

OPERATIONS MANUAL

RESIDENTIAL FURNACES CERTIFICATION PROGRAM



AHRI OM RFRN – OCTOBER 2018

2311 Wilson Blvd, Suite 400
Arlington, Virginia 22201
(703) 524-8800

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PREFACE

The following manual outlines the procedures and policies of the Performance Certification Program for Residential Furnace (RFRN) operated by the Air-Conditioning, Heating, and Refrigeration Institute (AHRI). This manual is to be used in conjunction with the AHRI General Operations Manual (GOM) for AHRI Certification Programs. Where the AHRI GOM and this product-specific manual differ, this product-specific operations manual shall prevail.

The revision of this manual supersedes all previous revisions. The current edition of this manual, as well as the AHRI GOM, can be accessed through the AHRI website, www.ahrinet.org.

The RFRN Certification Program by AHRI provides for independent verification of the Residential Furnaces manufacturers' stated equipment performance. Safety criteria are not within the scope of this program.

Participation in the program is voluntary. Any manufacturer, regardless of AHRI membership, may obtain approval of Program Ratings and use of the AHRI RFRN Certification Mark hereinafter referred to as the "Mark". The Mark is the Participant's public representation that the ratings of randomly selected samples have been verified by an independent laboratory in accordance with test procedures prescribed by this operations manual. A Certification Agreement is executed between the manufacturer and AHRI specifying the conditions under which such Ratings and the Mark may be used. No manufacturer has the right to use Program Ratings or to state that their products have been tested in conformance with the procedures outlined in this Rating Procedure unless and until they have received written authority from AHRI to use the Marks as applied to the specific approved Program Ratings.

This Operations Manual has been prepared to assure that administration of the program is carried out in a uniform manner. It is an amplification of the Certification Agreement signed by licensees and AHRI. General information, procedural details, and copies of forms are included in this Operations Manual. Provisions of the Operations Manual may be amended as provided in the Certification Agreement.

This certification program complies with requirements of the ISO/IEC Standard 17065:2012, *General Requirements for Bodies Operating Product Certification Systems*.

Note:

This manual supersedes the Residential Furnace Operations Manual – January 2018.

CERTIFICATION OPERATIONS MANUAL FOR
RESIDENTIAL GAS AND OIL-FIRED CENTRAL FURNACES

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1. Program Overview

1.1 Applicable Rating Standard. It is mandatory for program Participants to comply with Department of Energy (DOE) furnace test procedures as published in the latest edition of the Code of Federal Regulations, 10 CFR Part 430, Subpart B, Appendix N (Standard). A copy of the Standard is available for download from the U.S. Government Printing Office website, GPO Access, at www.gpo.gov/fdsys.

1.2 Product Definitions.

1.2.1 Residential Central Furnace. A product which is either a gas-fired or oil-fired central furnace, and uses a single-phase electric current or DC, and has a heat input rate of less than 225,000 Btu/h.

1.2.1.1 Residential Gas-Fired Central Furnace. A Residential Central Furnace utilizing natural gas or propane as its fuel source.

1.2.1.2 Residential Oil-Fired Central Furnace. A Residential Central Furnace utilizing heating oil as its fuel source.

1.3 Program Scope. This program applies to Production Models of Residential Furnaces, as defined in Section 1.2.

1.4 Intended Market. The Intended Market for this Certification Program includes all products defined in Section 1.3 that are sold for use in the U.S. (including U.S. Territories) and Canada.

1.5 Basic Model Groups (BMGs). A Participant's listing shall be grouped by BMG. A BMG is a family of models which have identical ratings for heating input (refer to Section 1.5.1 for Oil-Fired Furnaces), output heating capacity, electric power (PE), auxiliary electrical energy consumption (E_{AE}), fossil fuel energy consumption (E_F), and annual fuel utilization efficiency (AFUE).

