

University of Alaska Anchorage	Section EHS/RM
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## 1. Purpose

University of Alaska Anchorage (UAA) employees, student workers, faculty, staff, and outside contractors who use compressed gas cylinders in the course of their work functions, risk injury if improperly managed. The hazards associated with compressed gas cylinders can be substantially reduced by using the equipment properly and taking precautions. This program for compressed gas cylinders is intended to ensure workers are knowledgeable in the hazards when using compressed gas cylinders and the steps to be taken to protect themselves and others.

## 2. Objective

UAA, in its continuing effort to provide employees with safe, healthful working conditions, and to comply with the Occupational Safety and Health Act is implementing the following program for compressed gas cylinders to protect people working at the University, by helping employees, student workers, faculty, staff, and outside contractors better understand general procedures for safe handling of compressed gas cylinders.

## 3. Scope

This policy applies to UAA employees, student employees, faculty, staff, and outside contractors working on UAA equipment who work with or around compressed gas cylinders.

## 4. Definitions

Compressed gas - A gas or mixture of gases having an absolute pressure exceeding 40 psi at 70 degrees F (21.1 degrees C); or, a gas or mixture of gases having an absolute pressure exceeding 104 psi at 130 degrees F (54.4 degrees C) regardless of the pressure at 70 degrees F; or, a liquid having a vapor pressure exceeding 40 psi at 100 degrees F (37.8 degrees C)

Compressed gas cylinder handling - moving, connecting or disconnecting a compressed or liquefied gas container under normal conditions of use

Cylinder - compressed gas container having a maximum water capacity of 1,000 or less pounds or approximately equivalent to 120 gallons.

Pressure Regulator - A device used to prevent the pressure from rising above a predetermined maximum, thereby, preventing rupture of a normally charged cylinder when subjected to a standard fire test

Valve Protection Cap - rigid removable cover provided for container valve protection during handling, transportation and storage

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## 5. Authority and Responsibilities

In addition to the roles and responsibilities outlined in the UAA Training Program, the following apply to the Compressed Gas Cylinder Safety Program.

### EHS/RM

- Assist with training when necessary
- Works with departments to determine proper equipment, storage selection and safe-work practices unique to each department's work activities
- Create, track, and/or conduct inspections on compressed gas cylinders where applicable with this standard

### Supervisor

- Ensure defective, damaged, or prohibited compressed gas cylinders and associated handling and storage equipment are removed from service
- Conduct periodic inspections of compressed gas cylinders in their department to ensure proper storage and handling
- Ensure employees are properly trained in this compressed gas cylinders program and the use of compressed gas cylinders in their work areas

### Department Safety Coordinator

- Assist in the determination of defective, damaged, or prohibited compressed gas cylinders and associated equipment
- Conduct periodic inspections of compressed gas cylinders in their department to ensure integrity
- Assist in the determination of safe methods when handling compressed gas cylinders

### Employees/Student Workers

- Visually inspect compressed gas cylinders prior to every use for defects and damage
- Alerts department supervisor when compressed gas cylinders and associated equipment need replacement

### Outside Contractors

- Perform all work in compliance with their company's compressed gas cylinders program, which will be reviewed and approved by the EHS/RM department
- If the company does not have a program, they must comply with this program

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## 6. Hazards Associated with Compressed Gas Cylinders

The following hazards associated with compressed gas cylinders can lead to personal injury or death:

- Gas leaks causing:
- Oxygen displacement and asphyxiation
- Fires, explosions
- Toxic gas exposure
- Physical hazards associated with damage to the gas cylinder and rapid release of ~~high pressure~~high-pressure gasses
- Ergonomic hazards while moving cylinders
- Cold stress/ rapid release of high-pressure gasses

## 7. Engineering Controls

Engineering controls are design plans or changes to the working environment to prevent or reduce employee exposure to hazards associated with compressed gas cylinders. The following example of engineering controls should be considered in area design to reduce the risks of handling compressed gas cylinders.

