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## SAFETY POLICY & PROCEDURE

# Compressed Gas Cylinders

**SPP# 1910.101**

### Quick Reference

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## 1.0 Purpose

The purpose of this safety policy and procedure is to establish guidelines for the protection and safety of North Carolina Department of Transportation (NCDOT) employees who handle and use compressed gases.

## 2.0 Scope and Applicability

Compressed gases are typically stored under pressure in metal cylinders. These cylinders are designed and constructed to withstand high pressures. Improper handling and use of compressed gases can result in devastating consequences.

This safety policy and procedure provides guidelines for the safe handling and use of compressed gases. It includes provisions for training and presents safe handling guidelines. It also presents the types, uses, inspection, and marking requirements of compressed gas cylinders. Additionally, this safety policy and procedure presents transportation and storage requirements for compressed gas cylinders.

This safety policy and procedure also details the areas of responsibility for managers/unit heads, supervisors, employees, Safety and Risk Management and Central Equipment Unit within NCDOT.

This safety policy and procedure affects any employee who as a result of his or her job duties is exposed to or handles compressed gas cylinders.

## 3.0 Reference

This safety policy and procedure is established in accordance with Occupational Safety and Health Standards for General Industry on Compressed Gases (29 CFR 1910.101) and Storage and Handling of LP Gas (29 CFR 1910.110).

## 4.0 Policy

It is the policy of NCDOT to provide a place of employment that is free from recognized hazards that cause or are likely to cause death or serious physical harm to employees or the public. Therefore, compressed gas cylinders will not be handled until employees have been trained concerning their use. When hazards exist that cannot be eliminated, then engineering practices, administrative practices, safe work practices, Personal Protective Equipment (PPE), and proper training regarding Compressed Gas Cylinders will be implemented. These measures will be implemented to minimize those hazards to ensure the safety of employees and the public.

### 5.0 General Responsibilities

It is the responsibility of each manager/unit head, supervisor, and employee to ensure implementation of NCDOT's safety policy and procedure on Compressed Gas Cylinders. It is also the responsibility of each NCDOT employee to report immediately any unsafe act or condition to his or her supervisor. Specific responsibilities are outlined in Section 6.3.

### 6.0 Procedure

This section provides applicable definitions, establishes general provisions, and identifies responsibilities required by NCDOT's safety policy and procedure on Compressed Gas Cylinders.

#### 6.1 Definitions

**Compressed Gas**

Material or mixture that, when enclosed in a container, has an absolute pressure exceeding 40 psia at 70°F or, regardless of pressure at 70°F, exceeds 140 psia. at 70°F.

**Cylinder**

A portable compressed gas container, fabricated to or authorized for use by the U.S. Department of Transportation (DOT), or fabricated to Transport Canada (TC) or the "Rules for the Construction of Unfired Pressure Vessels," Section VIII, ASME Boiler & Pressure Vessel Code.

**Flammable Gas**

A gas that is flammable in a mixture of 13 percent or less (by volume) with air, or the flammable range with air is wider than 12 percent regardless of the lower limit, at atmospheric temperature and pressure.

**Handling**

Moving, connecting, or disconnecting a compressed or liquefied gas cylinder.

**Inside Diameter (I.D.)**

Inside cylinder diameter.

**Liquefied Gas**

A gas, which under charging pressure, is partially liquid at a temperature of 20°C (70°F).

**Liquefied Petroleum Gas (LP Gas)**

Any material which is composed predominantly of any of the following hydrocarbons, or mixtures of them; propane, propylene, butanes (normal butane or iso-butane), and butylene.

**Nonflammable Gas**

A gas that does not meet the definition of a flammable gas.

**Outside Diameter (O.D.)**

Outside cylinder diameter.

**Oxidizing Gas**

A gas that can support and accelerate combustion of other materials.

**Safety Relief Device**

A device intended to prevent rupture on a cylinder under certain conditions of exposure.

**Standard Cubic Foot (SCF)**

One cubic foot of gas at 70°F (21°C) and 14.7 psia (an absolute pressure of 101 kilopascals [kPa]).

