## DEPARTMENT OF ENERGY

### 10 CFR Parts 429 and 431

**[EERE–2021–BT–TP–0019]**

**RIN 1904–AE43**

## Energy Conservation Program: Test Procedure for VRF Multi-Split Systems

**AGENCY:** Office of Energy Efficiency and Renewable Energy, Department of Energy.

**ACTION:** Notice of proposed rulemaking and request for comment.

**SUMMARY:** The U.S. Department of Energy (''DOE'') proposes to amend the test procedure for variable refrigerant flow multi-split air conditioners and heat pumps (''VRF multi-split systems'') to incorporate by reference the latest version of the industry test standard. DOE also proposes to adopt the integrated energy efficiency ratio metric in its test procedures for VRF multi-split systems. Additionally, DOE proposes to adopt provisions in the updated industry test procedure relevant to certification and enforcement, including a controls verification procedure. DOE welcomes written comment from the public on any subject within the scope of this document (including topics not specifically raised in this proposal), as well as the submission of data and other relevant information.

**DATES:**

*Comments:* DOE will accept written comments, data, and information regarding this notice of proposed rulemaking (NOPR) on or before February 8, 2022. See section V, ''Public Participation,'' for details.

*Meeting:* DOE will hold a webinar on Thursday, January 20, 2022, from 1:00 p.m. to 4:00 p.m. *See* section V, ''Public Participation,'' for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

**ADDRESSES:** Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at *www.regulations.gov.* Follow the instructions for submitting comments.

Alternatively, interested persons may submit comments, identified by docket number EERE–2021–BT–TP–0019, by any of the following methods:

1. *Federal eRulemaking Portal: www.regulations.gov.*

2. *Email:* to *VRFMultisplitACHP2021TP0019@ee.doe.gov.* Include docket number EERE–2021–BT–TP–0019 in the subject line of the message. No telefacsimiles (''faxes'') will be accepted. For detailed instructions on submitting comments and additional information on this process, see section V of this document ''Public Participation.''

Although DOE has routinely accepted public comment submissions through a variety of mechanisms, including the Federal eRulemaking Portal, email, postal mail or hand delivery/courier, the Department has found it necessary to make temporary modifications to the comment submission process in light of the ongoing corona virus 2019 (COVID–19) pandemic. DOE is currently suspending receipt of public comments via postal mail and hand delivery/courier. If a commenter finds that this change poses an undue hardship, please contact Appliance Standards Program staff at (202) 586–1445 to discuss the need for alternative arrangements. Once the COVID–19 pandemic health emergency is resolved, DOE anticipates resuming all of its regular options for public comment submission, including postal mail and hand delivery/courier.

*Docket:* The docket, which includes **Federal Register** notices, public meeting/webinar attendee lists and transcripts, comments, and other supporting documents/materials, is available for review at *www.regulations.gov.* All documents in the docket are listed in the *www.regulations.gov* index. However, some documents listed in the index, such as those containing information that is exempt from public disclosure, may not be publicly available.

The docket web page can be found at: *www.regulations.gov/docket/EERE-2021-BT-TP-0019.* The docket web page contains instructions on how to access all documents, including public comments, in the docket. See section V ''Public Participation'' for information on how to submit comments through *www.regulations.gov.*

**FOR FURTHER INFORMATION CONTACT:**

Ms. Catherine Rivest, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Office, EE–5B, 1000 Independence Avenue SW, Washington, DC 20585–0121. Telephone: (202) 586–7335. Email: *ApplianceStandardsQuestions@ee.doe.gov.*

Mr. Eric Stas, U.S. Department of Energy, Office of the General Counsel, GC–33, 1000 Independence Avenue SW, Washington, DC 20585. Telephone: (202) 586–5827. Email: *Eric.Stas@hq.doe.gov.*

DOE has submitted the collection of information contained in the proposed rule to OMB for review under the Paperwork Reduction Act, as amended. (44 U.S.C. 3507(d)) Comments on the information collection proposal shall be directed to the Office of Information and Regulatory Affairs, Office of Management and Budget, Attention: Sofie Miller, OIRA Desk Officer by email: *sofie.e.miller@omb.eop.gov.*

For further information on how to submit a comment, review other public comments and the docket, or participate in the webinar, contact the Appliance and Equipment Standards Program staff at (202) 287–1445 or by email: *ApplianceStandardsQuestions@ee.doe.gov.*

**SUPPLEMENTARY INFORMATION:** DOE proposes to maintain and update previously approved incorporations by reference and incorporate by reference the following industry standard into parts 429 and 431:

AHRI Standard 1230, (''AHRI 1230–2021''), ''Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment;'' approved 2021.

ANSI/AHRI 1230–2010, 2010 Standard for Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment,'' approved August 2, 2010 and updated by addendum 1 in March 2011, (AHRI 1230–2010).

Copies of AHRI 1230–2021 and AHRI 1230–2010 can be obtained from the Air-Conditioning, Heating, and Refrigeration Institute, 2311 Wilson Blvd., Suite 400, Arlington, VA 22201 (703) 524–8800, or online at: *www.ahrinet.org/search-standards.aspx.*

DOE proposes to amend the previously approved incorporation by reference for the following industry standard in part 431:

ANSI/American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 37–2009, ''Methods of Testing for Rating Electrically Driven Unitary Air-Conditioning and Heat Pump Equipment,'' ASHRAE approved June 24, 2009.

Copies of ANSI/ASHRAE 37–2009 can be obtained from the American National Standards Institute, 25 W 43rd Street, 4th Floor, New York, NY 10036, (212) 642–4800, or online at: *webstore.ansi.org/.*

See section IV.M of this document for a further discussion of these standards.

### Table of Contents

## I. Authority and Background

Commercial package air conditioning and heating equipment is included in the list of ''covered equipment'' for which DOE is authorized to establish and amend energy conservation standards and test procedures. (42 U.S.C. 6311(1)(B) through (D)) Commercial package air conditioning and heating equipment includes variable refrigerant flow multi-split air conditioners and heat pumps (''VRF multi-split systems''). DOE's energy conservation standards and test procedure for VRF multi-split systems are currently prescribed at 10 CFR 431.97 and 10 CFR 431.96, respectively. The following sections discuss DOE's authority to establish the test procedure for VRF multi-split systems and relevant background information regarding DOE's consideration of the test procedure for this equipment.

### *A. Authority*

The Energy Policy and Conservation Act, as amended (''EPCA''),[1] authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. (42 U.S.C. 6291–6317) Title III, Part C[2] of EPCA, Public Law 94–163 (42 U.S.C. 6311–6317, as codified), added by Public Law 95–619, Title IV, section 441(a), established the Energy Conservation Program for Certain Industrial Equipment, which sets forth a variety of provisions designed to improve energy efficiency. This equipment includes small, large, and very large commercial package air conditioning and heating equipment, which includes VRF multi-split systems, the subject of this NOPR. (42 U.S.C. 6311(1)(B)–(D))

The energy conservation program under EPCA consists essentially of four parts: (1) Testing, (2) labeling, (3) Federal energy conservation standards, and (4) certification and enforcement procedures. Relevant provisions of EPCA include definitions (42 U.S.C. 6311), energy conservation standards (42 U.S.C. 6313), test procedures (42 U.S.C. 6314), labeling provisions (42 U.S.C. 6315), and the authority to require information and reports from manufacturers (42 U.S.C. 6316).

The Federal testing requirements consist of test procedures that manufacturers of covered equipment must use as the basis for: (1) Certifying to DOE that their equipment complies with the applicable energy conservation standards adopted pursuant to EPCA (42 U.S.C. 6316(b); 42 U.S.C. 6296), and (2) making representations about the efficiency of that equipment (42 U.S.C. 6314(d)). Similarly, DOE uses these test procedures to determine whether the equipment complies with relevant standards promulgated under EPCA.

Federal energy efficiency requirements for covered equipment established under EPCA generally supersede State laws and regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C 6316(a) and (b); 42 U.S.C 6297) DOE may, however, grant waivers of Federal preemption for particular state laws or regulations, in accordance with the procedures and other provisions of EPCA. (42 U.S.C. 6316(b)(2)(D))

Under 42 U.S.C. 6314, EPCA sets forth the criteria and procedures DOE must follow when prescribing or amending test procedures for covered equipment. EPCA requires that any test procedures prescribed or amended under this section must be reasonably designed to produce test results which reflect energy efficiency, energy use or estimated annual operating cost of a given type of covered equipment during a representative average use cycle and requires that test procedures not be unduly burdensome to conduct. (42 U.S.C 6314(a)(2))

With respect to VRF multi-split systems, EPCA requires that the test procedures shall be those generally accepted industry testing procedures or rating procedures developed or recognized by the Air-Conditioning, Heating, and Refrigeration Institute (''AHRI'') or the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (''ASHRAE''), as referenced in ASHRAE/IES Standard 90.1, ''Energy Standard for Buildings Except Low-Rise Residential Buildings'' (''ASHRAE Standard 90.1''). (42 U.S.C 6314(a)(4)(A)) Further, if such an industry test procedure is amended, DOE must amend its test procedure to be consistent with the amended industry test procedure unless it determines, by a rule published in the **Federal Register** and supported by clear and convincing evidence, that the amended test procedure would be unduly burdensome to conduct or would not produce test results that reflect the energy efficiency, energy use, and estimated operating costs of that equipment during a representative average use cycle. (42 U.S.C. 6314(a)(4)(B))

[1] All references to EPCA in this document refer to the statute as amended through the Energy Act of 2020, Public Law 116–260 (Dec. 27, 2020).

[2] For editorial reasons, upon codification in the U.S. Code, Part C was redesignated Part A–1.

EPCA also requires that, at least once every 7 years, DOE evaluate test procedures for each type of covered equipment, including VRF multi-split systems, to determine whether amended test procedures would more accurately or fully comply with the requirements for the test procedures to not be unduly burdensome to conduct and be reasonably designed to produce test results that reflect energy efficiency, energy use, and estimated operating costs during a representative average use cycle. (42 U.S.C 6314(a)(1))

In addition, if the Secretary determines that a test procedure amendment is warranted, the Secretary must publish proposed test procedures in the **Federal Register**, and afford interested persons an opportunity (of not less than 45 days duration) to present oral and written data, views, and arguments on the proposed test procedures. (42 U.S.C 6314(b)) If DOE determines that test procedure revisions are not appropriate, DOE must publish in the **Federal Register** its determination not to amend the test procedures. (42 U.S.C. 6314(a)(1)(A)(ii))

DOE is proposing amendments to the test procedures for VRF multi-split systems in satisfaction of its statutory obligations under EPCA.

*B. Background*

DOE's existing test procedure for VRF multi-split systems appears at 10 CFR 431.96 (''Uniform test method for the measurement of energy efficiency of commercial air conditioners and heat pumps''). The Federal test procedure for VRF multi-split systems was last amended in a final rule for standards and test procedures for certain commercial heating, air conditioning, and water heating equipment published on May 16, 2012 (''May 2012 Final Rule''). 77 FR 28928. With regard to VRF multi-split systems, the May 2012 Final Rule adopted the test procedure American National Standards Institute (''ANSI'')/AHRI Standard 1230–2010 ''*2010 Standard for Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment,*'' approved August 2, 2010 and updated by Addendum 1 in March 2011 (''ANSI/AHRI 1230–2010''). 77 FR 28928, 28945–28946; *see* 10 CFR 431.96, Table 1. Specifically, the DOE test procedure for VRF multi-split systems was modified to reference ANSI/AHRI 1230–2010 with Addendum 1, but omitting sections 5.1.2 and 6.6. 77 FR 28928, 28990–28991. The May 2012 Final Rule also adopted additional requirements, listed in 10 CFR 431.96(c)–(f), for measuring the energy efficiency ratio (''EER'') and coefficient of performance (''COP'') for air-cooled VRF multi-split systems with a cooling capacity between 65,000 Btu/h and 760,000 Btu/h and water-source VRF multi-split systems with a cooling capacity less than 760,000 Btu/h. *Id.* These additional requirements specify provisions for equipment set-up and provide for limited involvement of manufacturer representatives during testing. 77 FR 28928, 28991.

In 2016,[3] ASHRAE Standard 90.1 was updated, but the 2016 update did not make changes to the test procedure references in ASHRAE Standard 90.1–2013 for VRF multi-split systems. On July 25, 2017, DOE published a request for information (''RFI'') (''July 2017 ASHRAE TP RFI'') to collect information and data to consider amendments to DOE's test procedures for commercial package air conditioning and heating equipment with the test procedure updates included in ASHRAE Standard 90.1–2016. 82 FR 34427. As part of the July 2017 ASHRAE TP RFI DOE requested comment on the VRF multi-split systems test procedure, under the 7-year lookback requirement. 82 FR 34427, 34429. DOE identified several issues that might have warranted modifications to the applicable VRF multi-split systems test procedure, in particular concerning incorporation by reference of the most recent version of the relevant industry standard(s); efficiency metrics and calculations; and clarification of test methods. 82 FR 34427, 34427.

DOE received a number of comments regarding VRF multi-split systems from interested parties in response to the July 2017 ASHRAE TP RFI, which covered multiple categories of equipment. Table I–1 lists the commenters that provided comments relevant to VRF multi-split systems, along with each commenter's abbreviated name used throughout this NOPR. Discussion of the relevant comments, and DOE's responses, are provided in the appropriate sections of this document.

TABLE I–1—INTERESTED PARTIES PROVIDING COMMENT ON VRF MULTI-SPLIT SYSTEMS IN RESPONSE TO THE JULY 2017 ASHRAE TP RFI

| Name | Abbreviation | Type |
|---|---|---|
| Air-Conditioning, Heating, and Refrigeration Institute | AHRI | IR. |
| Appliance Standards Awareness Project, Alliance to Save Energy, American Council for an Energy-Efficient Economy, Northwest Energy Efficiency Alliance, and Northwest Power and Conservation Council. | Joint Advocates | EA. |
| Carrier Corporation, part of United Technologies Climate, Controls & Security Business | Carrier | M. |
| Goodman Global, Inc | Goodman | M. |
| Trane Technologies | Trane | M. |
| Lennox International Inc | Lennox | M. |
| Mitsubishi Electric Cooling & Heating, a division of Mitsubishi Electric US, Inc | Mitsubishi | M. |
| National Comfort Institute | NCI | IR. |
| Pacific Gas and Electric Company, Southern California Gas Company, San Diego Gas and Electric, and Southern California Edison (collectively, California Investor-Owned Utilities). | CA IOUs | U. |

EA: Efficiency/Environmental Advocate; IR: Industry Representative; M: Manufacturer; U: Utility.

[3] No publication date is printed on ASHRAE Standard 90.1–2016, but ASHRAE issued a press release on October 26, 2016, which is available at *www.ashrae.org/news/2016/ashrae-ies-publish-2016-energy-efficiency-standard.* Last accessed April 30, 2021.

A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.[4]

In September 2017, AHRI published an update to ANSI/AHRI 1230, *i.e.,* ANSI/AHRI 1230–2014 with Addendum 1 (although published in 2017, the update uses a 2014 designation).

On April 11, 2018, DOE published in the **Federal Register** a notice of its intent to establish a negotiated rulemaking working group (''Working Group'') under the Appliance Standards and Rulemaking Federal Advisory Committee (''ASRAC''), in accordance with the Federal Advisory Committee Act[5] and the Negotiated Rulemaking Act,[6] to negotiate the proposed test procedure and amended energy conservation standards for VRF multi-split systems. 83 FR 15514. The purpose of the Working Group was to discuss and, if possible, reach consensus on a proposed rule regarding the test procedure and energy conservation standards for VRF multi-split systems, as authorized by EPCA. *Id.* at 83 FR 15514.

The Working Group comprised 21 voting members including manufacturers, energy efficiency advocates, utilities, and trade organizations.[7] On October 1, 2019, the Working Group reached consensus on a term sheet (''VRF TP Term Sheet'') that includes the following recommendations, which highlight the most substantial changes: (Docket No. EERE–2018–BT–STD–0003–0044)

1. VRF multi-split systems should be rated with the Integrated Energy Efficiency Ratio (''IEER'') metric to allow consumers to make consistent comparisons with rooftop air conditioner ratings.

2. The amended test procedure should not be required until the compliance date of amended energy conservation standards.

3. The Federal test procedure for VRF multi-split systems should be consistent with the September 20, 2019 draft version of AHRI 1230, with additional amendments to be implemented after the conclusion of ASRAC negotiations.

(*Id* at pp. 1, 3)

The additional recommended amendments are discussed further in section III of this NOPR.

On May 18, 2021, AHRI published an updated industry standard for VRF multi-split systems AHRI Standard 1230, ''*2021 Standard for Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment*'' (''AHRI Standard 1230–2021''), which in turn references ANSI/ASHRAE Standard 37–2009 (including Errata Sheet issued October 3, 2016) ''*Methods of Testing for Rating Electrically Driven Unitary Air-Conditioning and Heat Pump Equipment*'' (''ANSI/ASHRAE 37–2009'') for additional test setup and methodology specifications. AHRI standard 1230–2021 is discussed in further detail in section III.D.1 of this NOPR.

## II. Synopsis of the Notice of Proposed Rulemaking

In this NOPR, DOE proposes to update § 431.96, ''Uniform test method for the measurement of energy efficiency of commercial air conditioners and heat pumps,'' to align the relevant references to the most recent version of the industry test procedure as follows: (1) Incorporate by reference AHRI 1230–2021 and ANSI/ASHRAE 37–2009 (including Errata Sheet issued October 3, 2016); and (2) establish provisions for determining IEER for VRF multi-split systems. DOE further proposes to add new appendices D and D1 to subpart F of part 431, both entitled ''Uniform test method for measuring the energy consumption of variable refrigerant flow multi-split air conditioners and heat pumps (other than air-cooled with rated cooling capacity less than 65,000 Btu/h),'' (''appendix D'' and ''appendix D1'', respectively). The current DOE test procedure for VRF multi-split systems would be relocated to appendix D without change, and the new test procedure adopting AHRI 1230–2021 would be established in appendix D1 for determining IEER. Compliance with appendix D1 would not be required until such time as compliance is required with amended energy conservation standards for VRF multi-split systems that rely on IEER, should DOE adopt such standards.

