OPERATIONS MANUAL

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

VRF OM – DECEMBER 2023

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

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AHRI
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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 (GOM) 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 current 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, *Conformity assessment – Requirements for bodies certifying products, processes and services.*

Notes:
This manual supersedes VRF Operations Manual, December 2019.

Printed in U.S.A.

VRF CERTIFICATION PROGRAM OPERATIONS MANUAL

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1. Program Overview

1.1 *Applicable Rating Standard*. It is mandatory for program Participants to comply with the provisions of AHRI Standard 1230 – 2021, *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 (a service coil is not an Indoor Unit) that includes the following features:

- 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; and
- An integrated indoor blower (i.e. a device to move air including its associated motor). A separate designated air moving device that may be a furnace or a modular blower (as defined in appendix AA to 10 CFR Part 430, Subpart B) may be considered to be part of the Indoor Unit.

The following features may or may not included:

- Sheet metal or plastic parts not part of external cabinetry to direct/route airflow over the coil(s); 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.
- Three or more steps of control on common, inter-connecting piping.

1.2.2.1 *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.

1.2.2.2 *VRF Heat Recovery Multi-split System*. A VRF air-to-air Heat Pump or VRF Water source Heat Pump that can provide 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.

1.2.3 *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 moving device.

1.2.4 *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. Any references to Water Source Heat Pumps in this OM includes all capacities ≥ 17,000 Btu/h.

1.2.4.1 *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 normally include an indoor conditioning coil with air-moving means, at least one Variable Speed Compressor(s), and refrigerant-to- water or refrigerant-to-brine heat exchanger(s), including means to provide both cooling and heating, cooling-only, or heating-only functions. When such equipment is provided in more than one assembly, the separated assemblies should be designed to be used together. Such equipment may also provide functions of sanitary water heating, air cleaning, dehumidifying, and humidifying.

1.2.4.2 *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.

1.2.4.3 *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. The temperature of the brine is related to the climatic conditions and may vary from 23°F to 104°F.

1.2.4.4 *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 *Single Module*. A single Outdoor Unit or Water Source Unit that is assembled with multiple Indoor Units and controls to form a system.

1.2.6 *Combined Modules*. Two (2) or more single modules that are mechanically and electronically joined together by a licensed contractor in the field or a technician in a test lab to operate as a single Outdoor Unit that is assembled with multiple Indoor Units and controls to form a system.

1.2.7 Controls Verification Procedure (CVP). As defined in the Standard.

1.2.8 Critical Parameter(s). As defined in the Standard.

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);
- Use distributed refrigerant technology with cooling and heating capacities for Outdoor Units and Water Source Units from 12,000 Btu/h [3508 W] to 760,000 Btu/h [222,734 W] and Indoor Units from 5,000 Btu/h [1,462 W] to 144,000 Btu/h [42,202 W]. Each Indoor Init is designed to condition a single zone; and
- 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

1.3.1 *Program Scope Exclusions.* VRF Systems under 65,000 Btu/h will be tested per AHRI Standard 210/240 and corresponding OM until such time as these systems are transitioned into this program.

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
- All systems within a BMG must have the same nominal cooling capacity

1.5.1 *Optional Subdivisions of BMG*. The Participant may further sub-divide its BMGs. The following are examples of additional parameters that may be used to sub-divide BMGs:

- Heat pump and heat recovery may be in the same BMG
- Systems with different voltages may be in the same 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 General Operations Manual, Section 4.

STEP 2.1.1 *Certification Application Package*. In addition to the Application for AHRI Certification and New Applicant License Fee Form – Sales Volume 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 Standard.

- One test report for each BMG;
- Supplemental testing instructions PDF for each system (Appendix D of the Standard provides guidance on how to develop such instructions);
- 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*.

STEP 2.1.3.1.1 *For Single Module Systems ≥ 65,000 Btu/h*. For single module systems ≥ 65,000 Btu/h, 30% of an Applicant's BMGs shall be tested, with a minimum of two (2) systems. Fractional numbers 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).

