भारतीय मानक **IS 8198 (Part 7) : 2023**

Indian Standard

संपीड़ित गैसों के लिए इस्पात सिलेंडर रीति संहिता

भाग 7 अमोनिया गैस

(*दूसरा पुनरीक्षण*)

Steel Cylinders for Compressed Gases — Code of Practice

Part 7 Ammonia Gas

(*Second Revision*)

ICS 23.020.30

© BIS 2023

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

December 2023 **Price Group 7**

FOREWORD

This Indian Standard (Part 7) (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 1979 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) Reference of IS/ISO 11114 (Part 1) and IS/ISO 11114 (Part 2) have been added for material compatibility;
b) ICS code has been added; and
c) Reference standards have been updated.

For safe handling of cylinders containing compressed gases, one should be thoroughly conversant with the properties and characteristics of these gases. There are several precautions and safe practices which are to be observed on account of the nature of the gas and also because of the pressure to which the cylinders are subjected.

Manufacturers, fillers and users of the gas cylinders covered by this standard should be familiar with the precautions laid down in this standard 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 8 Common organic refrigerant gases
Part 9 Sulphur dioxide gas
Part 10 Methyl bromide gas
Part 11 Methyl chloride gas
Part 12 Gases for medical use

A refrigerant gas should be one that liquefies easily under pressure, for it works by being compressed to a liquid mechanically and then by absorbing large amounts of heat as it circulates through cooling coils and vaporises back into gas.

The earliest widely used refrigerant had been dry or anhydrous ammonia which liquefied under low pressure. Among the most popular refrigerant gases in the field today are the fluorocarbons, a family of almost indefinitely large size since they are any of the endless series of hydrocarbons which have been fluorinated. Fluorocarbons serve well as refrigerants because most of them are chemically inert to a large extent and they can be selected, mixed or compounded to provide almost any physical properties desired in particular refrigerant applications.

The relevant SI units and the corresponding conversion factors are given below for guidance:

$1\ kgf/cm^2 = 98.066\ 5\ kPa$ (kilopascal)
$= 10$ m of water column (WC)
$= 0.098\ 066\ 5$ MPa (megapascal)
$= 0.980\ 665$ bar
$1\ Pa = 1\ N/m^2$

(*Continued on third cover*)

Indian Standard

STEEL CYLINDERS FOR COMPRESSED GASES — CODE OF PRACTICE
PART 7 AMMONIA GAS

(Second Revision)

1 SCOPE

The standard (Part 7) covers filling, inspection, testing, maintenance and use of portable steel cylinders for the storage and transportation of liquefied ammonia gas in cylinders, of nominal capacity up to and including 130 litres water capacity.

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 edition of these standards.

3 TERMINOLOGY

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

4 PROPERTIES AND PHYSICAL CONSTANTS

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

Table 1 Properties and Physical Constant of Ammonia

(*Clause* 4.1)

Sl No.	Physical Classification	Low Pressure Liquefiable, Non-flammable But Supports Combustion
(1)	(2)	(3)
i)	UN No.	1005
ii)	Auto ignition temperature	651 °C
iii)	Affinity for water	Yes
iv)	Boiling point at 760 Torr	− 33.4 °C
v)	Color	Colourless
vi)	Odour	Pungent
vii)	Melting point	− 77.7 °C
viii)	Light sensitivity:	No
	a) Vapour density at 0 °C and 1 atm (air = 1);	0.597
	b) Liquid density at boiling point; and	0.674 g/ml
	c) Liquid density at 15 °C.	0.617 g/ml
ix)	Molecular mass	17.03
x)	Critical temperature	132.4 °C
xi)	Critical pressure	116.5 kgf/cm^2 (abs)
xii)	Critical density	0.235 g/ml
xiii)	Solubility in:	
	a) Water	47.3 percent by mass

Table 1 (*Concluded*)

