

OPERATIONS MANUAL

VARIABLE REFRIGERANT FLOW MULTI-SPLIT AIR-CONDITIONERS AND HEAT PUMPS CERTIFICATION PROGRAM



AHRI VRF OM – DECEMBER 2019

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

Sponsored and administered by:



PREFACE

The following manual outlines the procedures and policies of the Performance Certification Program for Variable Refrigerant Flow Multi-Split Air-Conditioners and Heat Pump (VRF) Certification Program operated by the Air-Conditioning, Heating, and Refrigeration Institute (AHRI). This manual is to be used in conjunction with the AHRI General Operations Manual for AHRI Certification Programs. Where the AHRI General Operations Manual and this product-specific manual differ, this product-specific operations manual shall prevail.

The revision of this manual supersedes all previous revisions. The latest effective edition of this manual, as well as the AHRI General Operations Manual, can be accessed through the AHRI website, www.ahrinet.org.

The AHRI VRF Certification Program by AHRI provides for independent verification of the performance of the Participant's equipment. 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 VRF Certification Mark hereinafter referred to as the "Mark". The Mark is the Participant's public representation that the ratings of randomly selected units 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 license 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*.

Notes:

1. This manual supersedes VRF Operations Manual, May 2019.

VRF CERTIFICATION PROGRAM OPERATIONS MANUAL

TABLE OF CONTENTS

SECTION		PAGE
1	Program Overview	
1.1	Applicable Rating Standard	1
1.2	Product Definitions	1
1.2.1	Indoor Unit.....	1
1.2.2	Variable Refrigerant Flow (VRF) System.....	1
1.2.3	System Types	1
1.2.3.1	VRF Multi-split Air-to-air System.....	1
1.2.3.2	VRF Heat Recovery Multi-split System.....	1
1.2.4	Outdoor Unit.....	1
1.2.5	Water-source Unit	1
1.2.5.1	Ground-loop Heat Pump	2
1.2.5.2	Ground-water Heat Pump	2
1.2.5.3	Water to Air Heat Pump and/or Brine to Air Heat Pump	2
1.2.5.4	Water Loop Heat Pump	2
1.2.6	Single Module	2
1.2.7	Combined Modules	2
1.3	Program Scope	2
1.4	Intended Market	2
1.5	Basic Model Group (BMG).....	3
1.6	Manufacturer's Installation Instructions (MII)	3
1.7	Supplemental Testing Instructions (STI).....	3
2	Qualification Process	
2.1	Original Equipment Manufacturer (OEM) Applicants.....	3
STEP 2.1.1	Certification Application Package	3
STEP 2.1.2	Processing Application Package	3
STEP 2.1.2.1	Performance Certification Agreement for Original Equipment Manufacturer (OEM Agreement)	3
STEP 2.1.2.2	Participation and Licensing Fee Invoice	4
STEP 2.1.3	Selection and Acquisition of Test Samples.....	4
STEP 2.1.3.1	Number of Qualification Tests	4
STEP 2.1.3.2	Acquisition of Qualification Test Samples/Selection Criteria	4
STEP 2.1.4	Qualification Testing	4
STEP 2.1.4.1	Operating Tests	4
STEP 2.1.4.1.1	Operating Test Failures	4
STEP 2.1.4.2	Successful Completion of All Qualification Tests	5
STEP 2.1.4.3	First Sample Qualification Test Failure.....	5
STEP 2.1.4.4	Second Sample Qualification Test Failure.....	5
STEP 2.1.5	Welcome to the Program	5
2.2	Private Brand Marketer (PBM) Applicants	5
STEP 2.2.1	Certification Application Package	5
STEP 2.2.2	Processing Application Package	5
STEP 2.2.2.1	Performance Certification Agreement for Private Brand Marketer (PBM Agreement)	5
STEP 2.2.2.2	OEM Agreement on Behalf of the PBM Applicant	5
STEP 2.2.2.3	Licensing Fee Invoice	5
STEP 2.2.3	Welcome to the Program	5
3	Equipment Selection and Testing	

