

# 7.0 Phosgene Transportation and Container Usage

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## *Introduction*

**Caution** - Information contained in this section of the Guidelines is based upon United States Department of Transportation (USDOT) regulations in effect in 2020. Refer to the actual USDOT regulations (49 CFR Parts 100 –185)<sup>1</sup> to review the regulations in their entirety and to see the most recent requirements that apply to your facility. It is the responsibility of each person shipping, transporting or using phosgene to know and to comply with all applicable laws and regulations pertaining to shipping, labeling and placarding.

Shipments originating within the United States are required by DOT to comply with the current issue of the Code of Federal Regulations (CFR), Title 49, Parts 100 to 185, inclusive.<sup>1</sup> Furthermore, many states and some municipalities have adopted the Federal and other state and local laws to govern the transportation of hazardous materials within their jurisdiction.

The information provided in this section should not be considered as a directive or as an industry standard that readers must adopt or follow. Instead, the information is intended to provide helpful ideas and guidance that users may wish to consider in a general sense (See Section 1.1 *Preface and Legal Notice*). Also included is a reference list of useful resources.

## **Contents**

7.1	Shipping Containers.....	2
7.2	Shipping Requirements.....	3
7.3	Loading and Unloading .....	5
7.4	Transportation Security .....	6
7.5	Retesting.....	6
7.6	Moving and Handling Cylinders and Ton Containers.....	6
7.7	Storing Containers .....	7
7.8	Using Containers .....	7
	References .....	9

## 7.1 Shipping Containers

### General

DOT requires phosgene shipping containers to comply with authorized specifications. See 49 CFR Section 173.192 (non-bulk containers) and Section 173.314 (bulk containers).<sup>3</sup>

Phosgene is authorized to be shipped by highway using private or common carriers (49 CFR Section 177.840) or by rail (49 CFR Part 174).<sup>4</sup>

### Non-bulk containers (Cylinders)

49 CFR 173.192 provides information about the container specifications required for the packaging of phosgene

The only non-bulk containers approved by USDOT for phosgene shipments are carbon steel cylinders that conform to applicable USDOT specifications (49 CFR Part 178). Specification 8, 8AL and 39 cylinders are not authorized by USDOT. The type of cylinders used are typically DOT 3AA seamless high-pressure cylinders with a service pressure rating of 1800 psig. These may come with or without a full-length dip tube. Packaging of cylinders must comply with 49 CFR Section 173.40.

### Bulk containers, - Ton Containers - 2,000 lbs. Capacity

As described in 49 CFR Part 179, DOT specification 106A500X tank car tanks, these tank car tanks are filled to a maximum of 2000 pounds. The containers are commonly referred to as “ton containers.” Ton containers are carbon steel with loaded weights up to 3700 lbs. The container is approximately 87% full when shipped. Each valve connects with an internal education pipe. The valves are protected by a gas-tight removable steel valve protection bonnet designed to withstand the hydrostatic test pressure of the container. The containers and the valves are not equipped with fusible metal type safety relief devices.

### Other Containers

No other containers are authorized by USDOT.

## Compliance with Shipping Regulations

DOT provides that shippers who supply containers are responsible for determining that containers provided for transportation of hazardous materials are made, assembled, marked, etc., in compliance with applicable regulations. Users are responsible for determining that containers comply with shipping regulations before returning to shipper.

### 7.2 Shipping Requirements

**DOT Shipping Requirements:** 49 CFR Parts 171-179 provides shipping requirements for transportation of phosgene in the United States.

**Shipping Name:** Phosgene

**Technical Name:** Phosgene

**Hazard Class:** 2.3

**UN/NA Number:** UN1076

**Packing Group:** None

**Label(s):** Inhalation Hazardous Gas (2), Corrosive (8)

**Placard(s):** Inhalation Hazardous Gas (2) UN1076

**Markings:** UN1076

**Hazardous Substance:** Yes

**RQ:** 10#

**Poison / Inhalation hazard:** Yes, containers must be marked "poison inhalation hazard."

**Marine Pollutant:** No

**Packaging Requirements:** Bulk - 173.314, Non-bulk 173.192

**Exemption Number:** None

**Bill of Lading Description:** UN1076, Phosgene, 2.3, (8), RQ(Phosgene), Poison inhalation hazard, Hazard Zone A, (List Container Size here), Inhalation Hazardous gas and Corrosive labels affixed, Current USDOT Emergency Response Guide ERG125.

