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Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

IS 15190-2 (2002): Acetylene Pipelines - Code of Practice, Part 2: For Pressures from 155 kPa (g) to 2550 kPa (g) [MED 16: Gas Cylinders]

"जाने से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartrhari—Nitisatakam
"Knowledge is such a treasure which cannot be stolen"
Indian Standard
ACETYLENE PIPELINES — CODE OF PRACTICE

PART 2 FOR PRESSURES FROM 155 kPa (g) TO 2 550 kPa (g)

ICS 25.160.20; 77.140.75
FOREWORD

This Indian Standard (Part 2) was adopted by the Bureau of Indian Standards, after the draft finalized by the Gas Cylinders Sectional Committee had been approved by the Mechanical Engineering Division Council.

Acetylene gas is distributed to consumers from a source such as a generation plant or cylinder discharge manifold by means of pipelines. In view of the explosive behaviour of acetylene in piping systems, special precautions need to be taken in design, fabrication, erection, testing and commissioning of acetylene gas pipelines. This Code stipulates engineering requirements for safe design, construction and commissioning of acetylene gas pipelines. It is based on the concept of ‘Working Ranges’, which also has been followed by Industrial Gases Committee (IGC), Paris.

The concept of ‘Working Range’ includes a combination of parameters, such as ‘Deflagration Pressure Limit’, ‘Deflagration Pressure Limit’, nature and place of ignition.

The guidelines given in this Code are based on published information and observations made by various authorities on the subject of acetylene gas in pipelines. It is expected that adherence to the guidelines presented in this Code will significantly reduce the safety hazard related to acetylene transmission through pipeline systems. Behaviour of acetylene gas transmitted in pipelines is given in Annex A.

This Code is being published in two parts. Part 1 is as under:

Part 1 For pressure up to 155 kPa (g).

Unless otherwise stated, the pressures mentioned in this Code are gauge pressures.

This Code is intended to recommend safety requirements for design and construction of acetylene pipelines having a working pressure rating of 155 kPa (g) (1.55 kg/cm² g) to 2550 kPa (g) (26 kg/cm² g). This covers pipelines connecting acetylene compressors and high pressure dryers as well as filling and discharge manifolds for acetylene. Unless otherwise stated, the pressures mentioned in this Code are gauge pressures.

In preparation of this Code, assistance has been derived from the following publications:

a) Code of practice for acetylene pipelines based upon working range (IGC Document No. 9/78/E).


c) National Fire Protection Association Standard for acetylene cylinder charging plant, specification No. NFPA 51A.


The composition of the Committee responsible for formulation of this standard is given in Annex B.

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 standard.
ACETYLENE PIPELINES — CODE OF PRACTICE
PART 2 FOR PressURES FROM 155 kPa (g) TO 2 550 kPa (g)

1 SCOPE

1.1 This Code (Part 2) applies to new plant and premises which may be engaged in production and compression and filling of acetylene in cylinders and premises where acetylene is discharged from dissolved acetylene cylinder banks through discharge manifolds.

It is applicable to any addition, modification or revamping of such plant or system.

1.2 This Code does not cover the following:

The existing plant or premises where acetylene is produced and filled in dissolved acetylene (DA) cylinders or where acetylene is distributed from cylinder bank through discharge manifolds. The plant, which only compresses acetylene for chemical process or which only, produces compressed acetylene at less than 155 kPa (g) (1.55 kg/cm² g). The installations where acetylene is directly used from one cylinder through hose assembly for welding, cutting, heating and heat treatment operations.

2 REFERENCES

The following Indian Standards contain provisions, which through reference in this text constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<table>
<thead>
<tr>
<th>IS No.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS 308</td>
<td>Dissolved acetylene gas (third revision)</td>
</tr>
<tr>
<td>IS 554</td>
<td>Pipe threads where pressure type tight joints are required on the threads — Dimensions, tolerances and designation (fourth revision)</td>
</tr>
<tr>
<td>IS 1040</td>
<td>Calcium carbide (third revision)</td>
</tr>
<tr>
<td>IS 1323</td>
<td>Code of practice for oxy-acetylene welding for structural work in mild steels (second revision)</td>
</tr>
<tr>
<td>IS 2148</td>
<td>Flameproof enclosures for electrical apparatus (second revision)</td>
</tr>
<tr>
<td>IS 2379</td>
<td>Colour code for identification of pipe lines (first revision)</td>
</tr>
<tr>
<td>IS 3043</td>
<td>Code of practice for earthing</td>
</tr>
</tbody>
</table>

3 TERMINOLOGY

For the purpose of this Code, the following definitions shall apply.

