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Gas cylinders — Safe handling

Bouteilles à gaz — Sécurité de manutention

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 11625 was prepared by Technical Committee ISO/TC 58, *Gas cylinders*, Subcommittee SC 4, *Operational requirements for gas cylinders*.

This second edition cancels and replaces the first edition (ISO 11625:1998) which has been technically revised.

Introduction

The following guidelines are for everyone who handles gas cylinders, and are based upon experience. Some precautions are also applicable to gas suppliers and distributors. It should not be assumed that every applicable safety precaution or regulation is contained herein.

Gas cylinders are constructed, maintained and used in accordance with applicable regulations and are safe for the purposes for which they are intended. Accidents occurring during the transportation, handling, usage and storage of these cylinders can often be traced to failure to follow the guidelines set forth in this International Standard.

Users of compressed, liquefied or dissolved gases should become familiar with the properties and inherent hazards of the products they use. Valuable information pertaining to each specific gas is contained within its product labelling and safety data sheet.

Gas cylinders — Safe handling

1 Scope

This International Standard specifies requirements for safe handling, use and storage of gas cylinders for compressed, liquefied or dissolved gases. This International Standard applies only to single gas cylinders of sizes from 0,5 l to 150 l water capacity.

For specific gas applications such as welding, diving, inerting, etc., additional requirements apply which are not covered in this International Standard.

Maintenance, repair, marking, labelling, inspection and retesting of gas cylinders, which are normally under the responsibility of the gas cylinder owner, are also not included in this International Standard.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 32, *Gas cylinders for medical use — Marking for identification of content*

ISO 5145:2004, *Cylinder valve outlets for gases and gas mixtures — Selection and dimensioning*

ISO 7225, *Gas cylinders — Precautionary labels*

ISO/TR 7470, *Valve outlets for gas cylinders — List of provisions which are either standardized or in use*

ISO 10286, *Gas cylinders — Terminology*

ISO 11117, *Gas cylinders — Valve protection caps and valve guards — Design, construction and tests*

ISO 13769, *Gas cylinders — Stamp marking*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 10286 and the following apply.

3.1
air line mask
breathing mask connected to a pipeline (the ‘air line’) with breathable air

3.2
handling
moving, connecting or disconnecting a gas cylinder under normal conditions of use

3.3
manifold
gas distribution system that transfers product through multiple inlets from gas cylinders to the supply pipeline [to the point(s) of use]

NOTE The pressure regulator, non-return device(s), flame arrestor (acetylene) and gauges can be integrated in the manifold.

3.4
misuse
utilizing a gas cylinder for a purpose other than that for which it was made, e.g., roller, support, etc.

3.5
label
information durably attached to the cylinder or indicated by an adherent and clearly visible means such as printing, stencilling or any other equivalent process

3.6
supplier
any entity that manufactures and packages gas

3.7
transfilling
transfer of gas from one cylinder to another

3.8
user
any entity other than a supplier

4 Content identification

Cylinders offered for shipment shall have their contents identified as prescribed by relevant national and/or international regulations and standards. Content identification shall be present during the transportation, delivery to user and during use.

The primary and only accurate identifier of cylinder content is the cylinder label (see ISO 7225). Cylinders may be painted (colour coded, see ISO 32) to permit recognition of the contents or hazard and to permit segregation more readily in gas supplier handling operations.

The user should read the label to verify that the correct gas ordered has been supplied. Cylinders that do not bear a legible label to identify the content or cylinders that bear more than one label with contradictory identification shall not be used. They shall be returned to the supplier, unused, together with appropriate explanations.

5 Safe handling requirements

5.1 General

Gas cylinders shall be handled and used only by properly trained persons. The following rules apply to all gas cylinders.

5.2 User responsibilities

5.2.1 General

The user is responsible for the safe use and handling of the cylinder and its contents. When cylinders are rented, on an exchange programme or otherwise owned by a distributor, gas supplier or other such entity, the user shall maintain and care for the cylinder to ensure that it is returned or exchanged in the same safe condition as it was received.

