

Howden Risk engineering

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HOWDEN



Introduction

Gases in cylinders (often referred to as bottled gases) in which the gas is contained at high pressure, are commonly used in industry as well as schools, laboratories and other occupancies. A cylinder is the term applied to the gas container; normally a container with a maximum capacity of 150 litres.

In some cases, the gases are highly flammable. A small leak of such a gas may explode when in contact with a suitable ignition source e.g. a lighted match or electrical spark. When involved in a fire, the cylinders are liable to explode, with pieces of the container projected over considerable distances. This is not just restricted to those cylinders, which contain flammable gases, as any high-pressure gas cylinder has the potential to explode when exposed to heat in fire conditions.

A few months ago, a truck carrying over 60 cooking gas cylinders exploded in Ghaziabad in February 2025. The explosion destroyed several furniture shops and damaged nearby vehicles. The firefighters took approximately 90 minutes to extinguish the blaze.

In another incident in Delhi, an LPG cylinder exploded at a home in Shahdara area which led to a fire causing suffocation. This resulted in four fatalities and 13 other were injured due to cylinder blast.



The objective of these recommendations is to provide guidance on risk improvement measures, which should be taken. They relate to common industrial gases found in cylinders, including petroleum gas (i.e. LPG - in containers of up to 150 litres/66 KG), but excluding special gases such as xylene/phosgene, which may require additional fire safety precautions.

The statutory requirements laid down in the Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR), may apply to premises where LPG is kept.

SUGGESTED BEST PRACTICES FOR PRESSURIZED CYLINDER HANDLING

1. General-

- a. All users of such gases should be aware of the properties of the gas and correct operating procedures. Such data sheets and operating instructions should be obtained from suppliers of the cylinders. Adequate training, including guidance on appropriate action to be taken in the event of an emergency should be provided prior to the use of such equipment.
- b. The contents of gas cylinders can be readily identified from the color of the cylinder and label. Examples include Oxygen - white collar, Acetylene - maroon, LPG/ Propane - red or grey; Butane - blue. It should be ensured that the correct cylinders have been supplied for the intended use.
- c. All cylinders should be handled with care, especially during transportation in the workplace. They should not be rolled along the ground. Any damaged or contaminated cylinders should be returned to the supplier. No attempt should be made to repair cylinders or valves, this means the correct selection and installation of the proper equipment.

2. Storage- General Guidance-

a. The quantity of cylinders on the premises should be restricted to the minimal working number required for effective operations. Any spare cylinders should be kept chained or bracketed upright against a wall. Where only one or two cylinders are stored, where practicable, consideration should be given to keeping them in a secure metal cabinet.

b. Storage should not be below ground level or near to drains, manholes, openings to manholes or near other storage areas. The ground should preferably be a compacted, level, load bearing surface, preferably concreted or paved.

c. Storage areas should be accessible but secure from all unauthorized access and used solely for the designated purpose, i.e. storage of gas cylinders. The stores should not contain other products,

particularly oil, paint or corrosive liquids. LPG and oxygen cylinders should be stored at least 3m apart from each other and other fuel gases. Toxic and corrosive gases should be stored separately from other gases. Full cylinders should also be stored separately from nominally empty cylinders



(i.e. a cylinder where most of the contents have been discharged, but which still may contain residual vapors).