3.1 Deflagration — A flame produced by decomposition or combustion that travels into the unreacted gas at a velocity, which is less than that of sound. The rate of propagation of a deflagration flame increases with the density, the temperature and the turbulence of unreacted gas. Since these three parameters tend to increase as a deflagration progresses, the rate of propagation is usually not steady but tends to increase continuously and sometimes lead to detonation.

3.2 Detonation — A flame produced by decomposition or combustion that travels into the unreacted gas at a rate above the speed of sound. Unlike a deflagration, where the pressure ahead or behind the flame front rises at the same time, a detonation involves a sharp difference in pressure between the reacted and unreacted gas. The change from the low pressure of the unreacted gas to the high pressure of the reacted gas takes place in a shock wave at the front of the flame.

3.3 Flame or Flash Back Arrestor — An equipment, which quenches a flame front (flash back or decomposition). It shall be suitable for flame, which may occur due to deflagration and/or detonation. Its design and application shall be such that it shall withstand and be effective in stopping a flame coming from either one or both directions (see also IS 11006).

3.4 Manifolds — A system in which two or more individually valved, dissolved acetylene cylinders are connected by pipes or hoses to a common inlet header through which all cylinders are charged simultaneously without dismantling the cylinders or are normally discharged simultaneously through the common outlet header.

3.5 Portable Manifolds — They are basically two types:

a) In this, gas passes from connected cylinders through individual leads to a single common lead or block. From there through a single
3.6 Stationary Manifolds — These are essentially manifolds supported on wall or floor and provided with fittings for connecting individual cylinders by means of leads (pigtails). In case of discharge manifolds, one or more permanently mounted regulators are provided to reduce and regulate the pressure of the gas from the cylinders.

3.7 Nominal Diameter (DN) — Every part of a piping system manufactured by hot and cold rolling methods and/or by piercing and cold drawing shall be identified by its nominal diameter. Nominal diameter is derived from the approximate inside diameter up to 100 mm. The nominal diameter shall be designated by the abbreviation DN. The typical designation of a pipeline system where nominal diameter is 50 mm shall be DN 50.

3.8 Predetonation Distance — The distance that a deflagration travels in a Class 3 category pipeline before it develops into a detonation. For evaluation of predetonation distance, for systems under various operating conditions at different pressures shall be taken from Fig. 1.

**Fig. 1 Evaluation of Predetonation Distance for Acetylene Pipelines Under Various Operating Conditions**

NOTE — For acetylene pressure of 2.8 kg/cm² absolute, for example, the predetonation distance lies in the range of 2.4 metres to 16.75 metres provided the diameter of the tubes is large enough so that it does not preclude detonation at this pressure. The horizontal lines of the above figure shows the least pressures required for detonation in tubes of different diameters. It also shows that the 2.4 to 16.5 metres range for detonation to occur, applies to tubes larger than 35.5 mm internal diameter but not smaller.

The above figure applies to detonations that develop in acetylene gas from deflagrations and which in turn, is initiated from non-shock thermal source of initiation.
3.9 Reflection — If in case of detonation the forward moving shock wave hits an obstruction such as the end of a pipe or a closed valve, the pressure increases considerably and the shock wave is reflected, similar to water hammer.

3.10 Working Pressure ($P_w$) — It is the maximum operating pressure in kPa of a piping system.

3.11 Acetylene Compression — Compression to a pressure of 155 kPa (g) (1.55 kg/cm²g) or above, the pressure rises being achieved by compression either in single stage or multiple stages.

3.12 Leads or Pig Tails — Flexible device made of metallic reinforced rubber, teflon or steel suitable to connect the main manifold pipe to the cylinder through proper connections.

3.13 Unpierced Wall — A wall which may have pipes or conduits passing through it or windows, glazed with safety glass and/or wired glass set in it, but such openings must be sealed to prevent flow of air between the spaces separated by the wall.

4 LOCATION AND GENERAL ARRANGEMENT OF PREMISES AND SAFETY

4.1 Location and general arrangement of building shall conform to the Ministry of Industry, Government of India, Notification No. 625 dated 7 August 1983 or any other notifications issued in this regard by the appropriate authority.

4.1.1 The building housing acetylene compressor, filling manifold of discharge manifold of the acetylene manufacturing and charging plant shall be located at least 15 meters from public right of way and from line of adjoining property or building that may be built upon. Boundary wall or barbed wire fencing shall be laid around the building at a minimum distance of 9 meters to avoid unauthorized entry of any person. Clear sign boards ‘Hazardous area — No smoking in the premises’ and ‘No trespassing — No smoking or open flame’ shall be displayed in the premises prominently.

4.2 The buildings walls shall be constructed preferably of non-combustible materials. Any combustible materials used shall have a fire resistance rating of at least one hour.

4.2.1 The compressor station or filling manifold or discharge manifold shall not be housed in a building which has a basement or floor below it or of a floor above it.

4.2.2 The roof of the buildings shall be made of light material or be provided with explosion venting area of not less than 0.06 m²/m³ of building volume.