1.5.1 Oil-Fired Central Furnaces. A BMG shall consist of a common heat exchanger, blower assembly and cabinet. If a Participant provides various burner and/or nozzle options for this model, all models resulting from the various burner and/or nozzle options shall be included in the same BMG. For example, if Model A's shipped-as heating input is 100,000 Btu/h and the manufacturer provides two burner options for Model A, such that the resulting Models B and C have heating inputs of 70,000 Btu/h and 120,000 Btu/h respectively, Models A, B and C shall be considered as one (1) BMG.

2. Qualification Process

2.1 Original Equipment Manufacturer (OEM) Applicants. With the additions noted below, the OEM qualification process shall proceed according to the AHRI GOM, Section 4.

STEP 2.1.1 Certification Application Package. In addition to the Application for AHRI Certification, Annual Sales Volume Form, and product-specific ratings and data, noted in the AHRI General Operations Manual, Section 4, STEP 1, Applicants shall submit the following documentation to AHRI:

- Test reports to support the ratings in accordance with DOE's rating procedure for a model representative of each BMG;
- Published installation instructions in printed or electronic format;
- An Applicant requesting AHRI to submit data to CEC, DOE, FTC, and NRCan shall submit third-party authorization, compliance forms and other necessary information; and
- Additional information may be needed to meet EPA ENERGY STAR® program requirements.

Electronic forms shall be obtained from AHRI.

STEP 2.1.2 Processing Application Package.

STEP 2.1.2.1 Performance Certification Agreement for Original Equipment Manufacturer (OEM Agreement). No further action required beyond that listed in Section 4, STEP 4.2 of the AHRI GOM.

STEP 2.1.2.2 Participation and Licensing Fee Invoice. Payment of the Participation and Licensing Fee is due within 30 calendar days of the invoice issue date. Testing shall not be conducted until the invoice is paid in full. No further action required beyond that listed in Section 4, STEP 4.2 of the AHRI GOM.

STEP 2.1.3 Selection and Acquisition of Test Samples.

STEP 2.1.3.1 Number of Qualification Tests. 30% of the Applicant's BMGs shall be tested, with a minimum of two (2) models. Fractional models should be rounded up to the nearest whole number.

STEP 2.1.3.2 Acquisition of Qualification Test Samples/Selection Criteria. Within 30 calendar days of a request from AHRI, the Applicant shall have samples available for selection. Samples shall be acquired in accordance with Section 3 of this manual.

STEP 2.1.4 Qualification Testing. AHRI shall supply the Independent Third-Party Laboratory contracted by AHRI (Laboratory) with the Published Ratings. The Laboratory shall conduct the testing of the samples in accordance with the Standard, against the Published Ratings.

STEP 2.1.4.1 Successful Completion of All Qualification Tests. If all qualification tests pass proceed to STEP 2.1.5.

STEP 2.1.4.2 First Sample Qualification Test Failure. Refer to Section 3.9.1 of this Operations Manual for details regarding the first sample qualification failure options.

STEP 2.1.4.3 Second Sample Qualification Test Failure. Refer to Section 3.9.2 of this Operations Manual for details regarding the second sample qualification failure options.

STEP 2.1.5 Welcome to the Program. No further action required beyond that listed in Section 4, STEP 4.5 of the AHRI GOM.

2.2 Private Brand Marketer (PBM) Applicants. Refer to Section 5 of the GOM.

3. Equipment Selection and Testing

3.1 Annual Testing Requirement. 20% of a Participant's BMGs shall be tested annually, with a minimum of one (1) model. Fractional numbers shall be rounded up to the nearest whole number.

3.2 Location of Tests. Testing shall be performed at the Laboratory and the sample shall be installed in the test facility in accordance with the Participant's published installation instructions, in printed or electronic format.

3.3 Selection of Test Samples. Selections shall be made based on data contained in the Directory of Certified Product Performance (Directory). AHRI shall inform the Participant, in writing, of the sample(s) selected for test, including model number, fuel type, and configuration.

3.3.1 Basis for Selection. The following criteria may be used to select models for testing:

- Voluntarily re-rated models;
- At random;
- Models anticipated to provide the majority of the participant's production volume;
- For cause; and
- New models.