If the user has any difficulty understanding any of the precautions and requirements in this International Standard, concerning the gas cylinder, the user shall contact the cylinder supplier before the gas is used.

The user shall inform the supplier if the gas cylinder has been misused or damaged.

5.2.2 Prescribed markings

Markings on cylinders are required by the relevant authority. Markings shall be clear and legible while the cylinder is in service. The user shall not add, remove or alter any of the markings on the cylinder (see ISO 13769) unless specifically allowed by the relevant authority.

5.2.3 Labels

If applied, labels shall be clear and legible. The user shall not deface, alter or remove any labels.

5.2.4 Cylinder modifications

The user shall not modify, tamper with, obstruct, remove or repair any part of the cylinder or valve including the pressure relief device, retest ring and other accessories if so equipped.

The user shall not alter or modify (for any reason) the colour of the cylinder unless the user has received authorization to do so from the owner.

5.2.5 Contamination

Contamination can occur when foreign substances, other gases, process materials or fluids enter the cylinder through the valve. If contamination has occurred or is suspected, the user shall identify and clearly mark the cylinder and shall notify the gas supplier of details on the contamination. It is the user's responsibility to ensure the valve is closed during transport to the supplier.

5.2.6 Misuse

Gas cylinders shall not be used as rollers, supports or for any purpose other than to deliver the gas content.

5.2.7 Electrical circuits

Cylinders shall not be placed where they become part of an electrical circuit. When gas cylinders are used in conjunction with electric welding, they shall not be used for earthing (grounding) of electrical equipment. Arc welding near gas cylinders should be avoided. The use of a cylinder to test the arc performance shall not be allowed. Observing these precautions will prevent the cylinder from being arc burned.

5.2.8 Magnetic resonance imaging (MRI)

Cylinders and accessories with ferritic (magnetic) material (in most cases steel cylinders) shall not be used in the proximity of magnetic resonance imaging (MRI) equipment. There is the risk of personal injury/fatality and equipment damage from such cylinders being magnetically attracted by the unit.

5.2.9 Temperature limits

Gas cylinders shall not intentionally be exposed to temperatures above 65 °C. Never apply a flame or heat directly to any part of a gas cylinder or allow it to come in contact with an electrically energized system. If ice or snow accumulates on a cylinder or related accessories, with permission of the supplier, thaw the cylinder at room temperature or with water at a temperature not exceeding 50 °C. In the event that the cylinder has been accidentally heated above these temperatures, the user shall segregate the cylinder and notify the supplier. In the case where the supplier is not the owner of the cylinder, it shall be the responsibility of the supplier to pass this information along to the owner.

Cylinders shall not be subjected to artificially created low temperatures without the approval of the supplier. Cylinders are designed for use under ambient conditions; normally the temperatures for design are − 20 °C to + 50 °C.

Gas cylinders that have been in, or exposed to fire shall not be shipped if they still contain gas under pressure. Consult the gas supplier prior to returning such cylinders.

NOTE 1 Cylinders exposed to elevated temperatures can suffer mechanical damage, which could lead to an unsafe cylinder. Certain materials and alloys (such as aluminium or non-metallic valve components) are more susceptible to temperature elevations, but cylinders of all materials can suffer mechanical damage from elevated temperatures.

NOTE 2 Acetylene cylinders with elevated temperatures pose the risk of gas decomposition.

5.2.10 Leaking cylinders

Do not use a cylinder found to be leaking. Only trained and prepared personnel who have knowledge of the gas hazard(s) and who have proper protective equipment shall handle a leaking cylinder. If the hazard of the gas warrants it, all other personnel should be evacuated from the area, and emergency response people should be allowed to handle the situation.

When personnel are addressing a leaking cylinder, it can be moved to a well-ventilated area or contained so that the leaking gas poses no threat to human health or life.

NOTE If the leaking cylinder contains corrosive or toxic gas, consider emergency action by placing it in a special cylinder containment vessel (e.g. salvage container) for disposal.