Sl No.	Physical Classification	Low Pressure Liquefiable, Non-flammable But Supports Combustion
(1)	(2)	(3)
	b) Menthanol absolute	29.3 percent by mass
	c) Ethanol absolute	20.95 percent by mass

Table 2 Vapour Pressure of Anydrous Ammonia

(*Clause* 4.1)

Sl No.	Temperature °C	Vapour Pressure kgf/cm^2	Temperature °C	Vapour Pressure kg/cm^2
(1)	(2)	(3)	(4)	(5)
i)	− 50	0.42	55	23.6
ii)	− 40	0.73	60	26.6
iii)	− 30	1.22	65	29.04
iv)	− 20	1.89	70	33.7
v)	− 10	2.93	75	37.7
vi)	0	4.52	80	42.1
vii)	5	5.35	85	47.5
viii)	10	6.21	90	52.1
ix)	15	7.00	95	58.1
x)	20	8.72	100	63.5
xi)	25	10.2	105	70.4
xii)	30	11.8	110	77.3
xiii)	35	13.7	115	84.6
xiv)	40	15.7	120	92.7
xv)	45	17.9	125	107
xvi)	50	20.6	130	111

4.2 Ignition Range in Air

Ignition range in air is 15 percent to 30 percent by volume. This means that within this range of concentration, the gas is capable of forming mixtures with air in which at an initial temperature of 20 °C and an at initial pressure of 1 atmosphere, there is propagation of ignition, started by an ignition source.

4.3 Maximum Permissible Toxicity

Threshold limit value-time weighted average (TLV-TWA) is 25 ppm by volume. This is the maximum concentration in air to which nearly all workers may be exposed for a conventional 8 h workday. Short term exposure (STEL) is 35 ppm (maximum 15 min exposure at any time of the day). Inhalation of air containing more than 5 000 ppm of ammonia may cause death. Permanent eye injury may result from exposure to 700 ppm concentrations for longer than 30 min.

4.4 Chemical Reaction with Metals

When dry, ammonia does not react with most of the metals. When mixed with even very little water, it vigorously attacks copper, zinc, silver and many alloys, especially those containing copper. Hence absolutely no brass or bronze valve fittings are to be used for ammonia cylinders. Fittings should be made of iron or steel since ammonia will not attack these materials.

5 APPROVED SPECIFICATION AND GENERAL GUIDANCE FOR MANUFACTURE

5.1 The cylinders used for the storage and transportation of ammonia gas shall conform one of the specifications approved by 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 super imposed upon the stress due to internal pressure. The vertical acceleration considered should be those occurring in normal road transport. The provisions to be made in these and other respects as well was 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 other 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 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 A steel maker's guarantee certificate ensuring that the steel used for making the cylinder is manufactured in accordance with the approved process and is available with the manufacturer, and that the material used for making each cylinder has been examined by him and found to be sound in all respects.

6.1.3 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 The length, capacity and mass of each cylinder were found within tolerance limit.

6.1.5 The hydrostatic test for each cylinder has been witnessed and that the cylinder has passed the same [*see* **15.1** of IS 3196 (Part 4)].

6.1.6 The heat treatment of the cylinders was supervised and found to be in conformity with the requirements.

6.1.7 All cylinders which pass the above tests and accepted have been officially stamped by him.

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

6.2 lnspection during Usage

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

6.2.1 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 The statutory requirements valves, markings, fittings and paintings are complied with.

6.2.3 The external condition of the cylinder body is sound. Any defect, such as dent, bulge, cut, gauge 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 The outlet threads of valves are in good condition. The spindle is sound and not broken, and the gland washers which shall be of good quality and compatible with ammonia are not worn out.

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

6.2.6 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.

6.3 Periodic Inspection and Testing

Cylinder 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 examination and testing of the cylinder 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. In case of suspected damage to the parent metal, all protective coatings 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.

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 in for a period of one year.

8 FITTINGS

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

8.2 The cylinder shall have its valve protected against damage by the provision of a stout metal cap or shroud, securely attached to the body of the cylinder.

