of the regulator ruptures, the gas shall be sent to an outlet vent pipe made of brass or plastic in order to ventilate or drain the gas out of the building. The vent pipe will, however, lead to outer air about 1 m above the topmost storey of the building. Means shall be employed to prevent water from entering this pipe and also to prevent stoppage of it by insects or other foreign bodies.
- b) If the gas pressure at the outlet of the regulator falls below 50 percent of the operating gas pressure or rises above twice the operating gas pressure, the gas input to the pressure regulator shall be cut off.
- c) In the event of malfunctioning of this safety device, a supplementary device shall connect the low pressure circuit to the outlet circuit (vent pipe) as soon as the exit pressure reaches 7 kN/m^2 .

3.3 It shall also be ensured by the supply authority that the calorific value and supply pressure of gas shall not exceed the values for the type of gas used.

4 SERVICE SHUT-OFF VALVES

4.1 Service shut-off valves shall be installed on all new services including replacements in a readily accessible location.

4.2 Service shut-off valves shall be located upstream of the meter if there is no regulator or upstream of the regulator, if there is one.

4.2.1 Service shut off valves shall be located in the upstream of the meter, if a single regulator is supplying more than one consumer and each such stream shall have one additional shut off valve upstream of regulator.

4.3 All gas services operating at pressure greater than 7 kN/m^2 shall be equipped with an approved service shut-off valve located on the service pipe outside the building.

4.4 Underground shut-off valves shall be located in a covered durable curb box, manhole, vault or stand pipe which is designed to permit ready operation of the valve and the covers of which shall be clearly marked 'Gas'.

5 EXISTING WORK

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

6 RULES FOR TURNING GAS ON

6.1 No person, unless is the employ of the gas company or having permission from the gas company, shall turn on the gas at a service shut-off valve or at any valve that controls the supply of gas to more than one consumer.

6.2 Gas shall not be turned on at any meter valve without specific permission from the gas company or other authority if any of the following conditions exists :

- a) If the gas piping appliances or meter supply through the meter valve are known to leak or otherwise to be defective (see **10**).
- b) If required inspection of the piping or appliance has not been made.
- c) If the gas company or other authority has requested that the gas be left turned off.
- d) If the meter valve is found shut off for some reason not known to the gas fitter.

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

6.3 Gas shall not be turned on at any branch line valve if any of the conditions specified in **6.2** prevails. 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.

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

7 RULES FOR SHUTTING OFF THE GAS

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

- a) If ordered to do so by the Authority.
- b) If leakage of gas is noted, which appears to be sufficient to cause fire, explosion or asphyxiation.
- c) If an installation of some gas appliance is found to be such as to cause a serious hazard to persons or property.
- d) If any condition exists which threatens interruption of gas supply which may cause burner outage or otherwise prove dangerous.

7.2 It shall be the duty of the installing agency when the gas supply is to be turned off to notify all affected consumers.

7.3 Before turning off the gas at the meter, for the purpose of installation, repair, replacement or maintenance of piping or appliance, all burner 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 gas passing through the meter. Where there is more than one meter on the premises, precaution shall be exercised to ensure that the concerned meter is turned off.

8 INSTALLATION OF GAS PIPES

8.1 Installation, repair and replacement of gas piping or appliances shall be performed only by a qualified installing agency.

8.2 Piping

8.2.1 Piping shall be of wrought iron, steel, copper or cast iron when the gas pressure is less than 7kN/m^2 ; with higher gas pressure use of cast iron shall be prohibited.

8.2.1.1 SS 316/304/321 Flexible PE coated flexible pipe in rolls shall be permitted in low pressure system provided the pipe meets the required standard, to avoid the bends, fittings and leakages from the joint which are potential leakage points. Also, reference may be made to accepted standard [9-4(1)]. Heavy rubber flexible tube shall be permitted only as direct connection to burner from appliance valve.

8.2.1.2 For details regarding medical gas pipeline systems, a reference may be made to good practice [9-4(2)].

8.2.2 *Size of Gas Piping*

Gas piping shall be of such size and so installed as to provide supply of gas sufficient to meet the maximum demand without undue loss of pressure between the meter or service regulator when a meter is not provided, and the appliance(s).