3.4 Methods for Acquiring Test Samples. AHRI or the Laboratory personnel shall make a Random Sample Selection or a Random Component Selection from the Participant's stock inventory within 30 calendar days of a selection by AHRI. Selected samples shall be shipped to the Laboratory accompanied by the Participant's published installation instructions in printed or electronic format. The Laboratory is responsible for reviewing the manufacturer's installation instructions and ensuring that all necessary testing equipment and parts are available at the time of testing. Refer to Section 9 of the AHRI General Operation Manual.

3.4.1 Testing Punch List. The Participant shall complete and provide a Punch List (refer to the [AHRI website](#)) in electronic format to the Laboratory prior to sample arrival at the Laboratory. The Participant may choose to furnish a single Punch List for multiple tests.

The Punch List shall not contradict the installation and operations manual provided by the Participant. If there is a discrepancy between notes written on the Punch List, Installation and Operations Manual, and/or the Directory, AHRI shall determine which document takes precedent.

3.5 Sample Acquisition Timeframe. The Participant shall deliver the selected unit(s) to the Laboratory within 14 calendar days of Random Sample Selection or Random Component Selection by Laboratory personnel.

3.6 Tolerances. For annual verification testing, the Standard Rating shall be such that any Residential Furnace selected and tested in accordance with the Applicable Rating Standard has an AFUE and an Output Heating Capacity not less than 95% of the Standard Ratings.

3.7 Certified Data. In accordance with the Standard, the following certified ratings are verified by test:

- Annual Fuel Utilization Efficiency (AFUE), %
- Output Heating Capacity, MBtu/h

3.8 Test Failures.

3.8.1 Options Following First Sample Failure. When the Participant is notified of a first sample certified rating failure, it has seven (7) calendar days to select one (1) of the following options:

- Re-rate all models within the failed sample's BMG proportionate to the failed test's results. The failed model shall be re-rated to the nearest 0.10% for AFUE and/or the nearest thousand Btu/h of the Output Heating Capacity, and no better than the test results. Other models in the BMG shall be re-rated in accordance with the percentage by which the tested unit failed;
- Test second sample of the same model (sample shall be available within the timeframe and procedure allotted in Section 3.5 following notification of decision to AHRI via Manufacturer's Decision Form [MDF]); or
- Obsolete the model, which also obsoletes all models within the corresponding BMG.

3.8.2 Options Following Second Sample Failure. When the Participant is notified of a second sample certified rating failure, it has seven (7) calendar days to select one (1) of the following options:

- Re-rate all models within the failed sample's BMG proportionate to the failed test's results. The failed model shall be re-rated to the nearest 0.10% for AFUE and/or the nearest thousand Btu/h of the Output Heating Capacity, and no better than the test results. Other models in the BMG shall be re-rated in accordance with the percentage by which the tested unit failed.

- Test additional samples of the same model per 3.8.2.1; or
- Obsolete the model, which also obsoletes all models within the corresponding BMG.

3.8.2.1 *Additional Sample Testing of the Same Model.* In an effort to preserve the Published Ratings for the model in question, the Participant may opt to test up to 20 additional samples of the model that failed. If possible, the samples should be selected from different production runs. The final rating shall be the mean of the 1st sample, 2nd sample, and all tests requested by the Participant.

If a Participant exercises this option, testing of additional samples shall be completed within six (6) months of the second sample test.

- Following each test, if the mean result of all tested samples passes, no further action is required.
- If at the conclusion of additional sample testing, the mean result of all tested samples fails, the Participant shall elect to either obsolete or re-rate within seven (7) calendar days of notification of additional sample testing failure.

3.9 *Test Conditions.* For consistent and repeatable results, the establishment of the test conditions for the gathering of data supporting the calculation of AFUE shall be accomplished in accordance with Appendix B.

3.10 *Air Leakage Test.* The cabinet air leakage test and the supporting calculations for calculating ENERGY STAR metric, Air Leakage ($Q_{leak, EPA}$) shall be accomplished in accordance with Appendix A.

4. Challenge Tests

Refer to Section 10 of the AHRI GOM.