4.2.3 The building/room housing shall be well ventilated both at floor level and roof level. The ventilation provided should be such that flow of air is not less than 3.3 m³/min/m² of ceiling area. The ventilators should be covered with two layers of 11 meshes per linear centimetre stainless steel or any non-corroding material wire mesh; brass mesh if used, shall have not more than 65 percent copper content.

4.2.4 If any heating is required in the building, it shall be by steam or hot water.

4.2.5 Boiler, heaters and other heating equipment employing flames or capable of creating sparks shall be housed in a separate building located 15 m away from the building housing the acetylene compression equipment, charging manifold or discharge manifolds.

4.2.6 Electrical equipment and wiring in rooms housing compressor and equipment for filling and discharge of acetylene shall have flame proof fittings conforming to IS 2148 and suitable for at least gas group class IIB. All the equipment shall be electrically earthed (see IS 3043).

4.2.7 The acetylene or acetone fire, normally, shall not be extinguished with hose water or portable fire extinguishers. To avoid any fire, leak free pipelines and good quality valves shall be used. However, for fire protection the following precautions shall be taken:

a) For waste disposal the receptacles should be self-closing metal (non-sparking type).

b) The area shall be equipped with hose of dia 40 mm (nominal bore) station equipment unless continuous water spraying over filling or discharge manifold is available. Alternatively automatic sprinklers system may be provided ensuring that the water coverage is not less than 13 l/m²/m² of floor area.

c) The fire hose and water spray actuation valves shall be so located that they can be operated from out-door or at an exit.

4.2.8 Each plant shall adopt detailed emergency procedure and shall conduct periodic fire drill. A flameproof alarm shall be provided for summoning fire fighting and to caution people in emergency.

4.2.9 A maximum of 80 cylinders (or 480 cubic meter of gas) shall be connected to a manifold under one roof. In case more than 80 cylinders (or 480 cubic meter of gas) are to be connected under one roof, manifold shall be separated by a concrete wall of 2.5 m high and not less than 200 mm thick, so that in an area isolated by the concrete walls, not more than 80 cylinders (or 480 cubic meter of gas) are connected to manifolds that can be in operation (filling/discharge).
5 ACETYLENE COMPRESSOR

5.1 Installation

5.1.1 The inlet and outlet piping of each compressor shall be provided with readily accessible shut off valves that can be closed in an emergency.

5.1.2 Drain lines from high pressure [above 155 kPa (g) (1.55 kg/cm²(g))] oil separation condensate traps and drains shall be manifolded and lead to separators with a safety valve set at 147 kPa (g) (1.5 kg/cm²(g)) the outlet of which shall be connected to inlet of compressor suction or piped out to vent the gas at a height of at least 5 m and away from the building. The condensate, liquid, etc, shall be piped outside the building away from any source of ignition and combustible material or shall be drained to effluent water drains.

5.1.3 The compressor shall be fitted with pressure relief valve (safety valve) of full size on the discharge of each stage.

5.1.4 The compressor shall be provided at suction and discharge with pressure switch or a similar fail safe device capable of shutting down the compressor if the compressor suction pressure falls below 250 mm of water column or if the discharge cross the maximum set pressure, which is no case shall exceed 2744 kPa (g) (28 kg/cm²(g)). Shut-off valve or by pass valve for the pressure switches shall not be installed.

5.1.5 The flow of acetylene through the interconnecting piping shall be designed at velocity specified below:

<table>
<thead>
<tr>
<th>Pressure (kg/cm²(g))</th>
<th>Linear Velocity (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 6</td>
<td>10</td>
</tr>
<tr>
<td>6 to 11</td>
<td>5</td>
</tr>
<tr>
<td>11 to 21</td>
<td>3</td>
</tr>
<tr>
<td>21 to 26</td>
<td>2.5</td>
</tr>
</tbody>
</table>

5.1.6 Compressor shall be constructed so that the acetylene is cooled during and after each state of compression. When water is used, the flow of water from cooling jacket and inter-coolers shall be visible to the operator.

5.1.7 Where the compressor is water cooled, valve on water inlet line shall be provided for regulating water flow.

5.1.8 Transmission belt when used in compressor shall be anti-static type.

5.1.9 The piston speed shall not be more than 0.7 m/s.

5.2 The temperature of acetylene at the discharge valve of any stage shall not exceed 140°C.

5.2.1 All parts of the compressor coming in contact with acetylene under pressure shall be tested hydraulically at the test pressures given below:

<table>
<thead>
<tr>
<th>Maximum Working Pressure, ( P_w )</th>
<th>Test Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>kg/cm²(g)</td>
<td>kg/cm²(g)</td>
</tr>
<tr>
<td>Up to 0.2</td>
<td>3.75</td>
</tr>
<tr>
<td>0.2 to 1.5</td>
<td>12 to 24</td>
</tr>
<tr>
<td>Above 1.5</td>
<td>( 11 \times P_w + 10 )</td>
</tr>
</tbody>
</table>

5.2.2 The compressor shall have a connection so that the whole unit can be rinsed/purged with nitrogen and/ or water.

5.2.3 The compressor shall be pneumatically tested at its operating pressure by holding pressure in the system for 24 h without any visible leak. The fall in pressure shall not be more than 0.2 percent per hour of the initial pressure.

