قطر ستيل
QATAR STEEL

PROCEDURE

Storing and Handling of Compressed Gas Cylinders

REVISION HISTORY

Revision No.	Issue Date	Amendment Description	Date Effective	Date to be Revalidated
00	01-Jul-2016	Newly Established	30-Jun-2016	15-Feb-2020
01	15-Feb-2020	Used of new template for establishing procedure.	15-Feb-2020	14-Feb-2023

TABLE OF CONTENTS

REVISION HISTORY

TABLE OF CONTENTS

1. INTERNAL CONTROLS

1.1 Review of Procedure

To assure Managements, Shareholders and External agencies confidence in the company's policies & practices, QATAR STEEL Internal Audit may verify compliance with this procedure. [Department Owner] shall review this procedure every three years to ensure that it continues to serve the purpose intended.

1.2 Employee Responsibilities

All employees of the company are required to observe and abide with this procedure.

1.3 Approval

This procedure and any amendments made thereto; require the following approvals.

AUTHORITY DATE

Approved By:
Mohammed Nasser Al-Hajri
Managing Director & Chief Executive Officer (MD&CEO)

Checked By:
Alexander Stramrood
Manager – HSE Department

12/02/2020

Drafted By:
Firas Ben Khadra
Engineer – HSE

3/2/2020

This document has been reviewed by Document Controller. It complies with the requirements of policy 1.12.0.1.01.01 and it is considered ready for issue.

Signed by_____ **Date** 03 FEB 2020

2. PURPOSE

The purpose of this procedure is to establish procedures to strengthen the safety of Qatar Steel and to comply with Qatar Safety Standards. The purpose of this procedure is to provide guidance for the safe handling, storage, and use of compressed gas cylinders. Compressed gases can expose users to both chemical and physical hazards. Compressed gas cylinder contents can be toxic, flammable, oxidizing, corrosive, and/or inert. Chemicals that are in gaseous form and pressurized, can quickly spread throughout a space. Pressurized cylinders can become high speed projectiles if the cylinder valve is broken off.

3. SCOPE

This procedure applies to all QS employees, contractor & sub-contractor personnel who are involved in handling, storing, and using compressed gas cylinders. All users of compressed gas cylinders should review this procedure and the applicable Material Safety Data Sheet (MSDS) and implement applicable hazard control measures.

4. PROCEDURE

4.1 Definitions

Compressed Gas: A material in a container with an absolute pressure greater than 40 psi (pounds per square inch) at 21 degrees Celsius or an absolute pressure greater than 104 psi at 54 degrees Celsius.

Flammable Gas: Gas that may ignite if mixed with air. (Purging, ventilating, and elimination of ignition sources must be respected.)

Non-flammable gas: A gas that is neither flammable nor poisonous but can still cause asphyxia and death.

Oxidizing gas: A gas that initiates or promotes combustion of materials through release of oxygen. These gases can also spontaneously combust/explode. (Not to be stored with combustible material, do not use with oil or grease.)

Toxic gas: May chemically produce lethal health effects. They can be flammable, non- flammable, reactive and/or oxidizing. To be stored in a well-ventilated place. Refer to MSDS in case of any leakage.

Corrosive gas: Reactive gas that will corrode material or tissue. To be used with proper material. Observe the threshold limit of the gas at all times. Refer to MSDS.

Inert or Noble gas: Any of the six gases helium, neon, argon, krypton, xenon, and radon. These gases are un-reactive except under certain special conditions.

Non-flammable Non-toxic gas: Asphyxiation is the main hazard in case of a leak.

Asphyxiation: Breathing difficulties (suffocation), loss of consciousness and eventual death caused by an inadequate supply of oxygen to the body.

Short Term Exposure Limit (STEL): Maximum concentration of a gas that a person can be exposed to for a 15 minute period. Only 4 such exposure periods can occur within an 8 hour day and 1 hour break is required between exposure intervals.

Time Weighted Average (TWA): Maximum concentration of a gas that a person can be exposed to for 8 hours per day over a 5 day working week.