**Storage**

An inventory of compressed or liquefied gases in containers that are not in the process of being examined, serviced, refilled, loaded, or unloaded.

**Toxic Gas**

A gas capable of causing damage to living tissue, impairment of central nervous system, severe illness, or death when ingested, inhaled or absorbed by the skin. Toxic gas has a health hazard rating of 3 or 4 defined in NFPA 704, Standard System for the Identification of Materials for Emergency Response.

**Use**

The consumption of a compressed or liquefied gas in a nonrecoverable manner.

**User**

An individual, group, or organization who utilizes the compressed or liquefied gas in a nonrecoverable manner.

**Valve Protection Device**

A device attached to the neck ring or body of the cylinder for the purpose of protecting the cylinder valve from being struck or damaged from impact resulting from a fall or an object striking the cylinder.

**Valve Protective Cap**

A rigid, removable cover provided for compressed gas container valve protection.

## 6.2 General Provisions

This section details the provisions of this safety policy and procedure with each provision discussed in a separate subsection. These provisions are:

- Training
- General Safe Handling Guidelines
- Use
- Types
- Inspection
- Marking
- Transportation
- Storage
- Cylinder Protection
- Service

### 6.2.1 Training

Employees who use and handle compressed gas cylinders will be trained before initial job assignment and/or job reassignment. Employees will be trained in the safe use, inspection, handling, and storage of compressed gas cylinders. Refresher training shall be provided at the discretion of the supervisor.

### 6.2.2 General Safe Handling Guidelines

Serious accidents can result from the misuse, abuse, or mishandling of compressed gas cylinders. Employees assigned to the handling of cylinders under pressure should follow general safe handling guidelines. Appendix A presents these guidelines. Figure 1 presents the typical components of a compressed gas cylinder.

### 6.2.3 Uses

Compressed gas cylinders are used for variety of purposes in NCDOT. Compressed gas cylinders in NCDOT are commonly used in metal cutting operations. Cylinders should be handled carefully and only used for their designated purpose. See SPP# 1910.252, Welding, for additional related information.

### 6.2.4 Types

Compressed gas cylinders are used for a variety of gases in NCDOT. These gas cylinders fall into the following categories:

- Flammable
- Oxidizing
- Toxic and Poison

The flammable gas cylinder predominantly used in NCDOT is acetylene. Acetylene is used in torch heating, welding, and ferrous metal cutting operations.

Oxygen is primary oxidizing gas used in NCDOT usually with acetylene for welding and cutting operations.

Toxic and poison gas cylinders are used in a variety of applications within NCDOT. Methyl Bromide is the most common of these gas cylinders. These cylinders should be marked with a poison gas label.

