

AHRI Guideline K-2024 (I-P)

Containers for
Recovered
Fluorocarbon
Refrigerants



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ICS Code: 71.100.45

Note:

This guideline supersedes AHRI Guideline K-2015.

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Intent

This guideline is intended for the guidance of the industry, including manufacturers, engineers, installers, contractors, and users.

Review and Amendment

This guideline is subject to review and amendment as technology advances.

2024 Edition

This edition of AHRI Guideline K, *Containers for Recovered Fluorocarbon Refrigerants*, was prepared by the Refrigerants/Refrigerant Recovery Standards Technical Committee. The guideline was approved by the Multi-sector Standards Subcommittee on 9 April 2024.

Origin and Development of AHRI Guideline K

The initial publication was ARI Guideline K-1997, *Containers for Recovered Non-flammable Fluorocarbon Refrigerants*. Subsequent revisions were:

- ARI Guideline K-2004, *Containers for Recovered Non-flammable Fluorocarbon Refrigerants*
- AHRI Guideline K-2009, *Containers for Recovered Non-flammable Fluorocarbon Refrigerants*
- AHRI Guideline K-2015, *Containers for Recovered Non-flammable Fluorocarbon Refrigerants*

Summary of Changes

AHRI Guideline K-2024 (I-P) contains the following updates to the previous edition:

- To maintain AHRI Guideline K and make necessary changes to keep the guideline relevant in today's market:
 - Updated to include recovery cylinders for flammable refrigerants
 - Updated to meet the latest AHRI *Style Guide*

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Refrigerants/Refrigerant Recovery Standards Technical Committee (STC) Scope:

The Refrigerants/Refrigerant Recovery STC is responsible for the development and maintenance of AHRI standards and guidelines pertaining to refrigerants as defined in ASHRAE 34, and related refrigerant recovery equipment.

Out of scope for this STC are refrigerants not defined in ASHRAE 34.

Multi-sector Products Standards Subcommittee

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Multi-sector Products Standards Subcommittee (SSC) Scope:

The scope of the Multi-sector Products SSC is standards and guidelines related to components that are part of and methods that are for end products from any AHRI product sector. (The definition of and list of products associated with each sector are found on the AHRI website at www.ahrinet.org.)

These lists represent the membership at the time the Standards Technical Committee and Standards Subcommittee were balloted on the final text of this edition. Since that time, changes in the membership may have occurred. Membership on these committees shall not in and of itself constitute an endorsement by the committee members or their employers of any document developed by the committee on which the member serves.

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CONTAINERS FOR RECOVERED FLUOROCARBON REFRIGERANTS

Section 1. Purpose

Recovery, recycling, and *reclamation* of certain fluorocarbon refrigerants that are required to be recovered by EPA regulations can prevent unnecessary release of these compounds. For practical and safety reasons, there is a need for containers designed and identified specifically for these uses. This guideline is intended to be used on a voluntary basis for supply, use, store, or transport of containers for recovered fluorocarbon refrigerants. Federal requirements are referenced as of the date of publication of this guideline. This guideline does not provide a complete list of all applicable federal requirements. Applicable federal, state, and local requirements should be reviewed.

Section 2. Scope

2.1 Scope

This guideline applies to cylinders with a maximum *service pressure* of 400 psig and ton tanks with a maximum *service pressure* of 500 psig for the receipt, storage, and transportation of *recovered fluorocarbon refrigerants*.

Where this guideline mentions regulations that are mandated by the United States Federal Government, the reference to the Federal regulation is provided.

2.2 Exclusions

This guideline does not apply to American Society of Mechanical Engineers (ASME) pressure vessels for on-site recovery and storage that are not U.S. Department of Transportation (DOT) approved for transportation of fluorocarbon refrigerants.

Section 3. Definitions

All terms in this document follow the standard industry definitions in the *ASHRAE Terminology* website unless otherwise defined in Section [3.2](#). These guideline-specific defined terms are italicized throughout the guideline.

3.1 Expression of Provisions

Terms that provide clear distinctions between requirements, recommendations, permissions, options, and capabilities.

3.1.1 “Can” or “cannot”

Express an option or capability.

