*भारतीय मानक* **IS 8198 (Part 9) : 2023**

***Indian Standard***

# संपीड़ित गैसों के लिए स्टील सिलिंडर — रीति संहिता

## भाग 9 सल्फर डाइऑक्साइड गैस

*( दूसरा पुनरीक्षण )*

# Steel Cylinders for Compressed Gases — Code of Practice

## Part 9 Sulphur Dioxide Gas

*( Second Revision )*

ICS 23.020.30



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**December 2023** **Price Group 7**

Gas Cylinders Sectional Committee, MED 16

FOREWORD

This Indian Standard (Part 9) (Second Revision) 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.

This standard was first published in 1980 and subsequently revised in 1988. This standard is being revised again to keep pace with the latest technological developments and international practices. Also, in this revision, the standard has been brought into the latest style and format of Indian Standards, and references of Indian Standards, wherever applicable have been updated. The following major modifications have been incorporated in this revision of the standard:

a) Maximum permissible toxicity value has been modified;
b) The material requirement of gas cylinder, valve and accessories has been referred to IS/ISO 11114 (Part 1) and IS/ISO 11114 (Part 2);
c) ICS code has been added; and
d) Reference standards have been updated.

For safe handling of cylinders containing liquefied sulphur dioxide, one should be thoroughly conversant with the properties and characteristics of sulphur dioxide. There are several precautions and safe practices which are to be observed on account of the nature of the sulphur dioxide and also because of the pressure to which the cylinders are subjected. Manufacturers, fillers and users of the gas cylinders covered by this code should be familiar with the precautions laid down in this code in order to ensure safe and efficient operating conditions. For general information on different gases conveyed in cylinders, SP 9 : 1973 ‘Technical data sheet for gases conveyed in cylinders’ may also be referred.

This Indian Standard is published in many parts. The other parts in this series are:

Part 5 Liquefied petroleum gas (LPG)
Part 6 Liquefied chlorine gas
Part 7 Ammonia gas
Part 8 Common organic refrigerant gases
Part 10 Methyl bromide gas
Part 11 Methyl chloride gas
Part 12 Gases for medical use

The composition of the Committee responsible for the 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 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Indian Standard*

# STEEL CYLINDERS FOR COMPRESSED GASES — CODE OF PRACTICE

## PART 9 SULPHUR DIOXIDE GAS

*( Second Revision )*

### 1 SCOPE

This standard (Part 9) covers filling, inspection, testing, maintenance and use of portable steel cylinders for storage and transportation of liquefied sulphur dioxide gas in cylinders.

### 2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this text, constitute provisions 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.

### 3 TERMINOLOGY

For the purpose of the standard, the definition given in IS 7241 shall apply.

### 4 PROPERTIES AND PHYSICAL CONSTANTS

**4.1** The properties and physical constants of sulphur dioxide gas are described briefly in Table 1. The vapour pressure of sulphur dioxide at different temperatures is given in Table 2.

#### 4.2 Maximum Permissible Toxicity

Maximum short term exposure limit (STEL) by volume shall be 0.25 ppm. A 15 minutes exposure that should not be exceeded at any time during a workday.

#### 4.3 Chemical Reaction with Metals

Dry sulphur dioxide is not corrosive to ordinary metals. However, zinc reacts with sulphur dioxide containing minute quantities of moisture and most common metals will be corroded by sulphur dioxide holding sufficient amounts of moisture. Among materials suitable with moisture-bearing sulphur dioxide are certain stainless steels and lead. The materials used for gas cylinders, valves and accessories are compatible with ammonia according to IS/ISO 11114-1 for metallic materials and IS/ISO 11114-2 for non-metallic materials.

