AHRI Standard 700

2011 Standard for

Specifications for Fluorocarbon Refrigerants

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IMPORTANT

SAFETY DISCLAIMER

AHRI does not set safety standards and does not certify or guarantee the safety of any products, components or systems designed, tested, rated, installed or operated in accordance with this standard/guideline. It is strongly recommended that products be designed, constructed, assembled, installed and operated in accordance with nationally recognized safety standards and code requirements appropriate for products covered by this standard/guideline.

AHRI uses its best efforts to develop standards/guidelines employing state-of-the-art and accepted industry practices. AHRI does not certify or guarantee that any tests conducted under its standards/guidelines will be non-hazardous or free from risk.

Note:

This standard supersedes AHRI Standard 700-2006 with Addenda 1 and 2.

AHRI CERTIFICATION PROGRAMS PROVISIONS

Scope of the Certification Programs

The Reclaimed Refrigerant and Refrigerant Testing Laboratory Certification Programs are based on this standard. The Reclaimed Refrigerant Certification Program includes purity specifications for reclaimed refrigerants. The Refrigerant Testing Laboratory Certification Program includes verification for Refrigerant Testing Laboratories that perform testing of refrigerants to AHRI Standard 700.

Certified Ratings

The following ratings are verified by test for the Reclaimed Refrigerant Certification Program:

a. Water (ppm by weight).
b. Chloride (pass/fail).
c. Acidity (ppm by weight).
d. High Boiling Residue (% by volume or % by weight).
e. Particulates/Solids (pass/fail).
f. Air and Other Non Condensables (% by volume).
g. All Other Volatile Impurities (% by weight)
h. Halogenated Unsaturated Volatile Impurities (ppm by weight).

The following contaminants are verified by test for the Refrigerant Testing Laboratory Certification Program:

a. Water (ppm by weight).
b. High Boiling Residue (% by volume or % by weight).
c. Air and Other Non Condensables (% by volume).
d. All Other Volatile Impurities (% by weight).

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SPECIFICATIONS FOR FLUOROCARBON REFRIGERANTS

Section 1. Purpose

1.1 *Purpose.* The purpose of this standard is to establish purity specifications, to verify composition, and to specify the associated methods of testing for acceptability of fluorocarbon refrigerants regardless of source (new, reclaimed and/or repackaged) for use in new and existing refrigeration and air-conditioning products within the scope of AHRI.

1.1.1 *Intent.* This standard is intended for the guidance of the industry including manufacturers, reclaimers, repackagers, distributors, installers, servicemen, contractors and users of fluorocarbon refrigerants.

1.1.2 *Review and Amendment.* This standard is subject to review and amendment as technology advances or as additional data becomes available. This data can be submitted to AHRI for review.

Section 2. Scope

2.1 *Scope.* This standard specifies acceptable levels of contaminants (purity requirements) for fluorocarbon refrigerants (hereinafter referred to as refrigerants) regardless of source and lists acceptable test methods. These refrigerants are: R-11; R-12; R-13; R-22; R-23; R-32; R-113; R-114; R-115; R-116; R-123; R-124; R-125; R-134a; R-141b; R-142b; R-143a; R-152a; R-218; R-227ea; R-236fa; R-245fa; R-1234yf; R-401A; R-401B; R-402A; R-402B; R-403A; R-403B; R-404A; R-405A; R-406A; R-407A; R-407B; R-407C; R-407D; R-407E; R-407F; R-408A; R-409A; R-409B; R-410A; R-410B; R-411A; R-411B; R-412A; R-413A; R-414A; R-414B; R-415A; R-415B; R-416A; R-417A; R-417B; R-418A; R-419A; R-420A; R-421A; R-421B; R-422A; R-422B; R-422C; R-422D; R-423A; R-424A; R-425A; R-426A; R-427A, R-428A, R-430A, R-434A, R-437A; R-438A; R-439A; R-440A; R-500; R-502; R-503; R-507A; R-508A; R-508B; and R-509A as referenced in the ANSI/ASHRAE Standard 34 with Addenda.

Section 3. Definitions

All terms in this document follow the standard industry definitions in the current edition of *ASHRAE Terminology of Heating, Ventilation, Air Conditioning and Refrigeration* unless otherwise defined in this section.

3.1 *"Shall"* or "*Should"*. "Shall" or "should" shall be interpreted as follows:

3.1.1 *Shall.* Where "shall" or "shall not" is used for a provision specified, that provision is mandatory if compliance with the standard is claimed.

3.1.2 *Should.* "Should" is used to indicate provisions which are not mandatory but which are desirable as good practice.

Section 4. Characterization of Refrigerants and Contaminants

4.1 *Characterization.* Characterization of refrigerants and contaminants are listed in the following general classifications:

4.1.1. Water
4.1.2. Chloride
4.1.3. Acidity
4.1.4. High boiling residue
4.1.5. Particulates/solids
4.1.6. Air and other Non-condensables
4.1.7. All other Volatile impurities
4.1.8. Halogenated Unsaturated Volatile Impurities

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Identification of the refrigerant and volatile impurities shall be carried out by gas chromatography (GC).

Section 5. Sampling and Summary of Test Procedures

5.1 *Referee Test.* The referee test methods for the various contaminants are summarized in the following paragraphs. Detailed test procedures are included in Appendix C to AHRI Standard 700. If alternative test methods are employed, the user shall be able to demonstrate that they produce results at least equivalent to the specified referee test method.