3.1.2 “May”

Signifies a permission expressed by the document.

3.1.3 “Must”

Indication of unavoidable situations and does not mean that an external constraint referred to is a requirement of the document.

3.1.4 “Should” or “should not”

Indication of recommendations rather than requirements. In the negative form, a recommendation is the expression of potential choices or courses of action that is not preferred but not prohibited.

3.2 Guideline-specific Definitions

3.2.1 Reclamation

The reprocessing of refrigerant to new product specifications, by means that can include distillation. Chemical analysis of the refrigerant is used to determine that appropriate product specifications are met. This term can refer to the use of processes or procedures that can only be completed at a reprocessing or manufacturing facility.

3.2.2 Recovered Fluorocarbon Refrigerant

Refrigerant that has been removed from a system for the purpose of storage, recycling, *reclamation*, or transportation.

3.2.3 Service Pressure

The rated pressure marked on the cylinder or ton tank.

3.2.4 Special Permit Cylinder

A cylinder that has been by authorized by the DOT to be manufactured outside the scope of existing DOT regulations but in accordance with the requirements specified by DOT in a special permit. The requirements in the special permit can include design, composition, manufacture, testing, marking, and transportation criteria as well as special provisions.

Section 4. Containers

4.1 Cylinders for Recovered Fluorocarbon Refrigerants

See [Appendix B](#).

Federal law requires that cylinders comply with United States DOT packaging requirements, in accordance with CFR Title 49, or as specified in an applicable special permit as provided by the cylinder manufacturer.

Note: Federal law 49 U.S.C. 5124 forbids the transportation of DOT Specification 39 (see CFR Title 49) nonreusable/non-refillable cylinders, if refilled. Non-refillable cylinders meeting DOT Specification 39 should not be refilled or reused for any reason due to risk of serious personal injury.

4.1.1 Valve Outlet Connections

- 1) For non-flammable recovery cylinders, the valve outlets shall be right-handed threads,
- 2) For flammable recovery cylinders, the valve outlets shall be left-handed threads.
- 3) Valve outlet connections should comply with CGA V-1.
- 4) Pressure relief devices are required to comply with CGA S-1.1.
- 5) Valves used for vapor or liquid withdrawal, or both, should be clearly identified and marked.
- 6) For flammable fluorocarbon refrigerants please refer to Guideline M for additional valve specifications

4.2 Ton Tanks for Recovered Fluorocarbon Refrigerants

See [Appendix B](#).

Federal law requires that ton tanks comply with United States DOT specification 106A500X or 110A500W as detailed in 49 CFR Part 179, Subpart E.

Valve outlet connections should comply with CGA V-1.

Federal law, CFR Title 49, requires that pressure relief devices comply with CGA S-1.1.

For flammable fluorocarbon refrigerants, please refer to Guideline M for additional valve specifications.

4.3 Steel Drums for Recovered Low Pressure Liquid Fluorocarbon Refrigerants as referred to in Guideline N

DOT Specifications require that steel drums comply with UN Specification 1A1, as per 49 CFR Part 178, Subpart L.

Containers that originally contained new low pressure liquid fluorocarbon refrigerants (excluding those originally used for cleaning agents) can be used, provided the following:

- 1) The drums should be inspected internally and externally and found to be clean and free of dents, bulges, holes, cracks, rust, pits, creases, or other structural weaknesses.
- 2) Closure devices, including gaskets, should comply, in all respects, with the original requirements for the drum.
- 3) Drums that originally contained low pressure liquid fluorocarbon refrigerants should be made to comply with Section [6.6.4](#). Previous labels and markings should be removed and be replaced with new labels and markings per Section [6.4](#).

Section 5. Responsibility of Owner

This section applies only to cylinders and ton tanks, but not drums because drums are not compressed gas containers. See applicable definitions in 49 CFR Part 171, Subpart A.

5.1 Cylinder Filling

Only the owner can fill their containers or authorize another party to fill the containers.

Responsibility to assure that the service pressure rating of the cylinder or ton tank is appropriate for the material being recovered rests with the filler. Different refrigerants require different minimum *service pressures*, as per [Table 1](#), [Table 2](#), and [Table 3](#) in [Appendix B](#).