In this NOPR, DOE also proposes to update its certification, compliance, and enforcement (''CCE'') provisions for VRF multi-split systems, to provide information that is necessary for testing VRF multi-split systems consistent with the updated industry test procedure AHRI 1230–2021. Most significantly, these proposed changes include the incorporation of the controls verification procedure (''CVP'') from AHRI 1230–2021 into DOE's product-specific enforcement provisions at 10 CFR 429.134, as well as accompanying certification requirements at 10 CFR 429.43. DOE is also proposing to amend the sampling size requirements for enforcement from a maximum sample size of not more than four units to require testing of two units.

DOE's proposed actions are summarized in Table II–1 and addressed in detail in section III of this document.

TABLE II–1—SUMMARY OF CHANGES IN PROPOSED TEST PROCEDURE RELATIVE TO CURRENT TEST PROCEDURE

| Current DOE test procedure | Proposed test procedure | Attribution |
|---|---|---|
| Incorporates by reference ANSI/AHRI 1230–2010. | Incorporates by reference in a new Appendix D1 AHRI 1230–2021 and ANSI/ASHRAE 37–2009 (including Errata Sheet issued October 3, 2016). | Updates to the applicable industry test procedures. |
| Includes provisions for determining EER. | Includes provisions for determining both EER and IEER ..... | Updates to the applicable industry test procedures. |
| Does not include VRF-specific provisions for determination of represented values in 10 CFR 429.43. | Includes provisions in 10 CFR 429.43 specific to VRF multi-split systems to determine represented values for units approved for use with multiple refrigerants, and determine represented values for different indoor unit combinations. | Establish VRF-specific provision for determination of represented values. |

[4] The parenthetical reference provides a reference for information located in a docket related to DOE's rulemaking to develop test procedure for VRF multi-split systems. As noted, the July 2017 ASHRAE TP RFI addressed multiple different equipment categories and is available under docket number EERE–2017–BT–TP–0018. As this NOPR addresses only VRF multi-split systems, it has been assigned a separate docket number *i.e.,* EERE–2021–BT–TP–0019). The references are arranged as follows: (Commenter name, comment docket ID number, page of that document).

[5] 5 U.S.C. App. 2, Public Law 92–463.

[6] 5 U.S.C. 561–570, Public Law 104–320.

[7] A complete list of the ASRAC VRF Working Group members is available at: *www.energy.gov/eere/buildings/appliance-standards-and-rulemaking-federal-advisory-committee#Variable%20Refrigerant%20Flow%20Multi-Split%20Air%20Conditioners%20and%20Heat%20Pumps%20Working%20Group.*

TABLE II–1—SUMMARY OF CHANGES IN PROPOSED TEST PROCEDURE RELATIVE TO CURRENT TEST PROCEDURE—Continued

| Current DOE test procedure | Proposed test procedure | Attribution |
|---|---|---|
| Includes certification requirements in 10 CFR 429.43 consistent with testing to EER per AHRI 1230–2010. | Adopts reporting requirements consistent with new test requirements of AHRI 1230–2021, including tested combination, certified critical parameter values, and instructions for conducting the controls verification procedure (''CVP''). | Establish reporting requirements consistent with updated industry test method. |
| Does not include VRF-specific enforcement provisions in 10 CFR 429.134. | Adopts product-specific enforcement provisions for VRF multi-split systems including: Verification of cooling capacity, configuration of unit under test, manufacturer involvement in assessment or enforcement testing, provisions for when DOE would conduct a CVP, and how CVP results would affect critical parameters used in IEER enforcement testing by DOE. | Establish provisions for DOE testing of VRF multi-split systems. |
| Does not provide VRF-specific instruction for validating alternative methods for determining energy efficiency and energy use (''AEDM'') at 10 CFR 429.70. | Specifies VRF-specific AEDM validation criteria that are dependent on indoor unit combinations offered by the manufacturer. | Establish AEDM instructions specific to VRF multi-split systems. |
| Requires selection of not more than 4 samples for DOE enforcement testing following the sampling plan in 10 CFR 429.110. | Specifies an enforcement testing sample size of 2 units, with compliance based on the arithmetic mean of the sample. | Establish VRF-specific provision for enforcement sampling plan. |

DOE has tentatively determined that the proposed amendments described in section III of this NOPR regarding the establishment of appendix D would not alter the measured efficiency of VRF multi-split systems, or require retesting solely as a result of DOE's adoption of the proposed amendments to the test procedure, if made final. DOE has tentatively determined that the proposed amendments regarding the test procedure in proposed appendix D1 would alter measured efficiency if made final and that such amendments are consistent with the updated industry test procedure. Further, use of the updated industry test procedure provisions as proposed and the proposed amendments to representation requirements in 10 CFR 429.43 and 10 CFR 429.70 would not be required until the compliance date of amended standards in terms of IEER. Additionally, DOE has tentatively determined that the proposed amendments, if made final, would not increase the cost of testing relative to the updated industry test procedure. Discussion of DOE's proposed actions are addressed in detail in section III of this NOPR.

## III. Discussion

DOE's test procedure for VRF multi-split systems is set forth at § 431.96. DOE's current regulations require that manufacturers test VRF multi-split systems using ANSI/AHRI 1230–2010 with Addendum 1, except for Sections 5.1.2 and 6.6. *See* Table 1 at 10 CFR 431.96. DOE's current test procedure also requires that manufacturers adhere to certain additional requirements listed in 10 CFR 431.96(c) through (f), which specify additional provisions for equipment set-up and provide for limited involvement of manufacturer representatives during testing.

In the following sections, DOE discusses in detail relevant test procedure issues and proposes changes to the current DOE test procedure for VRF multi-split systems. DOE is generally proposing amendments such that the Federal test procedure is consistent with AHRI 1230–2021 and changes to the current certification, compliance and enforcement (''CCE'') regulations for VRF multi-split systems, also consistent with the updated industry test standard.

### *A. Scope of Applicability*

This rulemaking applies to variable refrigerant flow multi-split air conditioners and heat pumps. DOE defines variable refrigerant flow multi-split air conditioners and heat pumps as units of commercial package air conditioning and heating equipment that are configured as a split system air conditioner or heat pump incorporating a single refrigerant circuit, with one or more outdoor units, at least one variable-speed compressor or an alternate compressor combination for varying the capacity of the system by three or more steps, and multiple indoor fan coil units, each of which is individually metered and individually controlled by an integral control device and common communications network and which can operate independently in response to multiple indoor thermostats. 10 CFR 431.92. Variable refrigerant flow implies three or more steps of capacity control on common, inter-connecting piping. 10 CFR 431.92. VRF multi-split heat pumps use reverse cycle refrigeration as its primary heating source and may include second supplemental heating by means of electrical resistance, steam, hot water, or gas. *Id.*

DOE is not proposing to amend the current scope of the Federal test procedure for VRF multi-split systems. DOE's test procedure regulations for commercial air conditioners and heat pumps at 10 CFR 431.96 include test procedures that apply to air-cooled VRF multi-split air conditioners, air-cooled VRF multi-split heat pumps, and water-source VRF multi-split heat pumps,[8] all with cooling capacity less than 760,000 Btu/h. Table 1 of 10 CFR 431.96. Single-phase, air-cooled VRF multi-split air conditioners and heat pumps with cooling capacity less than 65,000 Btu/h are subject to DOE's consumer product regulations for central air conditioners, and test procedures for these products are specified in appendices M and M1 to subpart B of 10 CFR part 430. Test procedures for three-phase, air-cooled VRF multi-split systems with cooling capacity less than 65,000 Btu/h are not addressed in this NOPR and will instead be addressed in a separate test procedure rulemaking for air-cooled, three-phase, small commercial package air conditioning and heating equipment with a cooling capacity of less than 65,000 Btu/h.

### *B. General Comments*

In response to the July 2017 ASHRAE TP RFI, DOE received several general

[8] The EPCA definition for ''commercial package air conditioning and heating equipment'' specifically excludes ground water source equipment. (42 U.S.C. 6311(8)(A)).

comments not specific to any one equipment category or test procedure. This section addresses those comments.

NCI recommended that DOE follow the development of ASHRAE 221P, ''Test Method to Measure and Score the Operating Performance of an Installed Constant Volume Unitary HVAC System,'' and consider where it may be appropriately applied within EPCA test procedures. (NCI, No. 4 at pp. 1–2) NCI stated that it has collected data indicating that typical split systems and packaged units serving residential and small commercial buildings typically deliver 50 percent to 60 percent of the rated capacity to the occupied zone, thereby making laboratory tests unrepresentative of field performance. *Id.*

DOE notes that ASHRAE Standard 90.1 does not reference ANSI/ASHRAE Standard 221–2020, ''Test Method to Field-Measure and Score the Cooling and Heating Performance of an Installed Unitary HVAC System'' [9] as the applicable test procedure for VRF multi-split systems. NCI also did not provide data on field performance or any correlations between field performance and laboratory test performance for VRF multi-split systems for DOE to consider. Furthermore, ASHRAE 221–2020 does not provide a method to determine the efficiency of VRF multi-split systems. As discussed, DOE is proposing to incorporate by reference AHRI 1230–2021, the most recently published version of the industry test procedure recognized by ASHRAE Standard 90.1 for VRF multi-split systems.

The CA IOUs commented that while the July 2017 ASHRAE TP RFI expressed interest in reducing burden to manufacturers, DOE already took steps to reduce this burden by allowing alternative energy efficiency or energy use determination methods (''AEDMs''). (CA IOUs, No. 7 at pp. 1–2). The CA IOUs stated that there are no further opportunities to streamline test procedures to limit testing burden. *Id.* at 2. Additionally, the CA IOUs emphasized the importance of accurate efficiency ratings for its incentive programs and customer knowledge, referencing the statutory provision that test procedures must produce results that are representative of the product's energy efficiency. *Id.*

Lennox stated that it generally supports DOE meeting the statutory requirements to design test procedures to measure energy efficiency during an average use cycle, but requested that DOE also consider overall impacts to consumers and manufacturers. (Lennox, No. 8 at pp. 1–2) Lennox also stated that, in commercial applications, predicting actual energy use from a single metric is difficult, and such a metric better serves as a point of comparison. *Id.* Lennox suggested that DOE strike a balance between evaluating equipment in a meaningful way without introducing unwarranted regulatory burden from overly complex test procedures or calculations that provide little value to consumers. *Id.*

In response to the CA IOUs and Lennox, DOE notes that its approach to test procedures is governed by EPCA's requirements. As discussed, EPCA prescribes that the test procedures for commercial package air conditioning and heating equipment must be those generally accepted industry testing procedures or rating procedures developed or recognized by industry as referenced in ASHRAE Standard 90.1. (42 U.S.C. 6314(a)(4)(A)) If such an industry test procedure is amended, DOE must update its test procedure to be consistent with the amended industry test procedure, unless DOE determines by a rule published in the **Federal Register** and supported by clear and convincing evidence that the amended test procedure would not meet the requirements in 42 U.S.C. 6314(a)(2) and (3) related to representative use and test burden. (42 U.S.C. 6314(a)(4)(B) and (C)) In establishing or amending its test procedures, DOE must develop test procedures that are reasonably designed to produce test results which reflect energy efficiency, energy use, and estimated operating costs of a type of industrial equipment during a representative average use cycle and that are not unduly burdensome to conduct. (42 U.S.C 6314(a)(2)) DOE's considerations of these requirements in relation to individual test method issues are discussed within the relevant sections of this NOPR.

The Joint Advocates stated that there a number of ambiguities in industry test procedures and that DOE should address these ambiguities in order to provide a level playing field for manufacturers and to ensure that any verification or enforcement testing is consistent with the manufacturer's own testing. (Joint Advocates, No. 9 at p. 2)

DOE has evaluated the industry test standard in the context of the statutory criteria regarding representativeness of the measured energy efficiency and test burden. To the extent there are provisions in the relevant industry test procedure that may benefit from further detail, such provisions are discussed in the previous sections of this document.

### *C. Proposed Organization of the VRF Multi-Split System Test Procedure*

DOE is proposing to relocate and centralize the current test procedure for VRF multi-split systems to a new appendix D to subpart F of part 431. As proposed, appendix D would not amend the current test procedure. The test procedure as provided in proposed appendix D would continue to reference ANSI/AHRI 1230–2010 with Addendum 1 and provide for determining EER and COP. The proposed appendix D would centralize the additional test provisions currently applicable under 10 CFR 431.96, *i.e.,* optional break-in period for tests conducted using AHRI 1230–2010 (10 CFR 431.96(c)); refrigerant line length corrections for tests conducted using AHRI 1230–2010 (10 CFR 431.96(d); additional provisions for equipment set-up (10 CFR 431.96(e); and manufacturer involvement in assessment or enforcement testing for variable refrigerant flow systems (10 CFR 431.96(f)). As proposed, VRF multi-split systems would be required to be tested according to appendix D until such time as compliance is required with an amended energy conservation standard that relies on the IEER metric, should DOE adopt such a standard.

Pursuant to EPCA, DOE is also proposing to amend the test procedure for VRF multi-split systems by adopting AHRI 1230–2021 in a new appendix D1 to subpart F of part 431. DOE proposes to adopt the updated version of AHRI 1230, including the IEER metric, as discussed in the following sections. As proposed, VRF multi-split systems would not be required to test according to the test procedure in proposed appendix D1 until such time as compliance is required with an amended energy conservation standard that relies on the IEER metric, should DOE adopt such a standard.

### *D. Industry Standards*

#### 1. Updates to AHRI 1230

As discussed, DOE's current test procedure for VRF multi-split systems incorporates by reference ANSI/AHRI 1230–2010, excluding Sections 5.1.2 and 6.6. *See* Table 1 at 10 CFR 431.96. In September 2017, AHRI published an updated version of AHRI Standard 1230—AHRI Standard 1230–2014 with Addendum 1 ''*2014 Standard for Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment*'' (AHRI 1230–2014 with Addendum 1). Based on a comparison of the 2014 version and ANSI/AHRI 1230–2010, the edits changed the scope of the VRF certification program and

[9] Available at *https://webstore.ansi.org/Standards/ASHRAE/ANSIASHRAEStandard2212020.*

VRF-specific definitions, and added appendices for unit configuration for capacity above 65,000 Btu/h and development of supplemental testing instructions. DOE tentatively concludes that the changes in the 2014 version do not substantively affect testing for EER (the current Federal metric). Therefore, DOE has tentatively determined that its current test procedure, which references ANSI/AHRI 1230–2010, is consistent with AHRI 1230–2014 with Addendum 1.

As discussed in section I.B, the VRF TP Term Sheet recommended that DOE adopt the 2019 draft version of AHRI 1230, but with several additional changes to be implemented, including:

- A hierarchy of instructions for how to set up the unit under test, and a clarification that ''as-shipped'' settings should be used as a last resort when instructions are not provided in the supplemental testing instructions (''STI'') and/or the manufacturer's installation instructions (''MII'').
- Equations and example calculations of adjustments to measured results for steady-state tests if sensible heat ratio (''SHR'') [10] limits are not met at the 100 percent full load and/or 75 percent part load cooling test points.
- Further definition of the draft CVP, including definition of time periods for determining critical parameter validation and allowable critical parameter tolerances using manufacturer-provided data. (Docket No. EERE–2018–BT–STD–0003–0044 at p. 2)

After the VRF ASRAC Working Group meetings in 2019, DOE provided technical support in an AHRI 1230 Technical Committee to address the outstanding items identified in the VRF TP Term Sheet. On the last item—determining critical parameter tolerances—DOE compiled anonymized, aggregated test data to share with the committee. In a presentation to the AHRI 1230 Technical Committee on September 10, 2020, DOE shared data on the variability of critical parameter results as measured during different CVP runs, as well as data on how the measured IEER changed in response to changes in critical parameters. (EERE–2018–BT–STD–0003–0063) DOE presented options that could be considered to express the maximum allowable variation in critical parameters as a ''budget'' (see section III.H.4 of this NOPR for description of the critical parameter budget method). The AHRI 1230 Technical Committee incorporated a budget of 70 points (a measure of critical parameter variation, as discussed in section III.H.4 of this NOPR) in AHRI 1230.

