

SAFETY CODE FOR IRON & STEEL SECTOR		
MINISTRY OF STEEL, GOVT. OF INDIA	STORAGE, HANDLING & USE OF GAS CYLINDERS	Doc. No: SC/01
		Rev no. : 00 Effective Date : --

1. OBJECTIVE

To provide safety guideline for storing, handling and use of gas cylinders in the steel industry for protection against various hazards such as Fire / Explosion / Gas Leak / Bursting of Gas Cylinders/ hit by cylinders. However, medical gas cylinders are not in the scope of this standard.

2. SCOPE

Responsibility for implementation of this standard lies with all executing departments like Engg. & Projects, Engg. Services, Maintenance Departments and Contractors engaged for various work in steel industry.

3. PROCEDURE

3.1 DEFINITIONS

Cylinder: any closed metal container having a volume exceeding 500 ml but not exceeding 1000 litres intended for the storage and transport of compressed gas, including any liquefied petroleum gas (LPG) container/ compressed natural gas (CNG) cylinder fitted to a motor vehicle as its fuel tank but not including any other such container fitted to a special transport or under-carriage and includes a composite cylinder, however, the water capacity of cylinders used for storage of CNG, nitrogen, compressed air, etc. may exceed 1000 litres up to 2500 litres provided the diameter of such cylinder does not exceed 60 cm.

3.2 License Requirement as per Statutory Provisions

- i) The license in Form-F under Gas Cylinder Rules, 2004 is required for storage i.e., possession of cylinders filled with compressed gas. The license in Form-F is granted by respective Circle offices of the Department of Explosives. But when storage shed of cylinders is attached to the gas filling plant, the license is granted for storage of cylinder in the filling plant along with license for filling by the Chief Controller of Explosives, Nagpur.
- ii) No license needed for possession in certain cases as per Rule-52 of Gas Cylinder Rules, 2004.
- iii) Possession of any cylinder filled with a compressed gas by a carrier or other person for the purpose of transport in accordance with the provisions of these rules;
- iv) Possession of cylinders filled with –
 - a) Liquefied Petroleum Gas when the total quantity of gas does not exceed 100 kg at a time;
 - b) Any other flammable but non-toxic gas when the total number of cylinders containing

- such gas does not exceed 25 or the total weight of gas does not exceed 200 kg., whichever is less, at a time;
- c) Any non-flammable non-toxic gas when the total number of such cylinders does not exceed 200 at a time;
 - d) Any toxic gas when the total quantity of such cylinders does not exceed 5 at a time;

3.3 General Safety Precautions for Storage of Cylinders

- i) The gas cylinder storage shed must be located in an isolated area, as far as practicable.
- ii) The gas cylinder storage shed shall have roofing to protect from direct sunlight and have adequate ventilation.
- iii) Gas cylinders shall not be stored in exits or egress routes.
- iv) Gas cylinders shall not be stored in damp areas, near salt or corrosive chemicals, fumes, heat or in areas having exposure to the weather.
- v) The gas cylinder storage shed shall not be located close to any inflammable chemicals / fuel storage area / source of combustion activities / open flames / steam pipes.
- vi) Full and empty cylinders are to be stored separately.
- vii) The gas cylinders shall be stored in segregated manner, considering incompatibility (example bulk DA & bulk Oxygen; bulk Hydrogen & bulk Oxygen, bulk LPG & bulk Oxygen, toxic and flammable gas cylinders). Incompatible gas cylinders must be stored at least at a gap of 3 meters.
- viii) Incompatible gas cylinders must not be transported together.
- ix) The store in-charge / supervisor shall maintain the up-to-date inventory of Gas cylinders.
- x) Other than notified gas cylinders, no other material of any kind shall be stored inside the area.
- xi) All the gas cylinders shall be kept in upright position with chaining to prevent accidental fall.
- xii) A system of marking of gas cylinders for their individual identification & record of their hydrostatic test to be maintained by custodian deptt.
- xiii) All gas cylinders shall be capped when not in use.
- xiv) All gas cylinders shall be stored so that cylinders are used in the order in which they are received.
- xv) The gas cylinder storage area shall not have any loose electrical cables, wires or lines in the vicinity.
- xvi) Do not keep cylinders in battery room or oil storage room.
- xvii) Adequate warning signs / labeling / no smoking caution / safety instructions shall be displayed in the gas cylinder storage area in legible manner.
- xviii) Display of Material Safety Data Sheet (MSDS) of the stored gas to be done at appropriate place in legible & in local language/ English.

