STANDARD

SARNIA REFINERY

COMPRESSED GAS AND BREATHING AIR CYLINDERS

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1.0 SCOPE AND PURPOSE:

This standard prescribes the requirements for handling and storing Compressed Gas and Breathing Air Cylinders.

2.0 GUIDANCE AND STANDARDS

2.1 CYLINDER HANDLING

2.1.1 Cylinders shall be moved by tilting and rolling them on their bottom edges. They shall not be intentionally dropped, struck or permitted to strike each other violently.

2.1.2 Acetylene cylinders must NEVER be stored or transported in a horizontal position. Keep them vertical at all times. If an acetylene cylinder is inadvertently upended, it shall be stored upright for eight hours prior to use.

2.1.3 Valve protection caps shall not be used for lifting cylinders from one vertical position to another.

2.1.4 Bars shall not be used under valves or valve protection caps to pry cylinders loose.

2.1.5 Warm, not boiling water shall be used to thaw cylinders loose.

2.1.7 Unless cylinders are firmly secured on a special carrier intended for this purpose, regulators shall be removed and valve protection caps put in place before cylinders are moved.

2.1.8 A suitable cylinder truck, chain or other steadying device shall be used to keep cylinders from being knocked over while in use.

2.1.9 When work is finished, when cylinders are empty or when cylinders are moved at any time, the cylinder valve shall be closed with the valve protection cap in place.

2.1.10 Compressed gas cylinders shall be secured in position during transportation, storage or use. When containing acetylene, they shall be secured in the upright position.

2.1.11 When cylinders are hoisted, they shall be secured on a cradle, sling board or a pallet. They shall not be hoisted or transported by means of magnets or choker slings.

2.1.12 Compressed gas cylinders shall be legibly marked for the purpose of identifying the gas content, with either the chemical or the trade name of the gas. Such marking shall be by means of stenciling, stamping or labeling and shall not be readily removable.

2.1.13 The numbers and markings stamped into cylinders shall not be tampered with.

2.1.14 Do not use any cylinder that is not positively identified.

2.1.15 Cylinders, cylinder valves, couplings, regulators, hose and apparatus shall be kept free from oily or greasy substances. Oil or grease shall not be used for the lubrication of valves or fittings on oxygen cylinders.

2.1.16 A jet of oxygen must **NEVER** be permitted to strike an oily surface, greasy clothes or enter a fuel oil or other storage tank.

2.1.17 Do not direct compressed air toward the skin.

2.1.18 Cylinders shall never be used as rollers or supports, whether full or empty.

2.1.19 If cylinders are found to have leaky valves or fittings which cannot be stopped by closing of the valve, the cylinder shall be taken outdoors away from any sources of ignition. After consideration of the hazards and the appropriate protective measures they shall be slowly emptied and properly tagged "Out of Service".

2.1.20 No person, other than the gas supplier, shall attempt to mix gases in a cylinder.

2.1.21 No one shall tamper with safety devices on cylinders or valves.

2.1.22 All cylinders shall have a handle or wrench attached so that they can be turned off immediately, if necessary.

2.1.23 A hammer or wrench shall not be used to open cylinder valves with fixed hand wheels. If valves cannot be opened by hand, the cylinder shall be properly tagged "Out of Service" and removed from the work area with an explanation for the removal written on the tag.

2.1.24 Before connecting a regulator to a cylinder valve, the valves shall be opened slightly and closed immediately, to remove dirt. The valve shall be opened while standing to one side of the outlet; never in front of it. Never crack a fuel-gas cylinder valve near welding work or near sparks, flame or other possible sources

of ignition.

2.1.25 Before a regulator is removed from a cylinder valve, the cylinder valve shall be closed and the gas released from the regulator.