STEP 2.1.3.1.2 *For Combined Module Systems ≥ 65,000 Btu/h*. For Combined Module systems ≥ 65,000 Btu/h, 20% of an Applicant's BMGs shall be tested, with a minimum of two (2) systems. Fractional numbers 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) systems). 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 2.1.3.1.3 *CVP Testing*. AHRI shall select no less than two (2) systems, at random, of the qualification selection to be subject to CVP testing. All four (4) IEER testing points (100%, 75%, 50%, 25%) shall undergo CVP testing on these systems. CVP testing shall be conducted first, and follow the procedure listed in Appendix C of AHRI Standard 1230 – 2021.

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 in accordance 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 Participant.

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

- Maximum Operating Conditions (MOC);
- Voltage Tolerance for systems < 65,000 Btu/h only;
- Insulation Efficiency;
- Low Temperature Operation; and
- Condensate Disposal.

STEP 2.1.4.1.1 *Operating Test Failures.* If the first 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 2.1.4.5 *Critical Parameters Invalidated by CVP*. If Critical Parameters are found to be invalid according to the results of the CVP, follow the process as defined in Appendix D of this OM.

Note: If the new critical parameters result in IEER that is within the tolerance of the original rating, the result is passed. If the result is an IEER outside the original tolerance, follow section 3.11.1.

STEP 2.1.4.6 *Test Failures with CVP Failure*. If a sample test fails both CVP and a certified metric, then the second sample or penalty test shall also be subjected to CVP testing.

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*. No further action required beyond that listen in Section 5, STEP 5.1 of the AHRI General Operations Manual.

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 ≥ 65,000 Btu/h.* For single module systems ≥ 65,000 Btu/h, 20% of a 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 ≥ 65,000 Btu/h*. For Combined Module Systems ≥ 65,000 Btu/h, 20% of a Participant's BMGs shall be tested annually, with a minimum of two (2) systems. The selected systems shall contain 10% of combined module systems consisting of three (3) or more modules, with a minimum of one (1) system 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.

3.1.3 *CVP Testing*. AHRI shall select one (1) system, of the annual selection to be subject to CVP testing. All four (4) IEER testing points (100%, 75%, 50%, 25%) shall be conducted on this system. CVP testing shall be conducted first, and follow the procedure listed in Appendix C of AHRI Standard 1230 – 2021.

3.1.3.1 *Failed CVP Test*. Following a failed CVP test, the Laboratory shall verify CVP was conducted per the test standard and calculate RSS points total. The manufacturer representative may review RSS calculations and relevant data. This review shall take at most three hours.

3.1.3.2 *Oil Return Operation*. follow the procedures listed in the Standard. In the case where oil return occurs within the final 60min, it is not necessary to repeat the test if the RSS total was passed prior to the oil return (Condition tolerance per Table C1 still apply, except during the actual oil return and 30-minute pause).

3.2 *Location of Test*. Testing shall be performed at an AHRI recognized 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 sixty (60) 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. 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. If a system model with a status of Production Stopped cannot be supplied for testing, then that system model's listing shall be Discontinued from the Directory.

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 Indoor Unit samples available for selection = $id + 3$ or
Number of Outdoor Unit 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. Outdoor Units that are tested in a Combined Module system test may also be used for Single Module system testing.

3.5 *Sample Acquisition Timeframe*. Participants shall make all systems available for selection within sixty (60) calendar days after notification of selected systems by AHRI. Laboratory personnel shall make a selection from the Participant's stock inventory within the timeframe agreed upon by the Laboratory, Participant, and AHRI. Unless otherwise authorized by AHRI, the Participant shall deliver all selected sample(s) to the Laboratory within 60 calendar days of selection by Laboratory personnel.

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.

A Participant may assist in the setup of the test system as outlined in Appendix B.

The Participant shall be allowed in the Laboratory during setup and start-up of testing to verify the Participants' installation requirements and Best or adjust Critical Parameters.

3.7 *Sample Installation.* The sample shall be installed in the Laboratory in accordance with Appendix B, the Participant's published installation instructions in printed or electronic format, and the Participant's supplemental testing instructions PDF.