8.2.2.1 The size of gas piping depends upon the following factors :

- a) allowable loss in pressure from meter or service regulator, when a meter is not provided, to appliance;
- b) maximum consumption to be provided;
- c) length of piping and number of fittings; and
- d) specific gravity of gas.

8.2.2.2 No gas pipe smaller than 8 mm shall be used.

8.2.3 As far as possible, straight lengths of piping should be used. Where there are bends in the pipe line, these should have a radius of at least five times the diameter of the pipe.

8.2.4 For any thread joint proper sealant shall be used on male threads only.

8.3 The gas piping shall be of the colour stipulated by explosive authority to distinguish it from other piping and the piping shall be painted silver grey with red band of 150 mm width. The gas pipeline shall be painted canary yellow in case of natural gas.

8.4 Piping Underground

8.4.1 Protection of Piping

Piping shall be buried to a minimum depth of 1 m or covered in a manner so as to protect the piping from physical damage.

8.4.2 Protection against Corrosion

Generally 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. Under ground or concealed gas pipeline in contact with earth or other materials which may corrode the piping shall be protected against corrosion by application of adequate corrosion resistant coating backed up by cathodic protection system.

8.5 The building shall not be weakened by the installation of any gas piping.

8.6 Gas piping in building shall be supported with pipe hooks, metal pipe straps, bonds or hangers suitable for the size of piping and of adequate strength and quality and located at proper intervals so that the piping may not be moved accidentally from the installed position.

8.7 Pipe Entrance to Buildings

Where gas pipe enters a building through a wall or floor of masonry or concrete, any gas piping or other piping entering the walls or floors shall be suitably sealed against the entrance of water/moisture or gas.

The openings or imperfection of fit or design are also source of possible fire and smoke passing through them. Fire stops shall be provided to fill the openings around penetrating items such as gas pipes, etc. through the wall or floor openings. Non-combustible-sleeving may also be used as an alternative to proprietary seals for penetration of pipes of lead, aluminium, aluminium alloy, fibre cement or UPVC up to a specified nominal internal diameter. Proprietary fire stopping and sealing systems which have been shown by test to maintain the fire resistance of the wall or other elements, are available and may be used. Other fire stopping materials include cement mortar; gypsum-based plaster; cement or gypsum vermiculite/perlite mixes; glass fibre, crushed rock, blast furnace slag, or ceramic based products (with or without resin binders), and intumescent mastics. These may be used in situations appropriate to the particular material. Not all of them will be suitable in every situation. When sleeving is used, its length should be greater than the thickness of wall or floor. The sleeve shall be properly grouted to maintain fire/smoke separation.

Regarding protection of openings in walls or floors, from fire, reference shall be made to Part 4 'Fire and Life Safety'.

8.7.1 Piping in Floors

Piping in solid floors, such as concrete, shall be laid in channels in the floor suitably covered to permit access to the piping with a minimum damage to the building.

8.7.2 Single pipe without joint shall be used for wall crossing in any building.

8.8 Gas pipe shall not be bent. Fittings shall be used when making turns in gas pipe.

8.9 Generally concealed piping shall not be allowed. However, if it is necessary then it shall be under the **8.4** of underground piping and all protection such as coating, cathodic protection shall be done.

8.10 A drip shall be provided in the gas distribution system, if the moisture contents in the gas is likely to reach saturation point at any stretch of pipe line in the system; a drip shall, however, be provided at any suitable point in the line of the pipe where condensate may collect and from where it can be easily removed. This drip should be so installed as to constitute a trap where in an accumulation of condensate will shut off the flow of gas before it will run back into the meter.

8.10.1 Drip has to be provided in the case of gas consisting moisture content.

8.11 Prohibited Devices

No device shall be placed inside the gas piping or fittings that will reduce the cross-sectional area or otherwise obstruct the free flow of gas.

8.12 Piping shall be electrically continuous throughout its length and properly earthed except in stretches where cathodic protection system is used for protection against corrosion. It shall not, however, be used to earth any electrical equipment.

8.12.1 The distance between gas piping and electrical wiring system shall be at least 60 mm and, where necessary, they shall be securely fixed to prevent contact due to movement. The gas piping should run above the electrical wiring. In this type of installation in the event of any leakage of natural gas, the gas would move up (natural gas being lighter than air) and would not come directly in contact with the electrical wiring. If the gas to be supplied is heavier than the air then the gas piping should run below the electrical wiring.