5. AHRI Directory of Certified Product Performance

All certified products shall be listed in the Directory, www.ahridirectory.org. Certification shall not be implied nor claimed for any product not listed in the Directory. Except as noted below, the Participant shall follow the steps outlined in Section 11 of the AHRI GOM.

5.1 *Publication of Ratings in Certified Directory.* The following information pertaining to each model certified shall be published in the Directory:

- AHRI Certified Reference Number;
- Name of Manufacturer;
- Model Status;
- Brand Name of Model;
- Model Number(s) or Designation(s);
- Fuel type (gas or oil);
- Input Rating, MBtu/h;
- Output Heating Capacity, MBtu/h;
- Electric Power to Burner (PE), W;
- Auxiliary Electrical Energy Consumption (E_{AE}), kWh/yr;
- Fossil Fuel Energy Consumption (E_F), MMBTU/yr;
- Annual Fuel Utilization Efficiency (AFUE), %; and
- Mobile Home
- Electronically Commutated Motor (ECM)

5.2 Data Forms. Each Participant shall list its products by BMG. OEM and PBM Participants shall submit/edit product data via the Directory or data submittal sheets, as applicable. Forms may be downloaded on www.ahrinet.org or through AHRI.

6. Assessment and Payment of Certification Fees

Refer to Section 9 and 12 of the AHRI GOM.

7. Issuance of Violations and/or Termination

Refer to Section 14 of the AHRI GOM.

8. Program Hierarchy, Complaints, and the Appeals Process

Refer to Section 15 of the AHRI GOM.

9. Proper Use of the AHRI Certification Mark and Claims to Certification

Refer to the AHRI Brand Usage Guide.

APPENDIX A – TEST GUIDELINES FOR AIR LEAKAGE TEST

Section A1. Purpose

A1.1 Purpose. The purpose of this guideline is to provide details on the specific instrumentation, test setup, and testing procedures used to measure furnace air-leakage. This document has been drafted as an adjunct to the ASHRAE 193-2010 test method for determining airtightness of HVAC equipment. The guideline is used by the AHRI Residential Furnace Certification Program as a guideline providing clarification on how testing is conducted by the contracted third-party laboratory. None of the details contained in this document are intended to be counter to or inconsistent with the ASHRAE 193-2010 standard. In cases where the guideline is counter to ASHRAE 193-2010, the ASHRAE 193-2010 shall prevail.

A1.1.1 Intent. This guideline is intended for the guidance of the industry, including manufacturers and third-party laboratories.

A1.1.2 Review and Amendment. This guideline is subject to review and amendment as technology advances.

Section A2. Test Setup

A2.1 How to Seal a Furnace During Air Leakage Test. ASHRAE 193-2010, Section 6.1 and 6.2.1.1 allow the furnaces to be sealed using an impermeable blanking cap over the opening of the test apparatus to which the equipment under test is connected. The following shall be followed in order to seal the furnace:

A2.1.1. The open ends of the unit are the ends that connect to the return or supply ductwork. Whether the unit comes with a filler panel over the opening or not, the blanking cap shall be sealed to the unit around the perimeter of the return air or supply air opening.

A2.1.2 Seals may not be made over openings that will not otherwise be sealed when installed. For example, access doors or panels are to be held in place by the knobs or screws are provided with the unit, or as instructed in the manufacturers installation instructions.

A2.1.3. When knock-outs exist, they shall not be removed prior to test. If plugs are provided, they may be used as instructed by the installation manual. If auxiliary openings are made into the unit for reasons other than as instructed by the installation instructions, these openings shall be sealed.

A2.1.4 Seals shall be made using some type of impermeable method. Duct tape is acceptable for sealing the blanking cap to the unit.

Section A3. Test Procedure

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Section A4. Calculations

A4.1 Rated Airflow. Rated Airflow shall be 21.7 cfm per MBtu/hr of rated heating output capacity or 400 cfm per ton of rated cooling capacity, whichever is greater.