8.3 Safety device, if provided, shall be properly maintained (*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 values given in IS 15975.

9.2 The amount of anhydrous ammonia 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 cylinder 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 black ground colour and colour of band as signal red and golden yellow and ammonia symbol NH_3 (*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 mass;
g) Working pressure; and
h) Ammonia symbol (NH_3).

10.1.2 *On Valves*

The following markings shall be made on cylinder valves:

a) Number of the standard;
b) Ammonia symbol (NH_3);

c) Test pressure; and
d) Manufacturer's symbol and year of manufacture.

10.2 Labelling

Each filled cylinder shall carry an identifying label or stencil depicting the symbol given in Fig. 2 of IS 1260 (Part 1). The following information shall also be given.

AMMONIA, ANHYDROUS

WARNING — Hazardous liquid and gas under pressure liquid causes burns. Gas extremely irritating.

a) Do not breathe gas;
b) Do not get in eyes, on skin, on clothing;
c) In case of contact, immediately flush skin or eyes with plenty of water for at least 15 min;
d) Call a physician at once in case of burns, especially to the eyes, nose, throat or if the patient in unconscious;
e) Keep cylinders away from heat and sun. Do not store with flammable or explosive materials;
f) Never drop cylinders;
g) Be sure that the connections are tight. Use no oil or lubricants on valves; and
h) Never refill cylinders.

The labelling requirement shall also comply with *Gas Cylinder Rules*, 2016.

10.2.1 The other page of the label shall contain the details of cylinder, content of the cylinders, manufacturer of the content and details of filler.

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. It is preferable that cylinder storage room be fire-proof. The storage room shall not be used for any purpose other than the storage of cylinders.

11.2 Ventilation shall be provided through the structure in such a manner that full advantage of natural ventilation may be obtained. If natural ventilation is not sufficient, then storage area shall be equipped with suitable type at mechanical ventilation.

11.3 Pocketing of ammonia gas under floor roofs and similar structures shall be avoided.

11.4 Locations used for storage of cylinders shall be cut off from other occupancies and the building protected with automatic sprinklers, vapour-tight electrical equipment's, good natural ventilation, good floor drainage and adequate explosion venting.

11.5 Cylinder shall never be stored near gangways or elevators or near ventilating systems.

11.6 Dangers can be reduced by storing cylinders so that the oldest stock can be used first.

11.7 Keeping the full and empty cylinders separately and storing in an orderly way will reduce the necessary handling and 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.

11.8 Cylinders shall be stored in an upright position.

11.9 Cylinders shall not be stored outdoor.

12 HANDLING

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

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

12.3 Hoisting of cylinders is not recommended. However, if hoisting cannot be avoided, a lifting clamp cradle or carrier shall always be used. Ammonia cylinders shall never be hoisted with lifting magnet, rope or chain sling. A cylinder shall never be lifted by the hood as it is not strong enough to support the weight.

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

12.5 Travelling overhead hoists or specially equipped trucks and dollies may be used for moving the containers to storage or point of use.

13 TRANSPORATION

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 down.

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 cylinder shall not be transported.

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

13.8 The transport contractor or the personnel's involved for 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 the gas.

14 REMOVING AMMONIA FROM CYLINDERS

14.1 Connections

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

14.1.2 Stainless steel tube with minimum working pressure of 40 kgf/cm^2 shall be used for connecting between cylinder and stationary piping.

14.1.3 A shut-off valve suitable for liquid ammonia 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, end of the wrench shall be struck with the help of 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 The tube type cylinder is normally used in the horizontal position. Two general types of valves are supplied. Depending on which type is involved, either the valve outlet or the valve stem is kept at an angle with the longitudinal axis of the cylinder. The position of this valve outlet or stem determines whether liquid or gaseous ammonia will be discharged from the cylinder. When the valve outlet or stem is on top, the dip pipe on the inside of the cylinder is under the liquid, and, therefore, liquid anhydrous ammonia will be discharged. To discharge gaseous ammonia, the cylinder is turned so that the valve outlet or stem points downward. For this, instructions of the concerned ammonia manufacturer shall be followed.