2.1.26 Electrodes shall not be struck against a cylinder to strike an arc.

2.1.27 Cylinders shall not be dropped or, otherwise, roughly handled.

2.1.28 All cylinder valves shall be closed when work is finished. Where a special wrench is required, it must be left in position on the stem of the valve while the cylinder is in use so that the fuel-gas flow can be quickly turned off in case of emergency. In the case of manifold or coupled cylinders, at least one such wrench must always be available for immediate use. Acetylene is not to be used at a pressure in excess of 15 psi gauge, or 30 psi absolute.

2.1.29 Never allow a cylinder to empty completely. Consider it empty and remove it from service when the residual pressure falls to 25 - 50 psig above the pressure to which it is connected.

2.1.30 Empty cylinders should be clearly tagged before returning to the warehouse or supplier.

2.2 CYLINDER STORAGE

2.2.1 Keep oxygen cylinders 7.5 m away from fuel gas cylinders, such as acetylene, or separate them with a noncombustible barrier such as a wall at least 1.5 m high with a fire resistance rating of at least one half hour.

2.2.2 Cylinders shall be kept far enough away from the actual welding or cutting operation so that sparks, hot slag or flame will not reach them. When this is impractical, fire-resistant shields shall be provided.

2.2.3 Cylinders shall be placed where they cannot become part of an electrical circuit.

2.2.4 Acetylene cylinders should be stored in a cool dry place away from heat and direct sunlight.

2.2.5 Cylinders containing oxygen or acetylene or other fuel gas shall not be taken into confined spaces.

2.2.6 Empty cylinders shall have their valves closed and protection caps in place.

2.2.7 Cylinders containing compressed gas shall be stored in areas where the ambient air temperature does not exceed 52^{o}C.

2.2.8 Where cylinders containing compressed gas are stored outdoors, they shall be supported on raised concrete or other noncombustible platforms protected from the weather by a noncombustible canopy in an enclosure surrounded by a firmly

anchored fence and used for the sole purpose of such storage. The fence shall be designed to discourage climbing and shall be substantially constructed with a minimum height of 1.8 m. The fence shall be equipped with a gate which is to be kept locked when the enclosure is not staffed.

2.2.9 Cylinders containing compressed gas and located outdoors shall be:

- at least 1.5 m from any building opening if the aggregate capacity of expanded gas is not more than 170 m3,
- at least 7.5 m from any building opening if the aggregate capacity of expanded gas is over 170 m3 but not more than 500 m3, or
- at least 15 m from any building opening if the aggregate capacity of expanded gas is over 500 m3.

2.2.10 Cylinders containing flammable compressed gas stored indoors shall be located in a room that:

- is separated from the remainder of the building by a fire separation having a 2-hr fire-resistance rating,
- is located on an exterior wall of the building,
- can be entered from the exterior,
- if it has doors into the interior of the building, they are equipped with self-closing and latching devices, have a fire-protection rating of at least 1.5 hr and are constructed so as to prevent migration of gases from the room into other parts of the building,
- is constructed so that an exterior wall provides explosion venting
    - in the ratio of 0.2 m2 for each cubic meter of room volume, or
    - in the ratio computed in accordance with NFPA 68, "Guide for Venting of Deflagrations", except in no case less than 650 cm2 of vent area for each cubic meter of room volume,
- has ventilation conforming to 2.2.18.
- does not contain fuel fired equipment or high temperature heating elements, and
- is used for no purpose other than the storage of compressed gas.

2.2.11 Cylinders of flammable, lighter than air compressed gas (example: hydrogen) may be stored in rooms:

- in a building of combustible construction that is not sprinkled where the aggregate capacity of expanded gas is not more than 60 m3, in a sprinkled

building of combustible construction where the aggregate capacity of expanded gas is not more than 170 m3, or

- in a building of noncombustible construction where the aggregate capacity of expanded gas is not more than 170 m3.

2.2.12 Cylinders of flammable compressed gas which are heavier than air (example: butane, isobutene) may be stored in rooms if they are stored in a fire compartment having a fire-resistance rating of at least 3/4 hr and

- the aggregate capacity does not exceed 100 kg,
- the number of cylinders does not exceed 3,
- the cylinders are not located in the basement or other areas below grade, and
- the fire compartment has ventilation conforming to 2.2.18.