**Other information:** Special provisions: 1, B7, B46, N86 §172.102 Quantity Limitations: Passenger aircraft or railcar: Forbidden. Cargo aircraft only: Forbidden. Vessel Stowage Requirements: Vessel stowage: Category D. Other stowage provisions: 40 §176.84

## Precautionary Labeling

In preparing a label for containers of phosgene, there are a variety of items for consideration. Some items are presented below; the discussion focuses on product as shipped for industrial use. This information is for consideration, in addition to or in combination with any specific wording required by law. Individual statutes, regulations, or ordinances may require that particular information be included in the label, that certain information be displayed in a particular manner, or that a specific label be affixed to a container. Review of the information below will not ensure compliance with such laws; it is only general information. In the United States, such laws include the Federal Hazardous Substances Labeling Act; Federal Insecticide, Fungicide and Rodenticide Act, Occupational Safety and Health Administration hazard communication standard, and similar state and municipal legislation.

Items for consideration during precautionary labeling development:

- Physical and Chemical Hazards
  - Nature of liquid and gas under pressure
  - Potential health risks
  - Ventilation or engineering controls to meet Occupational Safety and Health Administration permissible exposure limit
  - Availability of emergency self-contained breathing apparatus or full-face air-line respirator
  - Evacuation procedures, personnel, equipment, etc.
  - Fire-related information (e.g., container removal and/or cooling)
  
- First Aid
  - Procedures for inhalation exposure
  - Procedures for contact with phosgene
  - Provide reference to the American Chemistry Council reference material *Phosgene - Information on Options for First Aid and Medical Treatment*<sup>7</sup>
  
- Handling and Storage
  - Storage conditions
  - Temperature limits
  - Training for personnel handling phosgene
  - Reference to Safety Data Sheet or product bulletin

- Ventilation or engineering controls to meet Occupational Safety and Health Administration permissible exposure limit
- Use of approved connections for unloading phosgene
- Maintenance of dry and clean piping conditions
- Procedures for returning empty containers

Treat all containers, whether empty or filled, according to the specifications for handling and labeling until the containers are completely purged and tests have verified that they are decontaminated.

### 7.3 Loading and Unloading

All persons involved in loading or unloading of phosgene must be properly trained, according to 49 CFR Section 172.704, which provides the United States training requirements.

#### **Tank Car Tanks (Ton containers):**

See 49 CFR Parts 100-185 for more detailed information. When tanks are loaded and prior to shipping, items for shippers to evaluate can include determining to the extent practicable that the tank, safety appurtenances, fittings, labels and markings are in proper condition for safe transportation.

The United States Department of Transportation requires that ton containers loaded onto a trailer shall meet the following requirements:

- Loaded on a flat floor or platform of a motor vehicle or onto a suitable frame of a motor vehicle.
- In either such case, such containers shall be safely and securely blocked or held down to prevent movement relative to each other when in transit.

It also requires that rail cars are equipped with approved metal clamps securely bolted to the car frame.

## **Cylinders**

Department of Transportation regulations require that cylinders be securely lashed in an upright position in racks securely attached to the motor vehicle or packed in boxes or crates of such dimensions as to prevent their overturning; or loaded and secured in a horizontal position.

Properly load shipments. Unless adequately designed, ends, sidewalls or doors of truck bodies or trailers may not prevent the shifting of heavy loads.

### **7.4 Transportation Security**

With regard to transportation of phosgene containers, strict security procedures, including the use of detailed security assessments and the implementation of strict measures, must be implemented according to 49 CFR §172.802.

### **7.5 Retesting**

According to DOT regulations, tanks (one-ton containers) and cylinders must be periodically tested at an authorized testing facility.

### **7.6 Moving and Handling Cylinders and Ton Containers**

Phosgene is a hazardous substance; handle containers with appropriate care. Use protective covering for the valves when moving containers. Dropping a container, or allowing any object to strike a container with force can result in container damage and associated risks.

Use equipment engineered specifically for movement of phosgene containers. Avoid rolling containers when moving them to reduce the hazard of damage.