3.1	Annual Testing Requirement	5
3.1.1	For Single Module Systems \geq 65,000 Btu/h [19,033 W]	5
3.1.2	For Combined Module Systems \geq 65,000 Btu/h [19,033 W]	5
3.2	Location of Test.....	6
3.3	Selection of Test Samples	6
3.4	Methods for Acquiring Test Samples	6
3.4.1	System Selection	6
3.5	Sample Acquisition Timeframe	7
3.6	Required Equipment and Personnel Provisions	7
3.7	Sample Installation.....	7
3.8	Break-in Operation and Start-Up of Test System	7
3.9	Refrigerant Line Length Considerations	7
3.10	Certified Data	7
3.10.1	For VRF Multi-Split Air-Conditioners < 65,000 Btu/h [19,033 W]	7
3.10.2	For VRF Multi-Split Air-Conditioners \geq 65,000 Btu/h [19,033 W].....	7
3.10.3	For VRF Multi-Split Heat Pumps < 65,000 Btu/h [19,033 W]	7
3.10.4	For VRF Multi-Split Heat Pumps \geq 65,000 Btu/h [19,033 W].....	7
3.10.5	For VRF Multi-Split Heat Recovery Systems (air source and Water- source)	7
3.11	Test Failures	7
3.11.1	Certified Rating Test Failure	8
3.11.1.1	Options Following 1st Sample Failure	8
3.11.1.2	Options Following 2 nd Sample Failure	8
4	Challenge Tests.....	8
5	AHRI Directory of Certified Product Performance	
5.1	Publication of Ratings for Air-cooled VRF Systems \geq 65,000 Btu/h [19,033 W] and all Water-source VRF Systems in Certified Directory.....	8
5.2	Data Forms	9
6	Assessment and Payment of Certification Fees.....	9
7	Issuance of Violations and/or Termination	9
8	Program Hierarchy, Complaints, and the Appeals Process.....	9
9	Proper Use of the AHRI Certification Mark and Claims to Certification.....	9

Appendices and Forms

Appendix A	Setup, Commissioning and Operating Procedures for Laboratory Personnel	10
Appendix B	Start-up Procedure for VRF Performance Verification Testing	11

1. Program Overview

1.1 Applicable Rating Standard. It is mandatory for program Participants to comply with the provisions of the latest effective edition of AHRI Standard 1230, *Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and heat pump Equipment* (Standard). A copy of the Standard is available for download from the AHRI website, www.ahrinet.org.

1.2 Product Definitions. All terms in this document shall follow the AHRI GOM and the Standard definitions unless otherwise defined in this section.

1.2.1 Indoor Unit. A separate assembly of a split system that includes the features listed in Sections 1.2.1, 1.2.2, 1.2.3, and 1.2.4; and may or may not include the features listed in Sections 1.2.5, 1.2.6, and 1.2.7.

- An arrangement of refrigerant-to-air heat transfer coil(s) for transfer of heat between the refrigerant and the indoor air;
- A condensate drain pan;
- An air temperature sensing device;
- An integrated indoor blower (i.e. a device to move air including its associated motor);
- Sheet metal or plastic parts not part of external cabinetry to direct/route airflow over the coil(s);
- A cooling mode expansion device; and
- External cabinetry.

1.2.2 Variable Refrigerant Flow (VRF) System. An engineered direct expansion (DX) Multi-split System incorporating the following:

- A split system air-conditioner or heat pump incorporating a single refrigerant circuit that is a common piping network to multiple Indoor Units;
- Air-conditioner, heat pump, or heat recovery type system;
- One or multiple-manifolded Outdoor Units with a specific model number with at least one variable capacity compressor;
- Indoor Units; and
- Three or more steps of control on common, inter-connecting piping.

1.2.3 System Types.

1.2.3.1 VRF Multi-split Air-to-air System. A VRF system air-conditioner or VRF heat pump with one or more manifolded Outdoor Units that have air-to-air heat exchangers.

1.2.3.2 VRF Heat Recovery Multi-split System. A VRF air-to-air heat pump or VRF Water-source heat pump that is capable of providing simultaneous heating and cooling operation, where recovered energy from the Indoor Units operating in one mode can be transferred to one or more other Indoor Units operating in the other mode. This may be achieved by a gas/liquid separator or a third line in the refrigeration circuit.

1.2.4 Outdoor Unit. A separate assembly of a split system that transfers heat between the refrigerant and the outdoor air or refrigerant and water, and consists of an outdoor heat exchanger, compressor(s), an air moving device, and in addition for heat pumps, may include a heating mode expansion device, reversing valve, and/or defrost controls; water-source heat pumps may not have an air movement device.