2.2.13 Cylinders containing poisonous compressed gas shall not be stored in a room containing combustible or flammable material.

2.2.14 Compressed gases that may react with one another shall be stored in separate fire compartments separated by a fire separation having a fire-resistance rating of at least 1 hr.

2.2.15 Cylinders containing compressed gases that are lighter than air (example: acetylene) and that may react with each other may be stored in the same fire compartment if they are separated:

- by a distance of at least 7.5 m, or
- by a concrete or masonry wall having a height of at least 2.0 m and projecting at least 1.0 m beyond the cylinders.

2.2.16 Cylinders containing compressed gases that may react with each other and are heavier than air (example: propane) may be stored in the same fire compartment if they are separated:

- by a distance of at least 15 m, or
- by a concrete or masonry wall having a height of at least 1.5 m, and projecting such that the minimum vapour travel distance between two cylinders of gases that may react with each other is not less than 15 m, measured horizontally.

2.2.17 Storage rooms shall have exterior signs with minimum 50 mm high letters indicating the nature of the compressed gases.

2.2.18 Ventilation requirements for indoor storage include:

- mechanical ventilation to the outside that ensures at least 1 air change per hour, or
- natural ventilation to the outside through non-closeable louvered openings with
  - at least one opening no more than 0.3 m from the ceiling and one opening no more than 0.3 m from the floor,
  - all openings at ceiling level having an aggregate free opening area of at least 0.2 m2 per 100 m2 of the floor area,
  - all openings at floor level having an aggregate free opening area of at least 0.2 m2 per 100 m2 of the floor area, and
  - the openings located to ensure cross ventilation.

2.3 PRESSURE REGULATORS

2.3.1 Pressure regulators are delicate instruments and should be handled accordingly.

2.3.2 Never force connections that do not fit. Connections shall not be altered.

2.3.3 Regulators, gauge hose and other devices provided for use with a particular gas or pressure must not be used on cylinders containing gases having different chemical properties or operating pressure.

2.3.4 When connecting a pressure regulator to a compressed gas cylinder, make sure the regulator connecting nut is tightly secured to the threaded cylinder outlet.

2.3.5 Oil or other flammable materials should never be permitted to come in contact with regulators, gauges or any fittings on oxygen cylinders.

2.3.6 The Compressed Gas Association (CGA) has various standard outlets for different families of gases to prevent interchange of regulator equipment between gases which are not compatible. Since the use of adapters defeats the intent of varying designs, their use is not permitted.

2.3.7 The threads on cylinder valve outlets are separated into four basic divisions - internal and external, as well as right hand and left hand. Within each of the four divisions, further separation is made by varying the pitch and diameter of the threads. The design and assignments of connections to the gases have been made to prevent the interchange of connections which may result in a hazard.

2.3.8 The CGA specifies pressure regulators and gas cylinder valve outlets available,

in CGA Pamphlet P-1, and in the Matheson Gas Data Book.

2.3.9 Only two stage regulators shall be used.

2.4 BREATHING AIR

2.4.1 The breathing air supplier is responsible for supplying certificates of analysis and for performing all required sampling, inspecting and testing.

2.4.2 A certificate of analysis shall be obtained from the supplier and kept in Livelink for all breathing air. (SR1 → Environmental, Health & Safety → Industrial Hygiene → Breathing Air CofA's)

- The Occupational Hygienist shall request and/or receive these documents and ensure they are made available in Livelink.

2.4.3 Breathing air cylinders shall be legibly labeled with information including the name of the supplier and fill date.

2.4.4 Breathing air cylinders that are filled by the in-house Labourer group via a cascade system must also be labelled with the supplier and expiry date for all bottles from which air was drawn to fill the bottle. (This information shall be used to assign an expiry date for the new bottle and to ensure the correct certificate(s) of approval can be located, if needed).