15.2 The bottle type or vertical type will discharge ammonia as a gas when placed in an upright or vertical position. Due to liquid ammonia expansion, a bottle type cylinder may, under certain elevated temperature conditions, discharge a small amount of liquid when the valve is opened. It is, therefore, recommended that bottle type cylinders be allowed to reach room temperature before the valve is opened. To discharge liquid anhydrous ammonia, this type of cylinder shall be placed in a horizontal position with the valve outlet pointed up.

15.3 The rate at which gaseous ammonia may be discharged from either type cylinders depends upon the temperature of the surrounding atmosphere and the surface area of the liquid ammonia.

15.4 When the cylinder is empty, it should be disconnected and the valve plug inserted and the cylinder protective cap replaced.

15.5 If a bottle type cylinder has become frozen during discharge, a pry under the valve end shall never be used to loosen the cylinder. Instead water should be used to loosen the cylinder or one should wait for it to thaw out.

15.6 Empty cylinders shall be stoned separately from filled cylinders. An 'EMPTY' tag shall be fastened on cylinders immediately upon emptying. Then valve shall be closed, plug or nut on valve outlet replaced and valve protecting cap secured smugly.

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 the cylinder for any reason.

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

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

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

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

16.5.1 A vacuum break loop or device as indicated in Fig.1 shall be employed whenever ammonia from cylinders is absorbed in a liquid.

17 GENERAL PRECAUTIONS

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

17.2 Attempts 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 colour 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 the supplier of the cylinder shall be consulted.

17.7 The cylinder shall not be filled with any other gas.

18 AMMONIA LEAKS AND SPILLS

18.1 Ammonia leaks shall always be taken care of immediately or they will become worse.

18.2 Leaks of ammonia shall be searched for, preferably with hydrochloric acid solution or with either chlorine gas or sulphur dioxide gas, using a small cylinder of the compressed gas. A white cloud is produced in the presence of ammonia. Because of the fire risk, sulphur candies should not be used.

18.3 If leaks or spills occur, only protected personnel should remain in the area. In case where leaks cannot be valved off, large volumes of water shall be sprayed directly on the leak and the contact maintained until the ontents have been discharged. Leaking cylinders shall be removed to the outdoors or to an isolated well-ventilated area and the contents transferred to other suitable containers. All spills shall be flushed away promptly with water.