5.2.11 Corrosion and other damage

If a cylinder or valve is noticeably damaged or corroded, the gas supplier shall be notified, and his instructions followed. Any other damage that might impair the safety of the cylinder during use or transportation shall be called to the attention of the gas supplier before the return of the cylinder.

5.2.12 Discharging gas

The discharge of contents from any gas cylinder shall not be directed toward any person. Corrosive or toxic gases shall not be discharged directly to the atmosphere. The user shall return cylinders containing these gases to the supplier for proper disposal.

Flammable gases under certain conditions may be discharged only under controlled conditions as recommended by the supplier.

Discharging gas can cause a variety of injuries to the body especially the eyes and hands. In the event of a release, precautions should be taken to prevent potentially hazardous accumulations, e.g. toxic, asphyxiant, flammable, etc.

5.2.13 Non-refillable cylinders

Non-refillable cylinders shall not be refilled after use of original contents. After usage, such cylinders shall be disposed of in accordance with the cylinder supplier's recommendations and national regulations.

5.2.14 Valve protection

Valves are designed either to have inherent valve protection or they require a protection device. Except for guards/shrouds noted below, when valve protection is provided by the supplier, the user shall keep such devices on the cylinder except when cylinders are connected to dispensing equipment. For a complete description of valve protection devices, see ISO 11117.

When cylinders are disconnected from dispensing equipment, valve protection devices shall be re-attached to the cylinder. The user shall verify that the re-attached protection device is of the same type and size that was supplied with the cylinder by the supplier.

Valve guards/shrouds are valve protection devices that are not removed, even when the cylinder is connected to dispensing equipment. Valve guards/shrouds shall not be removed by the user.

5.2.15 Valve outlet caps and/or plugs

Where valve outlet caps and/or plugs are provided on the valves, the user shall keep such devices on the valve outlet at all times except when cylinders are connected to dispensing equipment. Gas-tight valve outlet caps and plugs are required by regulations for some harmful gases. When the valve outlet cap/plug is supplied, it shall be tightened securely, immediately after use.

NOTE Cylinders fitted with single-use safety caps are not subject to this requirement (e.g. commercial LPG cylinders).

5.2.16 Handling of cylinders

Users shall not roll or drag cylinders in the horizontal position in order to move them. A suitable hand truck, forklift truck or similar material-handling device may be used with the cylinder securely held by the device, especially for large or heavy cylinders. However for short distances, larger cylinders may be manoeuvered manually by wheeling the cylinder on the base ring with the cylinder slightly tilted. Caution shall be used to guard against dropping or permitting cylinders to violently strike against each other or other surfaces.

Do not lift cylinders by using the valve protection device unless they have been designed for that purpose. Do not use ropes, chains or slings to suspend cylinders unless the supplier has installed appropriate lifting attachments such as lugs. Suitable cradles, platforms or pallets to hold the cylinders may be used for lifting.

NOTE 1 Some smaller cylinders are designed to have a carrying handle that also serves as the valve protection device. It is safe to carry cylinders by such handles/shrouds.

NOTE 2 Personnel handling cylinders should wear appropriate protective equipment (e.g. safety shoes).

5.2.17 Transfilling

The user shall not transfer gases from one cylinder to another cylinder, except where the system has been designed to safely permit transfilling and with authorization of the owner of the receiving cylinder or gas supplier, and if the local authority allows it.

EXCEPTION: Never transfill acetylene from one cylinder into another cylinder. A fire or explosion could result.

5.2.18 Valve removal

The user shall not remove, alter or tamper with the cylinder valve under any circumstances.

Even if it is suspected or believed that the cylinder is empty, valve removal is dangerous and an unsafe operation. Valves and their fittings shall not be modified, disassembled or repaired. In case of improper valve functioning, the supplier shall be contacted.

6 Use of gas cylinders

6.1 General

The following requirements apply when withdrawing content from gas cylinders.