1.2.5 Water-source Unit. A water-source heat pump is typically one of multiple units using fluid circulated in a common piping loop as a heat source/heat sink. The temperature of the loop fluid is usually mechanically controlled within a moderate temperature range. The heat pump

consists of one or more factory-made assemblies which normally include an indoor conditioning coil with air moving means, compressor(s) and refrigerant-to-water heat exchanger(s), including means to provide both cooling and heating or cooling only functions. When such equipment is provided in more than one assembly, the separated assemblies shall be designed to be used together, and the requirements of rating outlined in the standard are based upon the use of matched assemblies.

1.2.5.1 Ground-Loop Heat Pump. Brine-to-air heat pump using a brine solution circulating through a subsurface piping loop functioning as a heat source/heat sink. The heat exchange loop may be placed in horizontal trenches, vertical bores, or be submerged in a body of surface water. (ANSI/AHRI/ASHRAE ISO Standard 13256-1) The temperature of the brine is related to the climatic conditions and may vary from 23 °F to 104 °F.

1.2.5.2 Ground-water Heat Pump. Water-to-air heat pump using water pumped from a well, lake, or stream functioning as a heat source/heat sink. The temperature of the water is related to the climatic conditions and may vary from 41°F to 77°F for deep wells.

1.2.5.3 Water To Air Heat Pump and/or Brine to Air Heat Pump. A heat pump which consists of one or more factory-made assemblies which includes an indoor conditioning coil with air-moving means, at least one Variable Capacity Compressor(s), and refrigerant-to-water or refrigerant-to-brine heat exchanger(s), including means to provide both cooling and heating functions. Such equipment may also provide functions of sanitary water heating, air cleaning, dehumidifying, and humidifying.

1.2.5.4 Water Loop Heat Pump. Water-to-air heat pump using liquid circulating in a common piping loop functioning as a heat source/heat sink. The temperature of the liquid loop is usually mechanically controlled within a temperature range of 59 °F to 104 °F.

1.2.6 Single Module. A single Outdoor Unit or Water-source Unit that is assembled with multiple indoor units and controls to form a system.

1.2.7 Combined Modules. Two (2) or more Single Modules that are mechanically and electronically joined together to operate as a single Outdoor Unit assembled with multiple indoor units and controls to form a system.

1.3 Program Scope. This Certification Program applies to Production Models of 50 and 60 Hz VRF Systems, as defined in Section 1.2, that meet the following criteria:

- Include multi-split system air-conditioners and heat pumps irrespective of their type of electric power source, or secondary fluid (e.g. air-to-air or water-to-air) with cooling capacity equal to or above 65,000 Btu/h for Air-Source systems and all cooling capacities for Water-source systems;
- Use distributed refrigerant technology with cooling and heating capacities for Outdoor Units
- Indoor units from 5,000 Btu/h [1,462 W] to 144,000 Btu/h [42,202 W]. Each indoor unit is designed to condition a single zone;
- Consisting of the following matched components:
 - a) An Outdoor Unit with single or multiple compressors or variable capacity compressor;
 - b) Multiple Indoor Units; and
 - c) A zone temperature control device.

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. The Participant may choose to certify products outside of the intended market by Basic Model Group (BMG).

1.5 Basic Model Group (BMG). A Participant's listings shall be grouped by BMG. Each BMG shall have the following characteristics:

- Air-source and Water-source are in separate BMGs
- Heat pump and heat recovery may be in the same BMG
- Systems with different voltages may be in the same BMG
- All systems within a BMG must have the same nominal cooling capacity

1.6 Manufacturer's Installation Instructions (MII). Manufacturer's documents that come packaged with or appear in the labels applied to the unit(s). Online manuals are acceptable if referenced on the unit label or in the documents that come packaged with the unit. All references to "manufacturer's instructions," "manufacturer's published instructions," "manufacturer's installation instructions," "manufacturer's published recommendations," "manufacturer installation and operation manuals," "installation instructions", "manufacturer-specified", and other similar references means Manufacturer's Installation Instructions.

1.7 Supplemental Testing Instructions (STI). Additional instructions developed by the manufacturer and provided to the DOE. Supplemental Testing Instructions shall include:

- a) All instructions that do not deviate from Manufacturer's Installation Instructions but provide additional specifications for test standard requirements allowing more than one option; and
- b) Documentation of settings and software required to obtain all deviations from Manufacturer's Installation Instructions necessary to comply with Steady-state requirements.