3.7.1 *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 participant shall notify the laboratory of any break-in requests prior to laboratory selection.

3.8 *Refrigerant Line Length Considerations*. The correction factors listed in the Standard shall be applied for test setups where the actual refrigerant line length used by the Laboratory exceeds the minimum line length listed in the Standard.

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

3.9.1 *For VRF Multi-Split Air-Conditioners ≥ 65,000 Btu/h*

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

3.9.2 *For VRF Multi-Split Heat Pumps ≥ 65,000 Btu/h*

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

3.9.3 *For VRF Multi-Split Heat Recovery Systems (air source and water source)*

- Ratings listed in 3.9.1 or 3.9.2 above
- Simultaneous Cooling and Heating Efficiency (SCHE) (50% heating/50% cooling).

3.10 *Tests for Air-source Systems < 65,000 Btu/h*.

3.10.1 *Tests, Air-Conditioning*. All Air-Conditioning equipment shall be tested with the DOE “A” and “B” cooling tests as described in the Standard. Standard Rating tests shall be conducted using the nameplate rated voltage and frequency specified in the Standard. For dual nameplate voltage ratings (other than NAECA equipment), tests shall be conducted at 230V.

3.10.2 *Tests, Heat Pumps*. All Heat Pump equipment shall be tested with the DOE “A” and “B” cooling tests, High and Low Temperature Heating, and Frost Accumulation tests as described in the Standard. Standard Rating tests shall be conducted using the nameplate rated voltage and frequency specified in the Standard. For dual nameplate voltage ratings (other than NAECA equipment), tests shall be conducted at 230V.

3.10.3 *EER_A Test*. EER_A is calculated from the DOE “A” test conditions by dividing the capacity by the total system power. The calculated EER_A shall be within 95% of the rated value. For multi-stage systems, the highest rated capacity is used to determine EER_A.

3.10.4 *Default Factors*. At the completion of DOE “A” and “B” tests, the Laboratory calculates the SEER using the Cyclic-Degradation Coefficient (C_D) default factor 0.25 even if the sample is certified with a lower C_D, not less than zero.

For heat pumps, at the completion of heating mode and frost accumulation tests, the Laboratory calculates the HSPF with C_D default factor 0.25.

3.10.5 *DOE “C” and “D” Tests*. If the calculated SEER is less than 95% of the certified SEER, the sample may proceed through the DOE “C” and “D” tests at the Participant’s option and expense to obtain a tested C_D value. The tested C_D value shall be lower than the default C_D for it to be used to calculate SEER.

Even if the requirements are met using a default C_D value of 0.25, the Participant may opt for “C” and “D” tests to be performed at his expense. If the tested C_D is higher than the default value, the default value is to be used to calculate SEER and HSPF.

3.10.6 *High Temperature Heating Cyclic Test*. For heat pumps whose calculated HSPF is less than 95% of the certified HSPF, the model may, at the Participant’s option and expense, undergo High Temperature Heating Cyclic Test to obtain a tested C_D value. The tested C_D value shall be lower than the default C_D for it to be used to calculate HSPF.

Even if the requirements are met using a default C_D value of 0.25, the Participant may, at his expense, opt to perform the High Temperature Heating Cyclic Test.

3.11 *Test Failures.* A failure is a test result less than 96% of Published Ratings for capacities, 95% of published ratings for 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;
- Re-test the same unit if the unit has operated less than 16 hours, including any break-in running time.
- Test second sample or additional samples (up to 3 for systems < 65,000 Btu/h) 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.

3.11.1.3 *Critical Parameters Invalidated by CVP*. If Critical Parameters are found to be invalid according to the results of the CVP, follow the process as defined in Appendix D of this OM.

Note: If the new critical parameters result in IEER that is within the tolerance of the original rating, the result is passed. If the result is an IEER outside the original tolerance, follow section 3.11.1.

3.11.1.4 *Test Failures with CVP Failure*. If a sample test fails both CVP and a certified metric, then the second sample or penalty test shall also be subjected to CVP testing.