Upper and Lower Explosive Limits (UEL and LEL): Upper and lower concentration (in %) limits for which a particular gas is explosive in air.

Ignition Source: For a flammable gas within its flammable limits (or oxidizing gas to ignite), an ignition source must be present. There are many possible ignition sources including open flames, sparks, and hot surfaces.

Cylinder valve: The gas cylinder valve is the primary safety mechanism on a gas cylinder and shall not be tampered with. It is a device used to contain the contents of the cylinder that is under pressure. Cylinder valves are fitted with pressure relief valves of different types (depending on the cylinder) to protect against catastrophic failure of the cylinder valve.

Note: Cylinder valves on flammable gases have a left hand thread to attach the regulator. This is to distinguish them from non-flammable gases. The thread size of an Air or Nitrogen cylinder valve differs from Oxygen so that they cannot be mistaken in medical applications.

Regulators: The regulator is the next most important safety device to be fitted to a gas cylinder before operation/use. It allows for the high pressure of the cylinder contents to be brought down to a usable working pressure. Regulators come as single stage for short term applications and two stages for long term applications. Regulators are also constructed from different materials, mainly brass or stainless steel. The application will define the required regulator. If you are unsure of which kind of regulator to use, consult your gas supplier. Regulators are designed to be fitted directly to the cylinder valve. No other fittings, connections or lubricants shall be used to connect a regulator to a gas cylinder valve. Regulators for flammable gases are left hand threaded and have a notch cut out of faces on the securing nut to distinguish them from non-flammable gas regulators.

Check Valve (Non Return Valve): A check valve (non-return valve) is a valve that normally allows fluid (liquid or gas) to flow through it in only one direction.

Backfire: Flame enters into nozzle or torch with a violent popping sound. Flame either extinguishes or re-ignites at the nozzle.

Flashback: Flame enters into torch and travels back into supply system. The speed of such a flashback is more than twice the speed of sound.

Flashback Arrestor: A flashback arrestor or flash arrestor is a special gas safety device most commonly used in oxy-fuel welding and cutting to stop the flame or reverse flow of gas back up into the equipment or supply line and it prevents the user and equipment from damage or explosions.

Asphyxiant: An asphyxiant is a substance that can cause unconsciousness or death by suffocation (asphyxiation). Asphyxiants which have no other health effects and are sometimes referred to as simple asphyxiants.

4.2 Roles and Responsibilities

Health, Safety and Environment (HSE) Office

- Review, oversee and advise on implementation of this procedure.

Foreman / Supervisor of User Department

- Implement and maintain this procedure.
- Conduct a hazard analysis of handling, storing, using compressed gas cylinders, and implement appropriate control measures.
- Provide Tool Box training in the safe handling, storage, and use of cylinders to personnel.
- Ensure personnel comply with this procedure.
- Minimize the size and quantity of compressed gas cylinders used and stored at work spaces.

Personnel / User

- Review and implement this procedure and follow instructions from Department Foreman / Supervisor.

4.3 Basic Rules for safety

- Before dealing with the material, ensure you have basic knowledge of the properties and potential hazards of the product you are dealing with.
- Refer to the manufacturer safety procedures.
- Smoking is forbidden on site, except in designated smoking areas, where applicable.
- Wear Personal Protective Equipment.
- Become skilled in handling safety equipment such as fire extinguishers, fire hydrants and SCBAs.
- Report deficiencies, faulty equipment and unsafe conditions immediately.
- Do not start a job unless you have been trained to do it and know the correct procedure.
- Report all incidents to the supervisor immediately and get the first aid for even a minor cut or burn to reduce the risk of infection.
- Learn how to close valves quickly in the event of an emergency.
- Identify the emergency exits and where the firefighting equipment and first aid kit are located.

- When changing cylinders, valves should be closed before disconnecting.
- All fire and safety equipment must be kept clear of obstructions.

4.3.1 Types of Gas Cylinders

A. **High Pressure Cylinders** – High pressure cylinders come in a variety of sizes. Some examples of gases supplied in High pressure cylinders include Nitrogen, Helium, Hydrogen, Oxygen and Carbon Dioxide.