8.13 The distance between the gas piping and steam piping, if running parallel, shall be at least 150 mm. The gas piping should preferably run below the steam piping.

8.14 Piping installation shall be thoroughly gastight.

8.15 Smoking shall not be permitted when working on piping which contains or has contaminated gas.

8.16 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 and shall be easily accessible.

9 INSPECTION OF SERVICES

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 the tightness of the system, and a certificate has been issued by the Authority.

9.1.1 *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 gastight. Where any part of the system is to be enclosed or concealed, this test should precede the work of closing in. To test for tightness the piping may be filled with city gas, air or inert gas but not with any other gas or liquid. In no case shall oxygen be used. The piping shall stand a pressure of at least 20 kN/m^2 measured with a manometer or slope gauge, for a period of not less than 10 minutes without showing any drop in pressure.

9.1.2 When the gas pressure exceeds 7 kN/m^2 , the piping shall withstand a pressure of 0.6 MN/m^2 for 4 hours. (This test is for piping designed for working pressure less than 0.4 MN/m^2).

9.2 The Authority shall, within a reasonable time after being requested to do so, inspect and test a system of gas piping that is ready for such inspection and test, and if the work is found satisfactory and test requirements are complied with, it shall issue the certificate.

10 LEAKAGE CHECK

10.1 Before turning gas under pressure into any piping, all openings from which gas may escape shall be closed.

10.2 *Checking for Gas Leakage*

No matches, flame or other sources of ignition shall be employed to check for gas leakage from meters, piping or appliances. Checking for gas leakage with soap and water solution is recommended.

10.3 *Use of Lights*

Artificial illumination used in connection with a search of gas leakage shall be restricted to electric hand flash lights (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.

10.4 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 done by carefully watching the test dial of the meter to determine whether gas is passing through the meter. In no case should a leakage test be made using a gas meter unless immediately prior to the test it has been determined that the meter is in operating condition.

10.5 Checking of Leakage Without Using a Meter

This may be done by attaching to an appliance, orifice or a manometer or equivalent device and momentarily turning on the gas supply and deservng the gauging device for pressure drop with the gas supply shut-off. No discernible drop in pressure shall occur during a period of 3 minutes.

10.6 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.

10.7 After the gas piping has been effectively purged, all appliances shall be purged and the pilots lighted.

10.8 In addition to the checking of gas leakage with soap and water solution, a suitable gas detector is also recommended for use.

11 USE OF LIQUEFIED PETROLEUM GAS

11.1 The cylinders used for the storage and transportation of liquefied petroleum gas (LPG) shall conform to accepted standards [9-4(3)] approved by the statutory authority.

11.2 The handing, use, storage and transportation of liquefied petroleum gas in cylinders exceeding 500 ml water capacity shall be done in accordance with good practice [9-4(4)].

11.3 LPG Cylinder Installation

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

11.3.1 General Recommendations

11.3.1.1 Those responsible for the installation of cylinders, equipment and piping should understand the characteristics of LPG and be trained in good practice of handling, installing and maintaining installations.

11.3.1.2 The jointing compound used at different joints in the system shall be decided by the Qualified Installing Agency. Hemp and similar materials shall not be

used at the joint. In any joint in which the thread provides a gastight seal, jointing compound shall be used only on the male thread.

11.3.1.3 Fire extinguishers of dry powder type or carbon dioxide type conforming to accepted standards [9-4(5)] 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 number, type and size of the fire extinguishers shall be as follows:

	<i>Number</i>	<i>Type</i>	<i>Capacity</i>
a) For installations with LPG 40 kg to 200 kg	2	Dry Powder	10 kg
b) For installations with LPG more than 200 kg and up to 320 kg	3	Dry powder	10 kg
c) For installations with LPG more than 320 kg and up to 1 000 kg	4	Dry powder	10 kg

NOTE – For electrical installations, one number CO₂ fire extinguisher (4.5 kg capacity) shall be provided.

11.3.1.4 Liquefied petroleum gas shall not be transferred from the cylinders in which it is received to any other container.

