



Standard Practice for Handling, Transportation, and Storage of Halon 1211, Bromochlorodifluoromethane (CF₂BrCl)¹

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1. Scope

1.1 This practice covers guidance and direction to suppliers, recyclers, reclaimers, purchasers, and users in the handling, transportation, and storage of Halon 1211.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

D7673 Specification for Halon 1211, Bromochlorodifluoromethane (CF₂BrCl)

2.2 CGA Standards:³

C-6 Standards for Visual Inspection of Steel Compressed Gas Cylinders

C-7 Guide to Preparation of Precautionary Labeling and Marking of Compressed Gas Containers

P-1 Safe Handling of Compressed Gases in Containers

SB-1 Hazards of Refilling Compressed Refrigerant (Halogenated Hydrocarbon) Gas Cylinders

SB-5 Hazards of Reusing Disposable Refrigerant (Halogenated Hydrocarbon) Gas Cylinders

SB-18 Use of Refrigerant (Halogenated Hydrocarbon) Recovery Cylinders

2.3 U.S. Government Standards:⁴

CFR Title 40, Part 82.106 Environmental Protection Agency, Warning Statement Requirements

CFR Title 49, Part 172 U.S. DOT, Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements

CFR Title 49, Part 172.101 U.S. DOT, Tables of Hazardous Materials and Special Provisions

CFR Title 49, Part 173 U.S. DOT, Shippers-General Requirements for Shipping and Packagings

CFR Title 49, Part 178 U.S. DOT Specifications for Packagings

CFR Title 49, Part 180 U.S. DOT, Continuing Qualification and Maintenance of Packagings

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *containers*—storage vessel for Halon 1211.

3.1.2 *cylinders*—containers of Halon 1211.

3.1.3 *Halon 1211*—bromochlorodifluoromethane; a compound used to suppress a fire.

3.1.4 *insulated*—placed in an isolated situation to protect and prevent the transfer of damage.

4. Significance and Use

4.1 This practice provides requirements for the handling, transportation, and storage of Halon 1211 encountered in distribution through both commercial and military channels. It is intended to ensure that Halon 1211 is handled, transported, and stored in such a way that its physical property values are not degraded. Transport may be by various means, such as, but not limited to, highway, rail, water, and air.

5. Practice

5.1 To ensure safe handling, loading, storing, and transporting of material, personnel shall be trained in the CGA

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from the Compressed Gas Association.

⁴ Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20036.

publications, CFR regulations, and other documents, as listed in Sections 2.2 and 2.3, respectively.

5.2 Handling:

5.2.1 Handling shall be in accordance with CGA Publication P-1 *Safe Handling of Compressed Gases in Containers*.

5.2.1.1 Personnel who handle or store, or both, cylinders of Halon 1211 shall be trained properly to recognize and identify the characteristics of the product and the proper methods of safely handling full, partly full, and empty cylinders.

5.2.2 All Halon transfers between storage containers and recycling processes shall be performed by personnel trained in handling procedures.

5.2.3 Halon 1211 recycling and transfer processes shall be in conjunction with the equipment requirements specified by the manufacturer.

5.2.4 Halon 1211 handling shall be in nonsmoking, heater-free, ventilated areas to preclude product accumulation. Provisions shall be made to ensure that service areas limit Halon 1211 concentrations to not exceed 1 % by volume for 1 min and 0.01 % by volume for a time weighted exposure of 8 h.

5.2.5 Cylinders shall not be over filled. The liquid portion of the liquefied gas shall not completely fill the container's internal volume and the pressure shall not exceed five fourths the service pressure of the container at any temperature up to and including 130°F (54°C). The maximum permitted filling density for Type I product in accordance with Specification D7673 shall be 100 lb/ft³ (1602 kg/m³). Filling density requirements are specified in CFR Title 49, Part 173.304 and CFR Title 49, Part 173.305.

5.2.6 Handling of materials should be done in a manner that prevents contamination or commingling of materials other than Halon 1211.

5.2.7 Cylinders shall be free of dirt and contamination that would contribute to or would cause deterioration of the product during shipment or storage. Precautions should be taken to prevent the entry of oil, water, or any other foreign matter into the container. Unique coatings or preservatives applied prior to shipment to protect the containers are not considered contamination.

5.3 Transportation:

5.3.1 Transportation shall be as specified in accordance with DOT regulations of CFR Title 49 .

5.3.1.1 Shipment of materials between distributors, collectors, recyclers, and reclaimers should be within approved DOT guidelines for Class 2.2, regulated materials. Any further provisions for special transportation or packaging should be agreed upon between the collectors, recyclers, and reclaimers.

5.3.1.2 The minimum design pressure requirements shall be as stated in CFR Title 49, Part 173.304. The pressure inside the container at 70°F (21°C) shall not exceed the service pressure for which the container is marked. The pressure inside the container at 130°F (54°C) shall not exceed five fourths the service pressure for which the container is marked. Fig. 1 illustrates the effect of temperature on cylinders filled with mixtures of Halon 1211 and nitrogen.