B. **Low Pressure Cylinders** – Low pressure cylinders come in a variety of sizes. Some examples of gases supplied in low pressure cylinder are LPG and refrigerant gases.

C. **Acetylene Cylinders** – Acetylene is in a class of its own as the cylinder is filled with an aggregate material and dissolved in a liquid medium (acetone) to get sufficient product into the cylinder.

4.3.2 Identification of Classes of Gases

The following table shows the four main classes of gases. Gases can also have corrosive properties, e.g. Ammonia. However, it is also important for considering storage and handling/usage requirements.

Dangerous Goods Diamond	Class	Examples
	**Class 2.1 Flammable Gas**	**LPG, Hydrogen, Acetylene**
	**Class 2.2 Non- Flammable, Non- Toxic gases**	**Compressed air, Nitrogen, Argon, Carbon dioxide, Helium**
	**Class 2.3 Oxidizing Gas**	**Oxygen, Nitrogen Oxide, Entonox (50% Oxygen, 50% Nitrous Oxide)**
	**Class 2.4 Toxic gases**	**Methyl Bromide, Anhydrous Ammonia, Chlorine**

4.3.3 Characteristic of Some Common Gases

Nitrogen

Characteristics – Nitrogen is referred to as N2. It is a non-flammable, colorless, odorless and tasteless gas. Nitrogen is slightly lighter than air. The atmosphere normally contains 78% Nitrogen, 1% Argon and 21% Oxygen.

- Inert gases are not toxic, but do not support life and can act as asphyxiants.
- A person can become unconscious immediately when entering an atmosphere which contains excessive proportions of inert gases (and therefore, a shortage of Oxygen)
- Death can follow rapidly

Oxygen

Characteristics – Oxygen is referred to as O2. It is a colorless, odorless and tasteless gas, slightly heavier than air. The atmosphere normally contains 21% oxygen. An increase above this figure is known as enrichment; a decrease below this figure is known as deficiency. It is essential for combustion. However, high concentration of oxygen can cause rapid combustion and/or explosions.

- Do not use naked flames in an oxygen enriched environment
- Do not use oxygen as substitute for air, such as pneumatic tools, inflating tyres, starting diesel engines
- Make sure that all items which may come into contact with oxygen are free from oil and grease
- If you have been in an oxygen enriched atmosphere, ventilate your clothing in the open air for at least 15 minutes before smoking or going near to a source of ignition

Material compatibility

- Adequate material should be used with oxygen. Most materials will burn in pure oxygen, even if they cannot be ignited in air
- Oils, grease and materials contaminated with these substances can catch fire spontaneously in an enriched atmosphere
- Check with your supervisor that the materials which you use are approved for oxygen service.

Acetylene

Characteristics – Acetylene is a gas, often referred to as C2H2. It is colorless, invisible, slightly lighter than air, nontoxic and can cause asphyxiation. Industrial acetylene, because slightly impure, smells like garlic.

Flammability

- Acetylene burns with a smoky flame. Acetylene/air mixtures are flammable within a wide range (2.4 to 83%). This mixture ignite or explode easily
- It can be started by a spark, small flame or hot spot

Fire fighting

- To extinguish an acetylene fire, shut off the source of supply, if this can be done safely
- Keep nearby equipment and cylinders cool by drenching with water

Fire prevention

- Never release or vent acetylene into buildings or confined spaces
- The storage of acetylene should be well ventilated at high and low levels
- Use only approved tools and lighting devices near any acetylene installation
- Make sure you have a grounding system to prevent accumulation of any static electric charges

Decomposition

- When heated or compressed above normal operating limits, acetylene may decompose and explode

Decomposition prevention

- Never heat a pipe or vessel containing acetylene
- Open and close valves in acetylene systems slowly
- Avoid rapid increase in pressure in acetylene systems, for instance on cylinder charging racks

Material compatibility

- Only certain materials are suitable for use with acetylene; in particular, acetylene forms compounds with copper, silver and mercury