3.4 Handling and Usage

- i) Gas Cylinders shall be handled only by properly trained persons. Training must include the contents of this guideline as well as any specific information relevant to

the gas being used. While handling cylinders, the cylinder shall not be dragged or rolled.

- ii) Instructions shall be issued to all suppliers for mandatory affixing of cap guards, providing color coding and warning sticker as per Gas Cylinder Rules, 1981. In addition, supplier shall issue Test and Inspection Certificates.
- iii) Do not issue a cylinder unless contents are clearly identified.
- iv) Do not alter the color coding and marking of Gas Cylinders, as given below.

Type of Gas Cylinder	Color Coding
Non-flammable & non-toxic	--
Non-flammable but toxic	Yellow
Flammable but non-toxic other than LPG	Red
Flammable and toxic	Red and Yellow

- v) Do not use cylinders as rollers, work supports or jacks (sliding, dropping or playing with cylinders shall be strictly prohibited.)
- vi) Prevent damage to cylinders. Locate cylinders where they will be protected from physical damage by striking or falling objects, corrosion or damage from public tampering.
- vii) Containers shall not be used for any other purpose than holding the contents as received.
- viii) Damaged or leaking cylinders must be reported immediately for proper disposal. Cylinders shall not be picked up by pulling the cap.
- ix) Magnets shall not be used for lifting cylinders.
- x) Lowering & lifting of cylinders shall not be done manually. It shall be done by mechanized means (using winch, telfer, crane etc.) with proper cage for holding the cylinders.
- xi) Where appropriate lifting attachments have not been provided on the cylinder/ container, suitable cradles or platforms to hold the containers shall be used for lifting.
- xii) Do not use welded cylinders.
- xiii) Leaking, defective, fire burned and corroded containers shall not be used.
- xiv) Do not use chain slings for lifting cylinders; only fiber sling should be used.
- xv) Do not allow cylinders to come in contact with electrical apparatus or live wires.
- xvi) Do not lay gas cylinders on wet soil.
- xvii) Do not lubricate cylinders valve threads.
- xviii) Do not handle cylinders or valve assemblies with greasy hands or oil rags
- xix) Oil or grease shall not come in contact with the cylinder valve assembly or the regulator fittings.
- xx) Use red hose for acetylene and other fuel gases and black / green hose for oxygen. Never interchange hoses.
- xxi) To train workmen to handle and store dangerous cylinders properly and in case of any problem, it has to be capped and sent back to the supplier.
- xxii) Nozzle tips shall be always kept clean to prevent back fire.
- xxiii) Use hoses of equal length and do not coil the hoses around regulator or cylinder.
- xxiv) Ensure that regulator pressure control valve is relieved (i.e. closed) before attaching to tanks.