6.2 Labels and safety data sheets (SDS)

Before using any gas, read the label and safety data sheet information associated with the specific gas. Gas cylinders with more than one hazard label carry contents with more than one hazardous property. The meanings of the hazard labels are shown in Table 1.

Table 1 — Hazard labels

	Colour	Hazard
	green	non-flammable, non-toxic
	red	flammable
	white	toxic
	yellow	oxidizing
	white and black	corrosive

6.3 Connecting cylinders and withdrawing content

Cylinder valve connections that do not fit shall not be forced. Threads on regulator connections or other auxiliary equipment shall match the cylinder valve outlet without the use of an adaptor or any modification. The valve outlet connection should conform to a recognized standard, e.g. ISO/TR 7470 and ISO 5145.

6.4 Cylinder valve

— The cylinder valve shall be kept closed except when the cylinder is in use.

— Valve outlets shall be pointed away from all personnel when the valve is being opened.

— Valves without hand wheels have keys provided, and only those keys designed for the specific valve in use shall be used; the key shall remain on the valve while the cylinder is in use.

— For valves with hand wheels: spanners, wrenches, hammers or other tools shall not be used to open or close the valve.

— Do not apply excessive force to operate a cylinder valve.

— Contact the gas supplier if the valve is difficult to operate. **Never lubricate cylinder valves.**

— Automatically operated valves shall be operated in accordance with instructions.

— Residual pressure valves should not be tampered with, in particular the cartridge, which prevents the gas cylinder from being totally emptied of pressure.

6.5 Non-return valves

Gas cylinders shall not be attached directly to a process in which the cylinder can be contaminated by the backflow of other process material. Design of process equipment shall include the use of non-return valves and/or traps to prevent backflow. Non-return valves and/or traps shall be checked and maintained on a regular schedule to ensure proper operation.

6.6 Flame arrestor and shut-off device

Acetylene cylinder manifolds shall be equipped with an appropriate flame arrestor and shut-off device. The supplier should be consulted for details.

6.7 Manifolds

Where gas cylinders are connected to a manifold, the manifold and its related equipment, such as regulators, non-return valves, etc. shall be of correct design for the product(s) they are to contain at the appropriate temperatures, pressures and flows, and properly tested for leakage and pressure rating. Depending on the intended gas, information on the design of manifolds can be found in ISO 14113, ISO 14114, ISO 2503, ISO 7291 and ISO 15615.

6.8 Gas tightness of connections

Piping, regulators and other equipment shall be gas-tight to prevent leakage. This can be confirmed by the use of a compatible leak test material (e.g. liquid, foam, etc.) or an appropriate leak-detection instrument. Always leak test the cylinder connection when first installed. Leak test material shall be compatible with cylinder gas, connecting materials (e.g. valve, pipe, hose, etc.) and cylinder material.

CAUTION — Do not tighten connections or leaking fittings or attempt other repairs or servicing while the system is under pressure.

6.9 Residual cylinder pressure

The residual pressure of a gas cylinder shall not be reduced below the operating pressure of the system or below a minimum residual pressure in order to prevent the backflow of atmospheric air or other contaminants into the cylinder. The cylinder valve shall be closed to retain a residual pressure. The recommended minimum residual pressure ranges from 0,5 bar to 2 bar gauge where applicable.

Gas cylinders equipped with residual pressure valves (RPVs) shall also be closed after use of the gas.

6.10 Removing pressure regulator

Before a regulator is removed from the system, the cylinder valve shall be closed (unless self-closing) and the regulator relieved of gas pressure. Gas cylinder valves with integrated pressure regulators shall be closed after use.

6.11 Changing equipment service

Regulators, gauges, hoses and other equipment provided for use with a particular gas or group of gases shall not be used on cylinders for gases having different chemical properties or hazards. Information can be obtained from the gas supplier concerning gas compatibility. As an example, only pressure regulating devices

approved for use with oxygen shall be used in oxygen service. Such devices are marked with “FOR OXYGEN ONLY” or similar wording.