Following the completion of the AHRI 1230 Technical Committee meetings, in May 2021, AHRI published AHRI 1230–2021, which supersedes AHRI 1230–2014 with Addendum 1. The 2019 draft considered by the Working Group incorporated preliminary versions of the CVP, provided example calculations for IEER, and added other new provisions to clarify how the test procedure should be conducted. The changes recommended in the VRF TP Term Sheet were incorporated into AHRI 1230–2021. The following list includes substantive changes in AHRI 1230–2021 as compared to AHRI 1230–2010 currently used for certification:

1. Air-cooled VRF multi-split systems with cooling capacity less than 65,000 Btu/h were removed from the scope of the industry test standard. These systems are addressed by AHRI 210/240–2023 ''Performance Rating of Unitary Air-conditioning & Air-source Heat Pump Equipment.''
2. Maximum SHR limits of 0.82 and 0.85 were added for full load and 75 percent part-load conditions, respectively.
3. A CVP was added that verifies that the values certified in the STI for setting critical parameters during steady-state testing are within the range of critical parameters that would be used by the system's native controls at the same conditions. A 70-point budget was also added as the criteria for critical parameter validation during the CVP.
4. A hierarchy was added indicating which sources of manufacturer's instructions to use during testing in the case of conflicting information among different sources.
5. Provisions were updated for refrigerant piping length requirements and for the correction factors applied in the case of excess refrigerant piping length used during testing.
6. For water-source equipment, the maximum water flow rate was reduced and part-load entering water temperatures were modified.
7. New provisions were added to specify test methods and conditions for cases in which condenser head pressure controls result in unstable operation in part-load cooling tests.
8. The provisions for tested combinations, which specify the indoor unit combination to be used for testing, were updated to remove ''highest sales volume'' requirements and replaced with a specific hierarchy based on ''indoor unit model family''—*e.g.,* wall-mounted, compact 4-way ceiling cassette, mid-static ducted.
9. A maximum airflow rate of 55 standard cubic feet per minute (''scfm'') per 1000 Btu/h was added for non-ducted indoor units, and the maximum airflow rate was increased for ducted indoor units from 37.5 scfm per 1000 Btu/h to 42 scfm per 1000 Btu/h.
10. Test tolerances for indoor air entering wet-bulb temperatures were increased. Specifically, the indoor wet-bulb temperature operating tolerance was increased from 1 °F to 1.8 °F. The indoor wet-bulb temperature condition tolerance was also increased from 0.30 °F to 0.36 °F. Additionally, the operating tolerance for external static pressure (''ESP'') for ducted units was changed from 0.05 in H2O to 10 percent of the ESP reading.
11. Appendix D to ANSI/AHRI 1230–2010 with Addendum 1, ''Test Requirements,'' was amended in ANSI/AHRI 1230–2021 and redesignated as Appendix E, ''ANSI/ASHRAE Standard 37–2009 Clarifications/Exceptions.'' This appendix provides additional instruction and exceptions to the use of ANSI/ASHRAE 37–2009.
12. Informative appendices were added that show example calculations for IEER and the CVP ''budget'' method, which calculates the variation between measured critical parameter values and STI-reported critical parameter values.[11]

DOE is proposing to adopt the updated version of AHRI 1230, including the IEER metric, as described further in section III.E of this NOPR. DOE proposes to incorporate by reference AHRI 1230–2021 in a new appendix D1 to subpart F of part 431, which would become required for use starting on the compliance date for any amended energy conservation standards based on IEER. DOE reviewed AHRI 1230–2021 to determine whether it meets the requirements of EPCA for incorporation by reference as part of the Federal test method for determining compliance with minimum energy conservation standards. DOE has tentatively determined that the changes in AHRI 1230–2021 better reflect the field performance of VRF multi-split systems and provide additional clarification for testing provisions. Specifically, in the proposed test procedure for VRF multi-split systems in the proposed appendix D1, DOE is proposing to reference the following

[10] Cooling load is composed of both sensible and latent portions. The sensible load is the energy required to reduce the temperature of the incoming air, without any phase change. The latent load is the energy required to change the moisture in the air from water vapor into a liquid phase as it condenses on the cooling coil. Sensible heat ratio is a ratio of the sensible cooling capacity to the total cooling capacity at a given test condition.

[11] See section III.H.4 of this NOPR for further discussion of the CVP budget method.

sections from AHRI 1230–2021: Section 3 (except 3.10), Section 5 (except 5.1.2), Section 6 (except 6.3.3 and 6.5), Section 11, and Section 12. DOE is also proposing to reference appendix E from AHRI 1230–2021 but is not proposing to reference the other appendices. DOE proposes to exclude the remaining sections from its test procedure for VRF multi-split systems because they are either (1) informative appendices not needed in the DOE test procedure, (2) procedures specific to the AHRI verification program that are not warranted for a DOE test procedure, or (3) sections for which DOE is proposing modifications as discussed in the following sections of this NOPR, and listed as excepted previously.

2. ASHRAE 37

ANSI/ASHRAE 37–2009, which provides a method of test for many categories of air conditioning and heating equipment, is referenced for testing VRF multi-split systems by ANSI/AHRI 1230–2010, ANSI/AHRI 1230–2014 with Addendum 1, and AHRI 1230–2021. In particular, appendix E of AHRI 1230–2021 provides additional instruction and exceptions regarding the application of the test methods specified in ANSI/ASHRAE 37–2009 to VRF multi-split systems. As stated, ANSI/ASHRAE 37–2009 is referenced in ANSI/AHRI 1230–2010, which is currently the referenced industry test standard in the DOE test procedure for VRF multi-split systems. To reflect the use of ANSI/ASHRAE 37–2009 in conducting testing according to AHRI 1230–2021, DOE is proposing to incorporate by reference ANSI/ASHRAE 37–2009 in its test procedure for VRF multi-split systems. Specifically, in the proposed appendix D1, DOE is proposing to reference all sections of ANSI/ASHRAE 37–2009 except Sections 1, 2, and 4. Specific issues discussed in the July 2017 ASHRAE TP RFI pertaining to ANSI/ASHRAE 37–2009, and the related comments, are addressed in section III.F of this NOPR.

On October 3, 2016, ASHRAE published an errata sheet for ANSI/ASHRAE 37–2009 that corrected the total heating capacity equations for the outdoor liquid coil method in section 7.6.5.1 of the test standard.[12] Therefore, DOE proposes to incorporate by reference ANSI/ASHRAE 37–2009 including the Errata sheet published on October 3, 2016 in the proposed appendix D1.

[12] *www.ashrae.org/standards-research--technology/standards-errata.*

*E. Metrics*

1. IEER

DOE currently prescribes energy conservation standards for air-cooled VRF multi-split systems with cooling capacity greater than or equal to 65,000 Btu/h and water-source VRF multi-split heat pumps in terms of the EER metric for cooling-mode operation and in terms of the COP metric for heating-mode operation. Both EER and COP capture the system performance at single, full-load operating points in cooling and heating mode (*i.e.,* single outdoor air temperatures for air-cooled systems and single entering water temperatures for water-source systems). Neither metric provides a seasonal or load-weighted measure of energy efficiency.

In contrast, the IEER metric factors in the efficiency of operating at full-load conditions as well as part-load conditions of 75-percent, 50-percent, and 25-percent of full-load capacity. In general, the IEER metric provides a more representative measure of field performance by weighting the full-load and part-load efficiencies by the average amount of time equipment spends operating at each load. The IEER metric was first introduced into ASHRAE 90.1 for commercial air-cooled, water-cooled, and evaporatively-cooled air conditioning and heat pump equipment in the 2008 Supplement to Standard 90.1–2007, effective January 1, 2010. ASHRAE Standard 90.1–2010 included minimum efficiency levels in terms of both EER and IEER for air-cooled VRF multi-split systems. ASHRAE Standard 90.1–2016 added IEER levels for water-source VRF multi-split heat pump systems, including systems with cooling capacity less than 65,000 Btu/h, in addition to the specified EER levels.

On January 15, 2016, DOE published a direct final rule for energy conservation standards for air-cooled commercial unitary air conditioners (air-cooled CUACs, or ACUACs), which amended the energy conservation standards for ACUACs and changed the cooling efficiency metric from EER to IEER, with compliance required starting January 1, 2018. 81 FR 2420. VRF multi-split systems provide space heating and cooling to commercial buildings in a similar range of climatic conditions as ACUACs. In this NOPR, DOE has initially determined that IEER represents the efficiency of VRF multi-split systems operating in the field more accurately than EER because cooling loads do not require operation at full-load for the vast majority of cooling hours.

As discussed in the July 2017 ASHRAE TP RFI, manufacturers already test and rate VRF multi-split systems using the IEER metric in the AHRI *Directory of Certified Product Performance* for VRF multi-split systems.[13] 82 FR 34427, 34445. The publication of IEER ratings for most units on the market and the inclusion of minimum efficiency levels and test procedures in terms of IEER for VRF multi-split systems in ASHRAE Standard 90.1 and AHRI Standard 1230 indicates that IEER is an industry-accepted and widely-used metric for measuring efficiency of VRF multi-split systems. In the July 2017 ASHRAE TP RFI, DOE requested comment on any issues it should consider regarding potentially using IEER as an efficiency metric for air-cooled VRF multi-split systems with a cooling capacity greater than or equal to 65,000 Btu/h and water-source VRF multi-split systems. 82 FR 34427, 34445–34446.

In response to the July 2017 ASHRAE TP RFI, AHRI, Lennox, Mitsubishi, Trane, Goodman, Carrier, the CA IOUs, and the Joint Advocates all supported using an IEER metric for VRF multi-split systems. (AHRI, No. 11 at p. 31; Lennox, No. 8 at p. 6; Mitsubishi, No. 10 at p. 1; Trane, No. 12 at p. 2; Goodman, No. 14 at p. 5; Carrier, No. 6 at p. 17; CA IOUs, No. 7 at p. 4; Joint Advocates, No. 9 at p. 6) AHRI, Goodman, and Carrier further commented that IEER should replace EER as the Federal metric, and not be used as an additional metric. (AHRI, No. 11 at p. 31; Goodman, No. 14 at p. 5; Carrier, No. 6 at p. 17) AHRI and Goodman asserted that EPCA requires DOE to establish a single performance standard or a single design requirement. (AHRI, No. 11 at p. 31; Goodman, No. 14 at p. 5) The Joint Advocates commented that VRF multi-split systems should be regulated based on both EER and IEER, while the CA IOUs commented that the IEER metric is appropriate as a national standard as long as the EER value at each of the test points is individually published. (Joint Advocates, No. 9 at p. 6; CA IOUs, No. 7 at p. 4) The Joint Advocates further commented that regulating based on both EER and IEER would have no impact on test burden because manufacturers are already rating their equipment for both. (Joint Advocates, No. 9 at p. 6) CA IOUs also commented that the highest ambient test point required by DOE's test procedure (95 °F outdoor air dry-bulb temperature) is not representative of VRF multi-split systems operating conditions in the hot and dry western climate, and

[13] The AHRI directory for VRF multi-split systems is available at: *www.ahridirectory.org/NewSearch?programId=72&searchTypeId=3.*

recommended adding a hot-dry condition test point in IEER. (CA IOUs, No. 7 at p. 4)

During the proceedings of the ASRAC negotiated rulemaking process, the Working Group discussed the appropriateness of rating VRF equipment using an IEER metric at the test points prescribed in ANSI/AHRI 1230–2010. (Docket No. EERE–2018–BT–STD–0003–0051 at pp. 13–14) The Working Group also discussed the potential for adding new test points to the IEER metric, including the proposal to add a hot-dry condition test point for IEER, which was also suggested by the CA IOUs in their response to the 2017 ASHRAE TP RFI. (EERE–2018–BT–STD–0003–0051; CA IOUs, No. 7 at p. 4) Ultimately, the Working Group did not adopt a hot-dry condition test point in its recommendations. The VRF TP Term Sheet states that VRF multi-split systems should be rated with the IEER metric to allow consumers to make consistent comparisons with other products using the IEER metric. (Docket No. EERE–2018–BT–STD–0003–0044 at p. 1) Additionally, during a presentation delivered by DOE at the September 20, 2019 Working Group meeting, AHRI indicated that they would submit a letter to the docket stating that the AHRI certification program would continue to use both EER and IEER cooling metrics for VRF multi-split systems. (Docket No. EERE–2018–BT–STD–0003–0052 at p. 72).

In this NOPR, DOE is proposing to adopt the relevant provisions in AHRI 1230–2021 to determine IEER for VRF multi-split systems. As noted, the energy conservation standards for VRF multi-split systems are in terms of EER. Testing according to the DOE test procedure to determine EER would continue to be required until such time as the energy conservation standards are amended to rely on IEER, should DOE adopt such changes to the standards. Requiring both EER and IEER would result in multiple standards applicable to the cooling function of a VRF multi-split systems. However, EPCA directs DOE to establish an amended uniform national standard for the relevant ASHRAE equipment at the minimum level specified in the amended ASHRAE/IES Standard 90.1. (42 U.S.C. 6313(a)(6)(A)(ii)(I)) EPCA's use of ''uniform national standard'' and ''minimum level'' appears to prohibit DOE from establishing more than one standard applicable to the cooling function of a VRF multi-split system. *Id.*

Based on the discussion in the preceding paragraphs, DOE initially finds, that pursuant to 42 U.S.C. 6314(a)(4)(B)), there is a lack of clear and convincing evidence to establish a test procedure for IEER other than as specified in AHRI 1230–2021.

Consistent with DOE's proposal to adopt IEER in its test procedure for VRF multi-split systems, DOE also proposes to amend the current definition for ''Integrated Energy Efficiency Ratio, or IEER'' at § 431.92 to differentiate between ACUACs and VRF multi-split systems. Both systems would use the IEER efficiency metric, but the applicable test procedures are in separate sections of the CFR. Specifically, DOE proposes to amend the definition of ''Integrated Energy Efficiency Ratio, or IEER'' at 10 CFR 431.92 to clarify that IEER is measured per the test procedure in appendix A to subpart F of part 431 for ACUACs and per the proposed test procedure at appendix D1 for VRF multi-split systems.

*Issue 1:* DOE requests feedback on its proposal to adopt IEER as determined under AHRI 1230–2021 in the Federal test procedure for VRF multi-split systems. DOE also seeks comment on its proposed amendment to the definition for IEER at § 431.92 to distinguish between the test procedures for ACUACs and VRF multi-split systems.

DOE notes that AHRI 1230–2021 also provides test methods and calculations for measuring simultaneous cooling and heating efficiency (''SCHE''). ASHRAE Standard 90.1–2019 does not include efficiency levels for VRF multi-split systems in terms of SCHE, and the VRF TP Working Group did not consider or analyze the SCHE metric (and thus it was not included in the VRF TP Term Sheet). Further, SCHE is a distinctly different metric from other efficiency metrics for VRF multi-split systems, as SCHE combines cooling and heating performance into a single metric. For these reasons DOE is not proposing to include SCHE in its updated test procedure for VRF multi-split systems.

2. Test Conditions Used for Efficiency Metrics

AHRI 1230–2021 provides a number of test conditions for a variety of tests referred to in the industry test procedure as ''standard rating tests'' and ''performance operating tests.'' DOE is proposing to specify in the test procedure for VRF multi-split systems which test conditions would be required for compliance with standards, were DOE to amend the energy conservation standards based on AHRI 1230–2021, and to specify additional test conditions that would be included in the DOE test procedure for making optional representations of efficiency.

a. Air-Cooled VRF Multi-Split Systems

Table 9 of AHRI 1230–2021 specifies test conditions for standard rating and performance operating tests for air-cooled VRF multi-split systems. Were DOE to amend the applicable energy conservation standards based on AHRI 1230–2021, the relevant ratings for cooling tests would be those referred to as ''standard rating conditions'' in AHRI 1230–2021. To clarify this, DOE proposes to specify in section 3.1 of the proposed appendix D1 that the cooling test conditions used for compliance would be the ''Standard Rating Conditions, Cooling'' and ''Standard Rating Part-Load Conditions (IEER)'' conditions specified in Table 9 of AHRI 1230–2021.

For heating mode tests of air-cooled VRF multi-split systems, AHRI 1230–2021 includes ''Standard Rating Conditions'' for both a ''High Temperature Steady-state Test for Heating'' and a ''Low Temperature Steady-state Test for Heating'' (conducted at 47 °F and 17 °F outdoor air dry-bulb temperatures, respectively). Were DOE to amend the applicable energy conservation standards based on AHRI 1230–2021, the relevant ratings would be those referred to as ''High Temperature Steady-state Test for Heating'' in AHRI 1230–2021 and measured at 47 °F. To clarify this, DOE proposes to specify in section 4.1 of appendix D1 that the heating test conditions used for compliance would be the ''Standard Rating Conditions (High Temperature Steady-state Test for Heating)'' conditions specified in Table 9 of AHRI 1230–2021. Additionally, DOE proposes to also include the low-temperature (17 °F) heating test condition specified in Table 9 of AHRI 1230–2021 (referred to as ''Low Temperature Steady-state Test for Heating'') in the proposed test procedure, and specify in section 4.1.1 of appendix D1 that representations of COP at this low-temperature heating condition are optional.

b. Water-Source VRF Multi-Split Systems

Tables 10 and 11 of AHRI 1230–2021 specify test conditions for cooling mode and heating mode tests, respectively, for water-source VRF multi-split systems. These tables include conditions for both standard rating and performance operating tests. Furthermore, both tables specify test conditions for three different applications of water-source VRF multi-split systems: Water loop heat pumps, ground-water heat pumps, and ground-loop heat pumps. Were DOE to amend the energy conservation

standards based on AHRI 1230–2021, the relevant ratings for cooling and heating tests would be those referred to as ''standard rating conditions'' for ''water loop heat pumps'' in AHRI 1230–2021. To clarify this, DOE proposes to specify in section 3.2 of the proposed appendix D1 that the test conditions used for compliance would be the ''Part-load Conditions (IEER)'' conditions specified for ''Water Loop Heat Pumps'' in Table 10 of AHRI 1230–2021 for cooling mode tests and the ''Standard Rating Test'' conditions specified for ''Water Loop Heat Pumps'' in Table 11 of AHRI 1230–2021 for heat pump heating mode tests.

DOE also proposes to include cooling and heating mode test conditions specified for ''Ground-loop Heat Pumps'' in Tables 10 and 11 in the DOE test procedure for optional representations for water-source VRF multi-split systems. Specifically, DOE proposes to specify in section 4.2.1 of appendix D1 that representations of EER made using the ''Standard Rating Test'' conditions specified for ''Ground-loop Heat pumps'' in Table 10 of AHRI 1230–2021 and representations of COP made using the ''Standard Rating Test'' conditions specified for ''Ground-loop Heat Pumps'' in Table 11 of AHRI 1230–2021 are optional.

The EPCA definition for ''commercial package air conditioning and heating equipment'' specifically excludes ground-water-source equipment (42 U.S.C. 6311(8)(A)). Therefore, DOE is not proposing to include test conditions in the proposed Federal test procedure for making optional representations of cooling and heating efficiency for water-source VRF multi-split systems in the ''Ground-water Heat Pump'' application.

*F. Test Method*

This section discusses certain issues related to testing VRF multi-split systems, several of which were identified by DOE in the July 2017 ASHRAE TP RFI and subsequently addressed in AHRI 1230–2021. Additionally, several of the issues raised by DOE in the July 2017 ASHRAE TP RFI and by commenters relate to changes to the 2019 draft version of AHRI 1230 recommended by the VRF TP Term Sheet. These VRF TP Term Sheet recommendations have also been addressed in AHRI 1230–2021. Therefore comments received regarding these issues are briefly summarized but are otherwise addressed by referencing the relevant language in AHRI 1230–2021.