4.3.4 Identification of Contents of Compressed Gas Cylinders

- The contents of any compressed gas cylinder should be identified clearly so as to be easily, quickly, and completely determined by any worker
- Ensure cylinders are properly labeled when received
- Do not accept cylinders that are not labeled and identify its contents. Do not add, remove, or alter any cylinder markings or labels
- Color-coding is not a reliable means of identification; cylinder colors vary from supplier to supplier, and labels on caps have no value because many caps are interchangeable
- Tags should be attached to the gas cylinders on which the names of the users and dates of use can be entered
- If the labeling on the gas cylinder becomes unclear or defaced so that the contents cannot be identified, the cylinder should be marked "**contents unknown**" and the manufacturer contacted regarding appropriate procedures

4.3.5 Safe Storage Practices

- Cylinders should not be allowed to drop nor be struck violently
- Cylinders should be properly secured at all times to prevent falling or rolling by attaching to a wall, cylinder rack, or post
- Store all cylinders in an upright position and secure with a bracket, chain, or low-stretch strap around the upper third of the cylinder (above the center of gravity) or other suitable method
- Cylinders should be stored in a well-ventilated area away from flames, sparks, or any source of heat or ignition
- Cylinders should not be placed where they become part of an electrical circuit
- Avoid storing cylinders in aisles, alleyways, near elevators, heavily traveled areas, or near exits. Cylinders must not obstruct exit routes, electrical panels, or any emergency equipment
- Caps used for valve protection should be kept on the cylinders at all times except when the cylinder is actually being used.
- Cylinders should not be exposed to an open flame or to any temperature that exceed 125°F or 52°C
- Oxygen cylinders (empty or full) in storage should be separated from fuel-gas cylinders and combustible materials by a minimum distance of 20 feet or by a barrier at least 5 feet high having a fire-resistance rating of at least 90 minutes.
- Flammable gas cylinders should not be stored with oxygen or nitrous oxide cylinders or adjacent to oxygen charging facilities
- Separate empty and full cylinders during storage. Empty cylinders should be marked **"MT"** to prevent confusion
- Cylinders may be stored outdoors but should be protected from the ground to prevent bottom corrosion. Where extreme temperatures prevail, cylinders should be stored so they are protected from the direct rays of the sun.
- Cylinders should not be exposed to continuous dampness, stored near salt or other corrosive chemicals or fumes. Corrosion may damage cylinders and cause their valve protection caps to stick.
- Minimize the number of cylinders in use and storage with a time-in-hand ordering process.
- Cylinders must not be stored where moving objects may strike or fall on them.
- Storage areas must be prominently posted with the hazard class or the name of the gases stored (e.g., Hydrogen-Flammable Gas-No Smoking-No Open Flames).

4.3.6 Safe Transporting Practices

- Make sure you know the properties of the cylinders you handle.
- Know the color coding.
- Wear adequate PPE.
- When positioning cylinders, avoid trapping your fingers between them.
- If A Cylinder Starts To Fall, Do Not Try To Stop It - Let It Go.
- Cylinders transported by truck must be properly secured in an upright position.
- Cylinders should not be transported without safety caps. A cylinder's cap should be screwed all the way down on the cylinder's neck ring and should fit securely.

- Do not lift cylinders by the cap. The cap is for valve protection only.
- Always use a cylinder cart, pallets and trolleys to move compressed gas cylinders. Refrain from shocks, sliding, dragging or rolling cylinders on edge.
- Check that the floors of vehicles are free from oil.
- Use extra care in wet weather.
- Know the approved loading and unloading methods and use them at all times.
- Check that the fastening devices are used correctly.