11.3.2 *Cylinder Location*

11.3.2.1 *Stationary installations*

- Stationary installation not exceeding 50 kg of LPG may be installed indoors on any floor. It is recommended to have a minimum floor area of 5m² for such an installation.
- Stationary installations each not exceeding 50 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, the proportion of such installations to floor area is one installation per 5 m² and the aggregate quantity of gas of all such installations does not exceed 200 kg.
- Stationary installation not exceeding 100 kg of LPG may be installed indoors on any floor provided the floor area for such an installation is not less than 12 m².
- Stationary installations each not exceeding 100 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, the proportion of such installations to floor area is one installation per 12 m² and the aggregate quantity of gas of all such installations does not exceed 200 kg.

- e) Stationary installation not exceeding 400 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 installations above 400 kg (200 kg in case provision as in (e) is not possible) but not exceeding 1 000 kg shall be installed outdoors on ground floor level only. A minimum distance of 3 m shall be maintained between an installation and any building, public place, roadways, and other surroundings. The installation shall be protected from excessive weathering by sun, rain, etc and from tampering by unauthorized persons. A lean-to roof with expanded metal on angle-iron framework on the sides is considered suitable for this purpose. In any case, adequate ventilation at ground level to the outside air shall be provided.
- g) If the storage per installation is more than 1 000 kg, installations in multiples of 1 000 kg with manifold, safety devices, change over mechanism may be provided with minimum inter distance of 3 m from all sides. Total number of such installations shall not exceed 4 including stand by installation. If more than two installations are used, then number of cylinders per installations should not exceed 30.
- h) For storage installations of 1 000 kg or installations in multiple of 1 000 kg the number of cylinders to be connected per manifold shall not exceed 15 and for each 1 000 kg installation two such manifolds shall be provided.
- j) Cylinders shall be installed upright with the valves uppermost.
- k) Cylinder containing more than 20 kg of gas shall not be located on floors above ground level.
- m) Cylinders shall be located on a concrete or brick floor, preferably raised in case of outdoor installations.
- n) In order to prevent the hazardous collection of gas, cylinders shall be placed at least 1 m away from culverts, depressions, or openings leading to below ground level compartment and drains.
- p) Cylinders which have safety relief valves or similar devices incorporated in them shall be so positioned so that if the relief device operates, escaping gas is not hazardous.
- q) Cylinder installation for commercial/industrial/ domestic/residential complexes, etc, or at any public place shall meet the following requirements:
 - 1) For commercial and industrial cylinder installation for any public places like mall, buildings, industries, hotels, etc, the sum total of all stationery installations inside the building shall not exceed 400 kg of LPG in any case. In case sum total of net weight of all the cylinders installed indoors exceed 400 kg provision for outdoor installations shall be made. For installations where the sum total is less than 400 kg of LPG provisions of (b) to (e) shall apply.
 - 2) For commercial and industrial cylinder installation for any public place, industry, etc, if the net weight of all the cylinders installed is more than 400 kg but less than 1 000 kg, than the installation shall be provided outdoors in line with (f). The cylinder installation shall be provided in a covered industrial shed but open from all sides for proper ventilation. In case the installed capacity increases more

than 1 000 kg, than the installation shall be provided in line with (g). Two separate installations shall be provided and distance between each of the installations shall be minimum 3 m (this distance shall be between the outer edge of the two sheds).

- 3) For multi-storied buildings, flats housing society the reticulated installation of any capacity shall be provided at a safe place especially earmarked for this purpose. The installation shall not be provided by the side of road where there is continuous movement of vehicles or is approachable to residents especially children. The installation should be secured and should be provided in a covered shed open from all sides for ventilation. The area shall be demarcated by 1.5 m high chain link fencing having one gate. There should be minimum 3 m clear space all around the fencing and the space between the fencing and the edge of the shed should be minimum 2 m all around.
- 4) If the requirement is more than 1 000 kg, installations in multiples of 1 000 kg with manifold, safety devices, change over mechanism, not exceeding 4 such installations (including stand by) may be provided with minimum distance of 3 m from all sides. The number of cylinders per installations should not exceed 30
- 5) *Location of cylinder bank:*
 - i) The site for LPG cylinder manifold shall be located away from the kitchen/LPG utility area/residential building. Installation shall be slightly raised minimum 100 mm from surrounding ground level.
 - ii) Cylinders installation should not be located in inaccessible location, under a stairway, basements, cellars, where air movement across cylinders is very low/ not present, to prevent the cylinders from getting inadequate latent heat and unapproachable during emergency.
 - iii) Cylinders installation should not be close to steam pipes, boilers, transformers, DG sets, etc, to prevent cylinders from getting affected due to radiant heat.
 - iv) Cylinders shall not be installed at a place where they are likely to cause obstruction, suffer damage or be exposed to conditions likely to affect safety.
 - v) Cylinders installation should not be located along the drive way. Under unavoidable conditions, minimum distance of 3 m from drive way shall be maintained. Brick masonry (minimum 230 mm thick)/concrete (minimum 100 mm thick) walls or metallic Shields/ barriers (minimum 1.63 mm sheet) and of minimum 2 m height should be erected between drive way and cylinder installation for the safety and security of the installation.
 - vi) Cylinders shall be located on a concrete or brick floor that is firm, at level, smooth, drained in case of outdoor installation.
 - vii) The cylinder shall be installed in upright position with the valve pointing upwards and minimum 1 m away from any combustible materials.