Supplemental Testing Instructions shall provide steady operation that matches to the extent possible the average performance that would be obtained without deviating from the Manufacturer's Installation Instructions. Supplemental Testing Instructions shall include no instructions that deviate from Manufacturer's Installation Instructions other than those described in (b) above. (Appendix J of AHRI Standard 1230 provides guidance on how to develop such instructions);

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 General Operations Manual, Section 4.

STEP 2.1.1 Certification Application Package. In addition to the Application for AHRI Certification and Annual Sales Volume Form noted in the AHRI General Operations Manual, Section 4, Step 1, Applicants shall submit the following documentation to AHRI. System data submitted must be consistent with the Tested Combination definition contained in the latest edition of AHRI 1230.

- VRF DS4 data submittal forms (for systems $\geq 65,000$ Btu/h [19,033 W]);
- One test report for each BMG;
- Supplemental Testing Instructions PDF for each system;
- An Applicant requesting AHRI to submit data to CEC, DOE, and FTC shall submit third-party authorization, compliance forms and other necessary information.

Electronic forms shall be obtained from AHRI (available on www.ahrinet.org under the Product-Specific Certification Program).

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 General Operations Manual.

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 General Operations Manual.

STEP 2.1.3 Selection and Acquisition of Test Samples.

STEP 2.1.3.1 Number of Qualification Tests.

- For Single Module Systems. For Single Module systems, 30% of the Applicant's BMGs are rounded to the nearest integer number of system models using traditional rounding methods (i.e., calculated 2.49 tests results in the selection of two (2) systems and calculated 2.50 tests results in the selection of three (3) systems). No less than two (2) systems shall be tested.
- For Combined Module Systems. 20% of the Applicant's BMGs are rounded to the nearest integer number of system models using traditional rounding methods (i.e., calculated 2.49 tests results in the selection of two (2) systems and calculated 2.50 tests results in the selection of 3 units). No less than two (2) systems shall be tested. If a BMG contains both Single Module systems and Combined Module systems, the BMG will be counted as a BMG with Combined Module systems.

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 3.4 of this manual. All samples shall be provided with the requirements listed in Section 3.5 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.

In addition to the tests required to determine the energy efficiencies and capacities noted in 3.11, the following additional tests shall be conducted for qualification purposes at the expense of the Applicant.

STEP 2.1.4.1 Operating Tests. In addition to the Performance Rating tests, all qualification tests shall include the following Operating Tests to be conducted:

- Maximum Operating Conditions (MOC);
- Insulation Efficiency;
- Low Temperature Operation; and
- Condensate Disposal.

STEP 2.1.4.1.1 Operating Test Failures. If the sample fails the Operating Test, a second sample, to be selected by AHRI, shall pass in order to qualify into the program. If the second sample does not pass, then that system model and its BMG shall not be entered into the AHRI Directory of Certified Product Performance (Directory) and the Applicant shall cease production and sale of the failed system model in order to qualify into the certification program. A new system shall be selected and tested to continue the qualification process.

STEP 2.1.4.2 Successful Completion of All Qualification Tests. If all qualification tests pass proceed to STEP 2.1.5.

STEP 2.1.4.3 First Sample Qualification Test Failure. Refer to Section 4, STEP 4.4.2 of the AHRI General Operations Manual for details regarding the first sample qualification failure options:

STEP 2.1.4.4 Second Sample Qualification Test Failure. Refer to Section 4, STEP 4.4.3 of the AHRI General 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 General Operations Manual.

2.2 Private Brand Marketer (PBM) Applicants. With the additions noted below, the PBM qualification process shall proceed according to the AHRI General Operations Manual, Section 5. PBM Applicants are not required to undergo initial qualification testing. PBM product certification is contingent upon the certification of the associated OEM product.

STEP 2.2.1 Certification Application Package. In addition to the Application for AHRI Certification Form noted in the AHRI General Operations Manual, Section 5, STEP 5.1, Applicants shall submit the following documentation to AHRI:

- An Applicant requesting AHRI to submit data to CEC, DOE, and FTC shall submit third-party authorization, compliance forms and other necessary information.

STEP 2.2.2 Processing Application Package.

STEP 2.2.2.1 Performance Certification Agreement for Private Brand Marketer (PBM Agreement). No further action required beyond that listed in Section 5, STEP 5.2.1 of the AHRI General Operations Manual.

STEP 2.2.2.2 OEM Agreement on Behalf of the PBM Applicant. No further action required beyond that listed in Section 5, STEP 5.2.2 of the AHRI General Operations Manual.