5.2 Cylinder/Ton Tank Retesting

Federal law requires that refillable cylinders used to recover refrigerant must be inspected and hydrostatically tested a minimum of once every five years in accordance with 49 CFR Part 180, Subpart C or as specified in an applicable special permit as provided by the manufacturer of the cylinder.

Responsibility to assure the cylinder or ton tank is within the test date rests with the filler even if the filler is not the owner of the container. 49 CFR Part 180, Subpart C states that no cylinder is permitted to be filled with a hazardous material and offered for transportation in commerce unless that cylinder has been successfully requalified and marked in accordance with DOT requirements. 49 CFR Part 180, Subpart F states that no ton tank is permitted to be filled with a hazardous material and offered for transportation in commerce unless that ton tank has been successfully requalified and marked in accordance with DOT requirements.

Section 6. Labels and Markings

6.1 DOT Requirements

Specific container labeling and marking requirements apply for all DOT-regulated hazardous materials. Instructions in Section [6.1.1](#) and Section [6.1.2](#) apply to recovered fluorocarbon refrigerants.

Note: R-11 in drum quantities is not a DOT-regulated hazardous material. Bulk packaging of 5000 lb or more is subject to DOT regulation as a hazardous substance. R-113 and R-123, in any quantity, are not DOT regulated hazardous materials.

6.1.1 Labeling

Federal law requires that:

- 1) Each refrigerant gas cylinder must display its appropriate DOT diamond (square-on-point) label
- 2) The 3.9" x 3.9" diamond shaped label may be printed on a tag and attached to the cylinder prior to shipment
- 3) Ton tanks require two DOT labels, one on each end

6.1.2 Marking

Federal law requires that:

- 1) Each container of a regulated material be marked with a DOT proper shipping name and an appropriate UN identification number as specified in DOT CFR Title 49, Part 172 Subpart D

- 2) Consignee's or consignor's name and address are required to be shown on each container. Refer to CFR Title 49 for details of marking requirements

6.2 EPA Labeling Requirements

Each cylinder, ton tank, or drum containing a recovered refrigerant designated in the Clean Air Act by the U.S. Environmental Protection Agency as a Class I (CFC) or Class II (HCFC) substance is required by Federal law to display a warning statement indicating that the product(s) inside the cylinder or drum harms the earth's ozone layer.

40 CFR Part 82, Subpart E requires the following warning statement:

WARNING: Contains (insert name of substance) which harms public health and environment by destroying ozone in the upper atmosphere.

The chemical name of the substance can be abbreviated in the warning statement. For example, R-22 can be substituted for chlorodifluoromethane.

6.3 Fill Weight

The gross weight should be marked on each cylinder and ton tank. Maximum allowable gross weight should be determined using Equation 1.

$$\text{Maximum allowable gross cylinder weight} = (0.8 \cdot WC \cdot SG) + TW \qquad \mathbf{1}$$

Where:

- SG = Specific gravity of the refrigerant recovered at 77°F
- TW = Tare weight of the recovery cylinder, lb
- WC = Water capacity of the recovery cylinder, lb

6.4 Product Labeling and Marking

6.4.1 Label

Each container should display a precautionary label prepared in accordance with OSHA HCS 1910.1200. Federal law requires that this label include:

- 1) Product identifier
- 2) Signal word
- 3) Hazard statements
- 4) Pictograms
- 5) Precautionary statements
- 6) Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party

6.4.2 Marking

Federal law requires that cylinders and ton tanks be marked in accordance with 49 CFR Part 172, Subpart D.

6.4.3 Printing

Printing on labels should be clear and legible.

6.5 User Information

Each container should be labeled with the filler's name, address, and date filled.

6.6 Color

The following are examples of coloring schemes for various recovery containers. Depending upon the provider of the recovery container, the actual shading of the color can vary. The use of the color yellow as specified below will identify the container as a recovery.

6.6.1 Cylinders with Non-removable Collars

For nonflammable fluorocarbons, the body should be gray, and the collar should be yellow. For flammable fluorocarbons, the body should be red, and the collar should be yellow, or the body should be gray with a red band, in accordance with Guideline N, and the collar should be yellow.