**Table 1 Properties and Physical Constants of Sulphur Dioxide**

(*Clause* 4.1)

| Sl No. | Property | Physical Constant |
|---|---|---|
| (1) | (2) | (3) |
| i) | UN No. | 1079 |
| ii) | Physical Classification | Low pressure liquefiable, pungent odour, highly irritating colourless gas at room temperature and pressure. Highly oxidizing and reducing agent. |
| iii) | Chemical Properties | |
| | a) Flammability | Non-flammable |
| | b) Molecular formula | $SO_2$ |
| | c) Molecular weight | 64.07 |
| | d) Boiling point | − 10 °C |
| | e) Melting point | − 76 °C |
| | f) Specific gravity compared to air at 0 °C and 1 atmosphere | 2.264 |
| | g) Specific gravity of liquid at 0 °C | 1.434 |

**Table 1** (*Concluded*)

| Sl No. | Property | Physical Constant |
|---|---|---|
| (1) | (2) | (3) |
| | h) Critical temperature | 157.5 °C |
| | j) Critical pressure | 77.8 kgf/cm$^2$ |
| | k) Viscosity, gas at 18 °C | 0.012 42 centipoise |
| | m) Saturated vapour pressure at 65 °C | 11.95 kgf/cm$^2$ |

**Table 2 Vapour Pressure of Sulphur Dioxide at Different Temperatures**

(*Clause* 4.1)

| Sl No. | Temperature °C | Vapour Pressure kgf/cm$^2$ |
|---|---|---|
| (1) | (2) | (3) |
| i) | − 50.0 | 0.118 |
| ii) | − 47.5 | 0.139 |
| iii) | − 45.0 | 0.163 |
| iv) | − 42.5 | 0.190 |
| v) | − 40.0 | 0.220 |
| vi) | − 37.5 | 0.256 |
| vii) | − 35.0 | 0.294 |
| viii) | − 32.5 | 0.339 |
| ix) | − 30.0 | 0.388 |
| x) | − 27.5 | 0.443 |
| xi) | − 25.0 | 0.504 |
| xii) | − 22.5 | 0.573 |
| xiii) | − 20.0 | 0.648 |
| xiv) | − 17.5 | 0.732 |
| xv) | − 15.0 | 0.823 |
| xvi) | − 12.5 | 0.924 |
| xvii) | − 10.0 | 1.034 |
| xviii) | − 7.5 | 1.155 |
| xix) | − 5.0 | 1.286 |
| xx) | − 2.5 | 1.430 |
| xxi) | 0.0 | 1.585 |
| xxii) | + 2.5 | 1.755 |
| xxiii) | + 5.0 | 1.936 |
| xxiv) | + 7.5 | 2.135 |
| xxv) | + 10.0 | 2.347 |
| xxvi) | + 12.5 | 2.577 |
| xxvii) | + 15.0 | 2.823 |
| xxviii) | + 17.5 | 3.088 |
| xxix) | + 20.0 | 3.370 |
| xxx) | + 22.5 | 3.674 |
| xxxi) | + 25.0 | 3.997 |
| xxxii) | + 27.5 | 4.343 |
| xxxiii) | + 30.0 | 4.710 |
| xxxiv) | + 32.5 | 5.103 |

**Table 2** (*Concluded*)

| Sl No. | Temperature °C | Vapour Pressure kgf/cm$^2$ |
|---|---|---|
| (1) | (2) | (3) |
| xxxv) | + 35.0 | 5.518 |
| xxxvi) | + 37.5 | 5.960 |
| xxxvii) | + 40.0 | 6.427 |
| xxxviii) | + 42.5 | 6.923 |
| xxxix) | + 45.0 | 7.447 |
| xl) | + 47.5 | 8.001 |
| xli) | + 50.0 | 8.583 |
| xlii) | + 52.5 | 9.199 |
| xliii) | + 55.0 | 9.848 |
| xliv) | + 57.5 | 10.53 |
| xlv) | + 60.0 | 11.25 |
| xlvi) | + 65.0 | 11.95 |
| xlvii) | + 70.0 | 13.40 |

## 5 APPROVED SPECIFICATIONS AND GENERAL GUIDANCE FOR MANUFACTURE

**5.1** The cylinders shall conform to one of the specifications approved by statutory authority. A list of approved specifications for filling in this country is available from the statutory authority.

**5.2** Cylinders manufactured in accordance with approved specifications shall be provided with an additional wall thickness to allow for corrosion during service. It shall be borne in mind that corrosion is not related to the thickness of the container so that any additional thickness allowed for corrosion should be constant rather than a given proportion of thickness.

