



COMPRESSED GAS ASSOCIATION, INC.

SAFETY BULLETIN

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HAZARDS OF REFILLING OR REUSING COMPRESSED REFRIGERANT (HALOGENATED HYDROCARBON) GAS CYLINDERS

Hazards of refilling compressed refrigerant (halogenated hydrocarbon) gas cylinders

Serious personal injury and property damage can result from improperly refilled refrigerant cylinders. This is an area of serious concern to the Compressed Gas Association (CGA) because such accidents frequently involve cylinders that have been refilled in the field by unqualified persons who have had no training, have inadequate knowledge of the hazards, and/or lack the proper equipment.

NOTE—Federal regulations (40 CFR 82.34 and 82.154) require personnel who work with ozone depleting substances to be trained and certified [1].

It should be emphasized that the so-called disposable, nonreturnable, or nonrefillable thin-walled cylinders manufactured under U.S. Department of Transportation (DOT) Specification 39 (49 CFR 178.65) or Transport Canada (TC) Specification 39M and CTC-39 (CSA B340, *Selection and Use of Cylinders, Spheres, Tubes and Other Containers for the Transportation of Dangerous Goods, Class 2* section 4.6.5.4) *shall never be refilled* [2, 3].

Even those cylinders that are designed and manufactured for repetitive use can pose safety hazards when inexperienced operators, who lack adequate equipment and/or have insufficient knowledge of proper filling densities and other properties of the gases being handled, refill the cylinders. Liquid densities and therefore, safe filling limits vary for each refrigerant. A cylinder rupture causing serious personal injury or property damage can result from inadvertent overfilling. All operations involving the transfer of refrigerant gases from one cylinder to another require adequate equipment and experienced personnel, who have a thorough understanding of equipment operation and maintenance, to avoid these hazards and to prevent possible contamination of the refrigerant.

Requirements for basic safety measures, including cylinder specifications, filling, inspections, and handling and transporting compressed gases in cylinders, are included in the DOT regulations. Some important items in the regulations are:

- The specification for the required type of cylinder, valve protection, and pressure relief device based on the working pressure for each particular refrigerant;
- The stipulation of a maximum filling limit by cylinder type for each refrigerant gas;
- The requirement for periodic reinspection or hydrostatic testing of cylinders;
- The frequent inspection, repair, or replacement of pressure relief devices and other components; and
- The maximum civil and criminal penalties for violations of the regulations as described in 49 CFR Part 107.329(b) and 107.333 [2]. For example, the civil penalty referred to in 107.329(b) provides for a fine of not less than \$250 and not more than \$27,000, and the criminal penalty referred to in 107.333 provides for a fine or imprisonment for up to 5 years or both.

Dangers of cylinder refilling by untrained persons

Overfilling. Faulty charging equipment and inadequate technical knowledge of the proper filling densities and properties of the refrigerant being handled may lead to charging a cylinder beyond its safe capacity. This may not be evident at the time of charging, but an increase in temperature can lead to cylinder failure. The consequences can involve serious personal injury, severe property damage, or both. Never exceed the legal fill weight.

Use of improper containers. Minimum cylinder test criteria, materials, and fabrication techniques are published in DOT's specifications. Only containers and their appurtenances that satisfy these requirements should be used.

Loss of product quality. Each time a refrigerant is transferred, whether into equipment or into another cylinder, take precautions to preserve the quality of the product. Exclusion of contamination is essential to good performance and trouble-free operation of mechanical refrigeration and air conditioning equipment. Handling of a refrigerant transfer by nonexperts can introduce significant harmful contamination and render the gas unfit for use.

Manufacturers and suppliers of refrigerant gases are thoroughly familiar with the safety requirements of their products. They are equipped and staffed to perform the required testing of cylinders and auxiliary equipment and are qualified to perform essential maintenance work where necessary. As a final quality control measure, all refrigerant manufacturers analyze their products to make sure the packaged refrigerant meets acceptable purity standards. Generally, the analytical equipment essential to this task is not available in the field.

Hazards of reusing disposable refrigerant (halogenated hydrocarbon) gas cylinders

All "nonreusable," "disposable," "nonreturnable," or "nonrefillable" cylinders manufactured according to DOT or TC Specification 39 are:

- Designed for one-use service with a specific product and are considered by DOT and TC to be unserviceable after one use. These cylinders shall not be refilled or reused as containers for any pressurized liquid or gas;
- Designed as "thin-walled containers" and must be protected from mechanical abuse and, as such, are to be transported only when overpacked by a suitable protective structure; and
- Not to be refilled with any other material classified as hazardous by DOT regulations or as dangerous goods by TC's *Transportation of Dangerous Goods Regulations* [4]. DOT and TC prohibit refilling and transportation.

In the United States, each cylinder is marked with the following statement as required by 49 CFR 178.65(i)(2)(viii) [2]:

- For cylinders manufactured prior to October 1, 1996, "Federal law forbids transportation if refilled—penalty up to \$25,000 fine and 5 years imprisonment (49 U.S.C. 1809)," or "Federal law forbids transportation if refilled—penalty up to \$500,000 and 5 years imprisonment (49 U.S.C. 5124)."
- For cylinders manufactured on or after October 1, 1996, "Federal law forbids transportation if refilled—penalty up to \$500,000 fine and 5 years imprisonment (49 U.S.C. 5124)."

In Canada, the letters "NRC/RU" (nonrefillable container/*remplissage unique*) are required to be marked on the container, as a minimum, as outlined in CSA B339, *Cylinders, Spheres, and Tubes for the Transportation of Dangerous Goods* [5].

In Canada, refilling of Specification TC-39M and CTC-39 containers is prohibited by clause 4.6.5.4 of CSA B340 [3].

These stringent regulations were put into effect in recognition of the dangers inherent in the misuse of these special cylinders, which were designed for only limited service. Unfortunately, such misuse has already resulted in a number of severe personal injuries caused by ruptured cylinders. Cylinder failure in most of these cases could be attributed to the use of gases or liquids other than those for which the cylinder was intended.