6.6.2 Cylinders with Removable Caps

For nonflammable fluorocarbons, the body should be gray, and the shoulder should be yellow. For flammable fluorocarbons, the body should be red, and the shoulder should be yellow or the body should be gray with a red band, in accordance with Guideline N, and the shoulder should be yellow.

6.6.3 Ton Tanks

For nonflammable fluorocarbons, the body should be gray, and the ends and chimes should be yellow. For flammable fluorocarbons, the body should be red, and the ends and chimes should be yellow or the body should be gray with a red band, in accordance with Guideline N, and the ends and chimes should be yellow.

6.6.4 Drums

For nonflammable fluorocarbons, the drum should be gray, and the top head should be yellow. For flammable fluorocarbons, the drum should be red, and the top head should be yellow or the body should be gray with a red band, in accordance with Guideline N, and the top head should be yellow.

Section 7. Filling Procedures

Important: Do not mix refrigerants when filling containers.

7.1 DOT Requirements for Cylinders and Ton Tanks

Per DOT requirements, do not fill if the present date is more than five years past the test date on the container. No person may fill a cylinder overdue for periodic re-qualification with a hazardous material and then offer it for transportation. The prohibition against offering a cylinder for transportation that is overdue for re-qualification does not apply to a cylinder filled prior to the re-qualification due date. See 49 CFR Part 173, Subpart G.

The test date is stamped on the shoulder or collar of 4BA and 4BW cylinders; on the valve end chime of 106A and 110A ton tanks; and per the cylinder manufacturer’s design on *special permit cylinders*. See the example for the test date marking for each cylinder or ton tank below: this indicates the cylinder was re-tested in September of 2024 by re-tester number A132. X represents the five-year volumetric expansion test (the effective date for the additional markings (such as X) is 9/2023).

A1
9 24X
32

Cylinders and ton tanks should be continuously weighed during filling. The maximum allowable gross weight should never be exceeded.

Cylinders and ton tanks should be checked for leakage prior to shipment. Federal law per 49 CFR Part 173, Subpart G requires that leaking cylinders and ton tanks not be shipped and be immediately evacuated into DOT approved cylinders or ton tanks.

7.2 Drums

Recovered low pressure liquid fluorocarbon refrigerants should be placed into a new drum or a drum that previously contained the same type of refrigerant.

Drums should be continuously weighed during filling to prevent overfilling. Drums should be filled to allow a vapor space equal to at least 10% of the drum height between the top of the liquid and the bottom of the drum top.

Drums should be sealed by wrench-tightening the closure devices until the gaskets are seated and the closure is confirmed not to leak.

Drums should be checked for leakage prior to shipment. In accordance with 49 CFR Part 173, Subpart B, leaking drums must not be shipped and the refrigerant must be immediately transferred into DOT approved containers.

Section 8. Transportation

8.1 Local Regulations

Federal regulations in 49 CFR Part 173, Subpart G state that the shipper of recovered refrigerant is responsible to determine if there are any state or local regulations restricting transportation, such as classifying recovered refrigerant and oil mixtures as hazardous waste.

8.2 Shipping Requirements

The shipper must comply with 49 CFR Subchapter C, Part 172, when transporting recovered refrigerant.

APPENDIX A. REFERENCES – INFORMATIVE

This appendix lists standards, handbooks, and other publications that can provide useful information and background but are not essential for the use of this guideline. All references in this appendix are not part of the guideline.

- A.1. ASHRAE Terminology. ASHRAE. Accessed July 5, 2022. <https://www.ashrae.org/technical-resources/authoring-tools/terminology>.
- A.2. CGA V-1-2021, *Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections*, 2021, Compressed Gas Association, 8484 Westpark Drive, Suite 220, McLean, VA 22102, USA.
- A.3. CGA S-1.1-2011, *Pressure Relief Device Standards—Part 1—Cylinders for Compressed Gases*, 2011, Compressed Gas Association, 8484 Westpark Drive, Suite 220, McLean, VA 22102, USA.