4.3.7 Safe Handling Practices

- Wear eye protection, safety shoes, and gloves when handling cylinders.
- Move cylinders using a suitable trolley, hand truck or cart.
- Valve caps shall be in place and hand tightened when cylinders are in storage or being transported. Valve caps are not needed when cylinders are in use.
- Use a hand truck or approved lifting device to move cylinders. Never lift cylinders by the valve cap.
- When a cylinder or valve is corroded or malfunctioning, keep the cylinder separate and notify the gas supplier
- Do not modify or repair any part of the cylinder, including the pressure relief device and valve.
- Cylinders should not be used as rollers, supports, or for any purpose other than to contain and use the contents, as received from the supplier

4.3.8 Safe Using Practices

- Know and understand the properties, uses, and safety precautions of the gas before using the cylinder. Never use a compressed gas cylinder when the contents are unknown.
- Always use the proper regulator for gas in the cylinder. Always check the regulator for abnormalities before attaching it to a cylinder.
- Visually inspect the regulator for damage. Ensure the regulator is approved for the specific gas and it is rated and marked for the maximum pressure rating of the cylinder.
- Ensure that the regulator and valve fittings are free of dust, dirt and grease.
- Wipe the outlet with a clean, dry, lint-free cloth before attaching connections or regulators. The threads and mating surfaces of the regulator and hose connections should be cleaned before the regulator is attached.
- Gas delivery lines should be clearly labeled to identify the gas.
- Pressure regulators and valve fittings: A valve fitting is specific for every valve connection.

a) The thread type, size and direction vary with every valve type.
b) Consult the supplier for adequate valve fitting installation.
c) Two gauges indicate the inlet and outlet pressure in the regulator.
d) Make sure that the maximum inlet pressure is greater than the cylinder pressure before connecting.
e) Adequate material should be used.

- Connecting the pressure regulator
  a) Make sure the material used is adequate for the gas.
  b) Make sure that the fitting used is adequate for the cylinder valve.
  c) Remove the cylinder protective cap.
  d) Connect the regulator to the valve using adequate tools.
  e) Tighten the valve fitting.
  f) Make sure the regulator is closed.
  g) Open the cylinder valve slowly.
  h) Open the regulator slowly until the desired outlet pressure is reached.
- Disconnecting the pressure regulator
  a) Close the cylinder valve.
  b) Wait until the line is vented and there is no positive pressure in the pipe line.
  c) When both of the pressure regulator gauges reach zero, close the regulator.
  d) Disconnect the valve from the valve fitting using adequate tools.
  e) Put the protective cap on the cylinder.
- Use an appropriate wrench when fitting regulators and do not force cylinder valve connections that do not readily fit. Do not apply oil/grease/WD40 or Teflon tape on gas connections to cylinder.
- Fit check valves (non-return valves) on the torch, to prevent back-feeding of gas into the hoses. Inspect regularly and replace damaged non-return valves.
- Keep nozzles in good condition. Poorly maintained nozzles cause turbulent gas flow, which increases the risk of flashback.
- Fit flashback arresters onto the pressure regulators on both the acetylene cylinder and the oxygen cylinder.
- Valves shall be kept closed at all times except when the cylinder is in use.
- Slowly open the cylinder valve. Stand to the side of the regulator when opening the cylinder valve. If there is difficulty operating a cylinder valve, discontinue use and contact the supplier.
- Do not direct compressed gas streams toward any person. This could cause serious injury to the eye or body.
- Piping, regulators, and other apparatus shall be kept gas tight to prevent leakage.
- A leak test must be performed to check the regulator-cylinder valve seal prior to use (i.e. Static Pressure test or Snoop test).
- Do not attempt to repair cylinder valves or their relief devices while a cylinder contains gas pressure. Tag leaking cylinders or cylinders with stuck valves and move to a safe, secure outdoor location.
- Before a regulator is removed, close the container valve and release the gas pressure of regulator.
- Close valves on empty cylinders and mark cylinder "empty" with initials "**MT**".

Note: Check valves will not stop a flashback once it has occurred.

The fitting of flashback arresters is not a substitute for safe working practices.

4.3.9 Things to Remember

Never …..