r) Cylinder Storage Room

- 1) The cylinder storage room shall be made out of non flammable material that is concrete (minimum 100 mm thick) or brick masonry walls (minimum 230 mm thick) or steel structures made out of minimum 5 mm thick MS angle iron structure and 1.63 mm MS wire mesh of size minimum 11.
- 2) Since LPG is heavier than air, ventilation shall be provided at floor level, that is 100 mm above inside cylinder bank room, open to atmosphere. The ventilators shall be provided with 2 layers copper or non-corroding metal wire mesh not less than 11 to the linear centimeter. The size of the ventilators should be minimum 500 mm long and 300 mm height.
- 3) The storage room shall be well ventilated, that is openings/ventilators shall be provided in the walls of cylinder storage covering minimum 25 percent of wall area. It should also have adequate lighting. Both exteriors and interiors should be painted with weather proof paints. FLP fittings, approved by statutory authorities shall be provided for electrical use.
- 4) The doors of the room where cylinders are installed shall open outwards and shall have louvers/wire mesh to ensure visibility and ventilation.
- 5) Flammable materials like wood and plastic shall not be used. The cylinder bank storage room shall not used for storing any other materials.

11.3.2.2 Portable installations

When portability of cylinders is necessary, the following requirements shall be fulfilled:

- a) The sum total of capacity of the cylinders connected to each manifold shall not exceed 100 kg of LPG. The total quantity of gas thus installed in a workspace shall not exceed 200 kg.
- b) If cylinders are mounted on a trolley, the trolley shall be stable. Where necessary, the cylinders shall be secured to prevent them from falling.
- c) The regulator shall be connected directly to the cylinder valve or to a manifold which shall be connected to the cylinder valves by means of rigid connections to give adequate support to the regulator. The only exception to this requirement is where cylinders are mounted on a trolley and the manifold is rigidly supported on the trolley. In such a case flexible or semi-flexible connections may be used between the cylinder valves and the manifold but not between the manifold and the regulator.
- d) Anytime the total quantity of gas at portable installations shall be in proportion to the floor area as specified in **11.3.2.1 (a) to (f)**.
- e) At any time the provision at **11.3.2.1 (a) to (r)** shall be ensured for all installations.

11.3.3 Cylinder Manifolds

11.3.3.1 All materials, fittings, etc, used in cylinder manifold systems shall comply with the statutory provisions or relevant Indian Standards. In absence of any such provisions or Indian Standards, equivalent international norms shall be followed.

11.3.3.2 The individual component parts of manifolds, that is piping, fittings, pigtails, etc, which are subject to cylinder pressure shall be capable of withstanding a test pressure without bursting of 25 kgf/cm² or one and a half times the developed pressure at 65 °C, whichever is more.

11.3.3.3 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.

11.3.3.4 In case pressure regulators, manifold headers and automatic change-over devices are connected to cylinder by semi-flexible connectors, these shall be rigidly supported. Copper tube pigtails are considered to be semi-flexible for this purpose.

11.3.3.5 It is recommended that joints in manifold headers which do not have to be broken in normal use should be welded or brazed using a material which shall have a melting point of at least 540 °C.

11.3.3.6 All joints between manifold headers and cylinder connectors shall be readily accessible.

11.3.3.7 All joints in the manifold should be welded (except for valve fixation) and be easily accessible for inspection/repairs, etc.