For information on cylinder tank testing:

- A.4. U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, www.phmsa.dot.gov
- A.5. Code of Federal Regulations. United States Government Publishing Office Accessed July 5, 2022. <http://www.ecfr.gov>
- A.6. U.S. Department of Labor, Occupational Safety and Health Administration, www.osha.gov

APPENDIX B. SERVICE PRESSURES FOR SELECTED FLUOROCARBON REFRIGERANT RECOVERY CYLINDERS – INFORMATIVE

**Table 1 Service Pressures for Selected Single Component Fluorocarbon
Refrigerant Recovery Cylinders**

Refrigerant Number	Chemical Name	Vapor Pressure at 131°F, psig	Vapor Pressure at 70°F, psig	Minimum Required Cylinder Service Pressure, psig ^{1,2,3}
R-11	trichlorofluoromethane	24.8	—	225
R-12	dichlorodifluoromethane	183.0	70.1	225
R-13I1	trifluoroiodomethane	138.1	49.2	225
R-22	chlorodifluoromethane	300.8	121.4	241
R-32	difluoromethane (methylene fluoride)	495.8	205.8	397
R-113	1,1,2-trichloro-1,2,2-trifluoroethane	4.0	—	225
R-114	1,2-dichloro-1,1,2,2-tetrafluoroethane	59.3	12.7	225
R-115	chloropentafluoroethane	253.6	103.5	225
R-123	2,2-dichloro-1,1,1-trifluoroethane	21.1	—	225
R-124	2-chloro-1,1,1,2-tetrafluoroethane	113.1	34.4	225
R-125	pentafluoroethane	397.1	165.5	318
R-134a	1,1,1,2-tetrafluoroethane	201.6	71.1	225
R-141b	1,1-dichloro-1-fluoroethane	16.2	—	225
R-142b	1-chloro-1,1-difluoroethane	97.7	28.7	225
R-143a	1,1,1-trifluoroethane	359.3	150.4	287
R-152a	1,1-difluoroethane	178.5	62.3	225
R-218	octafluoropropane	248.5	98.4	225
R-227ea	1,1,1,2,3,3,3-heptafluoropropane	136.2	43.8	225
R-236fa	1,1,1,3,3,3-hexafluoropropane	82.2	19.9	225
R-245fa	1,1,1,3,3-pentafluoropropane	43.3	3.9	225
R-C318	octafluorocyclobutane	92.5	25.3	225
R-1132a	1,1-difluoroethylene	—	517.1	225
R-1224yd(Z)	cis-1-chloro-2,3,3,3-tetrafluoropropene	40.9	4.0	225
R-123€(E)	trans-1-chloro-3,3,3-trifluoro-1-propene	34.5	1.6	225
R-1234yf	2,3,3,3-tetrafluoro-1-propene	197.7	73.9	225
R-1234ze(E)	trans-1,3,3,3-tetrafluoro-1-propene	149.3	49.5	225
R-1336mzz(E)	trans-1,1,1,4,4,4-hexafluoro-2-butene	57.3	9.7	225

Refrigerant Number	Chemical Name	Vapor Pressure at 131°F, psig	Vapor Pressure at 70°F, psig	Minimum Required Cylinder Service Pressure, psig ^{1,2,3}
R-1336mzz(Z)	cis-1,1,1,4,4,4-hexafluoro-2-butene	15.7	—	225

Notes:

- Title 49 of the Code of Federal Regulations (CFR) 173.301a (c) states that the pressure in the container at 70°F must not exceed the *service pressure* for which the container is marked or designated.
- CFR Title 49, Section 173.301a (d) requires that the pressure in the container at 131°F shall not exceed 5/4 times the *service pressure*.
- CFR Title 49, Sections 178.51 and 178.61 state that the minimum service pressure for a DOT 4BA or DOT 4BW cylinder is 225 psig. *Special permit cylinders* should conform to CFR Title 49, Section 178.71 except as detailed in the Special Permit.

N/A - Not Applicable.