**5.3** Further additional wall thickness shall also be considered necessary in order that the cylinder can safely withstand stresses due to horizontal acceleration and retardation in normal road transportation. The cylinder shall be so designed that the maximum permissible equivalent stress will not be exceeded when the stresses in the cylinder due to vertical accelerations are superimposed upon the stress due to internal pressure. The vertical accelerations considered should be those occurring in normal road transport. The provisions to be made in these and other respects as well as manufacturing tolerances to be applied will generally be decided between the user and the manufacturer. If a pronounced departure from normal practice is proposed or if mother unusual features arise, the statutory authority shall be consulted.

## 6 INSPECTION

### 6.1 Inspection during Manufacture

One of the inspecting agents approved by the statutory authority shall visit the manufacturing works to check and verify the following.

**6.1.1** That the chemical composition and physical properties of the steel used for the manufacture of cylinders strictly conform in all respects to the required specifications and that the chemical analysis of the material has been verified.

**6.1.2** That a steel maker's guarantee certificate ensuring that the steel used for making the cylinder is manufactured in accordance with the approved process is available with the manufacturer, and that material used for making each cylinder has been examined by him and found to be sound in all respects.

**6.1.3** That the mechanical properties, the wall thickness, inner and outer surfaces of the cylinders were found satisfactory and in accordance with the requirements.

**6.1.4** That the length, capacity and the mass of each cylinder were found within tolerance limit.

**6.1.5** That the hydrostatic test for each cylinder had been witnessed by the inspection agency and that there was no sign of any leakage in the cylinders.

**6.1.6** That the heat treatment of the cylinders was supervised by the inspection agency and found to be efficient and satisfactory.

**6.1.7** That all cylinders which pass the above tests and are accepted have been officially stamped by him.

### 6.2 Inspection during Usage

All the cylinders shall be examined for the following, when received for filling.

**6.2.1** That the cylinders conform to one of the specifications approved by the statutory authority for use in this country.

**6.2.1.1** A cylinder, either not conforming to any of the standard specifications or when the specification is not known, shall not be accepted for filling, unless approved and cleared by the statutory authority.

**6.2.2** That the statutory requirements regarding valves, markings, fittings, safety devices and painting are complied with.

**6.2.3** That the external condition of the cylinder body is sound. Any defect, such as dent bulge, cut, gouge, corrosion, etc which is liable to weaken the cylinder wall as certified by a competent person, will render the cylinder unfit for further use. The acceptability limit of such damaged cylinder is detailed in IS 5845.

**6.2.4** That the outlet threads of valves are in good condition. That the spindle is sound and not broken and the gland washers which shall be of good quality and compatible with sulphur dioxide are not worn out.

**6.2.5** That the cylinder is not due for periodic inspection and testing as indicated from the markings on the cylinder.

### 6.3 Periodic Inspection and Testing

Cylinders shall be periodically tested and inspected as follows.

**6.3.1** All cylinders, when received for filling, shall be checked by the filler if they are due for the hydrostatic re-testing. Hydrostatic test shall be carried out in accordance with IS 5844.

**6.3.2** The cylinders are to be tested periodically as stipulated by the statutory authority (*see* IS 15975).

**6.3.3** The testing of cylinders shall be done by a competent person.

**6.3.4** All cylinders, whether new or in service, shall be carefully examined internally and externally for any damage. All protective coating and foreign matter, if any, shall be removed, where necessary, prior to such examination so that the surface can be properly examined. The damage, if any, shall be carefully ascertained, the acceptability limit of the same is detailed in IS 5845.

**6.3.5** The internal examination shall be conducted by an efficient electric lamp which will give adequate illumination to have a clear view so that the defect, if any, can be detected.

**6.3.6** Care shall be taken to ensure that cylinder is fully purged with an inert gas, alternatively washed with steam and dried before the test lamp is inserted for inspection.

## 7 DISPOSAL OF CONDEMNED CYLINDERS

**7.1** Cylinders which do not comply with the requirements of inspection and testing shall be destroyed in accordance with IS 9200.