5.2.4 At suction and discharge of the compressor and at each stage, pressure and temperatures measuring devices shall be provided.

5.2.5 Where oil lubrication is provided oil pressure gauge to show oil lubrication pressure shall be provided.

5.2.5.1 Oil used for acetylene compressor should be compatible with acetylene.

5.2.5.2 Provision should be made to check oil level.

5.2.6 In case of lubricated compressor having oil pump, a suction filter for lubricating oil shall be provided. Use of porous metallic or ceramic filter element is recommended. Provisions shall be made so that they can be cleaned from time-to-time.

5.2.7 If Nitrogen Fails

Safe device is connected directly to the acetylene; it shall have non-return valve and automatic devices to provide flow of nitrogen in the compressor in case of emergency.

5.2.8 The compressor shall be provided with a local as well as remote emergency switching off device.

5.2.9 A precooler with condensate trap shall be provided in the suction of the compressor.

5.3 High Pressure Drier

5.3.1 The high pressure drier shall have down-stream pressure regulator to regulate the back pressure at 1372 to 1666 kPa (g) (14 to 17 kg/cm²(g)).

5.3.2 The design of the high pressure drier shall be such that the velocity of acetylene shall increase by 0.20 to 0.25 m/s.
5.3.3 Before and after the high pressure drier filters shall be provided.

5.3.4 Where calcium chloride is used as drying medium, the drier shall have arrangements for blow off with nitrogen or acetylene to remove air after fresh charge or after long stoppage from use.

5.3.5 The drying agent like calcium chloride shall be filled in baskets made of steel sheet having perforation of 5 mm diameter in triangular pitch, or any similar device, for ease of removal and discharging.

6 PIPING AND SAFETY DEVICES

6.1 High pressure piping are the pipes having a working pressure above 245 kPa (g) (2.5 kg/cm² g) for use after first stage of the acetylene compressor up to filling manifold and for discharge manifold up to pressure reducing station.

6.2 Piping and fittings shall be made of steel, wrought iron, malleable iron or copper alloy having less than 65 percent copper. Unalloyed free silver or mercury shall not be used.

6.2.1 Steel is recommended as the material of construction for acetylene transmission systems. In a pipeline system, materials for all components like joints, seals, gaskets, diaphragms, hoses shall be so chosen that they are adequate resistant to the action of commercial grade acetylene, including its impurities as indicated in IS 1040 and IS 308 and solvents like acetone (if present), under the system operating conditions (that is temperature and pressure) and resistant to atmospheric corrosion.

6.3 All piping and equipments shall be electrically continuous and connected to any grounding electrode as defined in IS 3043.

6.4 Pipe sizes of more than DN 25 shall be avoided as far as possible, but in no case pipe size more than DN 40 shall be used. For higher flow, multiple pipes of DN 25 is recommended.

6.4.1 The diameter of a pipeline shall be finalized so that the required pressure is available at consumer, with the maximum flow in a given pipe run. It is recommended that the velocities be maintained between 2 to 4 m/s for sizing of pipelines.

6.5 Pipe material shall preferably have not less than the following mechanical properties:

- Tensile strength, Min 3 430 kPa (35 kg/cm²)
- Yield strength, Min 2 352 kPa (24 kg/cm²)
- Elongation on gauge length 5.65 \( \sqrt{S_o} \) percent, Min

6.6 The working pressure of acetylene pipe lines shall not be more than 2 548 kPa (g) (26 kg/cm² g) absolute.

6.7 Pipe used shall be seamless having a wall thickness calculated as given in 6.7.1 and 6.7.2.

6.7.1 Where pipe materials as specified in 6.2 is used the wall thickness shall be:

a) where the ends of pipe, bends, elbow, reducer, enlarger, joints, openings are strengthened by a length at least twice the inside diameter of pipe and to a thickness twice the pipe thickness, the thickness shall be 0.16 times of inside diameter. The strengthening may be complied by welding the reinforcement or by screwing or by bolting the reinforcement.

b) where no reinforcement is used the thickness of the pipe should be 0.30 times of inside diameter.