1. Setting Indoor Airflow and External Static Pressure

The performance of a VRF multi-split system can be significantly affected by variation in ESP or operation with an indoor airflow that is different from the intended or designed airflow. In the July 2017 ASHRAE TP RFI, DOE raised several issues associated with setting indoor airflow and ESP for VRF multi-split systems. 82 FR 34427, 34446. These issues are addressed in Section 6.3.1 of AHRI 1230–2021, and DOE is not proposing any deviations from those provisions. These issues are discussed in the following sections.

a. Indoor Airflow and ESP Settings for Different Capacity Ranges

DOE noted in the July 2017 ASHRAE TP RFI that a 2015 draft version of AHRI 1230 contained one set of instructions for setting the indoor air flow rates for systems with capacities less than 65,000 Btu/h (section 6.3.3.1) and another set for systems with capacities larger than 65,000 Btu/h (section 6.4.1). 82 FR 34427, 34446. It was not clear to DOE why alternate approaches are required for different systems, because the indoor units generally do not differ by system capacity. *Id.* Therefore, DOE requested comment on whether there should be a consistent approach for setting indoor airflow and ESP across all capacity ranges of VRF multi-split systems. *Id.* In response, Lennox commented that the airflow and ESP requirements for VRF multi-split systems with cooling capacity above and below 65,000 Btu/h should be the same. (Lennox, No. 8 at p. 8). Carrier commented that the different approach for setting indoor airflow rates across capacity ranges was being addressed by AHRI in drafting AHRI 1230. (Carrier, No. 6 at p. 19) AHRI commented that a more recent draft of AHRI 1230 contained new requirements for airflow, and that the test requirements would be different for part-load conditions but consistent for full-load conditions. (AHRI, No. 11 at pp. 34–35).

AHRI 1230–2021 includes updated provisions in Section 6.3.1 for setting indoor airflow and ESP that apply to air-cooled VRF multi-split systems with cooling capacity greater than or equal to 65,000 Btu/h and to all water-cooled VRF multi-split systems. Air-cooled VRF multi-split systems with rated cooling capacity less than 65,000 Btu/h are not within the scope of AHRI 1230–2021, and are instead within the scope of a different industry test procedure (AHRI 210/240–2023). Therefore, test procedures for three-phase, air-cooled VRF multi-split systems with cooling capacity less than 65,000 Btu/h are not being considered in this NOPR. Those will be addressed in a separate test procedure rulemaking for air-cooled, three-phase, small commercial package air conditioning and heating equipment with a cooling capacity of less than 65,000 Btu/h. DOE is not proposing any deviations from Section 6.3.1 of AHRI 1230–2021 regarding setting indoor airflow and ESP.

b. Test Setup for Non-Ducted Indoor Units

DOE explained in the July 2017 ASHRAE TP RFI that if a common duct is used for the combined discharge airflow of multiple individual units, the airflow for each individual unit cannot be verified. 82 FR 34427, 34447. Even if the ESP is set to zero in an attempt to replicate operation without ducting, based on a measurement of downstream pressure in a discharge duct this does not always guarantee that flow is identical to free discharge conditions, due to sensitivity of such in-duct pressure measurements to the air movement in the duct. *Id.* Finally, specification of unusually high air flows for testing of free discharge in indoor units may boost measured performance inconsistent with field operation. *Id.* DOE requested comment on how to confirm airflow for each indoor unit individually, or when there is deviation from free-discharge operation, when there is a common duct for multiple individual units. *Id.*

In response, AHRI, Carrier, Mitsubishi, and Goodman commented that it is not feasible nor economically justified to confirm airflow of individual indoor units when a common duct is used. (AHRI, No. 11 at p. 35; Carrier, No. 6 at p. 20; Mitsubishi, No. 10 at p. 2; Goodman, No. 14 at p. 7) Specifically, AHRI stated that it is currently infeasible to confirm airflow for multiple individual indoor units.[14] (AHRI, No. 11 at p. 35) AHRI stated that the third-party laboratory that it uses for its certification program is only equipped with one code tester (*i.e.,* airflow-measuring apparatus) per test room. (*Id.*) AHRI suggested, however, that the use of thermocouple grids on every outlet on each unit and temperature checks on indoor liquid and indoor gas per unit, combined with static pressure taps, helps identify any potential deviation from free-discharge

[14] AHRI stated that it is currently not feasible to test VRF products with up to 12 indoor units. Given DOE's awareness that industry has the capability to test VRF multi-split systems with up to 12 indoor units, DOE interprets AHRI's comment as referring to the infeasibility of confirming the airflow of individual indoor units.

operation on any unit. (*Id.*) Lennox commented that the test protocol for testing non-ducted indoor units does not guarantee zero static pressure at the inlet and outlet of each indoor unit; however, solving this issue is not easy due to laboratory limitations. (Lennox, No. 8 at p. 8) Lennox suggested that improvement to the test method could be made to measure airflow at each indoor unit, but that would require larger and more test rooms. (*Id.*) Lennox noted that experience has indicated that the common duct may show a lower airflow measurement compared to measuring airflow of each non-ducted indoor unit independently. (*Id.* at pp. 8–9)

Section 6.3.1.3 of AHRI 1230–2021 allows the use of a common duct to connect multiple indoor units to a single airflow-measuring apparatus. To ensure that the tests for non-ducted indoor units are being conducted under conditions that reflect operation absent the use of a common duct, AHRI 1230–2021 specifies that a static pressure tap be placed in the center of each face of each discharge chamber that connects each indoor unit to the common duct, and that the static pressure difference between each discharge chamber measurement and intake opening of the equipment under test be zero. DOE tentatively surmises that the approach provided in AHRI 1230–2021 represents industry consensus regarding the most appropriate and representative configuration for testing non-ducted indoor units. As discussed, DOE is not proposing any deviations from the provisions in Section 6.3.1 of AHRI 1230–2021 regarding setting indoor airflow and ESP.

c. Maximum Airflow Rate

Increasing the airflow rates at which indoor units of VRF multi-split systems are tested generally improves measured performance. Testing at an unusually high airflow rate may boost performance in a manner inconsistent with field operation. As part of the July 2017 ASHRAE TP RFI, DOE requested comment on whether there should be an upper limit of airflow per capacity for all non-ducted VRF indoor units, such as 55 scfm per 1,000 Btu/h, which was the limit included in the 2015 draft version of AHRI 1230. 82 FR 34427, 34447.

In response, AHRI, Carrier, and Goodman all expressed support for an airflow limit of 55 scfm per 1,000 Btu/h for non-ducted units, stating that such an upper limit would prevent manufacturers from running higher airflows for rating purposes that are not typical for actual use. (AHRI, No. 11 at pp. 34–35; Carrier, No. 6 at p. 20; Goodman, No. 14 at p. 7) Lennox did not support the 55 scfm per 1,000 Btu/h airflow limit for non-ducted indoor units, and commented that to align the test procedure with field operation, VRF multi-split systems should be tested without an airflow limit. (Lennox, No. 8 at p. 9)

Section 6.3.1.3 of AHRI 1230–2021 includes an upper limit on airflow per capacity for VRF multi-split systems with non-ducted indoor units during cooling tests. The rated airflow for each non-ducted indoor unit must not exceed the lower of two limits: (1) 105% of the nominal airflow published in product literature for that indoor unit, or (2) 55 scfm per 1,000 Btu/h of nominal indoor unit cooling capacity. Section 6.3.1.3 of AHRI 1230–2021 also specifies that if a common duct is used to measure airflow for multiple indoor units—if airflow is not individually measured for each indoor unit—these limits are calculated based on the sum of nominal capacities and nominal airflows for all of the indoor units connected to the common duct. Section 6.3.1.4 of AHRI 1230–2021 specifies that these same provisions (in Section 6.3.1.3) apply for ducted indoor units, except that the airflow limit for ducted indoor units is 42 scfm per 1,000 Btu/h instead of 55 scfm per 1,000 Btu/h. DOE surmises that the approach to maximum airflow rate provided in AHRI 1230–2021 represents the industry consensus regarding the most appropriate and representative maximum airflow rate for testing VRF multi-split systems. Therefore, DOE also surmises that Lennox's position on these provisions, expressed in the comments in response to the July 2017 ASHRAE TP RFI, changed while developing that industry consensus standard. As discussed, DOE is not proposing any deviations from the provisions in Section 6.3.1 of AHRI 1230–2021 regarding setting indoor airflow and ESP.

2. Condenser Head Pressure Controls

Condenser head pressure controls regulate the flow of refrigerant through the condenser and/or adjust operation of condenser fans/water valves to prevent condenser pressures from dropping too low during low-ambient operation. When employed, these controls ensure that the refrigerant pressure is high enough to maintain adequate flow through refrigerant expansion devices such as thermostatic expansion valves. The use of condenser head pressure controls impacts a unit's performance, making it important that this feature operate during testing because it would operate in the field. In the July 2017 ASHRAE TP RFI, DOE requested comment on the appropriateness of requiring head pressure control activation during testing of VRF multi-split systems. 82 FR 34427, 34447.

AHRI, Mitsubishi, and Carrier stated that head pressure controls should be activated during the test for VRF multi-split systems, as manufacturers have different algorithms for controlling head pressure and VRF multi-split systems cannot be maintained manually. (AHRI, No. 11 at p. 35; Mitsubishi, No. 10 at p. 2, Carrier, No. 6 at p. 20) Goodman stated that head pressure control activation is not necessary for testing, as all VRF multi-split systems are variable speed, and system refrigerant pressures are kept at appropriate levels by controlling the compressor and outdoor fan speed. (Goodman, No. 14 at p. 7) Lennox stated that whether head pressure control is activated or not will have no impact on testing. (Lennox, No. 8 at p. 8)

DOE also requested information regarding methods that could be added to the test procedure for VRF multi-split systems to be used if head pressure controls prevent stable operation at low-ambient, part-load conditions, such as the special test provisions described in section F7.1 of AHRI 340/360–2015 for CUACs. 82 FR 34427, 34441, 34447. Specifically, DOE requested comment on whether a head pressure control activation requirement was appropriate for testing of VRF multi-split systems, as well as any additional methods that could be incorporated into the VRF multi-split system test procedure to calculate system efficiency if head pressure controls prevent stable operation at low-ambient, part-load conditions. *Id.* In response, Goodman commented that there is no need for head pressure control activation when testing, and, therefore, no need to address head pressure control instability. (Goodman, No. 14 at p. 7) Carrier commented that VRF manufacturers need more time to evaluate the issue. (Carrier, No. 6 at p. 20)

Section 5.2 of AHRI 1230–2021 specifies that units with head pressure controls have those controls enabled and operating in automatic control mode during testing, set at factory settings or per manufacturer installation instructions. Section 5.2.2 of AHRI 1230–2021 also includes a head pressure control time average test, to be used if head pressure controls prevent a unit from achieving ''Stable Conditions'' as defined by the test standard. Sections 5.2.3 and 5.2.4 provide additional direction for achieving stability, and are to be used if the tolerances for the head

pressure control time average test cannot be met. Absent any indication that activation of condenser head pressure controls results in test results that are unrepresentative or that such activation is unduly burdensome, DOE proposes adopting the AHRI 1230–2021 provisions specifying activation of head pressure controls during testing, with the additional clarification (in section 5.1 of the proposed appendix D1) that head pressure controls are to be set per manufacturer installation instructions or per factory settings if no instructions are provided. DOE is not proposing any additional deviations from the head pressure controls provisions in Section 5.2 of AHRI 1230–2021.

3. Indoor Unit Operation During Part-Load Tests

When VRF multi-split systems operate at low cooling loads in field applications, typically only certain zones require cooling. Therefore, at low cooling loads VRF indoor units serving zones with no cooling or heating load typically turn off. In the July 2017 ASHRAE TP RFI, DOE requested information and data on the field operating states of indoor units of VRF multi-split systems when operating at low compressor speeds, near 25-percent load. 82 FR 34427, 34446.

Commenters generally responded that applications vary greatly with load characteristics, so there is not one operation mode that is representative of all field scenarios, and therefore manufacturers should not be required to turn off any indoor units during the test. (AHRI, No. 11 at pp. 33–34; Goodman, No. 14 at p. 6; Mitsubishi, No. 10 at p. 2; Carrier, No. 6 at pp. 18–19; Lennox, No. 8 at p. 7) Additionally, they commented that shutting off indoor units would require retesting and would add burden and variability to the test procedure. (*Id.*)

Section 5.10 of AHRI 1230–2021 requires that the number of indoor units that are thermally active during full-load and part-load tests be in accordance with the STI, and that at least half of the total indoor units—as calculated per the total capacity of the connected indoor units—remain thermally inactive for the 25 percent load test. Furthermore, section 5.10 requires the following for thermally inactive indoor units: (1) Forced air circulation through the units shall be prevented (*e.g.,* by blocking the inlet and outlet); and (2) the indoor unit control settings shall be set to ''OFF'' (*e.g.,* by using remote or wireless thermostat). DOE surmises that AHRI's and industry's original positions on these provisions regarding inactive indoor units, as set forth in the comments in response to the July 2017 ASHRAE TP RFI, changed while developing the industry consensus standard in AHRI 1230–2021. DOE is not proposing any deviations from the provisions regarding indoor units that are thermally active in Section 5.10 of AHRI 1230–2021.

4. Transient Testing: Oil Recovery Mode

VRF multi-split systems may periodically operate in an oil recovery mode to return oil from the refrigeration loop to the compressor. When undergoing oil recovery, the compressor(s) may increase operating speed, electronic expansion valves may open wider than normal, and indoor fans may be turned off, to allow more liquid refrigerant mass flow in the system. The higher refrigerant velocity helps to entrain the compressor oil that was blocked in the indoor refrigerant lines and return it to the compressor(s).

The current DOE test procedure for VRF multi-split systems specifies through reference to ANSI/AHRI 1230–2010 that oil recovery mode should be activated if the system is designed to initiate the oil recovery mode more frequently than every two hours, but the test procedure does not specify a transient test method or other provisions specific to testing a unit with oil recovery. In the July 2017 ASHRAE TP RFI, DOE requested comment on the impact of oil recovery mode on power input and heating/cooling provided to space. 82 FR 34427, 34446 (July 25, 2017). DOE also requested comment on whether any VRF multi-split systems operate in oil recovery mode more frequently than every two hours of continuous operation. *Id.* For such systems, DOE requested comment on whether and how the test method should address the transient operation occurring during and after oil recovery. *Id.* In addition, DOE requested comment on the performance variation associated with oil level and whether all measurements should be made within a certain time after the last oil recovery. *Id.* AHRI, Mitsubishi, Goodman, and Lennox all commented that they did not support the incorporation of oil recovery into the test procedure. (AHRI, No. 11 at p. 34; Mitsubishi, No. 10 at p. 2; Goodman, No. 14 at p. 6; Lennox, No. 8 at p. 8) They stated that oil recovery seldom occurs, and only during periods of time at very low refrigerant flow rates, which would not be expected to occur during testing. (*Id.*)

Section 5.1.3 of AHRI 1230–2021 specifies that oil recovery mode must be activated during test, regardless of the frequency of oil recovery cycles. If oil recovery occurs with a frequency that prevents a steady state test, AHRI 1230–2021 specifies the use of the transient test procedure as described in Section 8.8.3 (except Section 8.8.3.3) of ANSI/ASHRAE 37–2009, with modifications described in Section 5.1.3.1 of AHRI 1230–2021. In light of the inclusion of oil recovery mode provisions in AHRI 1230–2021, DOE surmises that AHRI's and industry's original position on these conditions, as set forth in the comments in response to the July 2017 ASHRAE TP RFI, changed while developing AHRI 1230–2021. DOE is not proposing any deviations from the provisions regarding oil recovery mode in Section 5.1.3 of AHRI 1230–2021.

5. Secondary Methods for Capacity Measurement

Section 7.2.1 of ANSI/ASHRAE 37–2009 is referenced by AHRI 1230–2021 and specifies the indoor air enthalpy method, plus an additional secondary method for calculating the test equipment capacity for all units with a rated cooling capacity less than 135,000 Btu/h. Additionally, Section 10.1.2 of ANSI/ASHRAE 37–2009 specifies that the secondary capacity measurement must agree with the primary capacity measurement to within 6 percent for equipment with cooling capacity less than 135,000 Btu/h. In the July 2017 ASHRAE TP RFI, DOE requested comment on the methods generally used for measurement of capacity for VRF multi-split systems and whether the selection of methods differs between cooling and heating tests. 82 FR 34427, 34447. DOE also requested comment on how to standardize the selection of test methods for measuring the capacity of VRF multi-split systems. *Id.*

Commenters stated that there are challenges associated with secondary capacity methods for VRF multi-split systems, such as the refrigerant enthalpy and outdoor air enthalpy methods. (AHRI, No. 11 at p. 36; Carrier, No. 6 at p. 21) For example, AHRI stated that the refrigerant enthalpy method is not possible due to the range at which the flow meter would need to operate, and the fact that the presence of a metering device in the outdoor unit of some equipment would make it impossible to use a refrigerant flow meter. (*Id.*) AHRI further stated that the outdoor air enthalpy method is possible, but would require multiple code testers for testing more than one outdoor unit, or additional testing to cover multiple outdoor units tested together. (*Id.*) Carrier stated that for heat pump VRF systems, the outdoor air enthalpy may be used. (Carrier, No. 6 at p. 21) Carrier asserted that this method would be

straightforward for single module systems; however, with multiple module systems, testing would be very complex, if not impossible because the ability to measure air flow and capacity from various modules has not been achieved. (*Id.*) Carrier further stated that there is no adequate secondary method for VRF systems with heat recovery. (*Id.*) Carrier asserted that neither the refrigerant enthalpy nor outdoor air enthalpy methods would work due to the complexity of the refrigeration circuits in these units. (*Id.*)

Section 5.1.1 of AHRI 1230–2021 requires that VRF multi-split systems be tested in accordance with ANSI/ASHRAE 37–2009, with additional instruction provided in appendix E of AHRI 1230–2021. Sections E9 and E13 of AHRI 1230–2021 include several modifications to secondary capacity measurement method provisions in ANSI/ASHRAE 37–2009. Specifically, section E9 provides that when using the outdoor air enthalpy method as the secondary method, secondary checks are conducted for only the high temperature full load tests for cooling and heating mode. Section E13 modifies the outdoor air enthalpy method provisions in Section 8.6 of ANSI/ASHRAE 37–2009—*e.g.,* section E13 specifies that the test used for capacity measurement for determination of efficiency metrics is the test without the outdoor air-side test apparatus connected to the outdoor unit. DOE surmises from the inclusion of these secondary method provisions in AHRI 1230–2021 that AHRI's and industry's original position on these conditions, as set forth in the comments in response to the July 2017 ASHRAE TP RFI, changed during the course of developing that industry consensus standard. DOE is not proposing any deviations from the provisions regarding secondary capacity measurement in appendix E of AHRI 1230–2021.