Table 2 Service Pressures for Selected Zeotropic Fluorocarbon Refrigerant Recovery Cylinders

Refrigerant Number	Nominal Composition	Vapor Pressure at 131°F, psig	Vapor Pressure at 70°F, psig	Minimum Required Cylinder Service Pressure, psig ^{1,2,3}
R-401A	R-22/152a/124 (53.0/13.0/34.0)	224.2	86.3	225
R-401B	R-22/152a/124 (61.0/11.0/28.0)	237.1	92.3	225
R-401C	R-22/152a/124 (33.0/15.0/52.0)	191.7	71.0	225
R-402A	R-125/290/22 (60.0/2.0/38.0)	382.9	162.1	306
R-402B	R-125/290/22 (38.0/2.0/60.0)	357.2	150.1	286
R-403A	R-290/22/218 (5.0/75.0/20.0)	343.4	145.5	275
R-403B	R-290/22/218 (5.0/56.0/39.0)	360.1	153.6	288
R-404A	R-125/143a/134a (44.0/52.0/4.0)	360.2	149.3	288
R-406A	R-22/600a/142b (55.0/4.0/41.0)	212.4	83.0	225
R-407A	R-32/125/134a (20.0/40.0/40.0)	362.6	148.8	290
R-407B	R-32/125/134a (10.0/70.0/20.0)	381.0	157.8	305
R-407C	R-32/125/134a (23.0/25.0/52.0)	345.2	140.5	276
R-407D	R-32/125/134a (15.0/15.0/70.0)	295.5	117.1	236
R-407E	R-32/125/134a (25.0/15.0/60.0)	333.9	135.1	267
R-407F	R-32/125/134a (30.0/30.0/40.0)	379.9	156.4	304
R-407G	R-32/125/134a (2.5/2.5/95.0)	218.2	79.4	225
R-407H	R-32/125/134a (32.5/15.0/52.5)	359.6	146.9	288
R-408A	R-125/143a/22 (7.0/46.0/47.0)	333.4	137.8	267
R-409A	R-22/124/142b (60.0/25.0/15.0)	228.7	89.8	225
R-409B	R-22/124/142b (65.0/25.0/10.0)	240.0	94.8	225
R-410A	R-32/125 (50.0/50.0)	484.1	201.8	387
R-410B	R-32/125 (45.0/55.0)	480.7	200.4	385
R-411A	R-1270/22/152a (1.5/87.5/11.0)	282.8	113.4	226
R-411B	R-1270/22/152a (3.0/94.0/3.0)	301.2	122.5	241
R-412A	R-22/218/142b (70.0/5.0/25.0)	252.9	102.0	225
R-413A	R-218/134a/600a (9.0/88.0/3.0)	228.6	86.87	225