6.7.2 Where any other material is used other than 6.5 the wall thickness \( t \) shall be:

a) Where reinforcements are used according to 6.7.1(a)

\[
t = \frac{20 \times P_w \times D}{(200 \times f) - (20 \times P_w)}
\]

b) Where reinforcement are not used:

\[
t = \frac{35 \times P_w \times D}{(200 \times f) - (35 \times P_w)}
\]

where

- \( P_w \) = maximum working pressure in kg/cm² absolute,
- \( D \) = inside diameter in mm, and
- \( f \) = allowable stress in kg/cm².

6.7.3 The length of pipe (straight portion) shall be such that it is less than or exceeds the ‘Predetonation Distance’.

6.7.4 The reinforcements of the pipes as recommended in 6.7.1 a need not be provided if flash back arrestor fitted with non-return valves are provided at each such point. However, reinforcements at the end of the pipe shall be necessary, as flash back arrestors does not serve any purpose at the ends.

6.7.5 All acetylene gas pipeline system shall be protected by flashback arrestors and non-return devices or a combination of both. To prevent entry of air or oxygen these should be fitted as near as practical to any outlet point.

6.7.6 The following locations shall be installed with flashback arrestors:
a) at the outlet of source of acetylene gas such as generation plant or discharge manifold.
b) at the entrance and exit of gas holders, if installed, within the acetylene gas conveying systems.
c) at the exit of each booster, if any installed on the acetylene gas pipeline system.
d) at branch point from main header to shop sub-header.
e) at the entry to each consuming unit.

6.7.7 Where a single unit of flash back arrestor may not be adequate to handle required flow rate, multiple units of flash back arrestors shall be installed for parallel operation and the individual gas inlets, outlets and liquid drain connections shall be interconnected to respective common headers.

6.8 The provision for expansion and flexibility shall take into consideration the maximum possible temperature differential between the design temperature and the ambient temperature in cold season.

6.8.1 All steel pipework shall be of socket/butt-welded construction. Use of socket weld joints are however, preferred. Welds on pipelines shall be located at places where the minimum bending stresses occur as far practicable. Flanges shall be provided on straight lengths as required for easy erection and maintenance. Flanged joints shall also be provided to match the connecting ends of equipment, valves and fittings, etc. Where screwed connections are permitted shall be of acceptable standard (see IS 554). Number of flanged and/or screwed joints shall be restricted to a minimum to minimize the possibility of gas leakage.

6.8.2 Joints are recommended to be assembled with the inside of all pipes and fittings smooth, clean and free from burns, blisters, scale, welding slag, sand and dirt. The inside edges of pipes and tubings shall be reamed after cutting to remove burrs. Wherever possible the inside of the weld without backing rings shall be ground smooth. Flange faces shall be free from particles of weld metal.

6.8.3 All jointing by electric arc and gas welding process shall be carried out according to IS 1323. However, provisions of statutory regulations and fire protection manual of the Insurance Association of India shall be complied with, wherever applicable.

6.8.4 All welding work shall be carried out by qualified welders. All filler materials, edge preparation, post-weld treatment shall give a good welding. All welds shall be made in such a manner that complete fusion and penetration are obtained without an excessive amount of filler metal beyond the root areas. Reinforcements, wherever required shall be applied in such a manner that it will have a smooth pipes and welded fittings.

6.8.5 Pipe and attachments shall be aligned accurately and held firmly prior to welding. If tack weld is used, the tacks shall be either fused into the first layer of weld or chipped out. All welds shall be built up by the application of multiple beads or pass; the thickness of metal deposited in each bead or pass shall not exceed 3 mm. Each bead shall be cleaned and, if not a work hardening material, shall be lightly preened before the next bead is laid. The complete weld and surrounding pipe shall be cleaned of slag and metal splatter on all surfaces and the inside beads shall be ground smooth where practicable.

6.8.6 Welded carbon steel piping need not be stress relieved except where specified.

6.8.7 Acetylene pipelines shall be clearly identified by the word 'Acetylene gas' or by colour coding according to IS 2379. The identification markings shall be repeated at regular intervals and visible locations to ensure that the pipeline(s) can be clearly identified and are not confused with adjacent pipelines carrying other substances.

6.9 Pipeline or manifold shall be supported as follows:

<table>
<thead>
<tr>
<th>Pipe Size, DN (mm)</th>
<th>Maximum Distance Between Supports (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>10</td>
<td>2000</td>
</tr>
<tr>
<td>15</td>
<td>2000</td>
</tr>
<tr>
<td>20</td>
<td>2000</td>
</tr>
<tr>
<td>25</td>
<td>2000</td>
</tr>
<tr>
<td>30</td>
<td>2500</td>
</tr>
<tr>
<td>40</td>
<td>3000</td>
</tr>
</tbody>
</table>

7 PRESSURE GAUGES/TEMPERATURE GAUGES AND SAFETY VALVES

7.1 Pressure gauge used in the system shall have safety type standard with blow (bursting) disc described in relevant clauses of IS 3624.