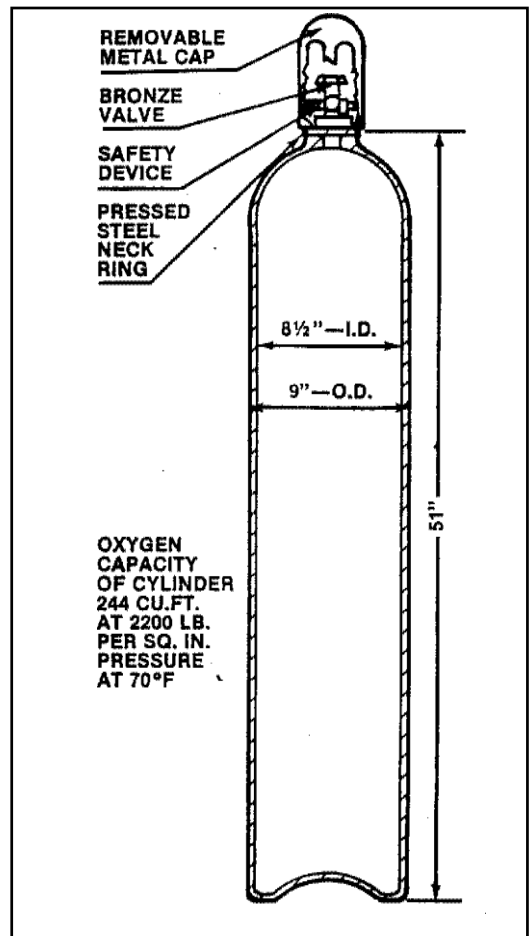


Figure 1

### 6.2.5 Inspection

Compressed gas cylinders should be visually inspected daily for leaks, cracks, etc. This visual inspection will include the cylinder, safety relief devices, valves, protection caps and stems. If a cylinder is thought to be defective, it should be returned to the supplier for replacement. Under no circumstances should employees attempt to repair defective cylinders. Gages should be checked to ensure that the gas under pressure is not left in hoses when operations are completed.

### 6.2.6 Marking

For the purpose of identifying the gas content, compressed gas cylinders shall be legibly marked with either the chemical or trade name of the gas. Such marking shall be by means of stenciling, stamping, or labeling, and shall not be readily removable. Whenever practical, the marking shall be on the shoulder of the cylinder for easy identification.

### 6.2.7 Transportation

Transporting gas cylinders requires careful consideration and appropriate precautions. These considerations and precautions include:

- Motor vehicle transport of cylinders
- Flammable gas and oxidizer cylinders transport
- Hand truck (dolly) transport of cylinders
- Cylinder transport precautions

**Motor vehicle transport of cylinders** shall only be done with vehicles equipped with truck transport racks or other means of securing the cylinders in a vertical position. Cylinders containing liquefied hydrogen or toxic gases shall be transported in open body vehicles.

**Flammable gas and oxidizer cylinders transport** must not be done together nor with poisons or corrosives. However, oxygen and acetylene cylinder joint transport is allowed if the cylinders are transported on welding cart in the rear truck bed.

Red label, yellow label, white label, green label, or poison label materials are not to be transported on the same load. Poison label materials are not to be transported with food or other items intended for human consumption.

**Hand truck (dolly) transport** of cylinders shall be used for the transfer of compressed gas cylinders from loading area to shop or laboratory or other within-building transfers.

### **Cylinder transport precautions include:**

- Cylinders having the valve protection cover in place while being transported
- Cylinders not being rolled or lifted by the valve or valve cap for moving
- Cylinder valves being shut off and valve caps in place during transit from location to location
- Cylinders that are dropped during transit being taken out of service and returned to the supplier for inspection
- Cylinders being securely supported at all times during transport
- Smoking being prohibited during loading, unloading, and hand transportation of flammable gas cylinders

### **6.2.8 Storage**

The storage of compressed gas cylinders requires some basic precautions and guidelines. These include:

- General cylinder storage precautions
- Specific gas cylinder storage guidelines
- Cylinder storage room guidelines

### **General cylinder storage precautions include:**

- Cylinders being secured in an upright position in a safe, dry, well-ventilated place prepared and reserved for the purpose
- Cylinders not being kept in unventilated enclosures such as lockers
- Cylinders not being stored in the same area as flammable substances, such as oil and volatile liquids or near sources of heat, such as radiators or furnaces
- Cylinders not being stored near elevators, gangways, stairwells, or other places where they can easily be knocked down or damaged
- Cylinders being stored on a level fireproof floor
- Cylinders stored in the open being protected from contact with the ground and against extremes of weather
- Cylinder storage being planned so that cylinders are used in the order that they are received from the supplier
- Empty and full cylinders being stored separately, with empty cylinders being plainly identified as such to avoid confusion
- Empty cylinders being grouped together that have held the same contents

**Specific gas cylinder storage guidelines** include additional precautions and guidelines for oxygen, hydrogen, and acetylene and liquefied fuel gas cylinders.

- **Oxygen cylinders shall not be stored within 20 feet (6 meters) of highly combustible materials, oil, grease, wood shavings, or cylinders containing flammable gases.**
- For NCDOT operations, oxygen and acetylene shall be paired and secured on a common transfer cart for use. If not to be used in the next 24 hrs., valves must be shut off, regulators removed, protective caps put in place and cylinders put back in storage.