3.11.2 *Re-Rate Following Test Additional Sample.* Following the decision to Test Additional Samples, if the Participant concedes to re-rate their rating or it has been determined that the rating is non-compliant through the statistical analysis, the model combination will be re-rated based on the DOE Rating Procedures, CFR Title 10, Part 429, Subpart B, §429.16. Furthermore, all models within the failed sample's BMG will be re-rated the same proportionately.

3.11.2.1 *Re-Rate Following First Additional Test "Second Sample".* If the Participant concedes to re-rate their rating after the first additional test or "second sample", the model combination will be re-rated to the second sample test results.

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 for Air-cooled VRF Systems ≥ 65,000 Btu/h and all Water source VRF Systems in Certified Directory*. The following information pertaining to each certified system model shall be published in the Directory:

- AHRI Certified Reference Number
- Brand Name
- Series Name
- AHRI Type
- System Model Number
- Module Model Number(s)
- Indoor Unit Type
- Cooling Capacity
- EER
- IEER
- SCHE[1]
- High Heating Capacity and COP[2]
- Low Heating Capacity and COP[2]

[1] For all VRF Heat Recovery Systems
[2] For VRF Air Source Multi-Split Heat Pumps and Air Source Heat Recovery Systems

Additional data may be shown for products sold in areas requiring further product information/ratings or EPA ENERGY STAR® listings.

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

5.2.1 *Making Changes to Submissions*. If a Participant submits new listings for products less than 65,000 Btu/h to the Directory via the input interface on the Directory, the Participant shall be able to make corrections to the listings until 11:59 pm ET on the date of the submission. The data is published and sent to the DOE after midnight.

6. Assessment and Payment of Certification Fees

Refer to Section 12 of the AHRI General Operations Manual.

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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, supplemental testing 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 manufacturer's installation instructions; and
    g. Verify that the unit is physically installed per the installation instructions.
3. Verify that the coil dimensions match the values in the AHRI Directory.
4. Verify that the ductwork meets ASHRAE Standard 37 requirements.
5. 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.
6. Inspect the indoor ductwork for leaks.
7. Inspect to ensure that the indoor coil is sitting in the housing and is positioned correctly.
8. Inspect to ensure the trap for condensate is clear of obstructions and check if the condensate is leaving.
9. Verify that the correct nozzles are selected for the given airflow range.
10. Verify that the voltage to be applied matches voltage listed on nameplate.
11. Verify that the major components are of compatible voltage.
12. Verify installation to the manufacturer's supplemental testing instructions PDF (if available).
13. Verify refrigerant line length between Outdoor and Indoor Units.
14. 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.
5. Last date that the LEAP was conducted.

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 installation instructions prevail, followed by the Outdoor Unit label, followed by the Indoor Unit installation instructions, 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).*

B2.1.1 *Manufacturer's representative shall set Critical Parameters at each load point to the values set in the supplemental testing instructions PDF. In cases where a Critical Parameter value is not in the STI, the system must operate per commands from the system controls for that parameter. Once set, Control Settings must remain unchanged for the remainder of the test. The initial setting and any allowable adjustment of Critical Parameters shall be performed by manufacturer's representative and monitored by a member of the Laboratory.*

B2.1.2 *If the system is unable to achieve the Rated Capacity +/-3% or the SHR is higher than 0.82, manually controlled critical parameters must be adjusted per Section 6.3.3 of the Standard. Once the manufacturer's representative has finished setting all Critical Parameters, they are recorded by the laboratory, and the manufacturer's representative must leave the area.*

B2.2 *During the part load tests Critical Parameters are set to the values set in the STI.*

B2.2.1 The following rules of testing apply for each of the remaining IEER tests (75% capacity, 50% capacity, and 25% capacity).

B2.2.2 Within 2.5 hours, the system shall operate at a stable condition and Critical Parameters shall be set to the values in the manufacturer's supplemental test instructions in PDF format. The initial setting and any allowable adjustment of Critical Parameters shall be performed by manufacturer's representative and monitored by a member of the Laboratory.