7.2 Upstream of every pressure gauge, a throttle shall be installed to limit the flow to less than 10 l/s at normal conditions.

7.3 Pressure gauge and temperature gauges range shall be such that at the normal working pressure the indicator points around the middle of the dial.

7.4 Temperature gauges for measurement of temperature shall have a minimum graduation of 2°C.

7.5 The maximum working pressure and temperature shall be marked in red on the dial of the gauges.
7.6 Safety valve shall be full flow type capable of venting maximum flow for which the pipeline is intended at 10 percent over pressure. The valve shall be fitted with test lever, so that operation of the safety valve can be checked manually.

7.7 The vent of the safety valves or any other vent shall be discharged outside the building at a height of 5 m and away from any part of the building or combustible material and or source of ignition or openings. The end shall be so constructed, that it cannot be obstructed by rain, snow, ice or birds. It should be hooded or bent and covered with wire mesh.

7.8 No isolation valve shall be provided on the safety valve inlet.

8 ACETYLENE CYLINDER CHARGING AND DISCHARGING MANIFOLDS

8.1 Each cylinder charging or discharging manifold shall be provided with a shut off valve, vent valve and a safety valve. The vent valve may be connected to the low-pressure system or vented outside the building to atmosphere.

8.2 A flash back arrestor shall be installed in the pipeline at each cylinder charging or discharging manifold or in each cylinder charging or discharging lead or pigtail.

8.3 Each outlet or inlet from the manifold shall be provided with shut off valve.

8.4 The cylinder charging or discharging leads (pigtailes) shall be so arranged that excessive mechanical stress in the cylinder leads are prevented.

8.5 The cylinder charging or discharging manifold pipe shall be so arranged they are at least 200 mm above or below the level of cylinder valves.

8.6 Each cylinder charging or discharging manifold shall be provided with three flame arrestor with non-return valve in series.

8.7 The length and size of manifold pipe shall be based on 1/m³ of acetylene flow per hour per connected cylinder. The spacing between two connections shall be not less than 1.25 times the maximum diameter of acetylene cylinder that will be connected to manifold, with a minimum distance of 300 mm.

8.8 All leads (pigtailes) shall have a minimum test pressure of 9 800 kPa (g) (100 kg/cm² g) and have a minimum bursting pressure of 58 800 kPa (g) (600 kg cm² g).

8.9 The electrical resistance where the leads are joined to the manifold shall not be more than 10 kilo ohms.

8.10 To protect the manifold from flame or over-heating, it is recommended to adopt the following practices:

- a) Water sprays on the cylinders and manifold or provide the manifold inside a channel filled with circulating water.
- b) Use of chilled water at a temperature in the range of 4 to 7°C may be used to improve the cooling effect.

8.11 Where rubber hose pipes are used, they shall be reinforced with metallic fibre and shall be compatible with acetylene and acetone. The metallic braiding of the hoses shall not be used for earthing.

9 VALVES AND FITTINGS

9.1 All fittings shall be seamless socket welded or butt-welded, but socket welding is preferable. Wherever butt welding is unavoidable, arrangements to clean the inside of weld shall be made or ‘Y’ filler or backing strips used.

9.2 For connecting pressure gauges, transmitter, etc, threaded joints may be used but the thread shall be tapered gas threads.

9.3 The valve shall be of a class suitable for the working pressure of 20 580 kPa (g) (210 kg/cm² g) at ambient condition.

9.4 The flanges used, if any, shall be suitable for a working pressure of 20 580 kPa (g) (210 kg/cm² g) and shall be slip-on type having male female faces.

9.5 The bolts and nuts used shall be high tensile type.

9.6 Gasket material used shall be compressed, graphited asbestos or S-buttons and/or neoprene rubber.

9.7 Packing material shall be graphite impregnated asbestos or teflon.

9.8 Unions, flanges and threaded joints shall be provided only to the extent to facilitate maintenance. As far as possible pipe joint shall be done by socket welding.

9.9 Bends formed with a minimum diameter of five times of inside diameter of the pipe are recommended in place of elbows, as far as practical.

9.10 Elbows, bends, tees shall preferably be forged from carbon steel and socket weld type suitable for working pressure of 27 440 kPa (g) (280 kg/cm² g).

10 INSPECTION AND TEST

10.1 Inspection

10.1.1 All components used for the construction of the acetylene system (except for site-fabricated components like bends, tees), shall be supported by
manufacturer’s test certificate(s). These test certificates shall be scrutinized to ensure that all components used are conforming to the requirements of this Code.

10.1.2 The equipment and pipework shall be subjected to visual inspection. The pipeline, after completion of erection, shall be inspected for its conformity with the construction drawings prepared according to the stipulations of this Code.