6. Heat Recovery

Some VRF multi-split systems include a heat recovery control unit to control refrigerant flow between indoor units and provide heating and cooling to different conditioned spaces simultaneously. In the July 2017 ASHRAE TP RFI, DOE requested comment on whether VRF multi-split systems with heat recovery capability can be operated without the heat recovery control unit attached, and if so, whether such systems are typically tested for determining EER, IEER, and COP with the heat recovery control unit attached. 82 FR 34427, 34447. DOE also sought data showing differences in test results with the heat recovery unit attached or unattached. *Id.*

AHRI, Lennox, and Carrier commented that heat recovery units should be included during all tests for heat recovery systems. (AHRI, No. 11 at p. 36; Lennox, No. 8 at p. 9; Carrier, No. 6 at p. 21) AHRI and Lennox stated that VRF heat recovery models cannot be operated without the heat recovery unit attached because the unit is an integral part of the system that cannot be removed, and, therefore, that the heat recovery unit should be accounted for in testing. (*Id.*)

Section F2.3 of AHRI 1230–2021 specifies that individual models of VRF multi-split systems distributed in commerce with heat recovery components must be tested with the heat recovery components present and installed. Consistent with Section F2.3 of AHRI 1230–2021, DOE proposes at § 429.43(a)(5) to specify that for basic models of VRF multi-split systems distributed in commerce with heat recovery components, the manufacturer must determine represented values for the basic model based on performance of an individual model distributed in commerce with heat recovery components.

*G. Specific Components*

An ASRAC working group for certain commercial heating, ventilating, and air conditioning (''HVAC'') equipment (''Commercial HVAC Working Group''),[15] which included VRF multi-split systems, submitted a term sheet (''Commercial HVAC Term Sheet'') providing the Commercial HVAC Working Group's recommendations. (Docket No. EERE–2013–BT–NOC–0023, No. 52) [16] The Commercial HVAC Working Group recommended that DOE issue guidance under current regulations on how to test certain equipment features when included in a basic model, until the testing of such features can be addressed through a test procedure rulemaking. The Commercial HVAC Term Sheet listed the subject features under the heading ''Equipment Features Requiring Test Procedure Action.'' (*Id* at pp. 3–9) The Commercial HVAC Working Group also recommended that DOE issue an enforcement policy stating that DOE would exclude certain equipment with specified features from Departmental testing, but only when the manufacturer offers for sale at all times a model that is identical in all other features; otherwise, the model with that feature would be eligible for Departmental testing. These features were listed under the heading ''Equipment Features Subject to Enforcement Policy.'' (*Id.* at pp. 9–15)

On January 30, 2015, DOE issued a Commercial HVAC Enforcement Policy addressing the treatment of specific features during Departmental testing of commercial HVAC equipment. (*See www.energy.gov/gc/downloads/commercial-equipment-testing-enforcement-policies*) The Commercial HVAC Enforcement Policy stated that—for the purposes of assessment testing pursuant to 10 CFR 429.104, verification testing pursuant to 10 CFR 429.70(c)(5), and enforcement testing pursuant to 10 CFR 429.110—DOE would not test a unit with one of the optional features listed for a specified equipment type if a manufacturer distributes in commerce an otherwise identical unit that does not include one of the optional features. (*Id* at p. 1) The objective of the Commercial HVAC Enforcement Policy is to ensure that each basic model has a commercially available version eligible for DOE testing, meaning that each basic model includes either a model without the optional feature(s) or a model with the optional features that is eligible for testing. *Id.* The features in the Commercial HVAC Enforcement Policy for VRF multi-split systems, (*id* at p. 5), align with the Commercial HVAC Term Sheet's list designated ''Equipment Features Subject to Enforcement Policy.''

AHRI 1230–2021 includes Appendix F, ''Unit Configuration for Standard Efficiency Determination—Informative.'' Section F2.4 includes a list of features that are optional for testing. Section F2.4 of AHRI 1230–2021 further specifies the following general provisions regarding testing of units with optional features:

- If an otherwise identical model (within the basic model) without the feature is not distributed in commerce, conduct tests with the feature according to the individual provisions specified in Section F2.4 of AHRI 1230–2021.
- For each optional feature, Section F2.4 of AHRI 1230–2021 includes explicit instructions on how to conduct testing for equipment with the optional feature present.

The optional features provisions in AHRI 1230–2021 are generally consistent with DOE's Commercial HVAC Enforcement Policy, but the

[15] In 2013, members of ASRAC formed the Commercial HVAC Working Group to engage in a negotiated rulemaking effort regarding the certification of certain commercial HVAC equipment, including VRF multi-split systems. The Commercial HVAC Working Group's recommendations are available at *www.regulations.gov* under Docket No. EERE–2013–BT–NOC–0023–0052.

[16] Available at *www.regulations.gov/document/EERE-2013-BT-NOC-0023-0052*.

optional features in Section F2.4 of AHRI 1230–2021 do not align with the list of features included for VRF multi-split systems in the Commercial HVAC Enforcement Policy. For VRF multi-split systems, the Commercial HVAC Enforcement Policy specifies four optional features—economizer, coated coil(s), steam/hydronic heat options, and dehumidification components. Of these, steam/hydronic heat options and coated coils are not included in the list of optional features in Section F2.4. DOE understands AHRI 1230–2021 to represent the industry consensus position on testing VRF multi-split systems. As such, DOE understands the industry consensus to be that steam/hydronic heat options and coated coils should not be treated as optional features for VRF multi-split systems and/or that VRF multi split systems are not distributed in commerce with these features.

The list of optional features in Section F2.4 includes five features that are not present in the Commercial HVAC Enforcement Policy for VRF multi-split systems: low ambient cooling dampers, ventilation energy recovery systems (''VERS''), power correction capacitors, hail guards, and fresh air dampers. Three of these features in Section F2.4—low ambient cooling dampers, hail guards, and fresh air dampers—are included for VRF multi-split systems in the ''Equipment Features Requiring Test Procedure Action'' section of the Commercial HVAC Term Sheet. The remaining two features—power correction capacitors and VERS—may be included in VRF multi-split systems distributed in commerce. Therefore, DOE has tentatively concluded that their inclusion as optional features for VRF multi-split systems is appropriate.

DOE notes that the list of features and provisions in Section F2.4 of appendix F of AHRI 1230–2021 conflates features that can be addressed by testing provisions with features that warrant enforcement relief (*i.e.,* features that, if present on a unit under test, could have a substantive impact on test results and that cannot be disabled or otherwise mitigated). This differentiation was central to the Commercial HVAC Term Sheet, which as noted previously, included separate lists for ''Equipment Features Requiring Test Procedure Action'' and ''Equipment Features Subject to Enforcement Policy,'' and remains central to providing clarity in DOE's regulations. Specifically, models including features for which the impact can be addressed by testing provisions (*e.g.,* UV lights, which can simply be turned off for testing) should be subject to testing and do not warrant enforcement relief (*i.e.,* no provisions allowing representations based on performance of an otherwise identical model without the feature, and DOE compliance could be assessed based on testing of the model containing the feature and not based on testing of an otherwise identical model without the feature).

Further, Section F2.4 of AHRI 1230–2021 does not provide provisions specific to how DOE would conduct enforcement testing with respect to specific components, as opposed to how manufacturers make representations. Therefore, provisions more explicit than those included in Section F2.4 of AHRI 1230–2021 are warranted to clarify (1) how manufacturers of VRF multi-split systems must make representations with regards to specific components; and (2) how DOE will conduct enforcement testing with respect to specific components (*e.g.,* in which situations DOE would test a tested combination including individual indoor unit models with a specific component present).

In order to provide clarity between test procedure provisions (*i.e.,* how to test a specific unit) and certification and enforcement provisions (*e.g.,* which model to test), DOE is not proposing to incorporate by reference appendix F of AHRI 1230–2021 and instead is proposing related provisions in appendix D1 to subpart F of part 431, § 429.43, and § 429.134. Specifically, in appendix D1, DOE proposes test provisions for specific components, including all of the components listed in Section F2.4 of 1230–2021. These provisions would specify how to test a unit with such a component (*e.g.,* for a unit with hail guards, remove hail guards for testing). These proposed test provisions are consistent with the provisions in Section F2.4 of AHRI 1230–2021 but include revisions for further clarity and specificity (*e.g.,* adding clarifying provisions for how to test units with modular economizers as opposed to units shipped with economizers installed).

In § 429.43(a)(4), DOE is proposing provisions that would allow, in specific cases, determination of represented values for a tested combination of VRF multi-split system based on performance of a system without certain specific components. These provisions are generally consistent with the Commercial HVAC Term Sheet, the Commercial HVAC Enforcement Policy, and Section F2.4 of AHRI 1230–2021. However, unlike in Section F2.4 of AHRI 1230–2021 (but consistent with the Commercial HVAC Term Sheet and the Commercial HVAC Enforcement Policy) and as discussed earlier in this section, the components to which these provisions apply are limited to those components for which the test provisions for testing a unit with these components may result in differences in ratings compared to testing a unit without these components—specifically, air economizers and dehumidification components, which were included in both the Commercial HVAC Enforcement Policy for VRF multi-split systems and appendix F of AHRI 1230–2021.

Also, because air economizers and dehumidification components are only ever installed as part of the indoor units of VRF multi-split systems, and VRF multi-split systems contain multiple indoor units with potentially distinct model numbers, DOE proposes to adopt language more specific to VRF multi-split systems than the language contained in the Commercial HVAC Enforcement Policy and Section F2.4 of AHRI 1230–2021—*i.e.,* applying the provisions to multiple indoor unit models and tested combinations. For example, DOE uses the term ''individual indoor unit models'' to account for potential discrepancies across individual indoor unit models that comprise the VRF multi-split system tested combination. This terminology allows for individual consideration of specific components on an indoor unit-by-indoor unit basis to account for scenarios in which one individual indoor unit model in the tested combination may have an ''otherwise identical'' indoor unit model while other individual indoor unit models in the tested combination may not have an ''otherwise identical'' indoor unit model.

In summary, for air economizers and dehumidification components, DOE proposes the following:

- If the indoor unit model(s) in a tested combination within a basic model include only individual indoor unit models distributed in commerce with a specific component, or does not include any otherwise identical individual indoor unit models distributed in commerce without the specific component, the manufacturer must determine represented values for the tested combination based on performance of individual indoor unit models with the component present (and consistent with any relevant proposed test procedure provisions in appendix D1).
- If the indoor unit model(s) in a tested combination within a basic model include both individual indoor unit models distributed in commerce with a specific component and otherwise identical individual indoor unit models

distributed in commerce without the specific component, the manufacturer may determine represented values for the tested combination based on performance of individual indoor unit models either with the component present (and consistent with any relevant proposed test procedure provisions in appendix D1) or without the component present.

DOE notes that in some cases, individual indoor unit models may include multiple of the specified components (*i.e.,* both an economizer and dehumidification components) or there may be individual indoor unit models within a tested combination that include various dehumidification components that result in more or less energy use. In these cases, the represented values of performance must be representative of the lowest efficiency found within the indoor unit model(s) in a tested combination.

Additionally, DOE is proposing at § 429.43(b)(4) a certification reporting requirement for supplemental test instructions for VRF multi-split systems regarding specific components, corresponding to the proposed representation requirements for specific components at § 429.43(a)(4). Specifically DOE proposes that the manufacturer must certify for which specific components (as listed in § 429.43(a)(4)(i)), if any, the following provisions are applicable: (1) The indoor unit model(s) in a tested combination within a basic model include both individual indoor unit models distributed in commerce with the specific component and individual indoor unit models distributed in commerce without the specific component; (2) at least one of the individual indoor unit models distributed in commerce without the specific component is otherwise identical to any given individual indoor unit model distributed in commerce with the specific component; and (3) represented values for the tested combination are based on performance of individual indoor unit models distributed in commerce without the specific component.

Also consistent with the Commercial HVAC Term Sheet and the Commercial HVAC Enforcement Policy, in 10 CFR 429.143(s)(1), DOE is proposing provisions regarding how DOE would test tested combinations within a basic model that include individual indoor unit models distributed in commerce with air economizers or dehumidification components. Specifically:

- If the manufacturer does not certify in accordance with 10 CFR 429.43(b)(4) both that (1) indoor unit model(s) in a tested combination within a basic model include both individual indoor unit models distributed in commerce with a specific component and otherwise identical individual indoor unit models distributed in commerce without the specific component and (2) represented values for the tested combination are based on performance of individual indoor unit models distributed in commerce without the specific component; then DOE may test the tested combination with individual indoor unit models with the component present (and consistent with any relevant proposed test procedure provisions in appendix D1).
- If the manufacturer certifies in accordance with 10 CFR 429.43(b)(4) both that (1) indoor unit model(s) in a tested combination within a basic model include both individual indoor unit models distributed in commerce with a specific component and otherwise identical individual indoor unit models distributed in commerce without the specific component, and (2) represented values for the tested combination are based on performance of individual indoor unit models distributed in commerce without the specific component, DOE will test the tested combination with otherwise identical indoor unit model(s) within the tested combination within a basic model that do not include the component, except in either of the following situations. In either of the following situations, DOE may test the tested combination with individual indoor unit models with the specific component present (and consistent with any relevant proposed test procedure provisions in appendix D1).
  - DOE is not able, through documented reasonable effort, to obtain individual indoor unit models for testing that do not include the component.
  - DOE becomes aware that the manufacturer's certification in accordance with 10 CFR 429.43(b)(4) regarding specific components is invalid.

Were DOE to adopt the provisions in appendix D1, § 429.43, and § 429.134 as proposed, DOE would rescind the Commercial HVAC Enforcement Policy to the extent it is applicable to VRF multi-split systems. In a separate certification rulemaking, DOE may consider requiring a manufacturer to identify, in its certifications, the otherwise identical models that do not include specific component(s) that are tested to support representations of basic models that include individual models with specific components.

*Issue 2:* DOE requests comment on its proposals in appendix D1, § 429.43, and § 429.134 regarding specific components.

*H. Controls Verification Procedure*

Section 5.1.2.1 of AHRI 1230–2021 specifies that during steady-state performance rating tests for cooling and heating efficiency, VRF multi-split systems must operate under commands from system controls except for certain components, referred to as ''critical parameters,'' which are allowed to be set by a manufacturer's representative. These critical parameters are (1) compressor speed(s), (2) outdoor fan speed(s), and (3) outdoor variable valve positions. Settings for critical parameters are allowed to be manually controlled using a manufacturer control tool, as opposed to all other components which must operate per commands from the system controls. The measured performance of VRF multi-split systems depends, in part, on the operating positions of each of these critical parameters. Accordingly, Section 5.1.2 of AHRI 1230–2021 states that operational settings for each of the critical parameters must be specified in the STI, and that each of the critical parameters must be allowed to be manually adjusted (to match the STI-certified values) during testing.

AHRI 1230–2021 also includes a normative Appendix C that specifies a controls verification procedure (''CVP''). The purpose of the CVP is to validate that the observed positions of critical parameters during the CVP are within tolerance of the STI-certified critical parameter values that are set by the manufacturer in steady-state IEER cooling tests (see section III.H.5 of this NOPR for discussion of CVP results). This ensures that the measured results of the IEER test procedure are based on critical parameter settings that are representative of critical parameter behavior that would be experienced in the field.

DOE proposes to adopt the CVP that is specified in appendix C of AHRI 1230–2021. Because the CVP is a verification procedure, not a test procedure used to develop represented values, DOE is proposing to distinguish the CVP as a validation procedure by adopting the CVP procedure in the product-specific enforcement provisions for VRF multi-split systems at § 429.134(s). The proposed inclusion of these provisions at § 429.134(s) would indicate how DOE would conduct a CVP in the event of assessment or enforcement testing. The following sub-sections discuss the CVP and DOE's CVP-related proposals in detail.

1. Background

DOE's current test procedure for VRF multi-split systems includes allowances in 10 CFR 431.96(f) for limited manufacturer involvement in assessment or enforcement testing. A manufacturer's representative may adjust components such as the compressor speed, fan speeds, and valve positions for the purposes of achieving steady-state conditions during testing. 10 CFR 431.96(f). This adjustment process is provided for VRF multi-split systems because of the complexity of VRF multi-split systems and the variety of settings needed to perform a test. 77 FR 28928, 28946 DOE's current certification requirements for VRF multi-split systems, found at § 429.43(b)(4), specify that the STI must include compressor frequency set points and required dip switch/control settings for step or variable components. However, DOE's current regulations do not require these settings to match system behavior when the VRF multi-split system is operating under its own controls. Further, there are no constraints regarding the allowable range of adjustments that a manufacturer's representative may make to reach steady state. Sections 5.1.2 and 5.1.3 of ANSI/AHRI 1230–2010 allow similar adjustments of modulating components to achieve steady-state conditions during ratings tests.

In October 2018, during the negotiation meetings of the Working Group, the CA IOUs raised concern with the representativeness of the ANSI/AHRI 1230–2010 method, particularly with respect to control inputs used at part-load test conditions. (Docket Nos. EERE–2018–BT–STD–0003–0011 and EERE–2018–BT–STD–0003–0013) The CA IOUs presented field and laboratory test data indicating decreased performance at part-load conditions as compared to the part-load performance indicated by the IEER rating and available published performance data for that system when a VRF multi-split system was tested under commands from the system controls (*i.e.,* not manually controlled). *Id.* The VRF TP Term Sheet from the Working Group recommended that DOE adopt an updated draft of AHRI 1230 that included a controls verification procedure as an appendix. (Docket No. EERE–2018–BT–STD–0003–0044 at pp. 1–2).