B2.2.3 If the unit cannot operate within 3% of the target cooling capacity (i.e., within 3% of the load fraction for a given part-load cooling test (75%, 50%, 25%), or the SHR is higher than 0.85 (75%), manually controlled Critical Parameters must be adjusted per Section 6.3.3 or the Standard.

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

B2.3.1 Critical Parameters shall remain set to the values in the STIs.

B2.3.2 For the high temperature heating capacity test, the system shall operate at a stable condition and Critical Parameters shall be set to the values in the manufacturer's supplemental test instructions in PDF format within 2.5 hours. No adjustments to Critical Parameters are allowed.

B2.3.3 For the low temperature heating capacity test, the system shall operate at a stable condition and Critical Parameters shall be set to the values in the manufacturer's supplemental test instructions in PDF format within 2.5 hours. No adjustments to Critical Parameters are allowed.

B2.4 *Performance Testing Adjustments.* At each load point, Critical Parameters must be set to the values in the STI. In cases where a Critical Parameter value is not in the STI, the system must operate per commands from the system controls for that parameter. Once set, Control Settings must remain unchanged for the remainder of the test (except for allowable adjustment of Critical Parameters as described in Section 6.3.3 of the Standard). The initial setting and any allowable adjustment of Critical Parameters shall be performed by manufacturer authorized personnel and monitored by a member of the Laboratory. Critical Parameters include:

B2.4.1 Compressor Speed(s)

B2.4.2 Outdoor Fan Speed(s)

B2.4.3 Outdoor Variable Valve Position(s)

Note: Section B2.4 is not applicable to the SCHE test point.

APPENDIX C. CERTIFICATION OF MODELS RATED WITH INTERNATIONAL RATING CONDITIONS

Certification of models rated with International Rating Conditions shall be certified using VRF OM and the GOM, with the following exceptions:

C1. *Basic Model Groups (BMGs)*. See Section 1.5.

C1.1 *Optional Additional BMGs.* In addition to the options in Section 1.5, a participant may choose to further subdivide its international products into separate BMGs from the North American products, using the following options:

- *Market*. The BMGs can be subdivided into 2 groups based on whether it is sold in U.S. & Canada or Outside of U.S. and Canada.
- *Rating Conditions.* The BMGs can be subdivided into 2 groups based on whether it is rated using AHRI Rating Conditions or International Rating Conditions.

C2. *Annual Testing Requirements.*

C2.1 *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, 20% of Participant's BMGs certified to International Rating Conditions 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.

C2.2 *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 , 20% of Participant's BMGs certified to International Rating Conditions shall be tested annually, with a minimum of two (2) systems. 10% of the selected Combined Module System BMGs certified to International Rating Conditions 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.

C2.3 *BMG Models with both AHRI Standard Ratings and International Ratings*. BMGs that have certified ratings for both AHRI Standard and International Rating Conditions shall be counted only once, under BMGs with AHRI Standard Rating Conditions.

C3. *Certified Data*. In accordance with the Standard, the following certified ratings are verified by test:

C3.1 *Certified Data at International Rating Conditions.* The participant shall certify the performance rating at one or more of the international rating conditions, as specified in Table C1. The participant may further choose to certify additional operating conditions specified in Table C3. Certification tests shall be conducted at all conditions at which the participant certifies the equipment.

C3.1.1 *For VRF Multi-Split Air-Conditioners*

- Cooling Capacity at T1, T2, T3, and/or T4, Btu/h; as applicable.
- Energy Efficiency Ratio (EER_{T1}T1, EERT2, EERT3, EERT4) T1, T2, T3, and/or T4, Btu/W·h, and Coefficient of Performance (COPT1, COPT2, COPT3, COPT4) at T1, T2, T3, and/or T4, W/W; as applicable; and
- Extra High Temperature Operating Requirement, as applicable.