STEP 2.2.2.3 Licensing Fee Invoice. Payment of the Licensing Fee is due within 30 calendar days of the invoice issue date.

STEP 2.2.3 Welcome to the Program. No further action required beyond that listed in Section 5, STEP 5.3 of the AHRI General Operations Manual.

3. Equipment Selection and Testing

3.1 Annual Testing Requirement.

3.1.1 For Single Module Systems. For all Water-source Single Module systems and Air-source Single Module systems with cooling capacities greater than or equal to 65,000 Btu/h [19,033 W], 20% of Participant's BMGs shall be tested annually, with a minimum of two (2) systems. Fractional numbers shall be rounded to the nearest whole number using traditional rounding methods.

3.1.2 For Combined Module Systems. For all Water-Source Combined Module systems and Air-source Combined Module systems with cooling capacities greater than or equal to 65,000 Btu/h [19,033 W], 20% of Participant's BMGs shall be tested annually, with a minimum of two (2) systems. 10% of the selected BMGs, shall be combined module systems consisting of three (3) or more

modules, with a minimum of one (1) and a maximum of two (2) systems to be tested. Fractional numbers shall be rounded to the nearest whole number using traditional rounding methods. If a BMG contains both Single Module systems and Combined Module systems, the BMG will be counted as a BMG with Combined Module systems.

3.2 Location of Test. Testing shall be performed at a third-party Laboratory of the Participant's choosing.

3.3 Selection of Test Samples. Selections shall be made by AHRI based on Active and Production Stopped data contained in the Directory. AHRI shall inform the Participant, in writing, of the systems selected for test.

3.4 Methods for Acquiring Test Samples. AHRI or the Laboratory personnel shall make a Random Sample Selection from the Participant's stock inventory within 60 calendar days of a selection by AHRI. Selected samples shall be shipped to the Laboratory accompanied by the Participant's published MII in printed or electronic format. Refer to Section 9 of the AHRI General Operation Manual. Production Stopped models may be acquired from the distribution chain. Expenses for this option are borne by the Participant.

3.4.1 System Selection. Laboratory personnel shall randomly select Outdoor Units and indoor units from a minimum of three (3) samples of each. However, for all selections that include multiples of identical Outdoor Units or indoor units, the number of samples available for selection shall be based on the formula below:

Number of samples available for selection = $id + 3$ or
Number of samples available for selection = $od + 3$

when $id > 1$ or
when $od > 1$

Where

id = Number of identical indoor units required
 od = Number of identical Outdoor Units required

Examples:

- If two (2) 10-ton identical Outdoor Units are selected by AHRI, the Participant shall make five (5) 10-ton identical Outdoor Units available for selection. [if $od = 2$, then number of outdoor units provided for selection = $od + 3 = 5$]
- If five (5) 2-ton identical indoor units are required for testing, the manufacturer shall make eight (8) 2-ton identical indoor units available for selection. [if $id = 5$, then number of indoor units provided for selection = $id + 3 = 8$]

Tested Outdoor Units and indoor units and interconnecting components can be re-used for testing in the same year. Doing so may result in additional charges billed by the Laboratory. The participant shall bear the labor and material cost for charging and vacuuming the outdoor unit module used for multiple AHRI tests (within normal laboratory operating hours) in the same program year. Outdoor Units that are tested in a Combined Module system test may also be used for Single Module system testing.

If a system component (outdoor module, indoor unit, etc.) is part of a first sample failure and is scheduled to be used in a separate test, the Participant shall decide whether to re-use the unit or provide another sample. If the Participant chooses to provide another sample, the sample must be selected and delivered to the lab within 30 days.

3.5 Sample Acquisition. Unless the chosen Laboratory is outside of the Intended Market, selections shall be made from Participant's stock inventory within the Intended Market. Unless otherwise authorized by AHRI, the Participant shall make the equipment available for selection by the Laboratory and deliver all selected sample(s) to the Laboratory within 90 calendar days from the date of selection letter.

3.6 Required Equipment and Personnel Provisions. The Participant shall provide the Outdoor Unit (Single Module or Combined Modules), indoor units and controls. Participants shall also provide information on connecting systems components electronically and mechanically, including piping layout and diameters and other listed system enhancement devices as a complete system for test. The Participant is responsible for shipping all necessary equipment and parts to the Laboratory in order to ensure that the sample functions properly and test(s) can be performed in accordance with the Standard. All refrigerant and refrigerant piping fees shall be borne by the Participant. Participants shall provide AHRI with a list of contacts available in case the Laboratory has an issue with testing and needs direction.