**7.2** Record of such cylinders shall be closed and kept for a period of one year.

## 8 FITTINGS

**8.1** Cylinders shall be fitted with a valve conforming to either IS 3224 or to any other specification approved by the statutory authority.

**8.2** It shall have a suitable protection for the valve.

**8.3** Safety device shall not be provided (*see* IS 5903).

**8.4** The colour of the paint on the cylinders (*see* IS 4379) shall always be maintained by periodically repainting them.

## 9 FILLING

**9.1** While filling, the cylinder shall be filled in such a manner that the filling ratio does not exceed the value specified in IS 15975.

**9.2** The amount of liquefied sulphur dioxide charged into each cylinder shall be determined by weighing after the cylinder has been disconnected from the line and on no account the cylinder shall be charged in excess of the filling ratio.

**9.3** All the cylinders shall be carefully examined for leaks after filling. Where leaks cannot be stopped, the cylinders shall be emptied and inspected for the cause of leakage.

**9.4** Emptying the cylinder shall not be accelerated by direct heating of the cylinder.

**9.5** Cylinders shall be filled in an approved filling station only.

**9.6** Filling staff shall identify the cylinders from their light bruns wick green ground colour and golden yellow band and the symbol $SO_2$ (*see* IS 4379) punched on the cylinder before proceeding to fill them. The colour coding shall be considered as secondary.

## 10 MARKING AND LABELLING

### 10.1 Marking

**10.1.1** *On Cylinders*

Each cylinder shall be permanently marked on the valve end of the cylinder with the following markings:

a) Serial number, identification and symbol of the manufacturer;
b) Number of the standard to which the cylinder conforms;
c) Test pressure;
d) The date of hydrostatic test with code mark of the station where the test was carried out;
e) Water capacity;
f) Tare and gross weight;
g) Working pressure; and
h) Sulphur dioxide symbol, $SO_2$.

**10.1.2** *On Valves*

The following markings shall be made on cylinder valves:

a) Number of the standard;
b) Month and year of manufacture;
c) Test pressure of valve; and
d) Manufacturer's symbol(s).

### 10.2 Labelling

**10.2.1** Each filled cylinder shall carry a label tacked to the cylinder, detailing the name of the filling station, its location, name of the gas in bold capital '**SULPHUR DIOXIDE**'; its grade, net weight and the warning instructions as stipulated in the *Gas Cylinder Rules*, 2016.

**10.2.2** The cylinder shall also carry an identifying label or stencil depicting the symbol given in Fig. 2 of IS 1260 (Part 1).

## 11 STORAGE

**11.1** Cylinders shall be stored in a dry ventilated place away from excessive heat or danger of fire and protected from accumulation of snow and ice. The storage shall not be used for any purpose other than storing the cylinders.

**11.2** Cylinders shall never be stored near gangways or elevators or near ventilating systems.

**11.3** Danger can be reduced by storing cylinders so that the oldest stock can be used first.

**11.4** Keeping the full and empty cylinders separately and storing in an orderly way will simplify handling, reduce confusion and permit frequent inspection for signs of leaks or other dangers. Valve protection hoods shall always be kept in place except when cylinders are actually being emptied.

**11.5** Cylinders shall be stored in an upright position. Cylinders shall be adequately supported in their vertical position while storing and during use to prevent from falling.

**11.6** Cylinders shall be protected from tampering by unauthorized individuals.

## 12 HANDLING

**12.1** The gas shall be called by its name.

**12.2** Adequate care shall be taken in handling the cylinders so that these are not dropped or struck against each other violently.

**12.3** Cylinders shall be moved on property balanced hand trucks, preferably with rubber tyres. A clamp or chain support two-thirds of the way up the cylinder shall be used.

**12.4** Hoisting of cylinders is not recommended. Clamp cradle or carrier shall always be used. However, if hoisting cannot be avoided, a lifting rope or chain sling. Cylinders shall never be hoisted with lifting magnet, support the weight.