C3.1.2 *For VRF Multi-Split Heat Pumps*

- Cooling Capacity at T1, T2, T3, and/or T4, Btu/h; as applicable.
- Energy Efficiency Ratio (EERT1, EERT2, EERT3, EERT4) T1, T2, T3, and/or T4, Btu/W·h and Coefficient of Performance (COPT1, COPT2, COPT3, COPT4) at T1, T2,

T3, and/or T4, W/W; as applicable.
- Heating Capacity at H1, H2, and/or H3, Btu/h; as applicable.
- Coefficient of Performance (COP_{H1}, COP_{H2}, COP_{H3}) at H1, H2, and/or H3; as applicable; and
- Extra High Temperature Operating Requirement, as applicable.

C3.1.3 *For Water source VRF Multi-Split Heat Pumps:*

- Cooling Capacity at T1, T2, T3, and/or T4, Btu/h; as applicable.
- Energy Efficiency Ratio (EERT1, EERT2, EERT3, EERT4) T1, T2, T3, and/or T4, Btu/W·h, and Coefficient of Performance (COPT1, COPT2, COPT3, COPT4) at T1, T2, T3, and/or T4, W/W; as applicable.
- Heating Capacity at H1, H2, and/or H3, Btu/h; as applicable; and
- Extra High Temperature Operating Requirement, as applicable.

C3.1.4 *For VRF Multi-Split Heat Recovery Systems (air source and Water source):*

- Ratings listed in C3.1.2 or C3.1.3 above.
- Simultaneous Cooling and Heating Efficiency (SCHE) (50% heating/50% cooling).

C4. *Certification Requirements.* Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and heat pumps Production models sold for use outside the intended market are eligible for AHRI certification at International Rating Conditions and shall be rated at one or more of the conditions shown in Table C1. Certification tests shall follow all the conditions specified in the applicable rating standard, except for the requirements specified in Section C.1, C.2, and C.3. Certification tests shall be conducted at all conditions at which the participant certifies the equipment.

Table C1. International Standard Rating Conditions (for I-P Standards)

Cooling – Temperature Conditions	T1 (Moderate Climates)	T2 (Cool Climates)	T3 (Hot Climates)	T4 (Hot Climates)
Indoor	80.6°F DB[1] & 66.2°F WB[2]	69.8°F DB & 59.0°F WB	84.2°F DB & 66.2°F WB	79.9°F DB & 66.9°F WB
Outdoor	95.0°F DB & 75.2°F WB	80.6°F DB & 66.2°F WB	114.8°F DB & 75.2°F WB	118.4°F DB & 75.2°F WB
Heating – Temperature Conditions	H1 (Warm Climates)	H2 (Moderate Climates)	H3 (Cold Climates)	H3 (Cold Climates)
Indoor	68.0°F DB and 59.0°F WB max.	68.0°F DB & 59.0°F WB max.	68.0°F DB and 59.0°F WB max.	68.0°F DB and 59.0°F WB max.
Outdoor	44.6°F DB and 42.8°F WB	35.6°F DB & 33.8°F WB	19.4°F DB & 17.6°F WB	19.4°F DB & 17.6°F WB

Note: 1. DB = dry-bulb
2. WB = wet-bulb

C4.1 *External Static Pressure*. The External Static Pressure shall be adjusted using Table C2.

C4.2 *Airflow*. The unit shall run at the rated airflow at the respective International Rating Condition temperature, specified by the manufacturer. Airflow shall be adjusted in accordance to Section 6, of the Applicable Rating Standard. The airflow shall be adjusted within ±3% of the rated airflow.

C4.3 *Certified Metrics.* Production models sold for use outside of the intended market may be optionally certified to the following metrics, as shown in Table C3, at the respective rating conditions.

