



# Standard Practice for Handling, Transportation, and Storage of HFC-236fa, 1,1,1,3,3,3-Hexafluoropropane (CF<sub>3</sub>CH<sub>2</sub>CF<sub>3</sub>)<sup>1</sup>

This standard is issued under the fixed designation D6427; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This practice covers guidance and direction to suppliers, purchasers, and users in the handling, transportation, and storage of HFC-236fa.

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:<sup>2</sup>

D6541 Specification for HFC-236fa, 1,1,1,3,3,3-Hexafluoropropane, (CF<sub>3</sub>CH<sub>2</sub>CF<sub>3</sub>)

### 2.2 CGA Standards:<sup>3</sup>

C-1 Methods for Pressure Testing Compressed Gas Cylinders

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

C-7 Guide to Classification and Labeling of Compressed Gases

P-1 Standard for Safe Handling of Compressed Gases in Containers

SB-1 Safety Bulletin: Hazards of Refilling or Reusing Compressed Refrigerant (Halogenated Hydrocarbon) Gas Cylinders

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

### 2.3 U.S. Government Standards:<sup>4</sup>

Code of Federal Regulations (CFR) Title 40, Part 82.106 Environmental Protection Agency, Warning Statement Requirements

CFR Title 49, Part 172 U.S. Department of Transportation (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 Packages

## 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *containers, n*—storage vessel for HFC-236fa.

3.1.2 *cylinders, n*—containers of HFC-236fa.

3.1.3 *HFC-236fa, n*—1,1,1,3,3,3-hexafluoropropane, a compound used to inert or suppress a fire or explosion hazard.

3.1.4 *insulated, v*—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 HFC-236fa encountered in distribution through both commercial and military channels. It is intended to ensure that HFC-236fa is handled, transported, and stored in such a way its physical properties are not degraded. Transport may be by various means, such as, but not limited to, highway, rail, water, and air.

<sup>4</sup> Available from U.S. Government Publishing Office, 732 N. Capitol St., NW, Washington, DC 20401-0001, <http://www.gpo.gov>.

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee D26 on Halogenated Organic Solvents and Fire Extinguishing Agents and is the direct responsibility of Subcommittee D26.09 on Fire Extinguishing Agents.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from Compressed Gas Association (CGA), 14501 George Carter Way, Suite 103, Chantilly, VA 20151, <http://www.cganet.com>.

## 5. Practice

5.1 To ensure safe handling, loading, unloading, storing, and transporting of material, personnel shall be trained in the CGA publications and Title 49 CFR regulations as listed in 2.2 and 2.3, respectively.

### 5.2 Handling:

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

5.2.1.1 Personnel who handle or store, or both, cylinders of HFC-236fa 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 HFC-236fa transfers between storage containers and recycling processes shall be performed by personnel trained in handling procedures.

5.2.2.1 Facility personnel must be trained in applicable Code of Federal Regulations (CFR) Title 49, Part 173 and Code of Federal Regulations (CFR) Title 49, Part 178, and the CGA documents referenced in 2.2.

5.2.3 The HFC-236fa recycling and transfer processes shall be in conjunction with the equipment specified by the manufacturer.

5.2.4 The handling of HFC-236fa shall be in nonsmoking, heater-free, ventilated areas to preclude product accumulation. Provisions shall be made to ensure that service areas limit HFC-236fa concentrations to not exceed 15 % for 1 min and 0.1 % for 8 h.

5.2.5 Cylinders shall not be over filled. The liquid portion of the liquefied gases must not completely fill the container's internal volume at any temperature up to and including 130°F (54°C). The maximum permitted filling density for HFC-236fa shall be 78 lb/ft<sup>3</sup> (1249 kg/m<sup>3</sup>). The maximum permitted filling density for HFC-236fa pressurized with nitrogen to 360 psig (25.8 bar) at 70°F (21°C) shall be 72 lb/ft<sup>3</sup> (1153 kg/m<sup>3</sup>). The maximum permitted filling density for HFC-236fa pressurized with nitrogen to 600 psig (42.4 bar) at 70°F (21°C) shall be 70 lb/ft<sup>3</sup> (1121 kg/m<sup>3</sup>). Filling density requirements are specified in Code of Federal Regulations (CFR) Title 49, Part 173 and Title 49 CFR, 173.305.

5.2.6 Handling of materials should be done in a manner that prevents contamination or commingling of materials other than HFC-236fa.

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 Shipment of materials between distributors, collectors, recyclers, and reclaimers shall be as specified in accordance with DOT regulations of Title 49 CFR.

5.3.1.1 The minimum design pressure requirements shall be as stated in Title 49 CFR, Part 173.301. 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  $\frac{5}{4}$  the service pressure for which the container is marked. Fig. 1 illustrate the saturated vapor pressure of HFC-236fa. Fig. 2 and Fig. 3 illustrate the effect of temperature on cylinders filled with HFC-236fa and super pressurized with nitrogen at 70°F (21°C) to 360 psig (25.8 bar) and 600 psig (42.4 bar), respectively.