- Proper storage areas for unused gasses
- Proper storage and stabilization support for cylinders while in use
- Proper equipment for transportation of cylinders
- Proper regulators and piping for gasses

## 8. Administrative Controls

Administrative controls are safe work practices and procedures designed to reduce the risks associated with working with compressed gas cylinders. Examples of administrative controls include the following:

- Train employees who work with compressed gas cylinders
- Routine inspections of compressed gas cylinders to ensure they are in safe working condition
- Immediate removal of any compressed gas cylinders that are found to be damaged or defective

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- Provide employees with the proper equipment for handling for their job tasks

## 9. Procedures

When handling compressed gas cylinders UAA personnel must always consider the two sets of hazards they introduce to the workplace, chemical hazard of the contents and the physical hazard of the high-pressure system. In addition, most cylinders are extremely heavy and present physical hazards when handling.

### **General Guidelines:**

The following must be considered each time UAA personnel use compressed gas cylinders:

- SDS sheets must be available for each gas used, if there is not an SDS available in the UAA SDS database, one must be obtained and provided to the ESH/RM Chemical Hygiene Officer prior to ordering
- All personnel handling the compressed gases must be familiar with the chemical hazards, and review the SDS if needed
- Only properly trained personnel shall handle and use compressed gas cylinders
- Cylinders shall be inspected prior to use. Inspection will include checking for dents, bulges, cracks, evidence of excess heat, etc. **Note: A cylinder shall not be used if damaged**
- All repairs or alterations to compressed gas cylinders must be performed by the gas supplier, or their designated contractor
- Compressed gas cylinders shall not be stored or placed in areas where they will be exposed to high or low temperature extremes
- Damaged compressed gas cylinders should always be returned to the supplier or properly disposed of
- All gas piping or tubing must be checked periodically and reported for repair, unless it is a supplier owned system
- If gas piping or tubing is found to be defective or damaged, the system must be taken out of service and the supplier contacted for replacement or repair
- Gasses shall not be transferred from one container to another without a proper procedure approved by department supervisor or PI
- Disposable gas cylinders, including lecture bottles cannot be refilled

### **Compressed Gas Cylinder Handling**

Due to the shape and weight of many compressed gas cylinders, moving and transporting them

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can be hazardous if not performed properly. The following must be considered when handling compressed gas cylinders:

- Always use a properly designed hand truck or cart when moving cylinders
  - The cylinder must be securely chained or strapped to the cart
  - Inspect the cylinder cart and wheels for wear and tear before each use.
  - Carts are for transporting cylinders, not for storage
  - Hand truck and carts must have a means to secure the cylinder to the cart
  - Cylinders should be placed on the cart as close to the storage area as possible and transported using the cart to the closest location to the work space
  - Cylinders must be transported with the cylinder upright (valve up)
  - If more than one cylinder is moved at a time the hand truck or cart must be designed for that purpose and all cylinders must be secured by its own restraint
- Prior to transport regulators must be removed from the cylinders and the protection cap put in place
- Do not lift cylinders by the cap
- Do not subject the cylinder to unnecessary rough handling or abuse
- Cylinders should be moved by passenger elevators only when freight elevator are not available, and other passengers should be removed from the car when a cylinder is inside

### **Valve Protection Caps and Regulators**

Compressed gas cylinder caps are necessary to protect the cylinder valve from being damaged and a sudden release of high-pressure gases.

- Compressed gas cylinders must have the protection cap in place anytime the cylinder is not secured or being moved
- Protection caps should never be forced on using tools, they should only be hand tightened
- Protection caps should always be in place if the cylinder is not going to be used for > 12 hours even when empty
- If used for multiple days, protection caps should be placed on the cylinder at the end of every work shift, unless the cylinder is stored in a long-term area with a designed cylinder

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support with an individual restraint for each cylinder

- Cylinders must never be used without a properly designed regulator
- Regulators are not always interchangeable for different gasses, always make sure the regulator is compatible with the gasses used, contact the supplier for assistance if needed
- Always use the cylinder valve, not the regulator to stop the flow of gas, unless the cylinder valve is found to be leaking

### **Storage**

Cylinders must be stored properly to avoid cylinder damage resulting release of high pressure gasses.