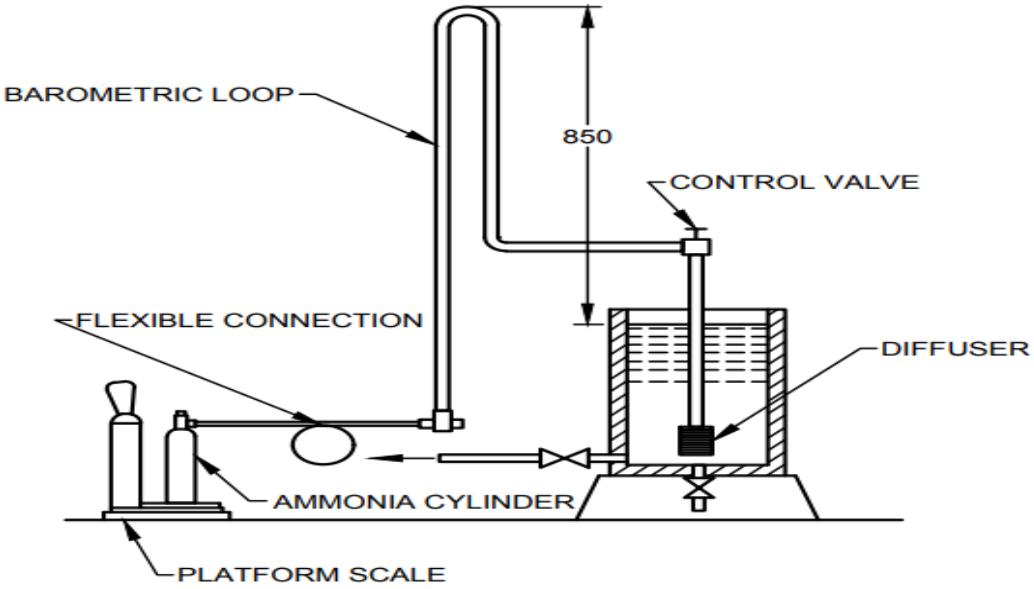

FIG. 1 VACUUM BRAKE DEVICE

18.4 Corrective measures shall be undertaken only by trained men wearing proper safety equipments.

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

18.6 If ammonia is leaking as liquid, the cylinder shall be turned so that the leaking side is on the top.

18.7 Leaks around valve stem, valve discharge outlet shall be stopped by closing the valve or tightening the packing gland or replacing gaskets.

18.8 A leaking container shall not be transported.

18.9 Suitable gas masks with eye shield shall be available within easy reach, wherever cylinders land containers are handled.

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 conform;

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 last hydrostatic test;

k) Water capacity in litres;

m) Date of the last hydrostatic test

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

p) Type of the valve fitted;

q) Type of the safety device, if fitted;

r) Mass of the ammonia charged;

s) Maintenance attended; and

t) 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 3196 (Part 4) : 2001	Welded low carbon steel cylinders exceeding 5 litre water capacity for low pressure liquefiable gases —Specification: Part 4 Cylinders for toxic and corrosive gases
IS 3224 : 2021	Valve fittings 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*)** SHRI K. S. RAO (*Alternate* I) SHRI P. SEENIRAJ (*Alternate* II)
All India Industrial Gases Manufacturers Association, New Delhi	SHRI SAKET TIKU SHRI K. R. SAHASRANAM (*Alternate*)
Ashok Leyland Limited, Chennai	SHRI VED PRAKASH GAUTAM SHRI FAUSTINO V. (*Alternate*)
Automotive Research Association of India, Pune	DR S. S. THIPSE SHRI SANDEEP RAIRIKAR (*Alternate*)
Bharat Heavy Electricals Limited, Project Engineering Management, Noida	SHRI SAYAN ROY SHRI KARAN YADAV (*Alternate*)
Bharat Petroleum Corporation Limited, Mumbai	SHRI RAJWINDER SINGH PANESAR SHRI AAKASH AGARWAL (*Alternate*)
Bhiwadi Cylinders Private Limited, New Delhi	SHRI MANVINDER SINGH 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 SHRI GHANSHYAM GOYAL (*Alternate* I) SHRI A. S. V. S. PRASAD (*Alternate* II)
Gujarat Gas Limited, Ahmedabad	SHRI DHARMESH SAILOR SHRI RAVI RAVIPALLI (*Alternate*)
Hindustan Petroleum Corporation Limited, Mumbai	SHRI RAKESH G. KHADE SHRI SHIVA SHANKAR (*Alternate* I) SHRI DINESH PANGTEY (*Alternate* II)
Ideal Engineers Hyderabad Private limited, Hyderabad	SHRI SATISH KABRA SHRI KUNAL KABRA (*Alternate*)
Indian Oil Corporation Limited, Mumbai	SHRI SOUMITRA CHAKRABORTY SHRI CHANDRAKANT GHATOL (*Alternate*)
Indraprastha Gas Limited, New Delhi	SHRI RAKESH KISHAN AGRAWAL SHRI BIMAL KARAN (*Alternate* I) SHRI AVIRAL RAJEEV (*Alternate* II)
INOX India Limited, Vadodara	SHRI DEEPAK V. ACHARYA SHRI NITIN JANSARI (*Alternate*)
International Industrial Gases Limited, Howrah	SHRI DEVENDRA K. GARG SHRI NIKHILESH K. GARG (*Alternate*)