11.3.3.8 Each manifold arm shall be fabricated in such a way that minimum joints are provided. Only seamless pipes are recommended for use in manifolds. There should be a minimum gap of 300 mm between the manifold and valve protection ring of the LPG cylinders.

11.3.3.9 The cylinders connected to a manifold shall be safely spaced for easy and safe replacement of cylinder when empty. A minimum distance of 400 mm shall be maintained between two nipples provided on the manifold for connecting the cylinders to the manifold. In case the diameter of the cylinder is higher than 400 mm then the distance between the two nipples shall be diameter of the cylinder plus 100 mm.

11.3.3.10 A pressure gauge of 100 mm dial shall be provided in the manifold to indicate the gas pressure in the manifold. The pressure gauge shall be suitable for a pressure range 0 to 10 kgf/cm².

11.3.4 Pressure Regulators

11.3.4.1 Pressure regulators and other devices used to control the gas shall comply with the distributing company's stipulations and accepted standards [9-4(6)].

11.3.4.2 Pressure regulator fitted with a safety valve shall be either:

- a) installed in the open air, or
- b) vented to the open by means of a metal vent pipe connected to the safety valve outlet.

11.3.4.3 Care shall be taken that safety valve outlets do not become choked with dust or other foreign matter.

11.3.4.4 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.

11.3.4.5 Pressure regulators and other control devices shall be adequately supported.

11.3.5 *Instructions to Consumers*

Consumers shall be instructed by the distribution company on the following:

- a) Operation of the whole system;
- b) How to recognize gas leaks;
- 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.

11.3.6 For detailed information regarding installation of LPG cylinders in commercial, industrial, educational and institutional premises, reference may be made to good practice [9-4(7)].

11.4 **LPG Bulk Storage Installations**

The following recommendations apply to LPG bulk storage installations where storage tanks over 450 litres water capacity are used at industrial, commercial and domestic consumers' premises.

The maximum capacity of an individual tank and group of tanks at industrial, commercial and domestic premises shall be as follows:

<i>Premises</i>	<i>Maximum Water Capacity of an Individual Tank , l</i>	<i>Maximum Water Capacity of Group of Tanks, L</i>
Industrial	130 000	260 000
Commercial	40 000	80 000
Domestic	20 000	80 000

11.4.1 Location and Spacing of Storage Tanks

11.4.1.1 Storage tanks shall be located outside the buildings and shall not be installed one above the other.

11.4.1.2 Each individual tank shall be located with respect to the nearest important building or group of buildings or line of adjoining property which may be built in accordance with Table 1. The distances given refer to the horizontal distance in plan between the nearest point of the storage tank and building/property line.

11.4.1.3 In heavily populated or congested areas the authority may determine the need for other reasonable protective methods to be taken, such as provision of fire walls, etc. If fire walls are to be provided, the authority may determine the extent to which the safety distances for above ground tanks may be reduced.

11.4.1.4 No LPG tank(s) shall be located within the bunded enclosures of any petroleum installation. The minimum distance of separation between LPG storage tanks and any petroleum installation shall be as prescribed under the *Petroleum Rules, 1976* or as specified in Table 1 whichever is more.

11.4.1.5 The number of storage tanks in one storage installation shall not exceed six. In case there are more than one storage installations, the safety distance between two installations shall be the same as the distance between the tanks and the property line in accordance with Table 1.

Table 1 Minimum Safety Distances
(Clauses 11.4.1.2 and 11.4.1.5)

SI No.	LPG Storage Capacity of Individual Tank	Distance from Building/Property Line		Distance between Tanks	
		Above Ground m	Under Ground m	Above Ground m	Under Ground m
(1)	(2)	(3)	(4)	(5)	(6)
i)	Up to 2 000	5	5	1	1.5
ii)	Above 2 000 and up to 10 000	10	7.5	1	1.5
iii)	Above 10 000 and up to 20 000	15	10	1.5	1.5
iv)	Above 20 000 and up to 40 000 adjacent	20	15	2	0.25 dia of vessel or 1.5 m (<i>Min</i>)
v)	Above 40 000 and above adjacent	30	15	2	0.25 dia of vessel or 1.5 m (<i>Min</i>)

NOTE - If the aggregate water capacity of a multi-tank installation is 40 000 litres or greater, the above minimum safety distances shall apply to the aggregate storage capacity rather than the capacity per individual storage tank.