- Gas cylinders should always be properly secured to prevent tipping, falling or rolling. This can be accomplished with chains, straps connected to a wall bracket or other secure surface, a cylinder stand, or a properly designed storage cage.
- Because UAA falls in an area of seismic activity, it is recommended to secure gas cylinders both toward the top of toward the bottom
- Cylinder storage areas should be posted with the names of the gases to be stored
- Do not store cylinders near highly flammable substances such as oil, gasoline or waste
- Empty cylinders will be taken out of service and clearly labeled EMPTY
- Charged and empty cylinders should be stored separately
- Storage should be laid out so the oldest stock can be used first, first in, first out
- Storage areas shall be constructed so that they are dry, well ventilated, and made with noncombustible materials. Shelves must be able to support cylinders
- When stored outside cylinders should be protected from the ground beneath to prevent rusting
- Compressed gas cylinders containing flammable gases such as butane, propane, or acetylene shall be stored in well ventilated locations or ventilated cabinets
- "NO SMOKING" signs shall be posted at all flammable gas storage areas. Smoking is prohibited within 6 meters (20 feet) of flammable gas storage areas
- Oxidizers shall be stored separately from flammable gas containers or combustible materials (especially oil or grease). A distance of 20 feet (6 meters) or a noncombustible barrier at least five feet high having a fire resistance rating of at least one-half hour is

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considered a minimum requirement

- Storage of small cylinders of LPG (nonrefillable propane or butane in nominal 1 lb or smaller cylinders) shall occur as outlined:
  - Cylinders shall be stored in a flammable gas cabinet, vented flammable liquids cabinet, or secured on an open shelf.
  - The maximum quantity of nominal 1 lb. LP-Gas cylinders in any storage area is 20 cylinders (20 lb. propane total capacity)
  - Cylinders shall be stored in areas protected from tampering and away from exits, stairways, or areas used or intended for use as safe egress for occupants.

## 10. Inspections

To ensure compressed gas cylinders at UAA are maintained in a safe condition and workers to not use defective equipment the following inspections are required:

Prior to every use UAA personnel will visually inspect compressed gas cylinders to ensure they are in proper working condition. Personnel will check for dents, bulges, cracks, evidence of excess heat, or leakage. Any cylinder found to be suspect must taken out of service, tagged and sent to the supplier for inspection.

Gas cylinders must undergo rigorous testing and requalification. When using vendor owned cylinders the vendor is responsible for monitoring and maintains cylinder recertification. When the cylinders are UAA owned the department is responsible for the determination of requalification frequency and procurement of a contractor to perform the requalification of the cylinder. A certified vender must requalify the cylinder on a specialized piece of equipment in one of two ways: hydrostatically or ultrasonically. Cylinders tested hydrostatically are filled to the brim with pressurized water to determine if the cylinder will expand properly when it is filled. An ultrasonic testing machine scans the outer and inner facings of the cylinder walls to look for defects and cracks which could not be seen otherwise. Both methods are regulated and approved by the DOT to ensure the safety of cylinders filled in the USA. If the cylinder passes inspection, a stamp is applied to the shoulder of the cylinder starting the month and year the cylinder was tested, as well as, the RIN number which identifies the specific testing facility which examined that cylinder. The frequency of requalification is dependent on the specification under which the cylinder was made. Table 1 of DOT regulation 49 CFR 180.209 found in Appendix B.

## 11. Training

UAA shall provide a training program for each employee using compressed gas cylinders as

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necessary.

The program shall enable each employee to recognize hazards related compressed gas cylinders and shall train each employee in the procedures to be followed to minimize these hazards.

The employer shall ensure that each employee has been trained by a competent person in the following areas, as applicable:

- The nature of compressed gas cylinder hazards in the work area
- The correct procedures proper handling techniques and equipment use
- The proper storage methods
- The chemical hazards of gasses used in the work area

Retraining shall be provided for each employee as necessary if an accident occurs, new workplace hazards are identified, a near loss incident has occurred, or there is a change in the type of cylinder, storage and handling methods, or chemical used, so that the employee maintains the understanding and knowledge acquired through compliance with this section.