Or

$$Q_{Rated-Airflow} = 21.7 * Q_{out}$$

$$Q_{Rated-Airflow} = 400 * \frac{Q_c}{12000}$$

Where;

$Q_{Rated-Airflow}$ = Rated Airflow of the heating/cooling appliance (cfm)
 Q_{out} = Rated Heating Output Capacity (MBtu/h)
 Q_c = Maximum Rated Cooling Capacity (Btu/h)

A4.2 ENERGY STAR Air Leakage. ENERGY STAR metric, Air Leakage ($Q_{leak,EPA}$) is defined as the percent of the rated airflow of the fan that is required to maintain the applied pressures, accounting for air that leaves or enters through cracks, joints and penetration in the furnace cabinet rather than through supply and return ducts installed in accordance with manufacturer's instructions. Air Leakage ($Q_{leak,EPA}$) shall be calculated as follows:

$$Q_{leak,EPA} = 100 * \frac{Q_{leak,ASHRAE-193}}{Q_{Rated-Airflow}}$$

APPENDIX B: Procedure for Establishing Test Conditions for Consistent and Repeatable Measurement of the Parameters Used in the Calculation of AFUE.

B1 FURNACES WITH A SINGLE RATED INPUT

B1.1 Select the lowest blower speed that allows the furnace to run at or above the minimum static pressure, at the rated input, and at a maximum rise of $([\text{mid-point rise}] + 2)^{\circ}\text{F}$ but not less than $([\text{mid-point rise}] - 2)^{\circ}\text{F}$.

B1.1.1. Permanent Split Capacitor (PSC) or constant torque Brushless Direct Current (BLDC) motor – If airflow at the lowest speed is still too high, increase static pressure to achieve temperature rise of $([\text{mid-point rise}] + 2)^{\circ}\text{F}$

B1.1.2. PSC or constant torque BLDC motor – If airflow at the highest speed is still too low, the unit will be considered an inoperable sample. The Laboratory should contact AHRI and the manufacturer.

B1.1.3. BLDC Motor with Constant Cubic Foot per Minute (CFM) control – If the test conditions at the minimum static pressure is not attainable at any of the available blower settings, the unit will be considered an inoperable sample. The Laboratory should contact AHRI and the manufacturer.

B2 FURNACES WITH MULTIPLE RATED INPUTS OR CONTINUOUSLY VARIABLE INPUT

B2.1 At maximum rate, select the lowest blower speed that allows the furnace to run at or above the minimum static pressure, at the rated input, and at a maximum rise of $([\text{mid-point rise}] + 2)^{\circ}\text{F}$ but not less than $([\text{mid-point rise}] - 2)^{\circ}\text{F}$.

B2.1.1. PSC or constant torque BLDC motor – If airflow at the lowest speed is still too high, increase static pressure to achieve $([\text{mid-point rise}] + 2)^{\circ}\text{F}$

B2.1.2. PSC or constant torque BLDC motor – If airflow at the highest speed is still too low, the unit will be considered an inoperable sample. The Laboratory should contact AHRI and the manufacturer.

B2.1.3. BLDC Motor with Constant CFM control – If the test conditions at the minimum static pressure is not attainable at any of the available blower settings, the unit will be considered an inoperable sample. The Laboratory should contact AHRI and the manufacturer.

B2.2 Testing at minimum rate shall be conducted without changing the duct system - the same physical restriction as determined in 2.1 above.

B2.2.1. Furnaces with the capability to set the low-fire blower speed independently from the high-fire blower speed. Set the blower speed such that the rise is the highest achievable value below the mid-point rise but no lower than the minimum nameplate rise. If this is not possible, the blower shall be set such that the rise is the lowest possible value above the mid-point rise but not higher than the maximum nameplate rise. If neither condition is attainable, the unit will be considered an inoperable sample. The Laboratory should contact AHRI and the manufacturer.

B2.2.2. Furnaces without the capability to set the low-fire blower speed independently from the high-fire blower speed – No adjustment to the blower speed shall be made. For the test, the control system of the furnace shall be provided a normal input corresponding to a low-fire call, and the blower shall be allowed to respond normally to the control system of the furnace. If the resulting rise is outside of the nameplate rise range, the unit will be considered an inoperable sample. The Laboratory should contact AHRI and the manufacturer.