- xxv) Close valves on gas cylinders when a system is not in use.
- xxvi) Remove all pressure from regulators not currently used (by opening equipment valves downstream after the regulators are closed).
- xxvii) Shut-off valves must not be installed between pressure relief devices and the equipment they are to protect.
- xxviii) Use pressure relief valves in downstream lines to prevent high pressure buildup in the event that a regulator valve does not seat properly and a tank valve is left on.
- xxix) Relief valves should be vented to prevent potential buildup of explosive or toxic gases.
- xxx) Never allow flames or concentrated heat sources to come in contact with a gas cylinder.
- xxxi) Never allow a gas cylinder to become part of an electrical circuit.
- xxxii) Never partially open a tank valve to remove dust or debris from the cylinder inlet.
- xxxiii) Never use cylinder gas as compressed air.
- xxxiv) Pressurize the regulators slowly and ensure that valve outlets and regulators are pointed away from all personnel when cylinder valves are opened.
- xxxv) Cylinders which require a wrench to open the main valve shall have the wrench left in place on the cylinder valve while it is open. Use adequately sized wrenches (12" long) to minimize ergonomic stress when turning tight tank valves. Never apply excessive force when trying to open the valves. Cylinders with "stuck" valves should be returned to suppliers to have valves repaired.
- xxxvi) Do not attempt to open a corroded valve; it may be impossible to reseal.
- xxxvii) Valves should only be opened to the point where gas can flow into the system at the necessary pressure. This will allow for quicker shutoff in the event of a failure or emergency.
- xxxviii) Use a cylinder cap hook to loosen tight cylinder caps. Never apply excessive force or pry off caps. Return to supplier to remove "stuck" caps.
- xxxix) Keep piping, regulators and other apparatus gas tight to prevent gas leakage.
- xl) Confirm gas tightness by using compatible leak test solutions (e.g., soap and water) or leak test instruments.
- xli) Release pressure from systems before connections are tightened or loosened and before any repairs.
- xl ii) Never use adapters or exchange fittings between tanks and regulators.
- xliii) Ensure flash arrestor in both cylinder & torch sides for cutting purpose.

3.5 Manifolds, Valves and Regulators

The following information applies to the use of manifolds, valves and/ or regulators:

- i) Where compressed gas containers are connected to a manifold, the manifold and its related equipment, such as regulators, shall be of proper design for the product(s) they are to contain at the appropriate temperatures, pressures and flows.
- ii) Use only approved valves, regulators, manifolds, piping and other associated equipment in any system that requires compressed gas. Care must be taken to ensure that pressure gauges on regulators are correct for the pressure of the gas cylinder used.

- iii) Valves and regulators should undergo periodic maintenance and repair. A visual inspection should be performed before each usage to detect any damage, cracks, corrosion or other defects. Long term maintenance or replacement periods vary with the types of gases used, the length of use, and conditions of usage.
- iv) Valves and regulator maintenance histories should be known before usage. Valves that pass visual inspection are still subject to failure, therefore it is critical that toxic or poisonous gases are used in ventilated enclosures and have local exhaust ventilation in place for downstream pressure relief valves, etc.
- v) Valves and regulators should only be repaired by qualified individuals
- vi) Display the license no. if the number of industrial LPG cylinders stored is more than five.

3.6 Gases with specific hazard classes

The following information regarding specific classes of gases is offered as additional guidance to be used in conjunction with the general usage requirements listed previously:

- i) Flammable Gases
 - a) Flammable gases, except for protected fuel gases, shall not be used near ignition sources. Ignition sources include open flames and sparks, sources of heat, oxidizing agents and ungrounded or non-intrinsically safe electrical or electronic equipment.
 - b) Portable fire extinguishers shall be available for fire emergencies. The fire extinguisher must be compatible with the apparatus and the materials in use.
 - c) Flames shall not be used for detecting leaks. A compatible leak detection solution shall be used for leak detection.
 - d) Spark proof tools shall be used when working with or on a flammable compressed gas cylinder or system.
 - e) Access doors to areas which use or store flammable gases shall be posted "No Open Flames".
- ii) Fuel, High Pressure and Oxidizing Gases
 - Oxidizing gases are non-flammable gases (e.g., oxygen), but in the presence of an ignition source and fuel can support and vigorously accelerate combustion. Do not use oil in any apparatus where oxygen will be used.
- iii) Toxic and Highly Toxic Gases
 - Unless otherwise indicated, all gases must be stored in a continuously mechanically ventilated gas cabinet, fume hood or other enclosure.