- For applications where oxygen and acetylene will be stored on the welding cart for more than 24 hrs., the cart must have a ½ hour fire rated barrier (**triple baffle firewall partition design**) at least 5 ft. tall. See Figures 2 and 3.



Figure 2



Figure 3

- For oxygen and acetylene storage closer than 20 feet, cylinders shall be separated by a wall or barrier with a fire-resistance rating of at least ½ hour.
- Hydrogen cylinders storage locations shall be permanently placarded as follows: “HYDROGEN-FLAMMABLE GAS-NO SMOKING-NO OPEN FLAMES,” or equivalent.
- Acetylene and liquefied fuel gas cylinders should be stored with the valve end up. If storage is within 100 feet (30.5 meters) of each other and not protected by automatic sprinklers, the total capacity of acetylene cylinders stored and used inside the building should be limited to 2,500 cubic feet. Acetylene storage areas must be well ventilated and open flames must be prohibited.
- Acetylene storage rooms should have no other compressed gases.

### Cylinder storage room guidelines include:

- Storage rooms for cylinders containing flammable gases being well ventilated to prevent the accumulation of explosive concentrations of gas
- No ignition sources being permitted
- Smoking being prohibited
- All permanent wiring being in conduit
- Electric lights (portable and fixed) being equipped with guards to prevent breakage
- Electric switches being located outside the room

### 6.2.9 Cylinder Protection

All gas cylinders with a water capacity of over 30 pounds shall be equipped with a valve protection cap or with a collar or recess to protect the valve. Protective cap must remain in place unless in use.



### 6.2.10 Service

Cylinder service, modifications or repairs will be performed by an authorized individual other than a NCDOT employee. will be repaired or replaced by the service representative. Any damaged or faulty equipment Cylinder valves that cannot be opened by hand will not be forced open with tools and will be returned to the supplier for service.

## 6.3 Specific Responsibilities

### 6.3.1 Managers/Unit Heads

Managers/Unit Heads are responsible for ensuring that adequate funds are available and budgeted for the purchase of compressed gas cylinder equipment and related supplies. They will also be responsible for identifying the employees affected by this safety policy and procedure. Managers/Unit Heads will obtain and coordinate the required training for the affected employees.

Managers/Unit Heads will also ensure compliance with this safety policy and procedure through their auditing process.

### 6.3.2 Supervisors

Supervisors will not allow any employee who has not received the required training to handle any compressed gas cylinders.

Supervisors will also note defective cylinders and tag them for repair.

### 6.3.3 Employees

Employees shall comply with all applicable guidelines contained in this safety policy and procedure. They shall report any defective or damaged cylinders to their supervisor.

### 6.3.4 Safety and Risk Management

Safety and Risk Management will provide prompt assistance to managers/unit heads, supervisors, or others as applicable on any matter concerning this safety policy and procedure. Safety and Risk Management will assist in developing or securing the required training.

Safety and Risk Management will also work with Central Equipment Unit to ensure that all newly purchased compressed gas cylinders equipment and supplies comply with current safety regulations and this safety policy and procedure.

Additionally, Safety Engineers will provide consultative and audit assistance to ensure effective implementation of this safety policy and procedure.