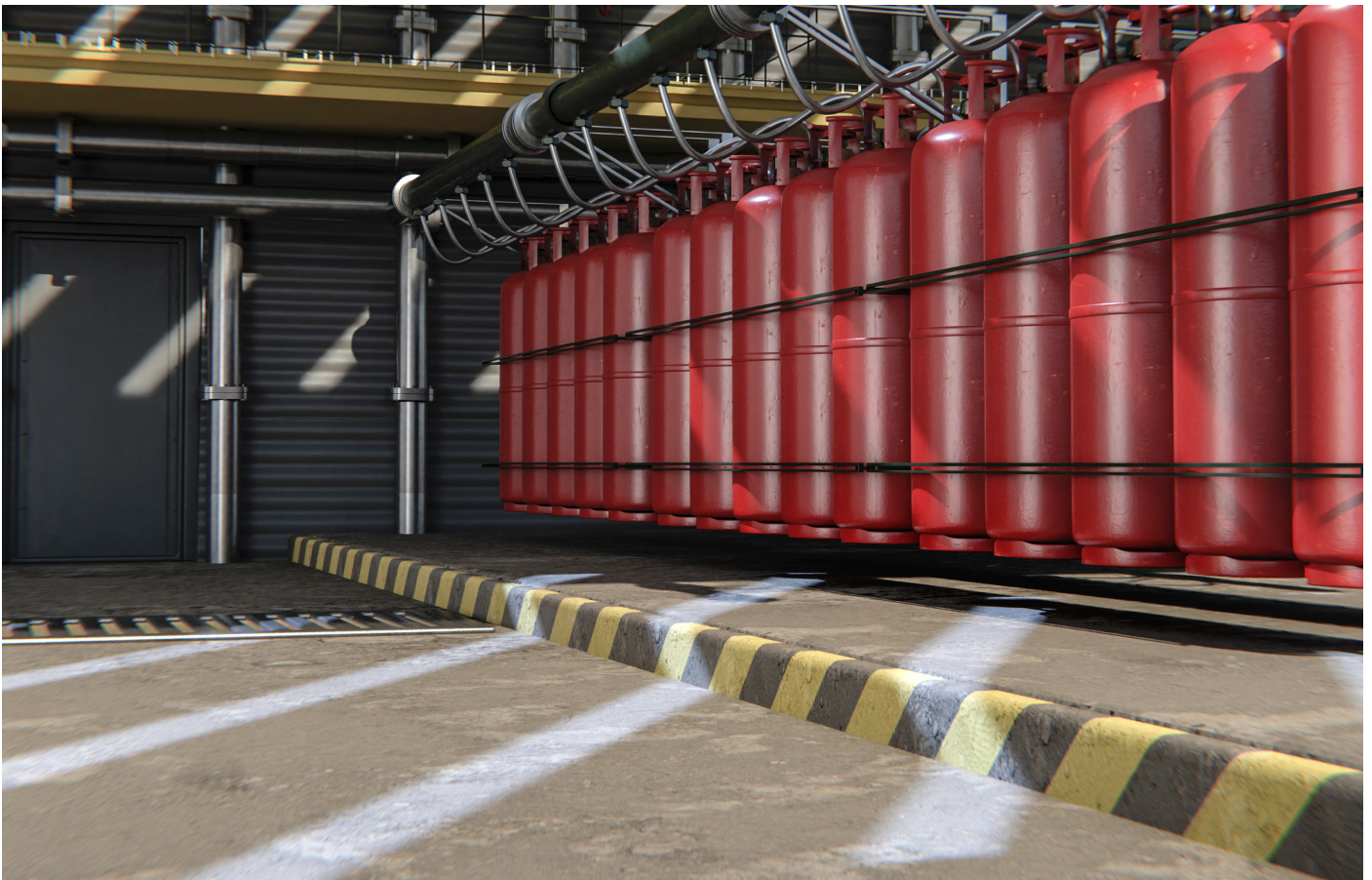
d. Permanent warning notices should be displayed at the storage areas, identifying the gases stored and prohibiting smoking and the use of naked lights and motor vehicles (except for loading and unloading cylinders).

e. Cylinders should be stored with their valves uppermost and protection valves covers used when the cylinder is not in use. Stock should also be rotated regularly.

f. Bulk stocks of gas cylinders should be stored in the open within a securely fenced compound or cage, which has free ventilation. Any roofing provided should be constructed entirely of noncombustible materials with sufficient space left above the gas cylinders to allow cooling water to be applied in the event of a fire. The enclosures should be sited at least 4 meters clear of any boundary fencing and out of main traffic routes to the site.

g. The storage area and adjacent areas should be kept clear of vegetation growth and other combustible materials.





h. In large areas where different classes of gas cylinders are stored, consideration should be given to the provision of radiation barriers. Such barriers should be built of non-combustible material having a fire resistance of at least 30 minutes. The barrier should have a height not less than that of the tallest cylinder.

3. Storage within Building-

a. It is preferable that bulk stocks of cylinders be stored

in a detached building used for no other purpose, and located as far away from other buildings as practical. The store should be constructed of non-combustible materials.

b. Bulk stocks of gas cylinders if kept within the main building, should be stored within a separate compartment (used solely for that purpose and located on the ground floor), separated from the remainder of the premises by walls and floors providing at least 2 hours fire resistance. One of the walls should be

external, with adequate ventilation (especially at low level) to vent gases to the open air. Any door opening should preferably be directly into the open from the stores.

c. All electrical equipment will need to be of an explosion proof type in accordance with IEC 60079-10 Electrical apparatus for explosive gas atmospheres Part 10 – 1 :2021 Classification of areas.

d. Storage areas should not be heated, nor located adjacent to steam or hot water pipes.