Refrigerant Number	Nominal Composition	Vapor Pressure at 131°F, psig	Vapor Pressure at 70°F, psig	Minimum Required Cylinder Service Pressure, psig ^{1,2,3}
R-414A	R-22/124/600a/142b (51.0/28.5/4.0/16.5)	215.5	84.0	225
R-414B	R-22/124/600a/142b (50.0/39.0/1.5/9.5)	216.1	84.0	225
R-415A	R-22/152a (82.0/18.0)	265.9	104.9	225
R-415B	R-22/152a (25.0/75.0)	195.5	70.4	225
R-416A	R-134a/124/600 (59.0/39.5/1.5)	178.2	62.3	225
R-417A	R-125/134a/600 (46.6/50.0/3.4)	285.2	113.4	228
R-417B	R-125/134a/600 (79.0/18.3/2.7)	348.1	143.5	278
R-417C	R-125/134a/600 (19.5/78.8/1.7)	237.0	89.3	225
R-418A	R-290/22/152a (1.5/96.0/2.5)	301.9	122.8	241
R-419A	R-125/134a/E170 (77.0/19.0/4.0)	317.4	130.0	254
R-419B	R-125/134a/E170 (48.5/48.0/3.5)	270.6	106.5	225
R-420A	R-134a/142b (88.0/12.0)	190.4	66.8	226
R-421A	R-125/134a (58.0/42.0)	304.0	122.0	243
R-421B	R-125/134a (85.0/15.0)	360.8	148.9	289
R-422A	R-125/134a/600a (85.1/11.5/3.4)	365.8	152.1	293
R-422B	R-125/134a/600a (55.0/42.0/3.0)	304.6	123.0	244
R-422C	R-125/134a/600a (82.0/15.0/3.0)	358.7	148.7	287
R-422D	R-125/134a/600a (65.1/31.5/3.4)	324.4	132.6	260
R-422E	R-125/134a/600a (58.0/39.3/2.7)	309.7	125.4	248
R-423A	R-134a/227ea (52.5/47.5)	183.5	64.0	225
R-424A	R-125/134a/600a/600/601a (50.5/47.0/0.9/1.0/0.6)	291.3	116.4	233
R-425A	R-32/134a/227ea (18.5/69.5/12.0)	283.3	111.5	227
R-426A	R-125/134a/600/601a (5.1/93.0/1.3/0.6)	211.8	76.7	225
R-427A	R-32/125/143a/134a (15.0/25.0/10.0/50.0)	330.4	134.4	264
R-428A	R-125/143a/290/600a (77.5/20.0/0.6/1.9)	384.7	161.2	308
R-429A	R-E170/152a/600a (60.0/10.0/30.0)	170.6	62.0	225
R-430A	R-152a/600a (76.0/24.0)	188.5	69.0	225
R-431A	R-290/152a (71.0/29.0)	295.3	125.0	236
R-434A	R-125/143a/134a/600a (63.2/18.0/16.0/2.8)	346.3	142.9	277
R-435A	R-E170/152a (80.0/20.0)	180.7	65.3	225
R-437A	R-125/134a/600/601 (19.5/78.5/1.4/0.6)	235.3	88.5	225
R-438A	R-32/125/134a/600/601a (8.5/45.0/44.2/1.7/0.6)	322.7	131.0	258
R-439A	R-32/125/600a (50.0/47.0/3.0)	483.3	202.4	387
R-440A	R-290/134a/152a (0.6/1.6/97.8)	182.5	64.7	225

Refrigerant Number	Nominal Composition	Vapor Pressure at 131°F, psig	Vapor Pressure at 70°F, psig	Minimum Required Cylinder Service Pressure, psig ^{1,2,3}
R-442A	R-32/125/134a/152a/227ea (31.0/31.0/30.0/3.0/5.0)	382.5	158.0	306
R-444A	R-32/152a/1234ze(E) (12.0/5.0/83.0)	232.4	92.1	225
R-444B	R-32/152a/1234ze(E) (41.5/10.0/48.5)	350.7	145.8	281
R-445A	R-744/134a/1234ze(E) (6.0/9.0/85.0)	274.0	123.7	225
R-446A	R-32/1234ze(E)/600 (68.0/29.0/3.0)	436.2	182.7	349
R-447A	R-32/125/1234ze(E) (68.0/3.5/28.5)	439.2	183.6	351
R-447B	R-32/125/1234ze(E) (68.0/8.0/24.0)	447.0	186.8	358
R-448A	R-32/125/1234yf/134a/1234ze(E) (26.0/26.0/20.0/21.0/7.0)	369.9	153.5	296
R-449A	R-32/125/1234yf/134a (24.3/24.7/25.3/25.7)	364.8	151.0	292
R-449B	R-32/125/1234yf/134a (25.2/24.3/23.2/27.3)	366.3	151.5	293
R-449C	R-32/125/1234yf/134a (20.0/20.0/31.0/29.0)	341.8	140.7	273
R-450A	R-134a/1234ze(E) (42.0/58.0)	177.2	61.4	225
R-451A	R-1234yf/134a (89.8/10.2)	202.6	75.7	225
R-451B	R-1234yf/134a (88.8/11.2)	203.0	75.8	225
R-452A	R-32/125/1234yf (11.0/59.0/30.0)	374.3	156.8	299
R-452B	R-32/125/1234yf (67.0/7.0/26.0)	461.0	192.5	369
R-452C	R-32/125/1234yf (12.5/61.0/26.5)	385.1	161.4	308
R-453A	R-32/125/134a/227ea/600/601a (20.0/20.0/53.8/5.0/0.6/0.6)	324.8	131.5	260
R-454A	R-32/1234yf (35.0/65.0)	382.7	161.2	306
R-454B	R-32/1234yf (68.9/31.1)	456.3	190.5	365
R-454C	R-32/1234yf (21.5/78.5)	335.1	141.2	268
R-455A	R-744/32/1234yf (3.0/21.5/75.5)	378.1	167.6	303
R-456A	R-32/134a/1234ze(E) (6.0/45.0/49.0)	215.5	80.7	225
R-457A	R-32/1234yf/152a (18.0/70.0/12.0)	303.4	125.3	243
R-457B	R-32/1234yf/152a (35.0/55.0/10.0)	326.5	127.6	—
R-458A	R-32/125/134a/227ea/236fa (20.5/4.0/61.4/13.5/0.6)	298.1	118.8	238
R-459A	R-32/1234yf/1234ze(E) (68.0/26.0/6.0)	450.8	188.3	361
R-459B	R-32/1234yf/1234ze(E) (21.0/69.0/10.0)	327.5	137.5	262
R-460A	R-32/125/134a/1234ze(E) (12.0/52.0/14.0/22.0)	344.8	142.8	276
R-460B	R-32/125/134a/1234ze(E) (28.0/25.0/20.0/27.0)	360.4	149.5	288
R-463A	R-744/32/125/1234yf/134a (6.0/36.0/30.0/14.0/14.0)	507.9	228.6	406
R-468B	R-1132a/32/1234yf (6.0/13.0/81.0)	349.3	156.5	279.4