### Appendix A: Compressed Gas Cylinders Safety Handling Guidelines

- Accept only cylinders approved for use in interstate commerce for transportation of compressed gases.
- Do not remove or change the marks and numbers stamped on the cylinders.
- Follow manufactures instructions.
- Cylinders must never be dragged, pushed, or pulled across the floor.
- Transport cylinders weighing more than a total of 40 pounds (18.2 kg) using hand truck or motorized truck, securing them from falling.
- Keep the cylinders clean and protect them from cuts or abrasions.
- Do not lift compressed gas cylinders with an electromagnet. Where cylinders must be handled by a crane or derrick, as on construction jobs, carry them in a cradle or suitable platform and take extreme care that they are not dropped or bumped. Do not use slings.
- Do not drop cylinders or allow them to strike each other violently.
- Do not use cylinders for rollers, supports, or any purpose other than to contain gas.
- Do not tamper with safety devices in valves or on cylinders.
- Consult the supplier of the gas when in doubt about the proper handling of a compressed gas cylinder or its contents.
- Clearly indicate “EMPTY” with marking or tags on empty cylinders that are to be returned to the vendor.
- Close cylinder valves and replace valve protection caps, if the cylinder is designed to accept a cap.
- Load cylinders to be transported to allow as little movement as possible. Secure them to prevent violent contact or upsetting.
- Always consider cylinders to be full and handle them with corresponding care.
- Secure compressed gas cylinders at all times. Cylinders must not be left “free- standing”, e.g., cylinders unloaded from truck to loading dock must be secured until placed on a hand truck for delivery within the building.
- Compressed gas cylinders should never be subjected to a temperature above 125°F.
- Never place cylinders where they might become part of an electrical circuit.
- Do not re-paint cylinders.
- Never use a flame to detect flammable gas leaks. Always use soapy water.

### PROPANE CYLINDERS

NCDOT regularly uses propane for heating of asphalt, portable torches, crack sealing, LP forklift and other equipment fuel and operations. Compressed Gases such as propane that are stored in cylinders create a significant hazard. Propane stored in tanks expands at 270 it’s stored pressure when changing from liquid to a vapor state. As the temperature rises, the liquid becomes less dense and expands.

Cylinders may not be stored near highly flammable substances such as oil, gasoline or waste. They also cannot be stored next to highly flammable solvents, combustible waste material or

similar substances. You may not store them in flammable storage cabinets due to the rise in temperature and expanding vapors. Doing so increases the chance for an explosion and increase the risk of fire and shrapnel. Small propane gas cylinders should be stored in cages.

### Storage

Storage of LPG containers within NCDOT buildings not frequented by the public shall not exceed 300 lbs. All outside storage for LPG/Propane tanks awaiting use, shall be located from the nearest building or group of buildings in accordance with the following. All storage will be in a suitable ventilated area where safety relief valves on tanks can vent without the danger of vapors or fumes getting near.

| Quantity of LP Gas stored | Distance |
|---------------------------|----------|
| 500 lbs. or less          | 0        |
| 501 to 6,000 lbs.         | 10       |
| 6,001 to 10,000 lbs.      | 20       |
| Over 10,000 lbs.          | 25       |

Cylinders will be stored on a concrete surface so that moisture will dissipate from the foot ring and prevent rusting to the cylinders and the tank. Cylinders shall be stored upright when possible. All cylinders will be securely chained to a wall or within a rack to prevent tipping.

Any cylinder stored in a horizontal position must be done so with the relief valve up. This allows the over pressure of the container to be in constant contact with the relief valve to blow off the excess pressure of the tank.

### Fire protection for Containers

Storage locations shall be provided with at least one approved Portable fire extinguisher having a rating of not less than 20-BC.

All containers weather portable or permanent tanks shall be located in an area protected by or free from damage by vehicular traffic.

### Inspections

All propane cylinders have a date of Mfg. stamped on the top collar of the cylinder. After the date of Mfg., the cylinders must be requalified every 12 years. From that point forward, they must be inspected every 5 years thereafter.

Items to be inspected include:

- Relief Valves,
- Service Valves
- Bleeder valves
- Stamped markings or nameplates,
- Protective collars (Neck rings)

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- Tanks that have not been inspected or are out of date are to be removed from service and sent to an authorized service center/dealer for inspection. The date of the inspection can be found on the collar of the tank.
- Foot rings.
- Tank condition. Minor rusting can be cleaned up and repainted.
- Any defects found such as major rusting, pitting of the surface, damage to welds, dents or damage to collars or foot rings will require removing the cylinders from service.

### Markings

All tanks, large or small shall be appropriately marked to show the dangers of the contents.



All tanks regardless of size should be marked so that labels denoting the contents can be read from the directions of travel.

Tanks 500 lbs. and over should be marked on at least two sides with:

- NFPA Diamond
- No Smoking
- Propane
- Flammable.