**12.5** The cylinders shall not be used as rollers to move other equipment.

**12.6** In case of tonne containers, stationary or movable jib cranes or travelling overhead rail hoists of at least two tonnes capacity and capable of clearing the load at least two metres above the track rail, are suitable for lifting tonne containers.

**12.7** A beam equipped with hooks to grip the edge of the tonne container is satisfactory device for lifting the tonne containers.

**12.8** Travelling overhead hoists or specially equipped trucks and dollies can be used for moving the tonne containers to storage or point of use.

**12.9** Tonne containers may be rolled on the flat surface but are more easily handled when rolled on steel rails supported a few centimetres above the floor.

**12.10** Repairing, painting or altering colour of cylinders or valves shall not be done by consumer. Markings stamped on the cylinder and valve shall not be tampered.

**12.11** Valves shall always be closed before the cylinders are moved.

**12.12** Cylinder shall not be:

a) Lifted with an electromagnet;
b) Kept near elevator, gangway or in a location where moving object can fall on it;
c) Left near a source of heat like furnace, flame nor naked light or hot slag;
d) Kept close to welding or cutting work so that spark may fall on it;
e) Used as rollers, supports or for any purpose other than storing gas;
f) Kept in contact with an electric wire or fitting so that it may become a path of an electric circuit;
g) Kept near acid or corrosive substances;
h) Kept so as to obstruct the approach to a fire extinguisher;
j) Lifted by its cap;
k) Dragged or slided on floor. A suitable hand-cart shall be used; and
m) Rolled over oily or greasy floor.

## 13 TRANSPORTATION

**13.1** Cylinders may be shipped by truck, rail or water.

**13.2** Cylinders shall not be loaded on vehicles in such a manner that they may bounce or strike against each other.

**13.3** During transport, cylinders shall not project in the horizontal plane beyond the sides or ends of the vehicle.

**13.4** Cylinder on vehicle shall be blocked or braced and secured to prevent movement or falling.

**13.5** There shall not be any sharp projections on the inside of the vehicle, which can damage the cylinder wall.

**13.6** Leaky or defective cylinders shall not be transported knowingly.

**13.7** When cylinders are transported by rail, it shall be done in accordance with the *Railway Red Tariff Rules*. Cylinders shall be pasted with label for dangerous and poisonous gas as recommended by the railways.

**13.8** The transport contractor or the personnel involved in the transport of cylinders shall be informed of the special care that has to be taken for cylinders and shall be well informed about toxicity of sulphur dioxide gas.

## 14 REMOVING SULPHUR DIOXIDE

### 14.1 Connections

**14.1.1** Outlet threads on container valves are not tapered pipe threads. Connections shall be made with yoke and adapter.

**14.1.2** Flexible 12.7 mm copper tube of at least 35 kgf/cm$^2$ working pressure shall be used for connections between cylinder and stationary piping.

**14.1.3** A shut-off valve suitable for liquid sulphur dioxide service shall be provided at the beginning of stationary piping to simplify changing of containers.

### 14.2 Valves

**14.2.1** To unseat the valve, the end of the valve lever shall be struck with hand and then opened slowly.

**14.2.2** One complete turn permits maximum discharge. The valve shall not be forced beyond this point.

**14.2.3** If the valve is too tight to open, the packing gland nut shall be slightly loosened to free the stem.

**14.2.4** Large wrenches or pipe wrenches shall not be used on valve opening.

## 15 DISCHARGE

**15.1** Cylinders discharge gas when upright and liquid when inverted.

**15.2** Inverted cylinders shall be supported at the shoulders and held in place by clamps or chains about the cylinder body.

**15.3** Tonne cylinders are unloaded from a horizontal position, one valve above the other. The upper valve discharges sulphur dioxide gas, the lower liquid sulphur discharge.

**15.4** Tonne containers shall be placed in a cradle or carefully blocked during discharge.

## 16 GAS FLOW

**16.1** The rate of gas flow can be increased by improving air circulation about the container or by increasing the room temperature if it is below normal.

NOTE — Heat shall not be applied directly to the cylinder for any reason.

**16.2** If a high rate of gas flow is required, sulphur dioxide shall be withdrawn as liquid and converted to gas by means of vaporizer.