Jai Maruti Gas Cylinders Private Limited, Gwalior	SHRI MANU K. NIGAM
Kosan Industries Limited, Surat	SHRI GIRISHBHAI K. DESAI SHRI S. B. BOLMAL (*Alternate*)
LPG Equipment Research Centre, Bengaluru	SHRI T. D. SAHU SHRI SANTOSH KUMAR GUPTA (*Alternate*)
Linde India Limited, Kolkata	SHRI RAMANA VUTUKURU
Mahanagar Gas Limited, Mumbai	SHRI S. MURALI SHRI MILIND M. RANADE (*Alternate* I) SHRI SACHIN GUMASTE (*Alternate* II)
Maruti Suzuki Indian Limited, Gurugram	SHRI GURURAJ RAVI SHRI ARUN KUMAR (*Alternate* I) SHRI RAJESH KUMAR (*Alternate* II)
RDCIS, Steel Authority of India Limited, Ranchi	SHRI K. K. SINGH SHRI SANTOSH KUMAR (*Alternate*)
Research and Development Estt (Engineers), Pune	DR SHANKAR BHAUMIK SHRI TAMHANKAR RAVINDRA (*Alternate*)
Society of Indian Automobile Manufacturers, New Delhi	SHRI K. K. GANDHI SHRI AMIT KUMAR (*Alternate*)
Steel Authority Of India Limited (SAIL), Research & Development Centre for Iron & Steel, Ranchi	SHRI K.K.SINGH SHRI SANTOSH KUMAR (*Alternate*)
Tata Motors Limited, Pune	SHRI PALLIPALAYAM GOWRISHANKAR SHRI SHAILENDRA DEWANGAN (*Alternate*)
Tekno Valves, Kolkata	SHRI Y. K. BEHANI SHRI ROHIT BEHANI (*Alternate*)
Trans Valves (India) Private Limited, Hyderabad	SHRI GAURAV JAIIN SHRI PRADEEP KUMAR MATHUR (*Alternate*)
Vanaz Engineers Private Limited, Pune	SHRI S. J. VISPUTE SHRI A. S. WAGH (*Alternate*)
BIS Directorate General, New Delhi	SHRI NAVINDRA GAUTAM, SCIENTIST 'E'/ DIRECTOR AND HEAD (MECHANICAL ENGINEERING) [REPRESENTING DIRECTOR GENERAL (*Ex-officio*)]