6.12 Ventilation

Before using a cylinder in a confined space, a risk assessment shall be made to ensure adequate ventilation. At a minimum, risks such as those identified in 6.15, 6.16, 6.17 and 6.18 shall be assessed.

6.13 Securing cylinders

Where appropriate, all gas cylinders in service at locations shall be secured to prevent falling.

6.14 Precautions for oxidizing gases

Any material used in contact with oxidizing gases (e.g. for oxygen and nitrous oxide) shall be suitable for this type of service. It is important that equipment used be clean. Oxygen-compatible materials shall be used and kept free from oils, greases and other contaminants. Deviations from this requirement can cause violent reactions and accidents.

6.15 Oxygen concentration in work areas

The oxygen concentration in work areas, other than hyperbaric chambers, shall not exceed a volume fraction of 25 %. The use of a detection and alarm system should be considered for detection of oxygen leakage or of an increase in concentration.

Where oxygen concentration is found to exceed 25 % and/or an uncontrolled leak is present, personnel shall be evacuated from the area immediately. Where clothing has become saturated with oxygen, personnel shall be removed from the oxygen source and from potential ignition sources and the clothing removed.

6.16 Asphyxiation by inert gases

All gases except oxygen and air can cause asphyxiation by displacing the ambient oxygen necessary to sustain life. Self-contained breathing apparatus or air line masks shall be worn in areas containing an oxygen deficient atmosphere (e.g. $\leqslant$ 19,5 % oxygen).

6.17 Hazards due to corrosive or toxic gases

Some gases create additional hazards other than those of fire, asphyxiation or oxygen enrichment. Exposure to these gases can present serious hazards to unprotected personnel. Before using a corrosive or toxic gas, carefully read the label and safety data sheet information associated with the specific gas. Personnel working in the immediate storage or usage area where exposure to these gases could occur shall be instructed concerning the hazards of the gases. Exposure to these gases shall be kept as low as possible, but in no case should concentrations exceed the exposure levels established by national regulations.

6.18 Emergency precaution and required equipment

Personal protection equipment shall be made available to prevent corrosive or toxic gas inhalation, or contact with the skin or eyes. Areas where corrosive gases are stored or used shall be equipped with emergency showers and eyewash fountains. Capability for prompt emergency medical treatment, including first aid, shall be provided.

Only trained and qualified personnel shall be allowed to handle, process or utilize corrosive and toxic gases. Training shall include the associated hazards of the materials, necessary precautions, protective equipment and emergency response procedures.

7 Storage

7.1 General

The storage of hazardous materials is often specified by regulations that come from a national or one or more relevant authorities. Most of what follows is a summary of such regulations, but does not replace regulations specified by the relevant authority.

Gas cylinders shall be stored according to hazard class. The following requirements are for storage/handling of the gas cylinder.

7.2 Hazard class

7.2.1 Gases are classified based upon their chemical and physical hazards. Personnel using gases shall have a thorough knowledge of gas properties in order to maintain a safe, controlled operation. Annex A of ISO 5145:2004 provides an example of classifications. In all cases follow relevant regulations.

7.2.2 Gases can present a hazard because of one or more of the following:

— asphyxiant;

— oxidizing;

— flammable;

— corrosive;

— toxic;

— under pressure.

7.2.3 Some gases can combine several of the above hazards. For example, a cylinder of hydrogen gas combines high pressure with the flammable hazard; chlorine is at the same time toxic, corrosive and highly oxidizing.

7.3 Storage (all hazard classes)

7.3.1 Storage areas shall be designed to accommodate the various gases required by the user. Adequate spacing or segregation by partitioning in accordance with applicable codes shall be provided so that cylinders can be grouped together by the hazard class of the gas. Separate storage of full and empty cylinders should be provided. The area shall be dry, well-ventilated and preferably of fire-resistant construction. Storage area temperatures shall not exceed 65 °C. Storage in subsurface locations should be avoided. Users shall ensure that there is adequate separation from combustibles as specified by relevant regulations. Cylinders shall not be stored near readily-ignitable substances, such as flammable liquids, or exposed to corrosive chemicals or fumes. Corrosion can damage the containers and can cause the container valve protection caps to stick.