**16.3** Joining together or manifolding of the outlets or several cylinders to increase the flow rate shall not be done.

**16.4** The amount of sulphur dioxide remaining in a cylinder shall be best found by comparing the weight of the cylinder with the tare weight when empty. If the container is placed on a scale during unloading, the amount remaining is known at all times.

**16.5** When sulphur dioxide is being absorbed in a liquid, there is sometimes a tendency for the liquid to be sucked back into the container as it becomes empty. This may result in serious accidents.

NOTE — A vacuum loop shall be employed whenever sulphur dioxide from cylinders is absorbed in a liquid.

## 17 GENERAL PRECAUTIONS

**17.1** Cylinders shall be handled by properly instructed and trained persons.

**17.2** Attempt shall never be made to remove the valve from the cylinder body except by competent persons fully conversant with the job.

**17.3** Cylinders with defects shall be immediately labelled appropriately and returned to the supplier.

**17.4** Marking and identification colours of a cylinder shall never be defaced.

**17.5** If any incident occurs to the cylinder, the supplier shall be immediately informed giving the cylinder number, nature of the damage and, if possible, the reasons for the incident.

**17.6** When there is a doubt in proper handling of the cylinder, the manufacturer or supplier of the cylinder shall be consulted.

**17.7** The cylinders shall not be filled with any other gas.

## 18 SULPHUR DIOXIDE LEAKS

**18.1** Sulphur dioxide leaks shall always be taken care of immediately or they will become worse.

**18.2** Corrective measures shall be undertaken only by trained men wearing proper safety equipment.

**18.3** If the leak is large, all persons in the affected area shall be warned.

**18.4** Leaky cylinder shall be moved quickly to a safe open area.

**18.5** If sulphur dioxide is leaking as liquid, the cylinder shall be turned so that the leaking side is on the top.

**18.6** Water shall not be poured on sulphur dioxide leak.

**18.7** Leaks at valve inlet and body usually require special handling and emergency equipment.

**18.8** Leaks around valve stems and valve discharge outlet shall be stopped by closing the valve or tightening the packing glad nut or replacing gaskets.

**18.9** A leaking container shall not be transported.

**18.10** Suitable gas masks with eye shields shall be available within easy reach, whenever cylinders and containers are handled.

**18.11** A sulphur dioxide leak indicates its presence by the characteristic pungent colour. The location of even the smallest teak may be readily determined by means of ammonia vapour, which produces dense white fumes.

## 19 RECORDS

**19.1** Filling station shall maintain the following record in respect of each cylinder examined and tested for filling:

a) Name of the manufacturer and the owner;
b) Cylinder number;
c) Specifications to which the cylinder conforms;
d) Date of original hydrostatic test;

e) Test reports and certificates furnished by the manufacturer;

f) Test pressure;

g) Maximum working pressure;

h) Water capacity in litres;

j) Date of the hydrostatic test;

k) Tare and gross weight of the cylinder;

m) Variation, if any, in the tare weight marked on the cylinder and actual tare weight at the time of hydrostatic test;

n) Type of the valve fitted;

p) Type of the safety device, if fitted;

q) Weight of the sulphur dioxide charged;

r) Maintenance attended; and

s) Remarks.

NOTE — Permission obtained from the statutory authority, permitting the use of cylinder, shall be preserved till the cylinder is condemned.

## ANNEX A

(*Clause* 2)