Member Secretary
SHRI PRASOON YADAV
SCIENTIST 'B'/ASSISTANT DIRECTOR
(MECHANICAL ENGINEERING), BIS

Low Pressure Gas Cylinders Subcommittee, MED 16:2

Organization	*Representative(s)*
Hindustan Petroleum Corporation Limited, Mumbai	SHRI DEBASHISH CHAKRAVERTY **(*Convener*)**
All India Industrial Gases Manufacturers Association, New Delhi	SHRI SAKET TIKU SHRI K. R. SAHASRANAM (*Alternate*)
Bharat Petroleum Corporation Limited, Mumbai	SHRI RAJWINDER SINGH PANESAR SHRI AAKASH AGARWAL (*Alternate*)
Bhiwadi Cylinders Private Limited, New Delhi	SHRI MANVINDER SINGH SHRI SUNIL K. DEY (*Alternate* I) SHRI RAJNEESH CHOPRA (*Alternate* II)
Directorate General of Quality Assurance, Ministry of Defence, New Delhi	COL SABIR HUNDEKAR
Hindalco Industries Limited, Mumbai	SHRI SOURABH MANOHAR SHRI DEVESH KUMAR (*Alternate*)
Hindustan Petroleum Corporation Limited, Mumbai	SHRI RAKESH G. KHADE SHRI SHIVA SHANKAR (*Alternate* I) SHRI DINESH PANGTEY (*Alternate* II)
Ideal Engineers Hyderabad Private limited, Hyderabad	SHRI SATISH KABRA SHRI KUNAL KABRA (*Alternate*)
Indian Oil Corporation Limited, Mumbai	SHRI SOUMITRA CHAKRABORTY SHRI CHANDRAKANT GHATOL (*Alternate*)
Jai Maruti Gas Cylinders Private Limited, Gwalior	SHRI ASHOK K. NIGAM SHRI MANU K. NIGAM (*Alternate*)
Kelvin Energy Solutions Private Limited, Mumbai	SHRI PRAFULLA WANKHEDE
LPG Equipment Research Centre, Bengaluru	SHRI T. D. SAHU SHRI SANTOSH KUMAR GUPTA (*Alternate*)
Petroleum and Explosive Safety Organization, Nagpur	SHRI P. SEENIRAJ SHRI SRINIVASA RAO KETA (*Alternate*)
Sahuwala Cylinders Private Limited, Visakhapatnam	SHRI P. K. GUPTA
Shri Shakti Cylinders Private Limited, Hyderabad	SHRI D. V. RAJASEKHAR MD YUNUS GEELANI (*Alternate*)
Steel Authority of India Limited (SAIL) - Salem Steel Plant, Salem	SHRI M. PRABAKARN SHRI N. K. VIJAYVARGIA (*Alternate*)
Supreme Cylinders Limited, Delhi	SHRI M. L. FATHEPURIA
Tata Iron and Steel Company Limited (TISCO), Jamshedpur	SHRI SUDIPTO SARKAR DR A. N. BHAGAT (*Alternate*)
The Supreme Industries Limited, Halol	SHRI PRADEEP KAMAT
Time Technoplast Limited, Mumbai	SHRI NAVEEN KUMAR JAIN SHRI VENKATESHWARN N. (*Alternate*)
Vanaz Engineers Private Limited, Pune	SHRI S. J. VISPUTE SHRI A. S. WAGH (*Alternate*)

(*Continued from second cover*)

The fluorocarbons constitute a large family of fluorinated hydrocarbon compounds that exhibit similar chemical properties and wide range of physical characteristics. This standard covers in general only some of the most widely used fluorocarbons, their quality specifications, cylinder filling, inspection and testing procedures and recommended practices on storage and handling.

Manufacture, possession and use of any gas when contained in cylinders in a compressed or liquefied state is regulated under the *Gas Cylinder Rules*, 2016 of the Government of India as amended from time to time. Although the standard has been prepared in consultation and agreement with the statutory authorities under these rules, should anything in the code conflict with the provisions of *Gas Cylinder Rules*, the latter shall be adhered to.

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.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Head (Publication & Sales), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.in.

This Indian Standard has been developed from Doc No.: MED 16 (20441).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices:		*Telephones*
Central	: 601/A, Konnectus Tower -1, 6th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002	2323 7617
Eastern	: 8th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091	2367 0012 2320 9474
Northern	: Plot No. 4-A, Sector 27-B, Madhya Marg, Chandigarh 160019	265 9930
Southern	: C.I.T. Campus, IV Cross Road, Taramani, Chennai 600113	2254 1442 2254 1216
Western	: Plot No. E-9, Road No.-8, MIDC, Andheri (East), Mumbai 400093	2821 8093

Branches : AHMEDABAD. BENGALURU. BHOPAL. BHUBANESHWAR. CHANDIGARH. CHENNAI. COIMBATORE. DEHRADUN. DELHI. FARIDABAD. GHAZIABAD. GUWAHATI. HIMACHAL PRADESH. HUBLI. HYDERABAD. JAIPUR. JAMMU & KASHMIR. JAMSHEDPUR. KOCHI. KOLKATA. LUCKNOW. MADURAI. MUMBAI. NAGPUR. NOIDA. PANIPAT. PATNA. PUNE. RAIPUR. RAJKOT. SURAT. VISAKHAPATNAM.

Published by BIS, New Delhi