7.3.2 The maximum quantity of gases to be stored is specified by various relevant regulations. Some regulations specify separation distances for storage in restricted areas.

7.3.3 Cylinder storage areas other than for individual personal use shall be posted with signs readily visible showing the hazard class or the name of the gases to be stored and with “NO SMOKING” signs where oxidizing or flammable gases are stored.

7.3.4 Cylinders shall be stored in protected areas to prevent chemical attack or other mechanical damage such as cuts or abrasions on the surface of the cylinder. Cylinders shall not be stored in locations where heavy moving objects can strike or fall on them.

7.3.5 Cylinders are usually stored out-of-doors. However, to prevent corrosion, prolonged exposure to a damp or corrosive environment should be avoided. To reduce corrosion to the base, cylinders shall, where practical, be stored on paved surfaces, such as concrete or asphalt that has been sloped to prevent accumulation of water.

7.3.6 Cylinders, when stored, shall not obstruct exit routes or other areas normally used or intended for the safe exit of people.

7.3.7 Where appropriate, all gas cylinders in storage at user locations shall be secured to prevent falling.

7.4 Storage by hazard class

7.4.1 General

The following procedures are meant to enhance safety for storage of various hazard classes. They are applicable for single gases and for gas mixtures.

The following general requirements for all hazard classes shall apply.

— Storage areas, buildings and rooms shall be in compliance with applicable regulations.

— Cylinders for gases heavier than air (e.g. for LPG, refrigerants, carbon dioxide) shall not be stored underground unless a risk assessment has been performed.

— “NO SMOKING” signs shall be posted around the storage area of buildings or at entrances to special storage rooms.

7.4.2 Storage of gas cylinders for asphyxiant gases

7.4.2.1 Inert gases are asphyxiants, chemically inactive, odorless, tasteless and colourless, and include argon, helium, xenon, neon, krypton and nitrogen. Also, carbon dioxide is an asphyxiant.

NOTE Nitrogen normally is considered an inert gas because it does not become reactive except at high temperatures and pressures and with catalysts.

7.4.2.2 Inert gases can cause asphyxiation by displacing the ambient oxygen necessary for life. Self-contained breathing apparatus or masks attached to an air line with breathable air shall be worn in areas containing an oxygen-deficient atmosphere.

7.4.2.3 Because inert gases in sufficient quantities can cause asphyxiation, storage areas shall be well ventilated. Only persons trained, qualified and using self-contained breathing apparatus with adequate back-up should respond to an inert gas leak or enter a storage area where gas could be present. Shut off the leak if doing so presents no risk; then ventilate the area.

7.4.3 Storage of gas cylinders for oxidizing gases

7.4.3.1 Oxidizing gases, including oxygen, are non-flammable gases, but in the presence of an ignition source and a fuel, they can support and vigorously accelerate combustion. Common oxidizing gases include chlorine, fluorine and nitrous oxide. Materials that normally will not burn in air can burn in an oxygen-enriched atmosphere. Oxygen is extremely reactive with organic materials such as oil, grease or tar if ignited by flame, impact or some other energy source. Materials that do burn in air will burn more vigorously and at a higher temperature in an oxygen-enriched atmosphere.

7.4.3.2 Oxidizing gas equipment shall be cleaned to remove grease, oils and other contaminants using cleaning agents that are oxygen compatible. Any material used in contact with oxidizing gases shall be suitable for this type of service. Valves, piping, fittings, regulators and other equipment used in oxygen service shall be of a material and pressure rating compatible with oxygen.

7.4.3.3 The oxygen concentration in work areas, other than in hyperbaric chambers, shall not exceed a volume fraction of 25 %. If it is suspected of exceeding 25 % and an uncontrolled leak is present, personnel shall be evacuated from the area immediately. Where clothing has become saturated with oxygen, personnel shall be removed from the oxygen source and from potential ignition sources and the clothing removed.