5.3.2 Transportation shall be in suitable vehicles to preclude cylinder damage by excessive mechanical vibration, shock, freezing, or deleterious high temperatures throughout the entire transport route.

5.3.2.1 If cylinders are expected 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 as specified under Code of Federal Regulations (CFR) Title 49, Part 178 and must be maintained in legible condition as required by Code of Federal Regulations (CFR) Title 49, Part 173. Warning labels shall be affixed to the cylinders conforming to requirements of Code of Federal Regulations (CFR) Title 40, Part 82.106.

### 5.4 Storage:

5.4.1 Storage shall be in accordance with P-1, in qualified cylinders in accordance with Code of Federal Regulations (CFR) Title 49, Part 173 and Code of Federal Regulations (CFR) Title 49, Part 178.

5.4.2 The cylinder 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 orientated so that safety requirements are fulfilled for storage of pressurized cylinders.

5.4.3 Storage cylinders 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 not 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 reinspection of cylinders used for HFC-236fa shall comply with Code of Federal Regulations (CFR) Title 49, Part 180.

5.4.4 Containers shall be clearly marked and labeled to identify whether the HFC-236fa container conforms to Specification D6541.

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 HFC-236fa meeting the standards of Specification D6541 is stored in the same area as material not meeting this requirement, storage shall be segregated or clearly identifiable as not similar.