3.7 Handling leaks and emergencies

- i) Preplanning
 - Despite strict adherence to safety practices, accidents involving gases may occur. Users of compressed gas cylinders must be familiar with necessary safety precautions. Standard Operating Procedures (SOPs) for using compressed gases shall include a discussion of possible accident scenarios, appropriate employee responses and should take into account the following factors:
 - a) The nature of the operation (e.g. equipment used and type of injury that might be inflicted).

- b) The quantities of material that might be released and the type of containment (i.e. compressed gas tank size, manifold systems, etc.).
 - c) The chemical and physical properties of the compressed gas
 - d) The hazardous properties of the compressed gas (e.g. its toxicity, corrosivity and flammability).
 - e) The availability and locations of emergency supplies and equipment.
 - f) A contingency plan which identifies building evacuation routes, emergency telephone numbers, chemical containment procedures, fire extinguisher usage, etc., should be posted at the site
- ii) Minor Leaks
- Occasionally a gas cylinder or one of its component parts may develop a leak. Most of these leaks occur at the top of the cylinder in areas such as the valve threads, pressure safety device, valve stem and valve outlet. The following information applies to the remediation of minor leaks:
- a) If possible, verify suspected leaks using a flammable gas detector or soapy water solution (a flame should not be used for detection). If the leak cannot be stopped by tightening a valve gland or packing nut, emergency action procedures should be initiated and concerned person should be notified.
 - b) For flammable, inert or oxidizing gases, the cylinder shall be moved to an isolated & well-ventilated area away from combustible materials. Post signs that describe the hazard.
 - c) For corrosive and toxic gases, the cylinder shall be moved to an isolated, well-ventilated area and use suitable means to direct the gas into an appropriate chemical neutralizer if possible.
 - d) If it is necessary to move a leaking cylinder through populated portions of the building, place a plastic bag, rubber shroud or similar device over the top and tape it (duct tape preferred) to the cylinder to confine the leaking gas.
- iii) Major Leaks
- a) In the event of a large gas release or if an accident takes place in which readily available Personal Protective Equipment (PPE) is inadequate to ensure worker safety, activate the following Emergency Procedures:
 - b) Immediately call Fire Brigade and report the incident.
 - c) Activate building and area fire alarms.
 - d) Evacuate the area, securing entrances and providing assistance to others on the way out.
 - e) Provide emergency response officials with details of the problem upon their arrival.
- iv) Accidents Involving Personnel Injury
- Assist persons involved and administer immediate first aid which may include:
- a) Washing under a safety shower (in case of burning clothing or chemical exposures).
 - b) Removing contaminated clothing.
 - c) Wash the eyes properly at eyewash station.
 - d) Administering artificial respiration.
 - e) Notify personnel in adjacent areas of any potential hazards (e.g. activate building or

- area alarms).
- f) Move injured personnel only if necessary to prevent their exposure to further harm.

REFERENCES

1. Gas Cylinder Rules, 2004
2. IPSS 1-11-029-17: Safety Standard on Storage, Handling & Use of Gas Cylinders in Steel Industry.

GAS CYLINDER STORAGE

-  **DANGER**
Compressed gas
-  **Keep well ventilated**
-  **No smoking or naked flames**
-  **No entry to unauthorised personnel**

Industrial Gas Cylinder Safety Guidelines

- Understand the Cylinder Properly
- Use the Personal Protective Equipment (PPE)
- Use Regulators Properly While Handling Cylinders
- Use Proper Handling Equipment to Move the Cylinder
- Inspect the Cylinders before Using Them
- Store the Cylinders Correctly



Safe Practices for Handling & Use

Some gases have very specific procedures for safe use. Before handling any compressed gas cylinder, locate the **Material Safety Data Sheet**, or **MSDS**, for the gas you are using. This document contains vital information for handling each gas.



Compressed Gas Cylinders