2.4.5 All breathing air cylinders shall be inspected monthly as part of the fire and safety checklist process.

2.4.6 Breathing air that is older than 12 months shall not be used.

- An annual PO is in place for Levitt safety to replace the breathing air cylinders for all SCBA and 5-min escape cylinders annually.
- Each area owner shall ensure that a PM is place for regular changeout of all remaining breathing air cylinders by the in-house Labourer group.
- Cylinders that need to be refilled or changed out prior to the scheduled changeout are done so by:
    - The in-house Labourer group:
        - Large cylinders are replaced with bottles from the compressed gas cylinder storage building on Sun Ave., which are supplied by Praxair;
        - SCBA and most 5-min escape cylinders are filled on-site in the Breathing Air Room via a cascade system of bottles from Praxair;
        - High pressure (>2200lb) cylinders are sent offsite (to HSE

Integrated) for refilling; or

- Levitt Safety – they may be called to request a supplemental site visit;

(Note: an inventory of site breathing air sources can be found in **Appendix A**. This list also identifies the applicable Fire and Safety Checklist and system in place for ensuring regular air changeout).

3.0 AUDIT

This standard will be audited by EH&S annually.

4.0 REFERENCES

- Ontario Occupational Health and Safety Act, Regulations for Industrial Establishments - Material Handling Compressed Gases
- Compressed Gas Association, P1 – Safe Handling of Compressed Gases in Containers
- Ontario Fire Code – Compressed Gas Cylinders
- CSA Z180 – Compressed Breathing Air and Systems
- CSA Z94 – Selection, Use and Care of Respirators

END OF STANDARD

REVISION LOG

Date MM/DD/YYYY	Revision	Section	Comment
11/23/2010	Original		Replaces Section 4 - Compressed Air and Gases in the Accident Prevention Manual.
06/27/2012	1	All	Updated format, but content was NOT altered.
07/24/2013	-	Header	Document Owner & Contact Updated. NO content change. (L. Lebert)
12/16/2016	2	2.4 Breathing Air	• Added responsibility for OH to obtain breathing air CofAs and make them available in Livelink. • Added requirement for bottles filled on-site to be labelled with all applicable Praxair bottle identifiers and assigned expiry date. • Added requirement for all breathing air cylinders to be inspected monthly as part of the fire and safety checklist process. • Added responsibility of area owner to maintain a PM for regular changeout of breathing air cylinders. • Added information about how breathing air cylinders are changed out or refilled.
		Appendix A	• Added inventory of site breathing air sources showing applicable Fire and Safety Checklist and system in place for ensuring regular air changeout.