4. Use-

a. Cylinder valves should only be opened with the correct key. If damage is suspected, no attempts should be made to open a valve. Cylinder valves should be closed whenever the equipment is not in use.

b. Gases should not be transferred from one cylinder to the other for the purpose of mixing. Furthermore,

individual cylinders should not be removed from a manifold pallet.

c. Cylinders should be kept clear of all heat sources such as welding tools and especially oxy- fuel gas torches.

d. Grease or oil should never be allowed to come into contact with cylinders, their valves or equipment. High pressure oxygen will react dangerously with grease or oil and may cause a fire and/or explosion. White or red lead jointing compounds or jointing tape should never be applied to any cylinders, valves or equipment.

e. Before assembling regulators and fittings, care should be taken that there are no particles of dirt in the cylinder outlet. Particles of dirt and residual moisture can be removed by 'cracking' or 'sniffling' open and immediately closing the valve. When carried out, eye protection must be worn and extreme care exercised that there is no possible source of ignition in the vicinity. The operator

should stand clear of the gas stream and not attempt to deflect it with the hand or face. In the case of high purity gases such as argon, the outlet of the cylinder valve should be dried beforehand with a clean cloth. Hydrogen must never be 'snifted' as the gas flow generates sufficient electrostatic charge to cause ignition.

f. When a cylinder is connected to a manufacturing or laboratory process in which the process pressure exceeds the cylinder supply pressure, adequate precautions require to be taken to prevent back flow of gases or liquids. This can be achieved by provision of a non-return valve, which will require to be subject to regular

maintenance and inspection. Ideally, an automatic shut off/ isolation valve should be provided, activated by a low-pressure signal when the supply gas cylinder reaches a level that requires the cylinder to be replaced.

5. Equipment-

- a. Only the regulator specifically designed for the gas in use should be used.
- b. Flash back arrestors should be fitted downstream of pressure regulators to all fuel gas hoses and oxygen supply hoses, to prevent flames travelling back to the cylinders.
- c. Hose check valves should



be fitted to oxy-fuel equipment to prevent back feeding to avoid the mixing of oxygen and fuel gas in a hose and subsequently a fire in the hose.

d. All hoses should be checked for signs of perishing, as this may lead to accidental discharge of gas and subsequent fire. Furthermore, before commencing operations it should be ensured that the container, pipework, fittings, valves, and hoses etc. are compatible and in good condition. Where any signs of perishing are found, the entire length of the hose must be renewed. The replacement hose should be in one continuous length; joins in hoses should be avoided.

e. Equipment (regulators, hoses, blowpipes etc.) should be disconnected prior to storage or transportation of cylinders. Where cylinders are fitted to a purpose made trolley for moving to a place of work, then the equipment may be left connected. However, the valves must be closed.

6. Maintenance-

a. All cylinders and equipment should be maintained by an authorized supplier. Special care is required in the storage of oxygen regulators. The nozzles of blowpipes should be regularly examined for any obstruction.

b. All equipment for use with cylinders should be returned to the supplier for routine examination/servicing at intervals recommended by the supplier. Where repairs are required these should always be arranged with the equipment supplier. Faulty or leaking regulator gauges should always be dealt with by returning the complete regulator assembly.

c. Cylinders owned by the gas supplier automatically submitted for maintenance and testing when returned to the gas supplier for filling. This is not the case when the cylinders are owned by the user who will need to satisfy statutory obligations.



7. LPG- Cylinder Filling-

- a. Ideally filling operations should be carried out in the open air, where this is not possible filling operations should be carried out within an open shelter constructed of non-combustible materials.
- b. Smoking and naked lights should be prohibited within a radius of 3m of the filling area and notices to this effect clearly displayed.
- c. LPG filling points should be sited so that the cylinders to be filled are separated by a clear space of at least 3m from the bulk storage vessel and at least 6 m from any other fuel dispensing points and the site boundary.
- d. LPG filling points should be located so that any part of an external wall of an adjacent building situated within 6m is constructed of non-combustible materials achieving a fire resistance of at least 2 hours.
- e. LPG filling operations should be carried out only by trained personnel in accordance with the manufacturers/suppliers instructions.

f. The bulk storage tank and cylinders should be earthed during filling operations. The procedure should be carried out on a non-sparking floor and operators should wear anti-static, conducting footwear.

g. The cylinder should be filled only with the type of LPG for which it is has been designed.

h. Cylinders should be removed from vehicles for filling.

8. Fire Protection-

a. No attempt should be made to extinguish an outbreak of fire involving burning fuel gases until such times as the gas supply has been shut off. It is inadvisable for untrained personnel to attempt to tackle a fire involving such gases and the fire brigade should be called immediately.

b. Provision should be made for adequate water supply for fire brigade use to provide

hose streams for cooling purposes, together with suitable access to storage area.

c. Approved fire extinguishers of a type suitable for extinguishing fires in nearby materials, should be provided in the vicinity of all areas in which gases are used and stored.

d. Consideration should be given to water spray or automatic sprinkler protection where significant quantities of fuel gases are stored.



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