Table C2. External Static Pressure for International Rating Condition Tests

Rated Cooling Capacity, Btu/h·1000	Minimum External Static Pressure (in. H_2O) [1]
0 < Q < 27	0.10
27 ≤ Q < 41	0.15
41 ≤ Q < 68	0.20
68 ≤ Q < 102	0.25
102 ≤ Q < 154	0.30
154 ≤ Q < 280	0.40
280 ≤ Q < 399	0.50
399 ≤ Q < 502	0.60
Q > 501	0.70

[1] For equipment tested without an air filter installed, the minimum external static pressure shall be increased by 0.040 in. H_2O

Table C3. Certification Metrics

Metric	Rating Condition
Cooling Capacity	T1, T2, T3, T4
EER (COP)	T1, T2, T3, T4
Heating Capacity	H1, H2, H3
COP	H1, H2, H3

C4.4 *Cooling Temperature Conditions*. The international T1, T2, T3 and T4 temperature conditions specified in Table C1 shall be considered Standard Rating Conditions for the determination of Cooling Capacity and energy efficiency.

C4.5 *Heating Temperature Conditions*. The international H1, H2, and H3 temperature conditions specified in Table C1 shall be considered Standard Rating Conditions for the determination of Heating Capacity.

C4.6 *Optional Operating Requirements.* Participant may choose to optionally certify equipment to the conditions for the operating tests specified in Table C4. The requirements of the optional operating condition tests are specified below.

C4.6.1 *Extra High Temperature Operating Requirement*. Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and heat pump Equipment shall pass the following extra high temperature operating condition test with an indoor-coil at the T3 condition airflow rate as determined under Section 6, AHRI Standard 1230.

C4.6.1.1 *Temperature Conditions.* Temperature conditions shall be maintained as shown in Table C4 ±1.0°F [0.6°C].

C4.6.1.2 *Voltages*. Tests shall be run at the unit's rated voltage.

C4.6.1.3 *Procedure*. Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and heat pump Equipment shall operate continuously at full capacity for 2 hours at the temperature conditions and voltage(s) specified.

C4.6.1.4 *Requirements*. During the test, the equipment shall operate without failure of any of its components.

Table C4. Conditions for Operating Requirement Tests for Air-cooled Equipment				
TEST	INDOOR SECTION		OUTDOOR SECTION	
	Air Entering Temperature			
	Dry-Bulb °F [°C]	Wet-Bulb °F [°C]	Dry-Bulb °F [°C]	Wet-Bulb °F [°C]
Extra High Temperature Operating Conditions	80.0 [26.7]	67.0 [19.4]	125.6 [52.0]	87.8[1] [31.0]
Note: 1. The wet-bulb temperature condition is not required when testing air-cooled condensers which do not evaporate condensate.				

C5. *Options Following International Rating Condition Optional Operating Requirement Test Failure*. If the Participant's model does not comply with an Optional Operating Requirement test (see Appendix M to Subpart B of 10 CFR Part 431), the model shall no longer be listed as compliant to the Optional Operating Requirement on the AHRI Directory and AHRI Certificate.

Failure of Optional Operating Requirement test shall not count towards the participant's standing in the certification program.

C5.1 *Options Following 1st Sample Failure.*

- Accept non-compliance, the model shall no longer be listed as compliant to the Optional Operating Requirement on the AHRI Directory and AHRI Certificate; or
- Test second sample of the same model (sample must be available within the timeframe and procedure allotted in Section 3.4 following notification of decision; or
- Obsolete the model, which also obsoletes all models within the corresponding BMG. This option also accepts non-compliance.

C5.2 *Options Following 2nd Sample Failure.*

- Accept non-compliance, the model shall no longer be listed as compliant to the Optional Operating Requirement on the AHRI Directory and AHRI Certificate; or
- Obsolete the model, which also obsoletes all models within the corresponding BMG. This option also accepts non-compliance.