## 12. Program Evaluation

The Compressed Gas Cylinder Program shall be evaluated on an annual basis utilizing the protocols set forth by EHS/RM. Annually, supervisors will inspect compressed gas cylinder areas with assistance from the EHS/RM Department upon request, utilizing the UAA Compressed Gas Cylinder Inspection Checklist (Attachment A). A copy of the checklist should be kept in the department and another sent to the EHS/RM Department

## 13. References

OSHA regulations that apply to Compressed Gas Cylinder safety are included below.

- 40 CFR 1910.101
- 40 CFR 1926.350



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#### 14. Revision History

Revision #	Date Revised	Description of Change	Revised By	Approved By
1	12/14/2018	Initial issue		
2				
3				
4				

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## Appendix A

### UAA Compressed Gas Cylinder Inspection Checklist

Inspection Item	Yes	No	Comments
Are cylinders stored in upright positions and immobilized by chains or other means to prevent them from being knocked over?			
Are cylinders stored away from highly flammable substances such as oil, gasoline, or waste?			
Are flammable gases separated from oxidizing gases in storage areas by 20 ft. or separated by a fire proof partition?			
Are storage rooms for cylinders dry, cool, and well- ventilated?			
Is the storage area posted with the names of the gases stored in the cylinders?			
Do all compressed gas cylinders have their contents and precautionary labeling clearly marked on their exteriors?			
Are all compressed gas cylinder valve covers in place when cylinders are not in use?			
Are charged or full cylinders labeled and stored away from empty cylinders?			
Is the bottom of the cylinder protected from the ground to prevent rusting?			
Are cylinder valves closed at all times, except when the valve is in use?			
Is a hand truck available for transport, and are compressed gas cylinders always moved, even short distances, by a suitable hand truck?			
Are compressed gases only handled by experienced and properly trained people?			

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## Appendix B

### 49 CFR 180.209 Table 1 Requalification of Cylinders

Specification under which cylinder was made	Minimum test pressure (psig) <sup>2</sup>	Requalification period (years)
DOT 3	3000 psig	5
DOT 3A, 3AA	5/3 times service pressure, except noncorrosive service (see § 180.209(g) )	5, 10, or 12 (see § 180.209(b) , (e), (f), (h), and (j)).
DOT 3AL	5/3 times service pressure	5, 10 or 12 (see § 180.209(e) , (j) and § 180.209(m) <sup>3</sup> ).
DOT 3AX, 3AAX	5/3 times service pressure	5, 10 (see § 180.209(e) .
3B, 3BN	2 times service pressure (see § 180.209(g) )	5 or 10 (see § 180.209(e) , (f)).
3E	Test not required.	
3HT	5/3 times service pressure	3 (see §§ 180.209(k) and 180.213(c)).
3T	5/3 times service pressure	5
4AA480	2 times service pressure (see § 180.209(g) )	5 or 10 (see § 180.209(e) or (h)).
4B, 4BA, 4BW, 4B-240ET	2 times service pressure, except non-corrosive service (see § 180.209(g) )	5, 10, or 12 (see § 180.209(e) , (f), and (j)).
4D, 4DA, 4DS	2 times service	5
DOT 4E	2 times service pressure, except non-corrosive (see § 180.209(g) )	5 or 10 (see § 180.209(e) ).
4L	Test not required.	
8, 8AL		10 or 20 (see § 180.209(i) ).
Exemption or special permit cylinder	See current exemption or special permit	See current exemption or special permit.
Foreign cylinder (see § 173.301(j) of this subchapter for restrictions on use)	As marked on cylinder, but not less than 5/3 of any service or working pressure marking	5 (see §§ 180.209(l) and 180.213(d)(2)).

<sup>2</sup> For cylinders not marked with a service pressure, see 49 CFR [173.301a\(b\)](#).

<sup>3</sup> This provision does not apply to cylinders used for carbon dioxide, fire extinguisher or other industrial gas service.