3.7 Sample Installation. The sample shall be installed in the Laboratory in accordance with Appendix B, the Participant's published MII in printed or electronic format, and the Participant's Supplemental Testing Instructions PDF.

3.8 Break-in Operation and Start-Up of Test System. At the Participant's expense, it may have the Laboratory operate the equipment for a Participant-specified number of hours, not to exceed 20 hours. The break-in requests shall be listed in the comments section of the Directory.

3.9 Refrigerant Line Length Considerations. The correction factors listed in the Standard shall be applied for test setups where the actual piping length, (not equivalent length) used by the Laboratory exceeds the minimum line length listed in the Standard.

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

3.10.1 For VRF Multi-Split Air-Conditioners

- Standard Rating Cooling Capacity, Btu/h [W];
- Energy Efficiency Ratio (EER), Btu/(W·h); and
- Integrated Energy Efficiency Ratio (IEER), Btu/(W·h).

3.10.2 For VRF Multi-Split Heat Pumps

- Standard Rating Cooling Capacity, Btu/h [W];
- Energy Efficiency Ratio (EER), Btu/(W·h);
- Integrated Energy Efficiency Ratio (IEER), Btu/(W·h);
- High Temperature Heating Standard Rating Capacity, Btu/h [W];
- High Temperature Coefficient of Performance (COP);
- Low Temperature Heating Standard Rating Capacity, Btu/h [W]; and
- Low Temperature Coefficient of Performance (COP).

3.10.3 For Water-source VRF Multi-Split Heat Pumps

- Standard Rating Cooling Capacity, Btu/h [W];
- Energy Efficiency Ratio (EER), Btu/(W·h);
- Integrated Energy Efficiency Ratio (IEER), Btu/(W·h);
- Heating Standard Rating Capacity, Btu/h [W];
- Coefficient of Performance (COP);

3.10.4 For VRF Multi-Split Heat Recovery Systems (air source and Water-source)

- Ratings listed in 3.10.2 and 3.10.3 above
- Simultaneous Cooling and Heating Efficiency (SCHE) (50% heating/50% cooling).

3.11 Test Failures. A failure is a test result less than 95% of Published Ratings for capacities, EER, and COP and less than 90% of Published Ratings for IEER and SCHE.

3.11.1 Certified Rating Test Failures.

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

- Re-rate all system models within the failed sample's BMG proportionate to the failed test's results;
- Test second sample of the same system model (sample shall be available within the timeframe and procedure allotted in Section 3.4 following notification of decision to AHRI via Manufacturer's Decision Form [MDF]); or
- Obsolete the system model, which also obsoletes all system models within the corresponding BMG.

3.11.1.2 Options Following 2nd Sample Failure. When the Participant is notified of a second sample certified failure, the Participant has seven (7) calendar days to select one of the following options:

- Re-rate all system models within the failed sample's BMG proportionate to the failed test's results; or
- Obsolete the system model, which also obsoletes all system models within the corresponding BMG.

4. Challenge Tests

Refer to Section 10 of the AHRI General Operations Manual.

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 General Operations Manual.

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

- AHRI Certified Reference Number;
- Name of Manufacturer;
- System Model Status;
- Brand Name of System Model;
- Series Name
- System Model Number;
- Module Model Number(s);
- Indoor Unit Type;
- Indoor Model Numbers
- Classification;
- Cooling Capacity, EER, and IEER;
- SCHE, if applicable;
- High Heating Capacity and COP, if applicable; and
- Low Heating Capacity and COP, if applicable.

5.2 Data Forms. Each OEM Participant shall list its products by BMG. OEM Participants shall submit/edit product data via the Directory.

6. Assessment and Payment of Certification Fees

Refer to Section 12 of the AHRI General Operations Manual.

7. Issuance of Violations and/or Termination

Refer to Section 14 of the AHRI General Operations Manual.

8. Program Hierarchy, Complaints, and the Appeals Process

Refer to Section 15 of the AHRI General Operations Manual.

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

Refer to Section 8 of the General OM.