C6 *Publication of Ratings at International Rating Conditions in Certified Directory*. The following information pertaining to each model certified shall be published in the Directory:

- AHRI Certified Reference Number;
- Model Status;
- Name of Manufacturer;
- Brand Name;
- Series Name;
- Model Number(s) or Designation(s);
- AHRI Type;
- Refrigerant;
- Standard Rating Cooling Capacity at T1 (Cooling Capacity T1), Btu/h (W); if applicable;
- Standard Rating Cooling Capacity at T2 (Cooling Capacity T2), Btu/h (W); if applicable;
- Standard Rating Cooling Capacity at T3 (Cooling Capacity T3), Btu/h (W); if applicable;

- Standard Rating Cooling Capacity at T4 (Cooling Capacity T4), Btu/h (W); if applicable;
- Energy Efficiency Ratio at T1 (EER_{T1}), Btu/W·h and Co-efficient of Performance at T1 (COP_{T1}); if applicable;
- Energy Efficiency Ratio at T2 (EER_{T2}), Btu/W·h and Co-efficient of Performance at T2 (COP_{T2}); if applicable;
- Energy Efficiency Ratio at T3 (EER_{T3}), Btu/W·h and Co-efficient of Performance at T3 (COP_{T3}); if applicable;
- Energy Efficiency Ratio at T4 (EER_{T4}), Btu/W·h and Co-efficient of Performance at T4 (COP_{T4}); if applicable;
- Standard Rating Heating Capacity at H1 (Heating Capacity H1), Btu/h (W); if applicable;
- Standard Rating Heating Capacity at H2 (Heating Capacity H2), Btu/h (W); if applicable;
- Standard Rating Heating Capacity at H3 (Heating Capacity H3), Btu/h (W); if applicable;
- Coefficient of Performance (COP_{H1}) at H1; if applicable;
- Coefficient of Performance (COP_{H2}) at H2; if applicable;
- Coefficient of Performance (COP_{H3}) at H3; if applicable;
- Extra High Temperature Operating Requirement;
- Rated Full Load Indoor Coil Air Quantity at T1, SCFM; if applicable;
- Rated Full Load Indoor Coil Air Quantity at T2, SCFM; if applicable;
- Rated Full Load Indoor Coil Air Quantity at T3, SCFM; if applicable;
- Rated Full Load Indoor Coil Air Quantity at T4, SCFM; if applicable;
- Rated Full Load Indoor Coil Air Quantity at H1, SCFM; if applicable;
- Rated Full Load Indoor Coil Air Quantity at H2, SCFM; if applicable;
- Rated Full Load Indoor Coil Air Quantity at H3, SCFM; if applicable; and
- Frequency (Hertz)

APPENDIX D. Invalidated Critical Parameter Settings

D.1 *Invalidated Critical Parameter Settings.* If Critical Parameter values are found to be invalid according to the results of the CVP, determine alternate critical parameter values for use in the corresponding IEER test. Determine alternate Critical Parameter values from the CVP results of the single system as follows:

D.1.1 *Select the CVP Measurement Period.* This period shall have a duration determined in accordance with C6.1.2 of the standard and shall be the period where the RSS Point Total has a lower average value over the measurement period than over any other period in the CVP of the same duration. If multiple periods exist with the same RSS Point Total, select the measurement period closest to but before t_{OFF}.

D.1.2 *Determine Alternate Critical Parameters*. Calculate the average position for each Critical Parameter during the measurement period selected in Section D.1.1. When initially setting critical parameters in accordance Section 5.1.2 of the standard, use the alternate Critical Parameter values as control inputs instead of using the Critical Parameter values. The same initial alternate Critical Parameter values shall be used for all systems in the testing sample, though Critical Parameter adjustments as needed to achieve target capacity or sensible heat ratio (SHR) limits are made independently for each tested system.

D.1.2.1 *Adjust Critical Parameters*. For each system, determine whether Critical Parameter adjustments are needed to achieve the target capacity or SHR limit for an IEER cooling test. Perform Critical Parameter adjustments independently on each system as described in Section 6.3.3 of the standard, with the following deviations:

- Replace all references to ‘‘Critical Parameter values’’ with ‘‘alternate Critical Parameter values’’ as determined in Section D.1.2.
- Determine CP_{Max} from a CVP conducted at full-load cooling conditions as the maximum value observed during the R2 period as described in Section C.4.4.2.3 of the standard.

If multiple components corresponding to a single parameter are present, determine CP_{Max} at the point during the R2 period when the average value across all components corresponding to that critical parameter is maximized.