2. Purpose and Description

As discussed, Appendix C of AHRI 1230–2021 establishes a CVP.[17] The CVP verifies whether critical parameter settings certified in the STI, implemented by the manufacturer's representative during full-load and part-load steady-state cooling tests for IEER, are within the range of settings that would be used by the system during operation in the field—the system's native controls. The behavior of each critical parameter is monitored and recorded throughout the duration of a CVP.

In contrast to steady-state tests in which test conditions are held constant, the CVP is a dynamic cooling test method in which certain test conditions are intentionally varied throughout the test. Specifically, the indoor room dry-bulb temperature is steadily decreased during the CVP using the room conditioning apparatus, in order to determine how the VRF multi-split system under test responds to approaching and achieving its setpoint. Outdoor room test conditions are held constant during the CVP. The CVP may be conducted at any of the four IEER outdoor air or entering water temperature conditions.

At the start of the CVP, the indoor room test chamber temperature is controlled to a manufacturer-specified value that must be between 82 °F and 86 °F, and the VRF indoor units are set to control to a constant indoor temperature, 80 °F, except as explained by Section 5.1.5 of AHRI 1230–2021. This Section provides instructions for adjusting the VRF indoor unit setpoints (deviating from 80 °F) to account for set point bias and set point offset.[18] VRF indoor units typically use the calculated temperature difference between the setpoint and the measured indoor air temperature as a control parameter for determining when to shut down and become thermally inactive. As discussed, the timing of the first indoor unit becoming thermally inactive dictates the allowable time period for determining whether certified critical parameter values have been validated, so it is crucial to account for set point bias and offset to ensure repeatable test results.

After setting initial indoor air temperature, including any adjustments to control for set point bias and offset, the CVP proceeds by incrementally decreasing the indoor room test chamber temperature while the VRF multi-split system setpoint is held constant. As the indoor room temperature approaches and eventually passes below the VRF multi-split system setpoint, the VRF multi-split system controls should begin to register that the cooling demand has been satisfied, and the system will begin to ''unload,'' meaning reduce capacity.[19] VRF multi-split systems typically unload by modulating component settings, including critical parameters, from the values used when providing full-load cooling capacity. During this unloading period and up until the time that the first indoor unit becomes thermally inactive, critical parameters are compared against the critical parameter values that are certified in the STI (validation criteria are discussed in a following section). Once the first indoor unit becomes thermally inactive, the indoor room dry bulb temperature continues decreasing until the indoor room reaches 77 °F.

3. Critical Parameter Definition

Section 3.10 of AHRI 1230–2021 defines the term ''critical parameters'' as ''Key variables affecting the measured result,'' meaning ''[a]ny operating state or position for a component, either set manually or automatically by System Controls, which significantly impacts system performance.'' Section 5.1.2.1 of AHRI 1230–2021 limits the range of critical parameters that can be manually adjusted to compressor speed(s), outdoor fan speed(s) and outdoor variable valve position(s). To be more explicit that ''critical parameters'' refers only to those parameters specified by Section 5.1.2.1 of AHRI 1230–2021, DOE is proposing not to reference the definition of critical parameters in Section 3.10 of AHRI 1230–2021, and instead to define the term ''critical parameter(s)'' in section 3 of appendix D1 as specifically referring to the following settings of modulating components of VRF multi-split air conditioners and heat pumps: Compressor speed(s), outdoor fan speed(s) and outdoor variable valve position(s). DOE has tentatively concluded that the proposed change to

[17] The concept for the CVP originated from a minimum compressor speed verification procedure provided in Japanese standard JIS B 8616:2006, *Package Air Conditioners,* which is included as an informative reference in appendix B of AHRI 1230–2021, but not directly referenced within AHRI 1230–2021. Available at *www.jsajis.org/index.php?main_page=product_info&cPath=2&products_id=13290.*

[18] AHRI 1230–2021 provides the following definitions for these terms in sections 3.29 and 3.30, respectively:

Set Point Bias—The difference between 80 °F and the nominal thermostat set point required for the thermostat to control for 80 °F sensed temperature at the sensed location.

Set Point Offset—The difference between the temperature indicated by a thermostat's temperature sensor and the actual temperature at the sensor's location.

[19] Figure C.1 in AHRI 1230–2021 displays an example schematic of the indoor dry bulb temperature in °F, compressor speed in Hz, and the number of thermally active indoor units over the duration of a CVP test.

the definition is editorial in nature and would not change or conflict with any testing provisions in AHRI 1230–2021.

*Issue 3:* DOE requests comment on its proposed definition for ''Critical Parameter(s)'', which specifies the three parameters that can be manually controlled in testing per Section 5.1.2.1 of AHRI 1230–2021—compressor speed(s), outdoor fan speed(s), and outdoor variable valve position(s).

4. Critical Parameter Variation and Budget Method

Appendix C of AHRI 1230–2021 includes methods for (1) calculating variation of critical parameters measured during the CVP from the values certified by the manufacturer in the STI (in Section C.4.4.2.3 of AHRI 1230–2021); and for (2) assessing whether the variation of critical parameters from certified values is within acceptable limits (in Section C.6 of AHRI 1230–2021).

Section C.4.4.2.3 of AHRI 1230–2021 provides instructions for calculating critical parameter variation during the CVP, specifying that at each measurement interval the instantaneous positions of all critical parameters are compared to the certified values. If multiple components corresponding to a single parameter are present (*e.g.,* multiple compressors), the average position across all components is calculated at each measurement interval when determining variation. This difference is then divided by the maximum value observed during a full-load cooling CVP, to arrive at a normalized percent difference referred to as the ''Parameter Percent Difference'' or ''$PPD_{i,t}$'' in AHRI 1230–2021.

Table C3 of AHRI 1230–2021 specifies weighting factors (referred to as ''nominal point values''), which are multiplied by the $PPD_{i,t}$ for each critical parameter. This results in a ''Points'' value (calculated per equation C4 of AHRI 1230–2021) for each of the three critical parameters. These nominal point values reflect the relative sensitivity of IEER to changes in each critical parameter for VRF multi-split systems. The nominal point values specified in Table C3 of AHRI 1230–2021 are independent of the load point and whether the measured critical parameter is above or below the STI-certified value. Section C6.1.1 of AHRI 1230–2021 specifies that the Points values for each critical parameter are combined into a single measure called ''RSS Points Total'' using a root-sum-squared calculation. RSS Points Total represents an aggregated and normalized measure of deviation of all critical parameters from their certified values.

The verification criteria specified in Section C.6 of AHRI 1230–2021 for critical parameters measured during the CVP is a ''budget method'' that is dependent on cumulative variation across multiple critical parameters, instead of being solely dependent on the behavior of a single critical parameter. The budget method specified in Section C.6 of AHRI 1230–2021 applies a limit to the calculated RSS Points Total across all three critical parameters instead of applying individual tolerances to each individual critical parameter.[20] This method allows manufacturers flexibility in critical parameter control strategies while still constraining the overall variation in VRF multi-split system performance. The budget method can be applied the same way regardless of the number of critical parameters that a manufacturer certifies to their STI. For any critical parameter whose value is not certified in the STI, *i.e.,* not designated as being controlled during the IEER cooling tests, the deviation in that parameter will be calculated as zero for the duration of the CVP.

5. Validation of Certified Critical Parameters

As discussed in the preceding section, AHRI 1230–2021 includes a budget method for calculating total variation in critical parameters from their certified values, expressed as a point total instead of measuring deviation individually for each critical parameter. Section C6.1.2 of AHRI 1230–2021 specifies that the certified critical parameters are valid if at least one measurement period of at least three minutes and a minimum of five sample readings exists where the average RSS Points Total is less than or equal to 70 points. Section C6.1.3 of AHRI 1230–2021 states that the manufacturer-specified critical parameters are invalid if no measurement period of at least three minutes and a minimum of five sample readings exists where the average RSS Points Total is less than or equal to 70 points. As discussed in section III.D.1 of this NOPR, the 70-point threshold was developed as part of AHRI 1230 Technical Committee meetings in which DOE presented anonymized and aggregated test data. As part of those meetings, DOE presented its finding that a minimum point budget of 32 points was required to account for the lab-to-lab and test-to-test variability observed in critical parameter behavior between CVP runs for a single system. (EERE–2018–BT–STD–0003–0063 at p. 23). To allow for additional variability (*e.g.,* sample-to-sample variability across the same VRF multi-split system and variability across different types of VRF multi-split systems), DOE recommended a 60-point budget to the Technical Committee. (*Id*). The Technical Committee ultimately agreed to provide a 70-point budget in AHRI 1230–2021.

DOE has tentatively determined that the language in Sections C6.1.2 and C6.1.3 of AHRI 1230–2021 could be construed and applied in multiple manners, and that this could lead to differing test burdens. The phrase ''a measurement period of at least three minutes and a minimum of five sample readings'' could be understood to indicate a measurement period with no upper limit, potentially encompassing the entire duration of the CVP. This reading could be understood to require iterative calculations of time periods of varying lengths when validating critical parameters during the CVP (*e.g.,* all three-minute periods, and all four-minute periods, and all five-minute periods). Taken to an extreme, this would result in thousands of calculations. Further, the language ''where the average RSS Points Total is less than or equal to 70 points'' does not indicate the specific procedure for determining the average value of RSS Points Total—*i.e.,* whether ''average'' refers to the average value within the measurement period or the cumulative average value of RSS points at the time of measurement.

Therefore, DOE proposes to clarify these provisions by providing additional instructions for validating critical parameters in § 429.134(s)(3)(ii). Specifically, DOE proposes to specify that the duration of the time period used for validating critical parameters must be whichever of the following is longer: Three minutes or the time period needed to obtain five sample readings while meeting the minimum data collection interval requirements of Table C2 of AHRI 1230–2021. DOE also proposes to specify that if at least one measurement period (with the aforementioned duration) exists before the first indoor unit goes thermally inactive that has an average RSS Points Total less than or equal to 70 points, then the certified critical parameter values are validated.

*Issue 4:* DOE seeks comment on its proposal for adding provisions at 10

[20] In addition to recommending inclusion of a CVP an appendix to the draft AHRI 1230, the VRF TP Term Sheet also recommended that DOE determine appropriate values for critical parameter tolerances using manufacturer-provided data. DOE subsequently conducted testing and sensitivity analysis of several VRF multi-split systems that were incorporated into the development of the ''budget method'' for CVP critical parameter verification specified in section C6 of AHRI 1230–2021.

CFR 429.134(s)(3)(ii) to clarify the language in Sections C6.1.2 and C6.1.3 of AHRI 1230–2021 for validating critical parameters during a CVP, particularly pertaining to the duration of the measurement period used for validating critical parameters.

6. Determination of Alternate Critical Parameters

AHRI 1230–2021 indicates that certified critical parameters shall be consistent with a valid CVP to be used for IEER testing. Specifically, Section 5.1.2.1 of AHRI 1230–2021 specifies that operational settings for critical parameters must be with RSS Points Total ≤70 points, as defined in Section C6 of AHRI 1230–2021. However, AHRI 1230–2021 does not explicitly provide for alternate critical parameters for the IEER cooling test if the certified critical parameters are invalidated by the CVP.

If a CVP is not conducted, or if a CVP is conducted and the manufacturer-specified critical parameters are validated, DOE proposes that the critical parameter values certified in the STI be used as the initial control inputs when conducting the IEER cooling test at the corresponding full- or part-load cooling condition. DOE understands this to be consistent with Section 5.1.2 of AHRI 1230–2021. Because AHRI 1230–2021 does not explicitly address how alternate critical parameters are to be determined in the case of a failed CVP, additional provisions are needed so that alternate critical parameters are determined in a repeatable and representative manner. Therefore, if the CVP invalidates the manufacturer-specified critical parameters, DOE proposes at § 429.134(s)(3)(iii)(B) that alternate critical parameter values would be determined by averaging the value for each critical parameter from a specified time period of the CVP data, and that these alternate critical parameter values would be used for IEER testing in lieu of the certified critical parameter values. DOE proposes to use the same procedure for determination of measurement period length as is proposed in § 429.134(s)(3)(ii)(A) and discussed in section III.H.5 of this NOPR: The longer of three minutes or the time period needed to obtain five sample readings while meeting the minimum data collection interval requirements of Table C2 of AHRI 1230–2021.

DOE also proposes to select the measurement period for determining alternate critical parameter values (with the aforementioned duration) that has the lower average RSS points total over the selected period than over any other period in the CVP having the same duration. If multiple such periods exist with the same RSS Points Total, DOE proposes to select the period closest to (but before) the time when the first indoor unit becomes thermally inactive ($t_{off}$).

As described in section III.H.4 of this NOPR, Point Total represents an aggregated and normalized measure of deviation of all critical parameters from their certified values; therefore, by selecting a time period having the lowest average RSS Point Total, DOE would be selecting the period from the CVP where the alternate critical parameter values are most similar collectively to their certified values. However, DOE acknowledges that other approaches could be considered for selecting the measurement period for determination of alternate critical parameters from a CVP that has invalidated the critical parameter settings. For example, DOE could consider selecting the measurement period based on the behavior of compressor speed alone (*e.g.,* the measurement period when deviation between certified and measured compressor speed is minimized), irrespective of other critical parameters. DOE could also consider selecting the measurement period based on test chamber conditions—*e.g.,* the measurement period when the indoor test chamber first passes below the VRF multi-split system thermostat setpoint, or the measurement period just before the first indoor unit becomes thermally inactive.

*Issue 5:* DOE seeks comment on its proposal to specify at § 429.134(s)(3)(iii)(B) how, in the event of a CVP that has invalidated the critical parameter settings, alternate critical parameters would be determined to use as initial control inputs during the corresponding IEER full- or part-load cooling test. DOE requests feedback on the proposed method for selecting a measurement period on the basis of minimized average RSS points total, and also on its proposal for using an average of critical parameter measurements over the selected measurement period to calculate alternate critical parameters. DOE will further consider any alternate approaches suggested by comments in developing any final rule.

7. When the CVP Is Conducted

While appendix C of AHRI 1230–2021 details how to conduct a CVP, it does not include instruction about the circumstances in which a CVP must be conducted. As noted previously in section III.D.1, DOE is proposing to adopt appendix C from AHRI 1230–2021 as a product-specific enforcement provision, as opposed to adopting it in proposed appendix D1. In other words, DOE is not proposing that the CVP be conducted as part of an IEER test per the DOE test procedure. Instead, DOE is proposing to include the CVP (via reference to appendix C of AHRI 1230–2021) as part of DOE's product-specific enforcement provisions for VRF multi-split systems in the proposed § 429.134(s).

*Issue 6:* DOE requests comment on its proposal to incorporate the CVP into its product-specific enforcement provisions for VRF multi-split systems at § 429.134(s) instead of the test procedure for VRF multi-split systems in the proposed appendix D1.

In addition to its proposal to incorporate the CVP into its product-specific enforcement provisions, DOE is proposing to specify at § 429.134(s)(3) that DOE would conduct a CVP at all of the four IEER cooling test conditions, consistent with the Working Group intention for DOE to verify controls performance. (Docket No. EERE–2018–BT–STD–0003–0044 at p. 2) DOE also proposes to specify that the CVP would be performed first at the full-load cooling condition to determine maximum critical parameter values, before conducting the CVP at part-load cooling conditions because the maximum critical parameter values are used for calculating normalized deviation for CVPs at part-load conditions.

DOE also proposes to specify that the CVP would be performed on a single system from the two-system sample during enforcement testing. As discussed in section III.H.5 of this document, DOE's preliminary testing to evaluate repeatability and reproducibility of the CVP indicated that a minimum point budget of 32 points would be required to account for lab-to-lab and test-to-test variability observed in a single system. A 70-point budget could therefore accommodate an additional 48 points due to additional sources of variability, including sample-to-sample variability across the same VRF multi-split system. DOE has tentatively determined that the 70-point budget would be sufficient to account for all sources of variability during testing, such that conducting the CVP on a single system from the assessment/enforcement sample would yield results that are representative of both systems in the sample.

Should alternate critical parameters be required as a result of a CVP that has invalidated the critical parameter settings, DOE proposes that the alternate critical parameters would be determined from the CVP results of the single

system. These alternate critical parameters would be used for the corresponding IEER test (as specified in appendix D1) for all systems tested as part of the enforcement sample. Figure 1 shows a diagram illustrating DOE's proposed use of the CVP in its enforcement provisions for VRF multi-split systems.

*Issue 7:* DOE requests comment on its proposed approach for conducting the CVP during enforcement testing. Specifically, DOE requests comment on the proposal that DOE would conduct the CVP for a single system during enforcement testing in order to validate the certified critical parameters. If commenters believe conducting the CVP on a single system as part of enforcement testing is insufficient, DOE requests test data demonstrating any issues with repeatability and reproducibility of the CVP that would indicate that the 70-point budget for critical parameter variation included in the industry consensus test procedure AHRI 1230–2021 is insufficient.