Service	Building/Unit	Used By	Location	Description	F&S Checklist	Air Changeout
Emergency	CB1	Offsites/Plant 1 Ops	Bunker gear area, packed in box, bunker gear area	1 SCBA units	02	Levitt PO
Emergency	CB1	Offsites/Plant 1 Ops	Bunker gear area, on floor and hanging on wall	8 SCBA units	02	Levitt PO
Emergency	CB1	Offsites/Plant 1 Ops	Permit area (North)	1 spare cylinder	02	Levitt PO
Emergency	CB1	Offsites/Plant 1 Console Ops	Outside – along East wall	2-cylinder cascade system + 1 spare cylinder	02	83782
Emergency	CB1	WA/EA Console Ops	Drawers under desk along West and South walls	2 5-min escape packs	02	Levitt PO
Emergency	CB1	TA Console Op	Drawer under desk along West wall	1 5-min escape pack	N/A	Levitt PO
Emergency	CB3	Plant 2 Ops	Hallway	3 SCBA units + 2 5-min escape packs	03A	Levitt PO
Emergency	CB3	Plant 2 Console Ops	Inside closet at NE corner of control room	2 cylinders	03A	114937
Emergency	CB3	Plant 2Console Ops	Cabinet under desk along West wall	3 5-min escape packs	03A	Levitt PO
Emergency	CB4	Plant 3/4 Ops	South Hallway	8 SCBA units	04	Levitt PO
Emergency	CB4	Plant 3/4 Console Ops	Inside closet near South door	2-cyclinder cascade system + 1 spare cylinder	04	MP#109647
Emergency	CB4	Plant 3/4 Console Ops	Cabinet under table in centre of control room	3 5-min escape packs	04	Levitt PO
Emergency	FT1	Fire Team	Cab	5 60min SCBA units	10A-FT1	Levitt PO
Emergency	FT1	Fire Team	Body compartments above rear wheel wells	4 spare 60min cylinders (2 on each side)	10A-FT1	Levitt PO
Emergency	FT2	Fire Team	Cab	5 30-min SCBA units	10A-FT2	Levitt PO
Emergency	FT2	Fire Team	Cab, under rear seat	4 spare cylinders	10A-FT2	Levitt PO
Emergency	FT2	Fire Team	Driver side, compartment above rear wheel	3 spare cylinders	10A-FT2	Levitt PO
Emergency	FT2	Fire Team	Passenger side, compartment above rear wheel	4 spare cylinders	10A-FT2	Levitt PO
Emergency	Command Vehicle	Fire Team	Driver side, 4th compartment from front	12 2216psi cylinders	10C	Levitt PO
Emergency	Command Vehicle	Hazmat Team	Passenger side, last (back) compartment	2 300 cu.ft. cylinders	10C	Levitt PO

Service	Building/Unit	Used By	Location	Description	F&S Checklist	Air Changeout
Emergency	Command Vehicle	Hazmat Team	Passenger side, 2nd compartment from front	4 4500psi cylinders	10C	Levitt PO
Emergency	Command Vehicle	Rescue Team	Passenger side, 3rd compartment from front	4 5-min escape packs	10C	Levitt PO
Emergency	Command Vehicle	Hazmat Team	Inside command unit	4 4.5 SCBA packs	10C	Levitt PO
Emergency	Fire Hall	Emergency Response Teams	Along East wall	Fluctuating quantity of spare SCBA cylinders in various sizes	N/Av	Levitt PO
Emergency	Rescue Station	Plant 1	Rescue Station #1 (N GDS)	2 SCBA units	02	Levitt PO
Emergency	Rescue Station	Plant 1	Rescue Station #2 (N of Crude unit)	2 SCBA units	01	Levitt PO
Emergency	Rescue Station	Plant 2	Rescue Station #3 (Crude unit)	2 SCBA units	03D	Levitt PO
Emergency	Rescue Station	Plant 2	Rescue Station #4 (BTX)	2 SCBA units	03D	Levitt PO
Emergency	Rescue Station	Offsites	Rescue Station #5 (Tank Farm)	2 SCBA units	05	Levitt PO
Emergency	Rescue Station	Plant 3	Rescue Station #6	2 SCBA units	04	Levitt PO
Emergency	Rescue Station	Plant 3	Rescue Station #7	2 SCBA units	04	Levitt PO
Emergency	Rescue Station	Offsites	Rescue Station #8 (WWT)	2 SCBA units	06	Levitt PO
Emergency	Rescue Station	Offsites	Rescue Station #9 (East Tank Farm)	2 SCBA units	05	Levitt PO
Emergency	Rescue Station	Plant 4	Rescue Station #10 (North DHT)	2 SCBA units	19	Levitt PO
Emergency	Plant Bldg	Plant 1	NWTB	1 SCBA unit	01	Levitt PO
Emergency	Plant Bldg	Plant 1	HCC Elevator	1 SCBA unit	01	Levitt PO
Emergency	Plant Bldg	Offsites	ETF MCC Bldg	2 SCBA units	05	Levitt PO
Emergency	North Dock	Dock Watch	Dock watch shack	1 SCBA unit	05	Levitt PO
Emergency	South Dock	Dock Watch	Dock watch shack	1 SCBA unit	05	Levitt PO
Operations/ Maintenance	Plant area	Plant 1 Ops/ Maintenance	West of Alky Ops Changeroom	18-cylinder cascade system + spare cylinders	02	MP#103741
Operations	Plant area	WB Operator	West of 19P003	2-cylinder cascade system	02	MP#103741
Operations	Plant area	Plant 2	S of 21P008, under 21V002	2 cylinders	N/Av	MP#114937
Operations	Plant area	Plant 2	W of 21T001	2 cylinders	N/Av	MP#114937
Operations	Plant area	Plant 2	W of 25E003	2 cylinders	N/Av	MP#114937
Operations	Plant area	Plant 3	E of 34P007, column JE06	3 cylinders (Hose reel - #2 station)	04	MP#114852
Operations	Plant area	Plant 3	W of 32P023, column HE04	3 cylinders	N/Av	MP#114852