APPENDIX A.
SETUP, COMMISSIONING AND OPERATING PROCEDURES FOR LABORATORY PERSONNEL

Setup checklist and operating procedures for the Laboratory personnel:

1. Check the nameplate model is the same as the AHRI requested model.
 - a. Check if there are additional comments in the data.
2. Follow the Manufacturer's Installation Instructions and related drawings (manufacturer representative may be present):
 - a. Charging instructions;
 - b. Tubing sizing;
 - c. Airflow settings;
 - d. Expansion device. If there is a use of a TXV, ensure there is insulation on the bulb. Check that the bulb is attached and positioned correctly;
 - e. Verify all enhancements per the rating are installed properly (e.g. demand defrost board, liquid line solenoid, TXV, time delay relay);
 - f. Note any deviations from the MII; and
 - g. Verify that the unit is physically installed per the MII.
3. Verify that the coil dimensions match the values in the AHRI Directory.
4. Verify that the indoor unit net weight matches the values specified in the Manufacturer's publicly available documentation as directed by the Participant's Representative. For Ceiling Cassettes, verify if the grill should be included. For ducted indoor units, verify the weight as-shipped. Tolerance for production variability of +5%.
5. Verify that the ductwork meets ASHRAE Standard 37 requirements.
6. Verify that there is a minimum of 3' clearance for the intakes of ducted indoor unit. Make sure that data reflects that intakes are not obstructed or restricted.
7. Inspect the indoor ductwork for leaks.
8. Inspect to ensure that the indoor coil is sitting in the housing and is positioned correctly.
9. Inspect to ensure the trap for condensate is clear of obstructions and check if the condensate is leaving.
10. Verify that the correct nozzles are selected for the given airflow range.
11. Verify that the voltage to be applied matches voltage listed on nameplate.
12. Verify that the major components are of compatible voltage.
13. Verify installation to the manufacturer's supplemental testing instructions PDF (if available).
14. Verify refrigerant line length between outdoor and indoor units.
15. Verify airflow rates of indoor units.

Additional checks following a failure:

1. For high and low speed:
 - a. ID airflow;
 - b. ID watts;
 - c. ID static;
 - d. OD airflow if OD air is the secondary check or refrigerant mass flow;
 - e. OD watts on fan motor;
 - f. Compressor watts;
 - g. Sub-cooling and superheat; and
 - h. Liquid temperature.
2. Photos of test setup.
3. Time between defrost
4. Report any error messages or abnormally flashing lights.

APPENDIX B.
START-UP PROCEDURE FOR VRF PERFORMANCE VERIFICATION TESTING

B1. *Start-up Procedure.* Manufacturers shall provide supplemental testing instructions PDF that describe and layout of system set-up in the testing laboratory. In the event of conflicting Instructions regarding the set-up of the system, outdoor unit MII prevail, followed by the outdoor unit label, followed by the indoor unit MII, followed by the supplemental testing instructions PDF.

Table B1. VRF Start-up Procedural Steps	
Procedural Step	Responsible Entity
1. Assemble system components (all components must be production models) a. Outdoor Unit(s) b. Indoor Unit(s) c. Heat recovery devices d. VRF system control devices e. Connecting devices; headers, branch connector, twinning kit, etc.	Laboratory
2. Assemble supplies a. Insulated copper tubing for supply and return lines between components – length based on ODU Type and capacity and IDU type b. Power wiring c. Control wiring d. Drain piping	Laboratory
3. Assemble test apparatus: a. Indoor Units test stand b. Air sampling trees c. Static ports	Laboratory
4. Position the system components and connect with insulated refrigerant piping a. IDUs for heat recovery systems must be appropriately split for SCHE test per the Supplemental Testing Instructions PDF	Laboratory Per Manufacturer's Piping Diagram and Supplemental Testing Instructions PDF
5. Evaluate the system for potential refrigerant leaks and repair as necessary	Laboratory
6. Pull a vacuum on the system to remove moisture and verify leak integrity	Laboratory (Default: initial vacuum of 500 microns).
7. Address Indoor Units / Port number setting for heat recovery devices (if necessary)	Manufacturer
8. Run power wire to each of the system components	Laboratory
9. Run control wiring to each of the system components	Laboratory
10. Check power to the system	Laboratory
11. Check communication wiring with the VRF system control device	Manufacturer
12. Check airflow of the IDU's with the refrigerant-side off	Laboratory
13. Check duct box to ensure complete insulation and no air leakage	Laboratory
14. Charge system with refrigerant per AHRI Standard 1230.	Laboratory Per Manufacturer's Instruction Manual
15. Laboratory to stabilize test room conditions with input from the manufacturer	Laboratory

16. Perform system start-up procedures (system initialization) at a non-standard rating, uncontrolled condition for up to 3 hours, per supplemental testing instructions PDF. If start-up procedures are not included in the supplemental testing instructions PDF, then skip step # 16.	Manufacturer
17. Allow the system to run for up to 20 hours to break-in the compressor as prescribed by the Manufacturer prior to testing. (optional). This time period includes the 3-hour period used in Step 16.	Laboratory Per Supplemental Testing Instructions PDF

B2. Testing Operation Procedure for Standard Rating Tests

B2.1 Standard Rated Cooling Capacity and EER (100% Cooling Test, SRT)

The variable operation components shall only be adjusted to conditions that are intended to operate in the field.

