Designation: D6231/D6231M – 21

Standard Specification for HFC-125 (Pentafluoroethane, C_2HF_5)[1]

This standard is issued under the fixed designation D6231/D6231M; 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 (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers the requirements for HFC-125 as a fire-fighting medium.

1.2 This specification does not address the fire-fighting equipment or hardware that employs HFC-125 or the conditions of employing such equipment, for example, hand helds, fixed installations, etc.

1.3 This specification does not address the storage or transportation of HFC-125. Storage, handling, and transportation issues are addressed in Practice D6268.

1.4 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.5 The following safety hazards caveat pertains to the test methods portion, Section 6, of this specification. *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* Specific hazards statements are given in 4.3.

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D6268 Practice for Handling, Transportation, and Storage of HFC-125, Pentafluoroethane (C_2HF_5)

D6806 Practice for Analysis of Halogenated Organic Solvents and Their Admixtures by Gas Chromatography

2.2 *U.S. Government Standards:*[3]

49 CFR Part 172 Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, Training Requirements, and Security Plans

49 CFR Part 172.101 Purpose and Use of Hazardous Materials Table

2.3 *AHRI Standard:*[4]

2008 Appendix C for Analytical Procedures for AHRI Standard 700-2014

2.4 *ASHRAE Standard:*[5]

ASHRAE Standard 34 Designation and Safety Classification of Refrigerants

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *halogenated hydrocarbon, n*—the halogenated compound coding terminology system provides a convenient means to reference halogenated hydrocarbons (see ASHRAE Standard 34). Halogenated hydrocarbons are saturated hydrocarbons in which one or more of the hydrogen atoms have been replaced by atoms of the halogen series: fluorine, chlorine, bromine, and iodine. It is convention to prefix the number with an abbreviation of the compound:

CFC = chlorofluorocarbon
HCFC = hydrochlorofluorocarbon
HFC = hydrofluorocarbon
FC = fluorocarbon
R = refrigerant

[1] This specification 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.

Current edition approved June 1, 2021. Published June 2021. Originally approved in 1998. Last previous edition approved in 2015 as D6231-11 (2015). DOI: 10.1520/D6231_D6231M-21.

[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] Code of Federal Regulations (CFR) documents available from U.S. Government Publishing Office (GPO), 732 N. Capitol St., NW, Washington, DC 20401, http://www.gpo.gov.

[4] Available from the Air-Conditioning, Heating, and Refrigeration Institute (AHRI), 2311 Wilson Blvd., Suite 400, Arlington, VA, 22201, http://www.ahrinet.org.

[5] Available from American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE), 1791 Tullie Circle, NE, Atlanta, GA 30329, http://www.ashrae.org.

3.1.1.1 *Discussion*—By definition, the right–most digit of the numbering system is the number of fluorine atoms. The second digit from the right is the number of hydrogen atoms plus one (+1). The third digit from the right is one less (–1) than number of carbon atoms in the compound (when this number is zero (0) it is omitted from the number). Unaccounted for valance requirements are assumed to be chlorine atoms. When the compound contains bromine or iodine, the same rules apply except the letter "B" for bromine or "I" for iodine follows the parent compound designated number and the number of the atoms is placed after the letter.

$$\text{Example: } C_2HF_5 = \text{R-125} = \text{HFC-125} \quad (1)$$

3.1.2 *HFC-125, n*—the compound pentafluoroethane; C_2HF_5.

4. Material Requirements

4.1 *Type I:*

4.1.1 The nitrogen (N_2) partial pressure shall be such that the safe working pressure of the receiving vessel is not exceeded. To prevent excessive pressure, the fill density of the HFC-125/nitrogen within the container should not exceed that needed to achieve complete filling of the container at the maximum expected storage temperature. For example, the U.S. Department of Transportation (DOT) 4BA500 cylinder partial pressure shall not exceed 24.8 bar at 21 °C [360 psig at 70 °F] for a 833 kg/m^3 [52 lb/ft^3] fill density. For this example, the safe working pressure of the 4BA500 cylinder is not exceeded for temperatures below 54 °C [130 °F].