## 7.7 Storing Containers

Containers may be stored in properly designed outdoor or indoor storage locations. Consider whether the storage area is well marked, secured for unauthorized access, and monitored for the presence of phosgene with appropriate monitoring/detection devices. Keep the storage area clean to help reduce fire hazards associated with accumulated trash. Consider storing containers away from elevators or ventilating systems so that dangerous concentrations of gas cannot spread rapidly if a leak develops. Indoor storage areas can be vented to a phosgene scrubbing system to help prevent accidental releases of phosgene to the atmosphere.

Consider whether the containers have been stored in a manner to minimize external corrosion. If standing water can collect, suitable platforms or supports can be provided. Steps can be taken to permit inspection and to facilitate prompt removal if a leak occurs. Hazards can be created if containers are stored in places where containers can drop, where heavy objects can fall on the containers, or where vehicles can strike the containers.

Subsurface storage areas can cause difficulties and are not used by a number of companies. Procedures can be established to discourage access by unauthorized persons.

Evaluate actions to help prevent the exposure of containers to flame, intense radiant heat or to high temperature steam lines.

To reduce potential risks, full and empty containers may be stored separately. Even though the container is empty, consider whether valve outlet caps and valve protection hoods are in place. Generally, cylinders are stored in an upright position, and ton containers on their sides above the ground or floor on steel, concrete, or wooden supports.

## 7.8 Using Containers

### General

Using cylinders and ton containers in the order in which they are received can offer benefits. Modifying, altering, repairing or using containers and valves in any manner except as authorized and without prior consultation with the supplier can raise significant concerns.

## Gas Discharge

Most cylinders have a dip pipe as well as a top valve so that either liquid or gas can be discharged with the cylinder in a vertical position. Some cylinders may need to be inverted to obtain liquid discharge. Ton containers in a horizontal position and with the valves in a vertical line deliver gas from the upper, and liquid from the lower, valve.

The flow of phosgene gas from a container depends on the internal pressure which, in turn, depends on the temperature of the liquid phosgene. In order to withdraw gas, liquid must be vaporized. This tends to reduce its temperature and thereby its vapor pressure. At low discharge rates, sufficient heat can usually be obtained from the surrounding air so the pressure in the container will remain constant and uniform flow can be maintained. At high discharge rates, however, the temperature and pressure within the container will fall due to the cooling effect of vaporization; the rate of flow will gradually diminish. At excessive discharge rates, the liquid will be cooled to such an extent that frost will form on the outside of the container. The insulating effect of the frost causes a further decrease in the rate of discharge. Discharge rates may be increased by circulating room temperature air around the container with a fan. Avoid exposing the container to excess heat, which can weaken the container due to over pressurization.

## Liquid Discharge

To obtain liquid phosgene from cylinders having a dip pipe, connect to the appropriate valve with the cylinder in an upright position. To obtain liquid from a cylinder which does not have a dip pipe, one approach has been to invert the cylinder and clamp it securely on a rack set at an angle of about 60° to the horizontal. Liquid phosgene is discharged from the lower valve of a ton container. When discharging liquid, very high withdrawal rates may be obtained. The rate depends on the temperature of the phosgene in the container and on the back pressure. Users should consider an appropriate discharge rate as part of their liquid discharge procedures.

Connection of containers discharging liquid to a manifold can be problematic because differences in pressure among the containers (due to temperature or non-condensable gases, or due to difference in elevation head) will cause liquid phosgene to flow to the container under the lowest pressure. Then, when the container valve is closed, and the temperature subsequently allowed to rise, the liquid expansion may generate an increase in hydrostatic pressure which could rupture the container.

## Weighing

The quantity of container contents can be determined by a weighing process. The weight of the full container is recorded and the net weight of the contents determined by subtracting the tare weight of the container.

## References

- <sup>1</sup>USDOT regulations (49 CFR Parts 100 –185)
- <sup>2</sup>Code of Federal Regulations (CFR), Title 49, Parts 100 to 185, inclusive
- <sup>3</sup>49 CFR Section 173.192 (non-bulk containers) and Section 173.314 (bulk containers).
- <sup>4</sup>49 CFR Section 177.840 or by rail 49 CFR Part 174.
- <sup>5</sup>Compressed Gases and Cryogenic Fluids Code, NFPA 55, National Fire Protection Agency: Quincy, MA.
- <sup>6</sup> Chemical Facility Anti-Terrorism Standards (CFATS), 6 CFR Part 27, Appendix A
- <sup>7</sup> Phosgene – Information on Options for First Aid and Medical Treatment – current revision; available at <http://www.americanchemistry.com/phosgenepanel>