5.2 *Refrigerant Sampling.*

5.2.1 *Sampling Precautions.* Special precautions should be taken to ensure that representative samples are obtained for analysis. Sampling shall be done by qualified personnel following accepted sampling and safety procedures. Refrigerants with critical temperatures near or below ambient temperature cannot be reliably sampled for both liquid and vapor phase without special handling.

5.2.2 *Cylinder Preparation.* Place a clean, empty sample cylinder with the valve open in an oven at 110°C for one hour. Remove it from the oven while hot, immediately connect it to an evacuation system and evacuate it to less than 56 kPa. Close the valve and allow it to cool. Weigh the empty cylinder.

5.2.3 *Vapor Phase Sampling.* A vapor phase sample shall be obtained for determining the non condensables. The source temperature shall be measured and recorded at the time the sample is taken. Non condensable gases, if present, will concentrate in the vapor phase of the refrigerant; care must be exercised to eliminate introduction of either air or liquid phase refrigerant during the sample transfer. Since R-11, R-113, R-123, R-141b, and R-245fa have normal boiling points near or above room temperature, non condensable determination is not required for these refrigerants.

5.2.3.1 *Special Handling for Low Critical Temperature Refrigerant.* A vapor phase sample is required to determine non condensables and volatile impurities, including other refrigerants. The vapor phase sample is obtained by regulating the sample container temperature to 5 K or more above the refrigerant critical temperature.

5.2.4 *Liquid Phase Sampling*. A liquid phase sample is required for all tests listed in this standard except the test for non condensables.

5.2.4.1 *Liquid Sampling.* Accurate analysis requires that the sample cylinder, at ambient temperature, be filled to at least 60% by volume; however, under no circumstances should the cylinder be filled to more than 80% by volume. This can be accomplished by weighing the empty cylinder and then the cylinder with refrigerant. When the desired amount of refrigerant has been collected, close the valve(s) and immediately disconnect the sample cylinder.

Note: Care should be taken to ensure that all connections and transfer lines are dry and evacuated to avoid contaminating the sample.

5.2.4.2 *Special Handling for Low Critical Temperature Refrigerant*. A liquid phase sample is required for all testing except non condensables and volatile impurities, including other refrigerants. The liquid phase sample is obtained by regulating the sample cylinder temperature to 2 ºC below the critical temperature of the refrigerant.

NOTE: If free water is present in the sample, cooling to below 0 ºC may result in the formation of ice. Clathrates may form at temperatures above 0 ºC with some fluorocarbon refrigerants.

5.2.4.3 *Record Weight.* Check the sample cylinder for leaks and record the gross weight.

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5.3 *Refrigerant Identification.* The required method shall be gas chromatography as described in Appendix C with the corresponding gas chromatogram figures as illustrated in Informative Appendix D to AHRI Standard 700. The chromatogram of the sample shall be compared to known standards.

5.4 *Water Content.*

5.4.1 *Method.* The Coulometric Karl Fischer Titration, as described in Appendix C, shall be used for determining the water content of refrigerants. This method can be used for refrigerants that are either a liquid or a gas at room temperature. For all refrigerants, the sample for water analysis shall be taken from the liquid phase of the container to be tested.

5.4.2 *Limits.* The value for water content shall be expressed in parts per million (ppm) by weight and shall not exceed the maximum specified in Tables 1A, 1B, and 1C.

5.5 *Conductivity.* (Alternative to Chloride and Acidity Tests).

5.5.1 *Method.* A refrigerant may be tested for conductivity as an indication of the presence of acids, metal chlorides, and any compound that ionizes in water. This alternative procedure is intended for use with new or reclaimed refrigerants, however, significant amounts of oil can interfere with the test results.

5.5.2 *Limits.* The value for conductivity shall be converted to and expressed in ppm by weight calculated as HCl and shall be compared with the maximum acidity value specified (see in Tables 1A, 1B, and 1C). If the conductivity is above this amount, then the Chloride and Acidity Tests shall be conducted. If the conductivity is not greater than this amount, then the Chloride and Acidity Tests may be omitted.

5.6 *Chloride.*

5.6.1 *Method.* The refrigerant shall be tested for chloride as an indication of the presence of hydrochloric acid and/or metal chlorides. The referee procedure is intended for use with new or reclaimed refrigerants; however, high boiling residue in excess of the amounts in Tables 1A, 1B, and 1C can interfere with the test results.

The test method shall be that described in Appendix C to AHRI Standard 700. The test will show noticeable turbidity at chloride levels of about 3 ppm or greater by weight.

5.6.2 *Limits.* The results of the test shall not exhibit any sign of turbidity. Report the results as "pass" or "fail."

5.7 *Acidity.*

5.7.1 *Method.* The acidity test uses the titration principle to detect any compound that is soluble in water and ionizes as an acid. The test method shall be that described in Appendix C to AHRI Standard 700. This test may not be suitable for determination of high molecular weight organic acids; however, these acids will be found in the high boiling residue test outlined in 5.8. The test requires a 100 to 120 gram sample and has a detection limit of 0.1 ppm by weight calculated as HCl.

5.7.2 *Limits.* The value for acidity shall be expressed in ppm by weight as HCl and shall not exceed the limits in Tables 1A, 1B, and 1C.

5.8 *High Boiling Residue.*

5.8.1 *Method.* High boiling residue shall be determined by either volume or weight. The volume method measures the residue from a standard volume of refrigerant after evaporation. The gravimetric method is described in Appendix C to AHRI Standard 700. Oils and/or organic acids will be captured by these methods.

5.8.2 *Limits.* The value for high boiling residue shall be expressed as a percentage by volume or weight and shall not exceed the maximum percent specified in Tables 1A, 1B, and 1C.

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