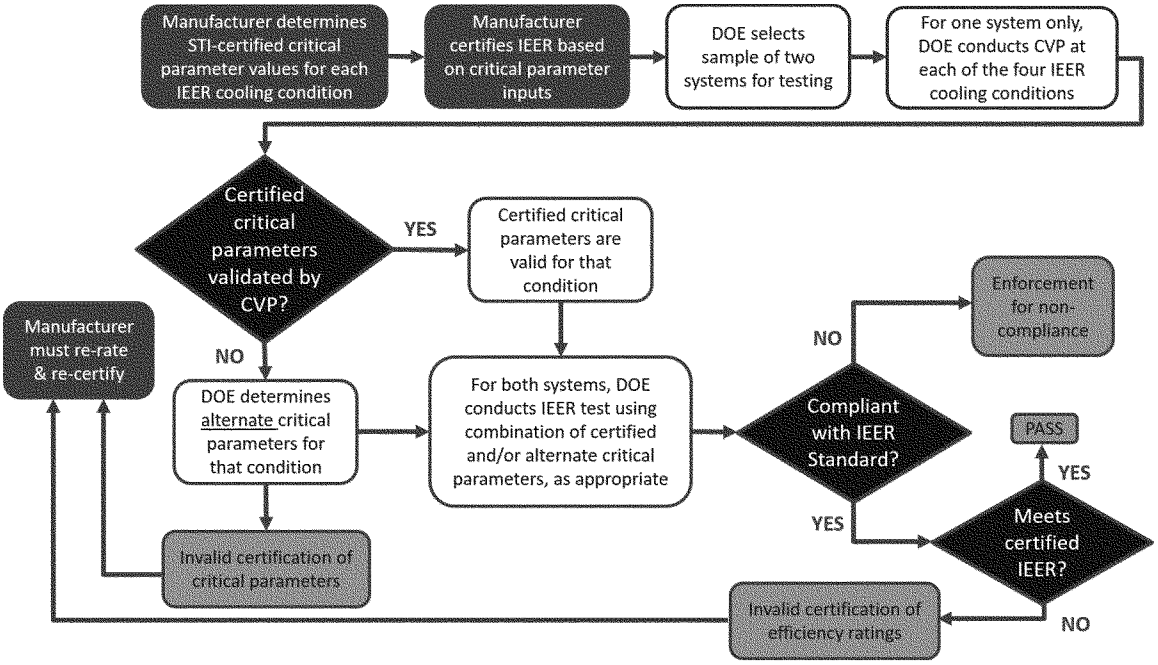


**Figure 1: Proposed Process for Conducting the CVP and IEER Testing for DOE Assessment and Enforcement Testing of VRF Multi-split Systems**

*I. Allowable Critical Parameter Adjustment*

1. Adjustment of Certified Critical Parameter Values

Section 6.3.3 of AHRI 1230–2021 provides instructions for adjusting critical parameters during the four specified full- or part-load IEER cooling test conditions in order to meet cooling capacity targets or to adjust SHR to below the allowable limit for the given IEER test point. Upon review of these provisions, DOE has tentatively determined that several amendments are required, and, therefore, proposes to include provisions to specify allowable critical parameter adjustments in section 5.2 of appendix D1 to subpart F of part 431.

Section 6.3.3.1.2 of AHRI 1230–2021 specifies that in cases for which the cooling capacity is above the upper tolerance, the critical parameters are adjusted according to the instructions provided in the STI—specifically, the manufacturer may specify that any or all of the three critical parameters are to be adjusted in this scenario. Section 6.3.3.1.2 further specifies that when adjusting critical parameters, the allowable adjustment is constrained by deviation resulting in an RSS points total of 70 points or fewer. However, this section does not explicitly describe RSS points total, nor does it refer to the provisions in Sections C4.4.2.3 and C6 that specify measurement and calculation of RSS points total in the context of a CVP. To remedy this, DOE is proposing instructions for calculating critical parameter variation (in terms of RSS Points Total) for steady-state IEER cooling tests for which the measured capacity is above the target load fraction. These proposed instructions are consistent with the provisions in Section C4.4.2.3 of AHRI 1230–2021 for calculating critical parameter variation in a CVP, except that DOE proposes to specify that the normalized deviation is to be measured between the certified STI values and the adjusted critical parameter values during steady-state IEER cooling tests, rather than between the certified STI values and an instantaneous measurement of critical parameter positions recorded during the CVP.

DOE is proposing two other clarifications to the provisions for critical parameter adjustment for IEER tests in section 5 of appendix D1. First, DOE is proposing to clarify that upward adjustments to compressor speed (*i.e.,* when the measured cooling capacity is too low or when the SHR is above the allowable limit) are not constrained by a budget on RSS Points Total. This is consistent with AHRI 1230–2021, which does not require an RSS Points Total budget be used for these adjustments.

Second, DOE proposes to clarify the instructions for calculating critical parameter variation in the scenario where a VRF multi-split system contains multiple components corresponding to a single critical parameter (*e.g.,* multiple compressors). Specifically, DOE proposes to replace all references to ''multiple instances of a single parameter'' with ''multiple components corresponding to a critical parameter''. This proposal is consistent with AHRI 1230–2021, but clarifies the wording because ''multiple instances'' could be interpreted to refer to multiple time points for a single component, rather than multiple components at a given time, as intended.

To the extent that the industry test procedure does not provide the specifications regarding adjustment of critical parameters as proposed, DOE tentatively finds that the industry test procedure would not ensure that measured results are comparative. Due to the potential variation resulting from the absence of the specification, the industry test procedure would not ensure that the results reflect the equipment's representative average energy efficiency or energy use. As such, DOE has initially determined, supported by clear and convincing evidence, that in the absence of the proposed specifications for adjustment of critical parameters the industry test procedure would not meet the statutory requirements of 42 U.S.C. 6314(a)(2)–(3), and, therefore, is proposing the supplemental specification.

*Issue 8:* DOE seeks comment on its proposed provisions (to clarify similar provisions in AHRI 1230–2021) in section 4 of the proposed appendix D1 to subpart F of part 431 that specify allowable adjustments to critical parameters for IEER tests. Specifically, DOE requests feedback on its proposal to specify, for IEER tests for which the tested capacity is above the target capacity, calculation of normalized critical parameter variation during the adjustment process (similar to the calculation specified for the CVP in Section C4.4.2.3 of AHRI 1230–2021).

2. Adjustment of Alternate Critical Parameter Values

As described in section III.H.5 of this NOPR, in the case of critical parameter values being invalidated by the CVP conducted as part of DOE assessment or enforcement testing, DOE is proposing to clarify how alternate critical parameters would be determined for use as control inputs for a steady-state cooling test conducted at the corresponding IEER test condition (instead of using the critical parameter values certified in the STI). In such a case, it may still be necessary to adjust the alternate critical parameter values (determined in the CVP) in order to meet tolerances for capacity and SHR limits for the IEER test. Accordingly, DOE is proposing to include provisions at § 429.134(s)(3)(iii)(B)(*3*) to indicate that in the case of invalidated critical parameter values in which DOE determines alternate critical parameters, additional adjustments to the alternate critical parameters are allowed to comply with capacity and/or SHR requirements. Specifically, DOE proposes to reference the methods for adjustment of critical parameters from section 5.2 of appendix D1 to subpart F of part 431 with two modifications. First, DOE proposes that in such a case, references in section 5.2 of appendix D1 to critical parameter values certified in the STI would be replaced with references to alternate critical parameter values determined under the CVP. Second, in such a case DOE proposes to determine the maximum operating state of each critical parameter (referred to as $CP_{Max}$ in AHRI 1230–2021 and the proposed regulatory text) based on the maximum operating state observed during a CVP conducted at 100 percent cooling load conditions, instead of using the information certified to the STI for the 100 percent cooling load point.

*Issue 9:* DOE seeks comment on the proposed provisions at § 429.134(s)(3)(iii)(B)(3) regarding allowable adjustment (to meet tolerances for capacity and SHR limits for an IEER test) of alternate critical parameter values determined by DOE in the event of a CVP that has invalidated the critical parameter settings.

*J. Certification, Compliance and Enforcement*

1. Represented Values

a. Tested Combination

In the July 2017 ASHRAE TP RFI, DOE noted that Section 6.2.1 of the 2015 draft version of AHRI 1230 included the following specification for tested combinations for systems with capacities greater than or equal to 65,000 Btu/h: Testing with standard 4-way ceiling cassette indoor units with the smallest coil volume per nominal capacity for non-ducted indoor units, and testing with mid-static units for ducted indoor units. 82 FR 34427, 34447. DOE also stated that there is a range of ductless indoor unit styles, which may have a range of efficiency characteristics, and that ducted systems may serve a range of ESPs. 82 FR 34427, 34447–34448 (July 25, 2017). DOE requested comment and data on variation of system efficiency related to indoor unit styles (both for ducted and non-ducted indoor units). *Id.* at 82 FR 34448. DOE also requested data on the most prevalent style and static pressure classification (low-static, mid-static, or conventional-static) of ducted units. *Id.*

AHRI, Carrier, Lennox, Mitsubishi, and Goodman commented that the 4-way ceiling cassette and mid-static unit styles specified by the 2015 draft version of AHRI 1230 for the tested combination of non-ducted and ducted indoor units, respectively, are the most common. (AHRI, No. 11 at p. 36; Carrier, No. 6 at pp. 22; Lennox, No. 8 at p.10; Mitsubishi, No. 10 at p.3; Goodman, No. 14 at p.7) AHRI additionally stated that it had recently surveyed its members and confirmed that these types of indoor units are the most prevalent in the industry. (AHRI, No.11 at p 36)

Section 6.2 of AHRI 1230–2021 specifies tested combination requirements for VRF multi-split systems that generally align with the specifications from AHRI 1230–2015 draft, with a few amendments. First, AHRI 1230–2021 amends the instructions for determining which indoor units to use if the primary option is not offered by the manufacturer. Instead of relying on the ''highest sales volume'' designation for determining the alternate indoor units to compose the tested combination, Section 6.2.1.1 of AHRI 1230–2021 specifies the following hierarchy of non-ducted indoor units: Compact 4-way ceiling cassette, three-way cassette, two-way cassette, wall-mounted, one-way cassette, floor-mounted, and ceiling-suspended. Section 6.2.1.2 of AHRI 1230–2021 specifies that the tested combination must use indoor units (with the lowest normalized coil volume) only from the indoor unit model family with the highest static capabilities. Second, AHRI 1230–2021 adds tested combination instructions for the new SDHV indoor unit model family. Specifically, Section 6.2.1.3 of AHRI 1230–2021 specifies that small-duct high velocity (SDHV) [21] tested combinations must use indoor units

[21] Section 3.17.3 of AHRI 1230–2021 defines the SDHV indoor unit model family to include indoor units that produce at least 1.2 inches water column of ESP when operated at the full-load cooling airflow of at least 220 scfm per rated ton of nominal cooling capacity. These criteria align with DOE's definition for ''small-duct high velocity system'' included in appendices M and M1 to subpart B of part 430, for consumer central air conditioners. The definition in Section 3.17.3 of AHRI 1230–2021 further provides additional clarification that the SDHV indoor unit model family is a separate indoor unit model family type that is not one of the ducted indoor unit model families.

with the lowest normalized coil volume/motor efficiency.

Although the tested combination is relevant to determination of represented values, rather than the method of test, DOE has tentatively determined that the AHRI 1230–2021 provisions regarding tested combination are appropriate. Therefore, for ease of use, DOE is proposing to incorporate by reference Section 6.2.1 of AHRI 1230–2021 in appendix D1 to subpart F of part 431.

b. Represented Values for Indoor Unit Combinations

DOE includes requirements for determining represented values for all commercial HVAC equipment (including VRF multi-split systems) in § 429.43(a). Represented values for each VRF multi-split system basic model must be determined either through testing in conjunction with the applicable sampling provisions in § 429.43(a)(1), or through application of an AEDM in accordance with the provisions in § 429.43(a)(2). In addition, DOE's current test procedure incorporates by reference Section 5.2 of ANSI/AHRI 1230–2010, which includes requirements for determining represented values of VRF multi-split systems through testing. However, DOE does not currently specify in § 429.43(a) any provisions specific to VRF multi-split systems for determining represented values.

In considering possible options for determining represented values for VRF multi-split systems, DOE reviewed AHRI 1230–2021, which includes provisions for determining represented values of VRF multi-split systems through testing in Section 7. Section 7.2.5 specifies provisions pertaining to represented values of different combinations of indoor unit types. Specifically, for basic models that include only non-ducted or only ducted indoor unit combinations, Section 7.2.5.1 states that ratings are determined by testing at least two complete system samples of the same combination of indoor units. Section 7.2.5.2 states that for manufacturers who offer both non-ducted combinations and ducted combinations, ratings are determined by testing two or more combinations of indoor units with each outdoor unit, with one combination consisting of only non-ducted indoor units and the second combination consisting of only ducted indoor units. Additionally, Section 7.2.5.2.3 specifies that the rating given to any untested system with a mix of ducted and non-ducted units is to be set equal to the average of the ratings for the non-ducted and ducted tested combinations.

As discussed in section III.J.1.a of this NOPR, Section 6.2 of AHRI 1230–2021 includes provisions regarding tested combinations of three overall types: Non-ducted, ducted, and SDHV. However, Section 7.2.5 of AHRI 1230–2021 addresses only ducted and non-ducted combinations, and does not include provisions for determining represented values through testing of VRF multi-split systems with SDHV indoor units. While Section 7.2.2 of AHRI 1230–2021 states that mixed ratings must be determined by the straight average of two individual systems' rated values containing homogenous kinds of indoor units, including non-ducted, ducted, and SDHV, Section 7.2.5 addresses mixed ratings of only non-ducted and ducted tested combinations.

DOE proposes to adopt requirements at § 429.43(a)(3)(iv)(B) for determining represented values for VRF multi-split systems that are consistent with the requirements from Section 7.2.5 of AHRI 1230–2021, but with additional detail to address SDHV indoor units and with language more appropriate for DOE's certification regulations. If a basic model includes only non-ducted indoor units, only ducted indoor units, or only SDHV indoor units, DOE proposes that the manufacturer must determine the represented values for the basic model by testing a sample of non-ducted tested combinations, ducted tested combinations, or SDHV tested combinations, as applicable, according to the sampling plan in § 429.43(a)(1), or by application of an AEDM as specified in §§ 429.43(a)(2) and 429.70. If a basic model includes more than one type of indoor unit combination—ducted, non-ducted, and/or SDHV—DOE proposes that the manufacturer must determine separate represented values for each type of indoor unit combination. DOE further proposes to specify that the represented values must be determined either through application of an AEDM, following provisions from §§ 429.43(a)(2) and 429.70), or through testing a minimum of a single tested combination for each type of indoor unit combination included in that basic model.

Additionally, DOE proposes that a manufacturer may determine represented values for optional ''mixed'' representations of any two required representations (*i.e.,* ducted, non-ducted, and/or SDHV) for a basic model by calculating the mean of the two required representations. For example, if a basic model includes representations for ducted and non-ducted indoor unit combinations, an optional ''mixed ducted/non-ducted'' representation would be determined by averaging the ducted representation and the non-ducted representation.

These proposals would only be required when certifying to amended standards in terms of IEER. DOE has tentatively determined that the proposed provisions would not be unduly burdensome to manufacturers. DOE typically requires manufacturers to follow the sampling plan in § 429.43(a)(1) for all representations based on testing (*i.e.,* a minimum of two test samples per represented value), rather than distributing the sampling plan testing requirements across a basic model with multiple representations (*i.e.,* the proposed approach for requiring only a single tested system per representation). However, DOE has tentatively concluded that the test burden for VRF multi-split systems is significantly higher than that of other commercial AC equipment, which warrants the proposed reduced testing requirements for determining represented values. VRF multi-split systems are tested with up to twelve indoor units connected in a single refrigerant circuit, which requires additional set-up and commissioning time to install refrigerant piping and ensure proper charge compared to testing other kinds of commercial HVAC equipment. This often requires VRF multi-split systems to be tested using 2 indoor test chambers in order to accommodate all 12 indoor units, while other types of commercial HVAC equipment only ever require a single indoor test chamber.

Further, DOE understands that most manufacturers of VRF multi-split systems offer both ducted and non-ducted indoor units for most basic models; therefore, for most basic models with representations based on testing, manufacturers would still be testing at least two samples (*e.g.,* one with non-ducted indoor units and one with ducted indoor units). Consequently, DOE has tentatively concluded that the proposed reduced testing requirements will reduce test burden while being reasonably designed to produce test results which reflect energy efficiency of the VRF multi-split systems during a representative average use cycle. Of note, DOE's enforcement regulations in subpart C to part 429 apply to a basic model, not to a representation. Therefore, the entire basic model would be considered non-compliant if any of the representations for that basic model were found to be invalid.

*Issue 10:* DOE requests comment on its proposals for determining represented values for VRF multi-split system basic models with different

indoor unit combinations. In particular, DOE seeks feedback on its proposal to allow for optional mixed representations of any two required representations (*i.e.,* ducted, non-ducted, and/or SDHV) for a basic model by calculating the mean of the two required representations.

c. Multiple Refrigerants

DOE recognizes that some commercial package air conditioning and heating equipment may be sold with more than one refrigerant option (*e.g.,* R–410A or R–407C). Typically, manufacturers specify a single refrigerant in their literature for each unique model, but in its review, DOE has identified at least one commercial package air conditioning and heating equipment manufacturer that provides two refrigerant options under the same model number. The refrigerant chosen by the customer in the field installation may impact the energy efficiency of a unit. For this reason, DOE is proposing representation requirements applicable to models approved for use with multiple refrigerants. These proposals would only be required when certifying to amended standards in terms of IEER.

Use of a refrigerant that requires different hardware (such as R–407C as compared to R–410A) would represent a different basic model, and according to the current CFR, separate representations of energy efficiency are required for each basic model. In contrast, some refrigerants (such as R–422D, R–427A) would not require different hardware, and a manufacturer may consider them to be the same basic model, per DOE's current definition for ''basic model'' at § 431.92. In the latter case of multiple refrigerant options that do not require different hardware, DOE proposes at § 429.43(a)(3)(iv)(A) that a manufacturer must determine the represented values (*e.g.,* IEER, COP, and cooling capacity) for that basic model based on the refrigerant(s)—among all refrigerants listed on the unit's nameplate—that result in the lowest cooling efficiency. These represented values would apply to the basic model for all refrigerants specified by the manufacturer as appropriate for use, regardless of which refrigerant may actually be used in the field.

*Issue 11:* DOE requests comment on its proposal regarding representations for VRF multi-split system basic models approved for use with multiple refrigerants.

d. Confidence Limit

DOE's regulations for commercial HVAC (including VRF multi-split systems) at § 429.43(a)(1) include requirements for determining represented values based on a sample of tested units. Specifically, represented values for energy efficiency of a basic model of VRF must be less than or equal to the mean of the sample of tested units or the lower 95 percent confidence limit, whichever is lower.