- Manufacturer’s representative adjusts each module’s compressor speed to achieve the Rated Capacity. All compressors shall initially operate at the setting provided to AHRI and/or the DOE supplemental testing instructions PDF.
- Manufacturer’s representative shall adjust the compressor speed to achieve 95% or greater of the Rated Capacity. This tested capacity becomes the capacity used for IEER and SCHE testing.
- Once the manufacturer’s representative is satisfied that the system has achieved the Rated Capacity and is operating under Stable Conditions for the full-load cooling capacity test, all variable components will be fixed, all compressor speeds are recorded by the laboratory, and the manufacturer’s representative must leave the area. If the system is unable to achieve the Rated Capacity, the test will continue to run to completion.

B2.2 Integrated Energy Efficiency Rating IEER (Part Load Tests) During the part load tests, the compressors can only be stopped if the manufacturer’s operating system control would cause that mode of operation in the field. The variable operation components shall only be adjusted to conditions that are intended to operate in the field.

- The following rules of testing apply for each of the remaining IEER tests (75% capacity, 50% capacity, and 25% capacity).
- The number of compressors can be stopped according to the manufacturer’s supplemental test instructions in PDF format. All IDUs are required to remain in operation during the test.
- Manufacturer’s representative adjusts each module’s compressor speed to achieve a Total Cooling Capacity value corresponding to 75%, 50%, or 25% (matching each particular part load test) of the tested full load cooling capacity.
- While adjusting the compressor speed(s), the manufacturer’s rep may also adjust any other variable operation components (such as expansion valves) within the system components (ODU’s, IDU’s, heat recovery devices) per Section C2.4 to achieve stable operation.
- Within 2.5 hours, the system shall achieve the capacity referenced in B2.2.3 and shall operate under Stable Conditions for the particular part load test, all variable components will be fixed, all compressor speeds are recorded by the testing agency - and the manufacturer’s representative, only for the 100% test, may adjust the set-up to achieve an appropriate balance between capacity and power. After making these setting the manufacturer’s representative must leave the area.

B2.3 High Temperature and Low Temperature Heating Standard Rating Capacity and COP

- Manufacturer’s representative adjusts each module’s compressor speed to achieve the Rated Capacity. All compressors should operate within the operating range provided to AHRI and/or the DOE supplemental testing instructions PDF.

- Manufacturer's representative shall adjust the compressor speed to achieve 95% or greater of the Rated Capacity.
- For the high temperature heating capacity test, the manufacturer representative shall have 2.5 hours to fix the compressor speed and all variable components. The manufacturer's representative may adjust the set-up to achieve an appropriate balance between capacity and power. With the system operating under Stable Conditions, all variable components will be fixed and all compressor speeds are recorded by the laboratory. After making these setting the manufacturer's representative must leave the area.
- For the low temperature heating capacity test, the manufacturer representative shall fix the compressor speed and all variable components. The manufacturer's representative may adjust the set-up to achieve an appropriate balance between capacity and power. With the system operating under Stable Conditions, all variable components will be fixed and all compressor speeds are recorded by the laboratory. After making these setting the manufacturer's representative must leave the area.

B2.4 Performance Testing Adjustments. The system shall operate per commands from the system control except where the control attempts to take action when the system is forced to operate at constant compressor speed. In the cases where forcing constant compressor speed causes 'abnormal' system operation, the manufacturer shall provide Instructions regarding what additional settings need to be made (specific Instructions on which components and what the required settings are) prior to test. This shall be included at the time the basic model is submitted to AHRI. The variable operation components below shall only be adjusted to conditions that are intended to operate in the field.

- Compressor Speed Input
- Outdoor Unit Expansion Valve
- Indoor Unit Expansion Valve
- Heat Recovery Device EXV
- Indoor Unit Fan Speed
- Outdoor Unit Fan Speed
- Defrost Timing