10.1.3 All welded joints shall be visually examined either during manufacture, fabrication and erection to ensure conformity with the requirements of this Code.

10.2 Pressure Tests

10.2.1 Prior to acceptance and initial operation, installed piping shall be pressure tested to ensure the system’s strength and leakproof.

10.2.2 In the event of repairs or additions are made following the pressure test; the affected piping shall be retested.

10.2.3 A piping system shall be tested as a complete unit or in sections. For the connecting piping and other appurtenances for testing, it is not required that the tie-in sections of pipes, be pressure tested.

10.2.4 The test procedure used shall be capable of locating all leaks in the section and shall be capable of establishing that the section being tested is capable of withstanding the test pressure. The test pressure shall be selected as per stipulations of this code and shall be done after giving due consideration to the volumetric content of the section and to its location.

10.2.5 Wherever possible, pipe joints including welds shall be left uncoated and exposed for examination during test.

10.2.6 Equipment which is not to be included in the test shall either be disconnected from the piping or isolated by blank flanges.

10.2.7 Prior to testing, the interior of the piping system shall be clear of all foreign material.

10.3 Hydraulic Testing

10.3.1 The following test pressure shall apply for hydraulic testing of systems/components (other than for the compressor, which shall be carried out according to 5.2.1 designed in accordance with this standard:

- For pressure less than 155 kPa (1.55 kg/cm² g), 1.5 times the maximum working pressure.
- For pressure more than 155 kPa (1.55 kg/cm² g) but less than 250 kPa (2.5 kg/cm² g), 10 times the maximum working pressure with minimum test pressure being 2,000 kPa (20 kg/cm² g).
- Pressure above 250 kPa (2.5 kg/cm² g), 20 times the maximum working pressure with minimum test pressure of 30,000 kPa (300 kg/cm² g).

NOTE — Rubber hoses or any part, which can withstand high pressure but can get permanently deformed, may be isolated and pressure released after holding the test pressure for a maximum of 30 s.

10.3.2 Test Duration

Test duration shall be not less than 30 min for each 14 m³ of pipe volume or fraction thereof. For piping system having a volume of more that 68 m³, the duration of test shall not be less than 24 h.

11 INSULATION

All overhead yard or exposed acetylene gas pipelines may be protected against excessive external heat and possible formation of liquid acetylene by suitable insulation. In all cases of insulation provided on acetylene lines, claddings (vapour barriers) shall be of fire resistant type.

12 DRAINS

Provisions shall be made to drain accumulated condensate or testing fluid from acetylene pipelines. To ensure condensate drainage and liquid drainage, pipelines shall be laid with a gradient of about 1 mm per metre run towards the drainage points. Drainage points shall be provided at the lowest points of acetylene gas pipework and special provisions shall be made in its design to prevent entry of air into the acetylene line and to prevent freezing of any seal liquid used. The size of the drain pipelines shall all be such that the entire pipeline between sectionalizing valves can be drained within the desired time period, which shall be not more that 30 min.

13 PRE-COMMISSIONING REQUIREMENTS

13.1 It has to be ensured before an acetylene system is put into commission that it has been designed, fabricated and erected in line with the construction drawings and with stipulations of this code.

13.2 In case the system is taken up for commissioning after a considerable time lapse of its erection and testing and there is a possibility that the system has deteriorated, then the system shall be retested before its commissioning.

13.3 Commissioning of acetylene system at dark is not recommended.

13.4 Adequate numbers of fire fighting personnel, fire
fighting equipment and appliances are placed in appropriate locations.

13.5 All consumers of acetylene shall be kept inoperative till such time that the commissioning of the system is over and the same is certified as being ready to be put into service.

13.6 All sources of heat and fire shall be kept at least 15 metre away from the acetylene system. Possibility of sparks from locomotives/automotives, chimneys/stacks, static electricity, and short circuits shall be completely eliminated.

13.7 Possibility and occurrence of vibration and physical shock to the acetylene pipelines shall be eliminated.

13.8 Unauthorized use of pipeline as electrical conductor or as a support for other items have not been made.

13.9 It shall be ensured that the safety devices and instruments installed are of the correct type and specifications do not show signs of deterioration or malfunction or unauthorised usage. Devices against entry of air and oxygen (that is condensate drainage system) shall be checked for proper operation and it shall be ensured that they are not blocked. Wet type flash back arrestors shall also be checked, for maintenance of correct water level. Filters and dry type flash back arrestors shall be examined for proper condition and has to be ensured that they are not blocked.

13.10 The setting of pressure regulators/reducing stations shall be as per specified parameters/duty conditions.

13.11 All valves at service points, isolation, vent, drain points and equipment connections shall be checked for complete opening and tight shut-off.