4.1.2 HFC-125 shall conform to the requirements prescribed in Table 1 when tested by the appropriate test method(s) listed in Section 6.

4.1.3 When material analysis is required, by agreement between the purchaser and the supplier, the total pressure in the HFC-125 container, partial pressure of the nitrogen, the fill density of the HFC-125 within the container, and the maximum safe storage temperature shall be part of the material analysis (certification). The pressure shall be reported in bar (preferred) or pound-force/in.^{2} gage (psig). The fill density shall be reported in kg/m^3 at 21 °C (preferred) or lb/ft^3 at 70 °F. The maximum safe storage temperature of the HFC-125 shall be reported in degrees Celsius (preferred) or in degrees Fahrenheit and shall conform to the applicable regulations for the HFC-125 container design and use.

4.2 *Type II*—HFC-125 shall conform to the requirements of Type I as listed in 4.1 and shall contain no more than 1.5 % by volume non-absorbable gases in the vapor phase, expressed as air when tested by the appropriate test method(s) listed in Section 6.

TABLE 1 Requirements

Property	Requirement
HFC-125 purity, mol/mol, min, %	99.0
Acidity, ppm by mass, as HCl, max	3.0
Water content, ppm by mass, max	10
Nonvolatile residue, max, % by weight	0.08
Suspended matter or sediment	none visible

4.3 By agreement between the purchaser and the supplier, analysis may be required and limits established for elements or compounds not specified in Table 1. (**Warning—**Exposure to concentrations of HFC-125 in excess of 10 % by volume in air during periods of elevated adrenaline could produce cardiac arrhythmia in some personnel.)

4.4 Unless otherwise specified, Type I is assumed.

5. Sampling

5.1 Samples of HFC-125 shall be taken from the liquid phase in a closed system as described in 2008 Appendix C to AHRI Standard 700-2014, Part 7.

5.2 The HFC-125 selected in accordance with 5.1 shall be tested for quality conformance in accordance with Section 6. The presence of one or more defects shall be cause for rejection.

6. Test Methods

6.1 *Purity*—Conduct the analysis in accordance with Practice D6806, or in accordance with 2008 Appendix C to AHRI Standard 700-2014, Part 7.

6.2 *Acidity*—Conduct the analysis in accordance with the method specified in 2008 Appendix C to AHRI Standard 700-2014, Part 1.

6.3 *Water Content*—Conduct the analysis in accordance with the method specified in 2008 Appendix C to AHRI Standard 700-2014, Part 2.

6.4 *Nonvolatile Residue*—Conduct the analysis in accordance with the method specified in 2008 Appendix C to AHRI Standard 700-2014, Part 3.

6.5 *Suspended Matter or Sediment*—While performing the nonvolatile residue analysis, examine visually for any suspended matter or sediment. Observation of any suspended matter or sediment shall constitute failure by this test method.

7. Container, Packaging, and Package Marking

7.1 Containers used for shipping and storage of HFC-125 conforming to this specification shall be marked in accordance with 49 CFR Part 172, Subpart D. The proper shipping name is UN3220, pentafluoroethane, "nonflammable gas" (49 CFR 172.101). The proper shipping name for nitrogen superpressurized 1,1,1,3,3,3–hexafluoropropane is "Liquefied Gas, nonflammable charged with nitrogen," UN1058 (49 CFR 172.101). In addition to DOT requirements, containers shall be marked with the following information as a minimum:

7.1.1 Supplier's name and address.

7.1.2 HFC-125 (pentafluoroethane).

7.1.3 Statement that material conforms to ASTM Specification D6231.

8. Keywords

8.1 C_2HF_5; FE-25[6]; fire fighting; fire fighting agent; fire protection; fire suppressant; HFC-125; hydrofluorocarbon; hydrofluorocarbon 125; pentafluoroethane

[6] FE-25 is a trademark of The Chemours Company.