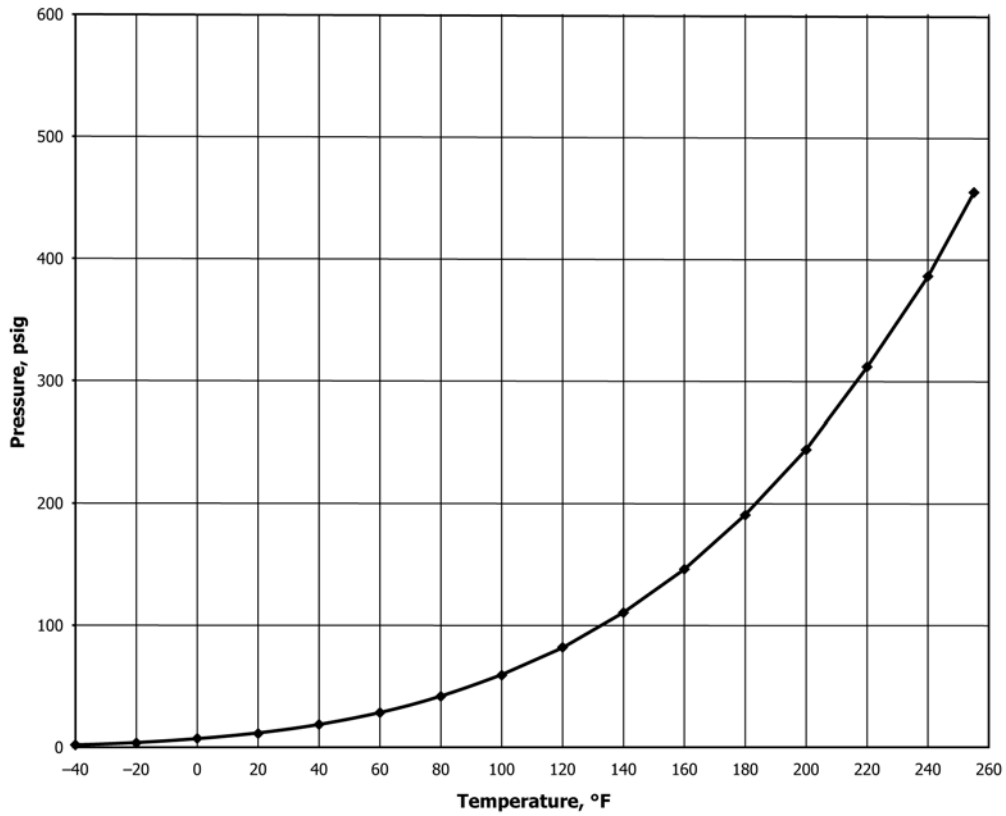


FIG. 1 Saturated Vapor Pressure of HFC-236fa

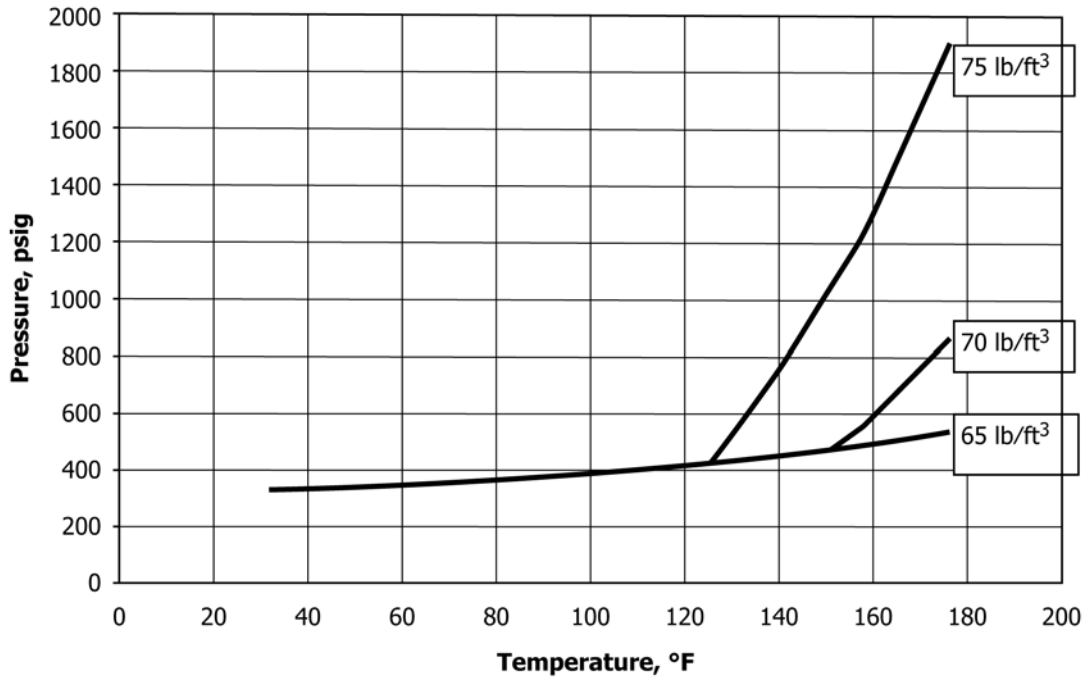


FIG. 2 Isometric Diagram of HFC-236fa Pressurized to 360 psig (25.8 bar) with Nitrogen at 70°F (21°C)

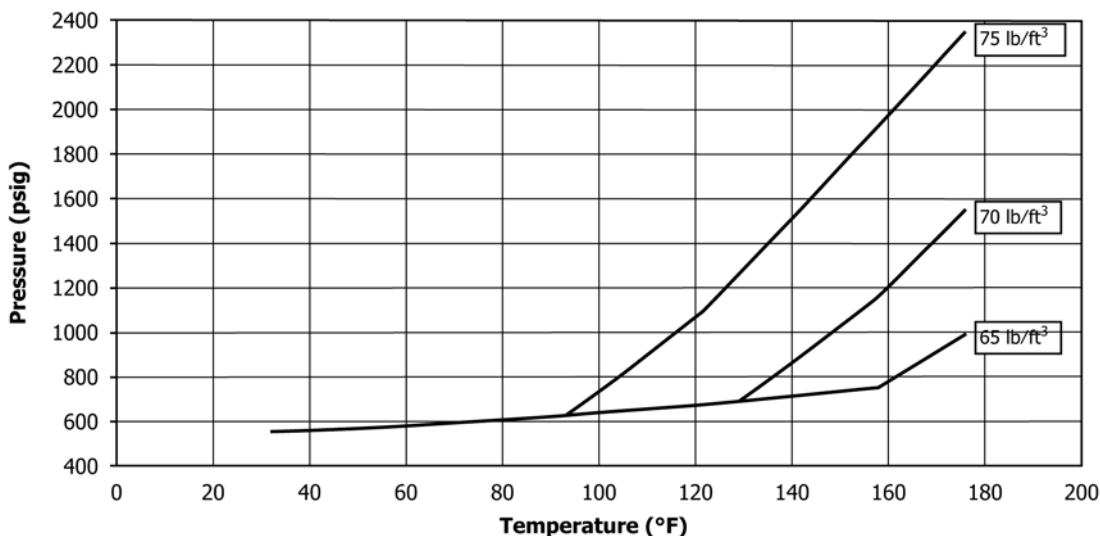


FIG. 3 Isometric Diagram of HFC-236fa Pressurized to 600 psig (42.4 bar) with Nitrogen at 70°F (21°C)

## 6. Inspection

6.1 The HFC-236fa that is reclaimed using approved reclamation systems may be released for reissue, provided test examination to validate the material to specification is fulfilled.

6.1.1 Reclaimed HFC-236fa that cannot be proven to comply with ASTM specifications for HFC-236fa shall not be reissued. The material shall be processed by environmentally acceptable methods until conformance to the product standard is achieved.

## 7. Keywords

7.1 1,1,1,3,3,3-hexafluoropropane;  $\text{CF}_3\text{CH}_2\text{CF}_3$ ; compressed gas; compressed liquefied gas; cylinders; explosion suppressant; FE-36<sup>5</sup>; fire suppressant; handling; HFC-236fa; storage; transport, reclamation, recovery, recycling

<sup>5</sup> FE-36 is a trademark of Dupont.

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