Service	Building/Unit	Used By	Location	Description	F&S Checklist	Air Changeout
Operations	Plant area	Plant 3	E of 34P023	3 cylinders (Hose reel - #6 station)	04	MP#114852
Operations	Plant area	Plant 3	SE of 34T011, S of 34P012, between columns JW04 & JW05	3 cylinders (Hose reel - #8 station)	04	MP#114852
Operations	Plant area	Plant 3	SW of 34T001, column KN02	3 cylinders (Hose reel - #9 station)	04	MP#114852
Operations	Plant area	Plant 3	3N of 34V002, column KS03	3 cylinders (Hose reel - #10 station)	04	MP#114852
Operations	Plant area	Plant 3	NW corner of 31V102	3 cylinders	N/Av	MP#114852
Emergency	Plant area	Plant 3	North sulphur unit, SKA pack station	5 5-min escape packs	04	Levitt PO
Operations	Plant area	Plant 3	31 unit, column HW28	3 cylinders	N/Av	MP#114852
Operations	Plant area	Plant 3	31 unit, column HE20	3 cylinders	N/Av	MP#114852
Operations	Plant area	Plant 3	E of 33V14, column JW13	2 cylinders	N/Av	MP#114852
Operations	Plant area	Plant 4	Flare Knockout Drum	3-cylinder cascade system	19	MP#109647
Operations	Plant area	Plant 4	Under Separator structure	3-cylinder cascade system	19	MP#109647
Operations	Plant area	Plant 4	SE of 41C001	2-cylinder cascade system	19	MP#109647
Operations	Plant area	Plant 4	Under Vacuum Structure	3-cylinder cascade system	19	MP#109647
Operations	Plant area	Plant 4	SWS pumps, stairs to 44V300	2-cylinder cascade system	19	MP#109647
Operations	Plant area	Plant 4	Amine filters, column WN07	2-cylinder cascade system	19	MP#109647
Operations	Plant area	Plant 4	SRU #1	2-cylinder cascade system	19	MP#109647
Operations	Plant area	Plant 4	SRU #2	2-cylinder cascade system	19	MP#109647
Operations	Plant area	Plant 4	TGTU, column WS14	2-cylinder cascade system	19	MP#109647
Maintenance	Breathing Air Room	Labourers	Back room against South wall	5-cylinder cascade system	N/Av	N/A – Regular Changeout by Labourers
Maintenance	Breathing Air Room	Mtce/Ops	Front room	Fluctuating quantity of SCBA packs, escape packs and spare cylinders available for use	N/Av	Levitt PO & Regular changeout by Labourers
All	Compressed Gas Bldg	Mtce/Ops	Inside Compressed Gas bldg on Sun Ave.	Fluctuating quantity of Praxair cylinders available for use	N/A	Regular changeout by Praxair

MP = Maintenance Plan

The following individuals have approved and signed this document.

UserName: Todd Murray (toddmurray)
Title: Mgr EH&S Sarnia Refinery
Date: Friday, 03 February 2017, 06:56 AM Mountain Time
Meaning:
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