….drag, roll or slide cylinders, even for short distances.
….drop cylinders or permit them to strike each other violently.
….subject cylinders to mechanical shocks that may cause damage to their valves.
….leave a cylinder unsecured.
….lift a cylinder by its cap using a sling or a magnet.
….never refill cylinders.
….remove any product labels or shipping hazard labels
….permit oil, grease, or other readily combustible substances to come in contact with cylinders, valves, or other equipment in oxidizer service.
….attempt to catch a falling cylinder.
….permit smoking or open flames in oxidizer or flammable gas storage areas.
….use oxygen as a substitute for compressed air.
….allow storage temperature to exceed 125°f (52°c).
….leave an open cylinder unattended.
….use a flame to locate gas leaks.
….attempt to mix gases in a cylinder.
….force improper attachments on to the wrong cylinder.
….carry gas cylinders of any kind in the passenger compartment of a vehicle.
….discard pressurized cylinders in the normal trash.

Always….

….move cylinders using a suitable hand truck or cart.
….leave the valve protection cap and valve seal outlet in place until the cylinder has been secured in place and is ready to be used.
….secure cylinders when in storage, transit, or use.
….when returning cylinders to the supplier, properly close the cylinder valve, replace and secure any valve outlet seals, and properly install the cylinder cap.
….use a cylinder cage or cradle to lift a cylinder
….use regulators approved for the specific gas.
….use check valves to prevent reverse flow into the cylinder.
….loosen the valve outlet seal slowly when preparing to connect a cylinder.
open cylinder valves slowly and carefully after the cylinder has been connected to the process.
….stand clear of the regulator and valve outlet while opening the valve.
….prevent sparks and flames from contacting cylinders.

4.4 Precautions

4.4.1 Precautions for Flammable Gases

- Flammable gases shall be stored in well-ventilated areas away from oxidizers, open flames, sparks, and other heat and ignition sources.
- Flammable gases (empty or full) that are not in use must be separated from cylinders containing oxidizers (empty or full) by a minimum distance of 20 feet or by a barrier at least 5 feet high which has a fire-resistance rating of at least one-half hour. (5/8" sheetrock provides at least a ½ hour fire rating).
- All lines and equipment associated with flammable gas systems shall be grounded and bonded.
- An open flame must never be used to detect leaks of flammable gases.

Note: Flammable cylinders that are in use (i.e., with regulators and associated piping/hoses attached) may be adjacent to oxidizers.

4.4.2 Precautions for Toxic Gases

- Cylinders larger than lecture bottles must be kept in a certified gas cabinet or other equivalent engineered enclosure that vents directly outside. Lecture bottle sized (approximately 2"x15") gas cylinders should be used and stored in a fume hood or ventilated enclosure.
- Gas detection systems may be required in labs or work areas that use toxic gases. Contact the HSE at Ext. 8333 / 44778333 whenever toxic gases are used in a lab or work area.

4.4.3 Precautions for Oxygen and Oxidizing Gases

- Do not permit oil or grease to come in contact with compressed oxidizing gases, regulators or fittings.
- Do not store or use near flammable solvents, combustible materials or near unprotected electrical connections, heat, and other sources of ignition.

4.4.4 Precautions for Corrosive Gases

- Cylinders should be periodically checked to ensure that the valve has not corroded. If a cylinder or valve is noticeably corroded, the gas supplier should be contacted.
- Use caution if flow does not immediately start when a valve is opened slightly. If the valve or delivery system could be obstructed, contact the gas supplier

4.4.5 Procedures for Leaking Cylinders

Toxic gas - If the cylinder is in a fume hood or vented enclosure, evacuate the immediate area and call 8333. If it is possible that a toxic gas could enter an enclosed space and expose personnel, warn others, immediately leave and close the door(s), activate the nearest fire alarm pull station, and call 8333 / 44778333 from a safe location.

Flammable or oxidizing gas - Follow the same steps for toxic gas and, if it can be done safely, attempt to shut off ignition sources and/or isolate the leak prior to evacuating the space.

Inert Gas - Warn others and evacuate the area if you are in an enclosed space without adequate ventilation, as this could create an asphyxiation hazard. Warn others and call 8333 / 44778333. If the leak is small and you are in a well-ventilated location, you may attempt to stop the leak.

4.5 Breach of this policy

Any breach of this policy will be treated as a potential disciplinary issue and dealt with through our disciplinary procedure