Refrigerant Number	Nominal Composition	Vapor Pressure at 131°F, psig	Vapor Pressure at 70°F, psig	Minimum Required Cylinder Service Pressure, psig ^{1,2,3}
R-468C	R-1132a/32/1234yf (6.0/42.0/52.0)	455.2	201.6	364

Notes:

1. Title 49 of the Code of Federal Regulations (CFR) 173.301a (c) states that the pressure in the container at 70°F must not exceed the *service pressure* for which the container is marked or designated.
2. CFR Title 49, Section 173.301a (d) requires that the pressure in the container at 131°F shall not exceed 5/4 times the *service pressure*.
3. CFR Title 49, Sections 178.51 and 178.61 state that the minimum service pressure for a DOT 4BA or DOT 4BW cylinder is 225 psig. *Special permit cylinders* should conform to CFR Title 49, Section 178.71 except as detailed in the Special Permit.

N/A - Not Applicable.

Table 3 Service Pressures for Selected Azeotropic Fluorocarbon Refrigerant Recovery Cylinders

Refrigerant Number	Nominal Composition	Vapor Pressure at 131°F, psig	Vapor Pressure at 70°F, psig	Minimum Required Cylinder Service Pressure, psig ^{1,2,3}
R-500	R-12/152a (73.8/26.2)	220.1	85.7	225
R-502	R-22/115 (48.8/51.2)	323.5	135.8	259
R-507A	R-125/143a (50.0/50.0)	368.5	153.0	295
R-509A	R-22/218 (44.0/56.0)	378.1	161.6	302
R-512A	R-134a/152a (5.0/95.0)	178.8	62.3	225
R-513A	R-1234yf/134a (56.0/44.0)	210.5	77.7	225
R-513B	R1234yf/134a (58.5/41.5)	210.3	77.8	225
R-514A	R-1336mzz(Z)/1130(E) (74.7 /25.3)	20.4	—	225
R-515A	R-1234ze(E)/227ea (88.0/12.0)	148.0	48.9	225
R-516A	R-1234yf/134a/152a (77.5/8.5/14.0)	202.8	75.3	225

Notes:

1. Title 49 of the Code of Federal Regulations (CFR) 173.301a (c) states that the pressure in the container at 70°F must not exceed the *service pressure* for which the container is marked or designated.
2. CFR Title 49, Section 173.301a (d) requires that the pressure in the container at 131°F shall not exceed 5/4 times the *service pressure*.
3. CFR Title 49, Sections 178.51 and 178.61 state that the minimum service pressure for a DOT 4BA or DOT 4BW cylinder is 225 psig. *Special permit cylinders* should conform to CFR Title 49, Section 178.71 except as detailed in the Special Permit.

N/A - Not Applicable.