5.3.2 Where possible, transportation shall be by suitable vehicles to preclude cylinder damage by excessive mechanical

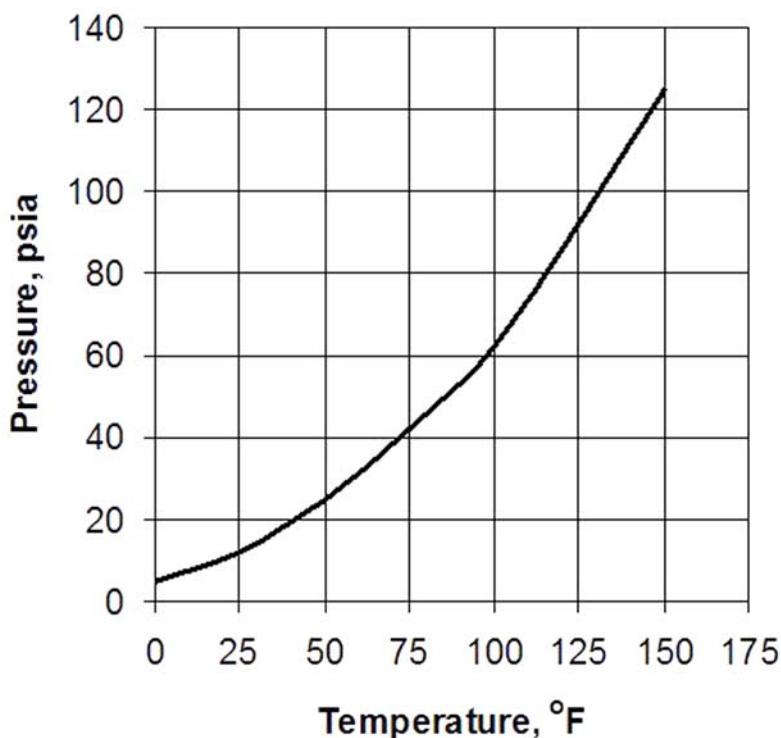


FIG. 1 Vapor Pressure of Halon 1211 versus Temperature

vibration, shock, freezing, or deleterious high temperatures throughout the entire transport route.

5.3.2.1 If cylinders are likely to be subject to unacceptable transport conditions, the cylinders should be placed under insulated conditions.

5.3.3 Compressed gas cylinder permanent marking requirements shall be in accordance with CFR Title 49, Part 178 and must be maintained in legible condition as required by CFR Title 49, Part 173. Warning labels shall be affixed to the cylinders conforming to the requirements of CFR Title 40, Part 82.106.

5.3.4 Containers used for shipping of Halon 1211 conforming to Specification **D7673** shall be marked in accordance with CFR Title 49, Part 172 Subpart D “Marking.” The proper shipping name for Specification **D7673** Type II (pure) Halon 1211 is “Chlorodifluorobromomethane or Refrigerant Gas R12B1 (do not list both),” UN 1974, Hazard Class 2.2 (nonflammable gas). The proper shipping name for nitrogen superpressurized Halon 1211 is “Liquefied Gas, nonflammable charged with nitrogen,” UN1058, Hazard Class 2.2 (nonflammable gas).

5.4 Storage:

5.4.1 Storage shall be in accordance with CGA Publication P-1 *Safe Handling of Compressed Gases in Containers*, in qualified cylinders in accordance with CFR Title 49, Parts 173 and 178.

5.4.2 Cylinders should be stored in areas that will protect vessels from physical and environmental damage, and tampering from unauthorized personnel.

5.4.2.1 Facilities should be constructed and oriented so that safety requirements are fulfilled for storage of pressurized cylinders.

5.4.3 Storage containers shall be fitted with pressure-release mechanisms to limit vessel pressure to not more than the minimum required test pressure of the cylinder. Safety relief valves shall be set at no less than 75 %, nor more than 100 %, of the minimum required test pressure of the cylinder. Safety relief valves shall be in contact with the vapor space of the cylinder.

5.4.3.1 Periodic hydrostatic testing and re-inspection of cylinders used for Halon 1211 shall comply with CFR Title 49, Part 173.34.

5.4.4 Containers used for storage of Halon 1211 conforming to Specification **D7673** shall be clearly marked and labeled to

identify whether the Halon 1211 contained conforms to either Type I or Type II of Specification **D7673**. The proper storage name for Specification **D7673** Type II (pure) Halon 1211 is “Chlorodifluorobromomethane or Refrigerant Gas R12B1 (do not list both),” UN 1974, Hazard Class 2.2 (nonflammable gas). The proper storage name for nitrogen superpressurized Halon 1211 is “Liquefied Gas, nonflammable charged with nitrogen,” UN1058, Hazard Class 2.2 (nonflammable gas).

5.4.5 Insulation shall be placed on pallets or shoring and provisions should be made to prevent excessive shock or thermal fluctuations to cylinders.

5.4.6 Cylinders shall be stored in a manner that will prevent contamination from external sources.

5.4.6.1 If Halon 1211 in accordance with Specification **D7673** is stored in the same area as material not in accordance with Specification **D7673**, storage shall be segregated or clearly identifiable as not being similar.

5.5 *Extreme Elevated Temperature Considerations*—When Type I or Type II mixtures of Halon 1211 may be exposed to constant temperatures at or greater than 131°F (55°C) during transportation or storage, higher container pressures will be encountered that require alternative fill in the container to that specified in 5.2.5. A maximum non-condensable gas content of 1.5 % is recommended for long-term storage of Type II Halon 1211. The vapor pressure diagram for Type II Halon 1211 is shown in Fig. 1.

6. Inspection

6.1 Halon 1211 that has been reclaimed or recycled using approved reclamation systems may be released for reissue, provided test examination to validate the material to specification is fulfilled.

6.1.1 Reclaimed or recycled Halon 1211 that cannot be proven to comply with Specification **D7673** shall not be reissued. The material shall be processed by environmentally safe methods until conformance to the product standard is achieved.

7. Keywords

7.1 bromochlorodifluoromethane; chlorodifluorobromomethane; Refrigerant Gas R 12B1; CF₂BrCl; compressed gas; compressed liquefied gas; cylinders; explosion suppressant; fire suppressant; Halon 1211; handling; reclamation; recovery; recycling; storage; transport

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