## LIST OF REFERRED STANDARDS

| *IS No.* | *Title* |
|---|---|
| IS 1260 (Part 1) : 1973 | Pictorial marking for handling and labelling of goods: Part 1 Dangerous goods (*first revision*) |
| IS 3224 : 2021 | Valve for compressed gas cylinders excluding liquefied petroleum gas (LPG) cylinders — Specification (*fourth revision*) |
| IS 4379 : 2021 | Identification of the contents of industrial gas cylinders (*second revision*) |
| IS 5844 : 2014 | Hydrostatic stretch testing of compressed gas cylinders — Recommendations (*first revision*) |
| IS 5845 : 1993 | Code of practice for inspection of low pressure welded steel gas cylinders other than LPG cylinders in use (*second revision*) |
| IS 5903 : 2014 | Recommendation for safety devices for gas cylinders (*first revision*) |
| IS 7241 : 1981 | Glossary of terms used in gas cylinder technology (*first revision*) |
| IS 9200 : 2021 | Methods of disposal of unserviceable compressed gas cylinders — Code of practice (*second revision*) |
| IS 15975 : 2020 | Gas cylinders — Conditions for filling gas cylinders (*first revision*) |
| IS/ISO 11114-1 : 2020 | Gas cylinders — Compatibility of cylinder and valve materials with gas contents: Part 1 Metallic materials (*first revision*) |
| IS/ISO 11114-2 : 2013 | Transportable gas cylinders — Compatibility of cylinder and valve materials with gas contents: Part 2 Non-metallic materials |

## ANNEX B

(*Foreword*)

## COMMITTEE COMPOSITION

Gas Cylinder Sectional Committee, MED 16

| *Organization* | *Representative(s)* |
|---|---|
| Petroleum and Explosive Safety Organization, Nagpur | SHRI P. KUMAR **(*Chairperson*)**<br>SHRI K. S. RAO (*Alternate* I)<br>SHRI P. SEENIRAJ (*Alternate* II) |
| All India Industrial Gases Manufacturers Association, New Delhi | SHRI SAKET TIKU<br>SHRI K. R. SAHASRANAM (*Alternate*) |
| Ashok Leyland Limited, Chennai | SHRI VED PRAKASH GAUTAM<br>SHRI FAUSTINO V. (*Alternate*) |
| Automotive Research Association of India, Pune | DR S. S. THIPSE<br>SHRI SANDEEP RAIRIKAR (*Alternate*) |
| Bharat Heavy Electricals Limited, Project Engineering Management, Noida | SHRI SAYAN ROY<br>SHRI KARAN YADAV (*Alternate*) |
| Bharat Petroleum Corporation Limited, Mumbai | SHRI RAJWINDER SINGH PANESAR<br>SHRI AAKASH AGARWAL (*Alternate*) |
| Bhiwadi Cylinders Private Limited, New Delhi | SHRI MANVINDER SINGH<br>SHRI SUNIL K. DEY (*Alternate*) |
| Directorate General of Quality Assurance, Ministry of Defence, New Delhi | COL. SABIR HUNDEKAR |
| Everest Kanto Cylinder Limited, Mumbai | SHRI AYUSH PAWAR<br>SHRI GHANSHYAM GOYAL (*Alternate* I)<br>SHRI A. S. V. S. PRASAD (*Alternate* II) |
| Gujarat Gas Limited, Ahmedabad | SHRI DHARMESH SAILOR<br>SHRI RAVI RAVIPALLI (*Alternate*) |
| Hindustan Petroleum Corporation Limited, Mumbai | SHRI RAKESH G. KHADE<br>SHRI SHIVA SHANKAR (*Alternate* I)<br>SHRI DINESH PANGTEY (*Alternate* II) |
| Ideal Engineers Hyderabad Private limited, Hyderabad | SHRI SATISH KABRA<br>SHRI KUNAL KABRA (*Alternate*) |
| Indian Oil Corporation Limited, Mumbai | SHRI SOUMITRA CHAKRABORTY<br>SHRI CHANDRAKANT GHATOL (*Alternate*) |
| Indraprastha Gas Limited, New Delhi | SHRI RAKESH KISHAN AGRAWAL<br>SHRI BIMAL KARAN (*Alternate* I)<br>SHRI AVIRAL RAJEEV (*Alternate* II) |
| INOX India Limited, Vadodara | SHRI DEEPAK V. ACHARYA<br>SHRI NITIN JANSARI (*Alternate*) |
| International Industrial Gases Limited, Howrah | SHRI DEVENDRA K. GARG<br>SHRI NIKHILESH K. GARG (*Alternate*) |

| *Organization* | *Representative(s)* |
|---|---|
| Jai Maruti Gas Cylinders Private Limited, Gwalior | SHRI MANU K. NIGAM |
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