11.4.2 Bunding

Since LPG is heavier than air, storage tank shall not be enclosed within bund walls. The accumulation of flammable liquid under LPG tanks shall be prevented by suitably slopping the ground.

11.4.3 Protection

11.4.3.1 To prevent trespassing or tampering, the area which includes tanks, direct fired vapourisers, pumping equipment and loading and unloading facilities shall be enclosed by an industrial type fence at least 2 m high along the perimeter of the safety zone. Any fence shall have at least two means of exit. Gates shall open outwards and shall not be self-locking.

11.4.3.2 When damage to LPG systems from the LPG tank lorry is a possibility, precautions against such damage shall be taken.

11.4.3.3 Underground tanks shall be protected from above ground loading by providing a suitable curb to prevent a possible accidental damage to the tank and its fittings by LPG tank lorry.

11.4.4 Grass and Weed Removal

Road ignitable material, such as weeds, long grass or any combustible material shall be removed from an area within 3 m from the shell of any LPG tank of up to 2 000 litres water capacity, and within 6 m from the shell of larger tanks. If weed killers are used, chemicals which are a potential source of fire hazard shall not be selected for this purpose.

11.4.5 Warning Signs

No smoking or naked flames shall be permitted within the safety zone of the installation. Prominent notices to this effect shall be posted at access point.

11.4.6 Fire Protection

The possibility of a major fire outbreak, leading to direct flame impingement of the storage tank, shall be minimized by sound engineering in plant design and layout, good operating practice, and proper education and training of personnel on both routine operations and on action to be taken in an emergency.

11.4.6.1 Water Supply

Provision shall be made for an adequate supply of water and fire protection in the storage area according to the local hoses and mobile equipment, fixed monitors or by fixed spray systems which may be automatic. Control of water flow should be possible from outside any danger area.

11.4.6.2 *Fire Extinguishers*

At least two dry chemical powder type fire extinguishers of 10 kg capacity each, conforming to the quality requirements in accordance with the accepted standards [9-4(5)], each shall be installed at points of access to the storage installations.

11.4.7 For detailed information regarding LPG bulk storage installations reference may be made to good practice [9-4(8)].

LIST OF STANDARDS

The following list records those standards which are acceptable as 'good practice' and 'accepted standards' in the fulfillment of the requirements of the Code. The latest version of a standard shall be adopted at the time of enforcement of the Code. The standards listed may be used by the Authority as a guide in conformance with the requirements of the referred clauses in the Code.

(1)	IS 14885:2001	Specification for polyethylene pipe for the supply gaseous fuel
(2)	IS/ISO 7396-1:2007	Medical Gas Pipelines Systems : Part 1 Pipelines Systems for Compressed Medical Gases and Vacuum
	IS/ISO 7396-2:2007	Medical Gas Pipeline Systems : Part 2 Anaesthetic Gas Scavenging Disposal Systems
(3)	IS 3196 (Part 1):2013	Welded low carbon steel cylinders exceeding 5 litres water capacity for low pressure liquefiable gases: Part 1 Cylinders for liquefied petroleum gases (LPG) — Specification (<i>sixth revision</i>)
	IS 7142:1995	Specification for welded low carbon steel cylinders for low pressure liquefiable gases not exceeding 5 litre water capacity (<i>first revision</i>)
(4)	IS 8198 (Part 5):1984	Code of practice for steel cylinders for compressed gases : Part 5 Liquefied petroleum gas (LPG) (<i>first revision</i>)
(5)	IS 15683:2006	Portable Fire Extinguishers — Performance and Construction — Specification
(6)	IS 9798:2013	Low pressure regulators for use with liquefied petroleum gas (LPG) mixtures
	IS 4786:2014	Specification for variable high pressure regulators for use with liquefied petroleum gas
(7)	IS 6044 (Part 1):2013	Liquefied petroleum gas storage installations — Code of practice: Part 1 Residential, commercial and industrial cylinder installations (<i>second revision</i>)
(8)	IS 6044 (Part 2):2001	Code of practice for liquefied petroleum gas storage installations : Part 2 Commercial, industrial and domestic bulk storage installations (<i>first revision</i>)