14 CLEANING

14.1 Acetylene system shall be properly cleaned internally by blowing compressed air or nitrogen gas through pipes. Velocity of blowing shall be between 15 to 20 m/sec and pressure at the air/nitrogen inlet shall be 600 kPa (g) to 700 kPa (g) (6 to 7 kg/cm² g). All vents, drains, service points including flash back arrestors shall be blown by means of blowing medium.

14.2 Wet type flash back arrestors shall be blown after draining the water. After blowing operation is over, the flash back arrestor shall be refilled with water up to the correct water level.

14.3 Dry type flash back arrestors may be cleaned in-situ by blowing compressed air/nitrogen.

15 PURGING AND COMMISSIONING

15.1 The purpose of process of purging and successful commissioning of the acetylene gas systems is to ensure that no air and/or oxygen comes in contact with acetylene gas.

15.2 Purging of system shall commence from the acetylene gas source. The isolation valve between the source and system shall remain closed. Nitrogen admission to the section/pipeline shall be started by opening the nitrogen inlet valve connection provided at the source end. Nitrogen gas admission shall be done by connecting the nitrogen supply system with flexible hose. At the same time vent valves located at the other end of the section/pipeline shall remain open.

15.3 For purging operations, nitrogen gas of Min 97.5 percent purity with a velocity of 15 to 20 m/sec shall be used.

15.4 Introduction of nitrogen gas shall be continued till samples taken at selected vent/purge out points show satisfactory oxygen content. The acetylene pipeline may be considered free from air if the outgoing nitrogen contains not more than 2 to 5 percent of oxygen. Nitrogen supply shall be terminated and all isolation/purge-in/drain/vent or purge out valves for the pipeline/section under consideration shall be kept completely shut-off under nitrogen pressure.

15.5 Once the purging operation for the section is complete, the nitrogen inlet valve at the source end and the vent valve at the other end shall be closed. The section, which has been purged, shall remain pressurized with nitrogen gas at a pressure of about 100 kPa (g) (1 kg/cm² g).

15.6 Once the entire system has been purged and pressurized with nitrogen gas, admission of acetylene gas shall be commenced. Acetylene from the source shall be admitted by opening the inlet isolation valve a few turns. The valves for purge out point and or discharge points shall be opened. Gas sample shall be collected for measuring acetylene gas concentration. The section or pipeline vent/purge port points shall be closed as soon as acetylene gas concentration of 10 percent by volume of nitrogen is reached. The acetylene gas consumption at the outlet or filling then can be commenced.

15.7 Acetylene gas/acetylene gas nitrogen mixture coming out of the terminal section inside a consuming shop shall be diverted away and out of any shop/work place to safe distance.

15.8 Any section of the acetylene gas system which is not in use, after commissioning, shall be purged with nitrogen and remain pressurized with nitrogen gas till it is put on stream.
ANNEX A

( Foreword )

BEHAVIOUR OF ACETYLENE GAS TRANSMITTED IN PIPELINES

Acetylene can burn in the presence of air from a range of 2 to 82 percent. In case of occurrence of a source of ignition of any form in an acetylene pipeline system, decomposition of acetylene gas into its constituents, namely carbon and hydrogen, can be initiated even in the near absence of air or oxygen. Hence the design of an acetylene conveying system shall include facilities to keep air/oxygen out of acetylene and to prevent acetylene leakage into air. The appearance of a bright flame, rise in temperature and pressure, and soot formation which resembles the explosive conversion of a mixture of fuel gas and oxygen are characteristics of acetylene decomposition.

Propagation of acetylene gas decomposition from the ignition source to the rest of the pipeline depends mainly on the working pressure of the pipeline and its size. The ignition energy required initiating the decomposition, its velocity and associated pressure rise within the pipeline are mainly dependent on the working pressure and size of the pipeline. If decomposition of acetylene is initiated in a pipeline due to a source of ignition ‘deflagration’ followed by ‘detonation’ may occur. The definition of ‘deflagration’ reflects the conditions under which the acetylene decomposition occurs and proceeds at a moderate velocity (below sonic) and at which associated rise in pressure to a maximum of 11 to 13 times the initial pressure occurs. The transition from ‘deflagration’ to ‘detonation’ occurs under conditions which are also indicated in the definition for ‘detonation’. Pipeline conveying acetylene shall be designed, constructed, tested and maintained to prevent occurrence of ‘deflagration’ and ‘detonation’ and withstand the same in case of their occurrence.
ANNEX B
( Foreword )

COMMITTEE COMPOSITION
Gas Cylinders Sectional Committee, ME 16

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<th>Representative(s)</th>
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<td>SHRI SHAMBHU PRASAD (Alternate)</td>
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<td>In personal capacity (303, Shantikunj, Athwalines, Surat)</td>
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Shri M. L. Chopra, Director & Head (MED)
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Shri S. B. Roy
Director (MED)

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