7.4.3.4 Oxidizing gases shall be stored separately from flammable gas cylinders where required by relevant regulations. Oxidizing gases shall not be stored with combustible materials (especially oil, grease, wood or paper). A minimum separation distance and non-combustible barrier as specified in applicable relevant regulations shall be maintained.

7.4.4 Storage of gas cylinders for flammable gases

Flammable gases should not be stored adjacent to oxidizers; this is subject to relevant regulations. Flammable gases shall not be stored near open flames, sources of heat, adjacent to non-explosion-proof electric systems or near unearthed electrical equipment.

— Fire extinguishers (of carbon dioxide or dry chemical types) shall be available for fire emergencies at storage installations.

— A flame shall not be used for detection of flammable gas leaks; either a flammable gas leak detector or compatible leak detection material (e.g. liquid, foam, etc.) shall be used.

— Electrical equipment shall comply with the applicable electrical code, i.e., be explosion proof, etc.; mobile telephones and portable electrical equipment shall not be taken into areas containing flammable gases.

— Heating of storage areas shall be by steam, hot water or other indirect means; direct heating by flames or fire shall be prohibited.

— Showers should be installed in the vicinity of the cylinders in use.

In the event of an emergency situation involving a flammable gas, whether a gas leak, fire or explosion, personnel should immediately evacuate the area. No attempt should be made to extinguish burning gas if the flow of product cannot be shut off immediately. Rescue or other emergency response activities should only be attempted by trained and qualified personnel.

In the specific case of fire associated with acetylene cylinders, care shall be taken to protect oneself against possible cylinder explosion. Then, from a protected place at a distance, abundantly spray with water any acetylene cylinder that has become hot either due to internal heating or through exposure to a fire. Evacuate personnel and only stop spraying if, after having ceased spraying for a few moments, the cylinder remains moist. Then immerse the cylinder for 24 h in water prior to transportation.

Facilities utilizing these gases in quantities exceeding the exempt amounts stipulated in applicable regulations shall have prepared an emergency response plan defining procedures and outlining responsibilities necessary to address emergency situations involving flammable gases.

7.4.5 Storage of gas cylinders for corrosive and toxic gases

7.4.5.1 Some gases create additional hazards other than those of asphyxiation, fire or oxygen enrichment. Exposure to these gases can present serious hazards to unprotected personnel. Before using toxic gas, carefully read the label and safety data sheet information associated with the specific gas. Personnel working in the immediate storage area where exposure to these gases could occur shall be instructed as to the hazards of the gases. Exposure to these gases shall be kept as low as possible, but in no case should concentrations exceed the exposure levels established by relevant regulations.

7.4.5.2 A comprehensive guideline does not exist that addresses storage requirements for these gases. Therefore, the user shall refer to the Safety Data Sheet (SDS) supplied by the gas supplier for appropriate guidance on the storage and use of the gases in question or the user shall contact the gas supplier.

7.4.5.3 Facilities utilizing these gases in quantities exceeding the exempt amounts stipulated in applicable regulations shall have prepared an emergency response plan defining procedures and outlining responsibilities necessary to address emergency situations involving toxic or corrosive gases.

7.4.5.4 Because of the hazardous nature of toxic gases, users of such gases are advised to contact the supplier for more complete information with regard to handling and emergency response procedures. Arrangements to provide medical attention in the event of excess exposure should be planned in advance.

7.4.5.5 Personal protection equipment shall be made available to avoid contact with the skin or eyes or inhaling any of the corrosive or toxic gases. Areas where corrosive gases are stored or used shall be equipped with emergency showers and eyewash fountains. The capability for prompt emergency medical treatment, including first aid, shall be provided.

Only trained and qualified personnel shall be allowed to handle, process or utilize corrosive and toxic gases. Training shall include the associated hazards of the materials, necessary precautions, protective equipment and emergency response procedures.

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