In a comment submitted in response to the July 2017 ASHRAE TP RFI, Lennox recommended that DOE harmonize the certification criteria in 10 CFR 429.43 for ''commercial air conditioning products'' with that for central air conditioners, a consumer product, in 10 CFR 429.16 that uses only a 90 percent confidence interval. (Lennox, No. 8 at p. 6). In particular, Lennox stated that commercial equipment currently has a more stringent confidence limit of 95 percent and asserted that current testing technology does not support this level of precision. (*Id.*) Lennox's recommendation for a narrower confidence interval would decrease the level of certainty that a tested efficiency would be greater than the rated efficiency, assuming the same test sample size.

Other manufacturers did not raise concerns regarding the confidence limit required for sampling commercial package air conditioners and heat pumps (including VRF multi-split systems), and Lennox did not provide data regarding variability of units in production and testing to support a different confidence limit. Absent more specific information or data regarding the stringency of the confidence level, DOE is not proposing to adopt the suggested change.[22]

2. Certification Reporting Requirements

DOE specifies certification reporting requirements for VRF multi-split systems in 10 CFR 429.43(b). Certification reporting requirements for VRF multi-split systems include both public equipment-specific information and STI. In this NOPR, DOE is proposing changes to certification reporting requirements to enable testing to the updated industry test procedure AHRI 1230–2021 and to align with DOE's proposals regarding determination of represented values for VRF multi-split systems, discussed previously in section III.J.1. DOE is proposing to amend the certification reporting requirements for VRF multi-split systems to address the IEER metric but is not proposing amendments to the current standards (in terms of EER). Therefore, the certification reporting requirement proposals would only apply when certifying to a future IEER standard; existing certification reporting requirements used when certifying to the current EER standards would not change unless DOE conducts a subsequent rulemaking amending the standard to rely on the IEER metric.

a. Certification Requirements

In this NOPR, DOE proposes to amend the reporting requirements consistent with the proposed amendments to the test procedure and metric. When certifying a VRF multi-split system to standards in terms of IEER, manufacturers would be required to report the following public information in addition to the current certification requirements:

- IEER values (replacing the current certification requirement for EER values).
- The rated heating capacity, in Btu/h.
- The indoor unit combination used to determine the represented values for an individual combination (*i.e.,* a non-ducted, ducted, SDHV, or mixed indoor unit combination), and all outdoor and indoor unit model numbers used to compose the tested combination. This proposal corresponds to the proposal regarding represented values for indoor unit combinations discussed in section III.J.1.b of this NOPR.
- The refrigerant used to determine the represented values for a basic model, per the proposal discussed in section III.J.1.c of this NOPR that manufacturers must determine all represented values for a basic model (*e.g.,* EER, IEER, COP, and cooling capacity) based on the refrigerant listed on the unit's nameplate that results in the lowest cooling efficiency.

Regarding heating capacity, DOE is proposing to include rated heating capacity in Btu/h (as measured according to the proposed amended test procedure in Appendix D1) as a public reporting requirement for all VRF multi-split heat pump systems (and not for VRF multi-split air conditioners). DOE's current certification reporting requirements for VRF multi-split systems at 10 CFR 429.43(b)(2) specify that manufacturers must include the rated cooling capacity (in Btu/h) and the rated cooling efficiency (EER, in Btu/W*h) in their public certification reports. For VRF multi-split heat pumps, the public certification report must also include the rated heating

[22] DOE notes that it has previously requested data regarding the variability of units of small, large, and very large air-cooled commercial package air conditioning and heating equipment in production and testing to enable DOE to review and make any necessary adjustments to the specified confidence levels. *See* 80 FR 79655, 79659 (Dec. 23, 2015). However, DOE did not receive any relevant data in response to that request.

efficiency (COP, in W/W), but the rated heating capacity is required to be reported as part of the STI instead of in the public certification report. DOE is proposing to require rated heating capacity as part of the public certification report instead of the STI to align with the certification approach for cooling capacity. As discussed in section III.E.1, manufacturers already test and rate VRF multi-split systems in the AHRI *Directory of Certified Product Performance* for VRF multi-split systems.[23] AHRI requires that manufactures publicly provide the rated heating capacity of VRF multi-split systems at two separate outdoor temperature conditions, including at the 47 °F outdoor temperature condition used in the proposed DOE test procedure. Because all VRF multi-split system manufacturers are AHRI members, DOE tentatively concludes that a requirement to report the rated heating capacity would not increase the reporting burden.

*Issue 12:* DOE requests comment on its proposed certification reporting requirements for VRF multi-split systems.

Manufacturers, including importers, must use product-specific certification templates to certify compliance to DOE. For VRF multi-split systems, the certification template reflects the general certification requirements specified at 10 CFR 429.12 and the product-specific public certification reporting requirements specified at § 429.43(b)(2). DOE is proposing to amend the product-specific public certification requirements for VRF multi-split systems in this notice. To help interested parties better appreciate these proposed changes, a draft certification template is included in the docket, which can be viewed as described in the Docket section at the beginning of this document and will be accessible on the DOE website.

b. Supplemental Testing Instructions

The STI generally provides equipment-specific instruction to allow for third-party testing of equipment. DOE has tentatively determined that updates in the industry test procedure AHRI 1230–2021 require corresponding amendments to the STI certification requirements to test VRF multi-split systems. DOE proposes to add or amend the following items at § 429.43(b)(4) as part of the required STI when certifying a VRF multi-split system to amended standards in terms of IEER, as these items would be needed for IEER testing per the proposed test procedure at appendix D1:

- Identification of the indoor units to be thermally active for each IEER test point;
- The rated indoor airflow for the full-load cooling, full-load heating, and all part-load cooling tests (for each indoor unit), in standard cubic feet per minute (scfm);
- The indoor airflow-control setting to be used in the full-load cooling test and the indoor airflow control setting to be used in the full-load heating test (for each indoor unit);
- For water-cooled units, the rated water flow rate in gallons per minute (gpm);
- System start-up or initialization procedures, including conditions and durations;
- The duration of the compressor break-in period. (Existing requirements in § 431.96(c) require manufacturers to include this information in the test data underlying the certified ratings that must be maintained according to 10 CFR 429.71);
- Instructions for adjustment of critical parameters to meet capacity targets and/or SHR limits, including hierarchy for adjusting;
- The layout of the system set-up for testing (previously required upon request) including a piping diagram, setup instructions for indoor units and outdoor units, charging instructions, a control wiring diagram, and identification of the location of each critical parameter;
- Explicitly providing that the nominal cooling capacity and nominal heating capacity (if applicable) in British thermal units per hour (Btu/h) must be certified for each outdoor unit and indoor unit;
- Requiring testing instructions for conducting testing for all indoor unit combinations with distinct represented values within a basic model, as applicable. (This proposal corresponds to the proposal regarding represented values for indoor unit combinations discussed in section III.J.1.b of this NOPR);
- Removing the current requirement to report compressor frequency set points and instead require reporting operational settings for all critical parameters to be manually controlled for each of the four IEER cooling test conditions and for the COP heating test;
- Removing the reporting requirement regarding whether the model will operate at test conditions without manufacturer programming, because the proposed VRF enforcement provisions (discussed in section III.J of this NOPR) allow for a manufacturer representative to be on site for DOE testing;
- Removing the reporting requirement for rated static pressure, which is unnecessary because AHRI 1230–2021 includes ESP requirements for testing; and
- The frequency of oil-recovery cycles.

Regarding the nominal cooling and heating capacity, DOE is also proposing to clarify that manufacturers must certify the nominal cooling capacity and nominal heating capacity (as applicable) for each indoor unit and outdoor unit as a part of their supplemental testing instructions. The existing STI requirements for VRF multi-split systems require reporting of ''nominal cooling capacity'' and ''rated heating capacity'', but do not specify whether these values need to be reported for the entire VRF multi-split system or for each indoor and outdoor unit. As described in section III.J.2.a, DOE is proposing to require public reporting of rated heating capacity for VRF multi-split heat pumps as part of the certification report. In sum, these proposals would require that manufacturers publicly certify the rated cooling capacity and rated heating capacity (as applicable) for each basic model of VRF multi-split system, and then separately certify (in supplemental testing instructions) the nominal cooling capacity and nominal heating capacity (as applicable) for each indoor unit and outdoor unit.

Regarding the CVP, DOE also proposes to require reporting as part of the STI the following manufacturer-specified input conditions for conducting a CVP at each of the four IEER cooling test conditions: The required thermostat set points to ensure control for 80 °F dry-bulb temperature when accounting for set point bias, the starting indoor dry-bulb temperature, and the indoor dry-bulb temperature ramp rate. This proposal corresponds to the proposal to adopt the CVP (as specified in Appendix C of AHRI 1230–2021) in § 429.134(s), as discussed in section III.H of this NOPR.

Regarding specific components, as discussed in section III.G of this NOPR, DOE is proposing an STI reporting requirement, corresponding to the proposed representation requirements for specific components at 10 CFR 429.43(a)(4). Specifically DOE proposes that the manufacturer must certify for which, if any, specific components (as listed in 10 CFR 429.43(a)(4)(i)) the following provisions are applicable: (1) The indoor unit model(s) in a tested combination within a basic model

[23] The AHRI directory for VRF multi-split systems is available at: *www.ahridirectory.org/NewSearch?programId=72&searchTypeId=3.*

include both individual indoor unit models distributed in commerce with the specific component and individual indoor unit models distributed in commerce without the specific component; (2) at least one of the individual indoor unit models distributed in commerce without the specific component is otherwise identical to any given individual indoor unit model distributed in commerce with the specific component; and (3) represented values for the tested combination are based on performance of individual indoor unit models distributed in commerce without the specific component.

The proposed STI certification requirements provide information that is necessary for testing VRF multi-split systems consistent with the updated industry test procedure AHRI 1230–2021. Further, section D3 of informative appendix D of AHRI 1230–2021 includes a list of recommended items to be included in STI when testing to AHRI 1230–2021, and most of the STI certification requirements proposed in this NOPR are included in the section D3 list. Therefore, DOE has tentatively concluded that the proposed STI certification requirements are warranted for testing according to the latest industry test procedure for VRF-multi-split systems and would not impose significant burden to manufacturers.

*Issue 13:* DOE requests comment on its proposed STI reporting requirements for VRF multi-split systems.

3. Models Required for AEDM Validation

As discussed, manufacturers of VRF multi-split systems may determine represented values through testing according to the sampling plan in § 429.43(a)(1), or by application of an AEDM as specified in §§ 429.43(a)(2) and 429.70. DOE proposes to adopt the following AEDM validation requirements for VRF multi-split systems to be similar to the sampling plan requirements for tested units, discussed in section III.J.3 of this NOPR.

If a manufacturer makes representations for only a single type of indoor unit combination (*i.e.,* ducted, non-ducted, or SDHV indoor unit combinations) within or across all its basic models to which the AEDM applies, DOE proposes that the manufacturer must validate the AEDM by testing at least a single tested combination of that type of indoor unit combination for each of the two selected basic models.

If a manufacturer makes representations for two types of indoor unit combinations (*i.e.,* ducted, non-ducted, and/or SDHV indoor unit combinations) within or across all its basic models to which the AEDM applies, DOE proposes that the manufacturer must test at least: (1) A single tested combination of a selected basic model as the first of those two types of indoor unit combination, and (2) a single tested combination of a different selected basic model as the second of those two types of indoor unit combination. For example, if an AEDM is validated through testing of two basic models (Model A and Model B) and Model A and Model B both include ducted and non-ducted indoor unit combinations, validation testing would need to be conducted on Model A with a ducted tested combination and Model B with non-ducted tested combination, or vice versa.

If a manufacturer makes representations for all three types of indoor unit combinations (*i.e.,* ducted, non-ducted, and SDHV indoor unit combinations) within or across all its basic models to which the AEDM applies, DOE proposes that the manufacturer must test at least a single tested combination of a selected basic model as a non-ducted tested combination and a single tested combination of a different selected basic model as a ducted tested combination. These proposals retain DOE's existing requirements for VRF multi-split systems at § 429.70(c)(iv) to test two basic models in order to validate an AEDM.

DOE has tentatively concluded that the proposed AEDM validation requirements are consistent with AHRI 1230–2021, because they ensure that values developed with an AEDM conform to the results of AHRI 1230–2021. These proposals would only be required when certifying to amended standards in terms of IEER.

*Issue 14:* DOE requests comment on its proposal to amend its requirements for AEDM validation for VRF multi-split systems.

4. Manufacturer Involvement

DOE does not allow manufacturer involvement in assessment and enforcement testing of most regulated equipment to ensure objectivity and repeatability. However, in acknowledgement of the uniquely complicated nature of VRF multi-split systems, the current DOE test procedure includes allowances in § 431.96(f) for limited manufacturer involvement during assessment and enforcement testing. 77 FR 28927, 28946. Specifically, a manufacturer's representative is allowed to witness assessment and enforcement testing, inspect set-up, discuss set-up with a DOE representative, and adjust modulating components to achieve steady-state operation. § 431.96(f). In AHRI 1230–2021, allowable manufacturer involvement is prescribed in Sections 5.1.2 and 6.3.3.

Section 5.1.2 states that manufacturer authorized personnel may support commissioning of the VRF multi-split system being tested (*i.e.,* ensuring that the system is properly installed and functioning as expected). Section 5.1.2.1 states that operational settings for critical parameters may be manually adjusted and shall be as specified in the STI but does not specify which party is responsible for setting the critical parameters during testing. Section 5.1.2.2 states that all compressors shall initially operate at the setting(s) provided in the STI, which is redundant with Section 5.1.2.1. Section 5.1.2.3 states that all control settings must be set by a member of the laboratory and states that all control settings must remain unchanged for all load points once system setup has been completed.

Section 6.3.3 specifies allowable critical parameter adjustments for the purposes of meeting capacity targets and/or SHR limits during IEER cooling tests. However, Section 6.3.3 includes unclear and contradictory language regarding who performs critical parameter adjustments. Specifically, Section 6.3.3 describes critical parameter ''adjustments'' as being performed by laboratory personnel, but also specifies that when a steady-state test is conducted in a third-party laboratory, a manufacturer's representative may ''set'' critical parameter values under the supervision of the third-party laboratory (using the service tool to monitor critical parameters). Further, Section 6.3.3 uses several different terms when describing who takes certain actions as part of adjusting critical parameters, for which it is unclear if any difference in meaning is intended: ''the lab'', ''a member of the laboratory'', ''lab personnel'', and ''the third party laboratory''.

Given the importance of explicitly specifying the specific actions the manufacturer's representative can take as part of assessment and enforcement testing of VRF multi-split systems, DOE does not propose to adopt Sections 5.1.2 and 6.3.3 of AHRI 1230–2021, and instead proposes to specify in § 429.134(s)(2) provisions for allowable manufacturer involvement during DOE assessment and enforcement testing. These provisions are generally consistent with Sections 5.1.2 and 6.3.3 of AHRI 1230–2021, but assign more

precisely the actions that a manufacturer's representative may take.

Specifically, DOE is proposing to clarify that a manufacturer's representative is allowed to support commissioning of the VRF multi-split system and to witness DOE assessment or enforcement testing, which is consistent with the current Federal test procedure. For all cooling and heating tests, DOE proposes that all control settings other than critical parameters must be set by a member of the third-party laboratory; a manufacturer's representative may initially set all critical parameters to their certified values. For IEER cooling tests only, DOE proposes to specify that if additional adjustments to critical parameters are required for meeting capacity targets and/or SHR limits (see section III.I of this NOPR), a manufacturer's representative may make such adjustments in accordance with section 5.1 of appendix D1 using a proprietary control tool. DOE further proposes that initial setting and any additional critical parameter adjustments performed by a manufacturer's representative during IEER testing must be monitored by third-party laboratory personnel using a service tool. For the heating test, DOE proposes that the manufacturer's representative would not be permitted to make any critical parameter adjustments during testing and would only be allowed to initially set critical parameters to their certified values. These proposals are a departure from the current DOE test procedure (which allows manufacturer control of modulating components for the purposes of reaching steady-state operation) and instead align with the latest industry test procedure AHRI 1230–2021 (with minor clarifications in wording, as discussed).

In the case that a manufacturer is not present for assessment or enforcement testing, third-party laboratory personnel may need a manufacturer's control tool to set critical parameters to their initial settings or make additional adjustments required by the test procedure. Accordingly, DOE is proposing to amend its test notice requirements for VRF multi-split systems at § 429.110(b)(1)(iv) to require manufacturers to include a means of control to set and adjust critical parameters with all systems provided for enforcement testing. Correspondingly, DOE is proposing provisions for VRF multi-split systems at § 429.104(b) that would require manufacturers to provide a means of control for assessment testing, although manufacturers would not be required to provide the VRF multi-split system for assessment testing. This proposal would enable the laboratory staff to perform IEER and heating tests in the event that a manufacturer's representative is not available for assessment and/or enforcement testing. DOE also proposes that, if a manufacturer's representative is not present for testing, a member of the third-party laboratory shall set and adjust critical parameter values in accordance with section 5.1 of appendix D1 using the means of control provided by the manufacturer in response to the test notice.

*Issue 15:* DOE seeks comment on its proposal to require a means of control to be provided by the manufacturer for assessment and enforcement testing.

Furthermore, AHRI 1230–2021 only partially addresses allowable manufacturer involvement during the CVP. Specifically, section C3.1 provides instructions that control settings must be identical to those used during the steady-state IEER tests, except that control settings for critical parameters shall not be controlled during the CVP. However, Appendix C to AHRI 1230–2021 does not provide instruction for which parties may interact with the unit under test, and under what circumstances. Also, the wording ''identical to those used during the steady-state IEER tests'' could be interpreted to mean that steady-state IEER tests must be conducted prior to a CVP, which should not be necessary. To address these issues, DOE proposes to specify in its product-specific enforcement provisions at § 429.134(s)(2) that a manufacturer's representative is allowed to support commissioning of the VRF multi-split system and witness the CVP. DOE also proposes to specify that the control settings used during a CVP must be set by a member of the third-party laboratory and must be set per the provisions in section 5.1 of appendix D1 to subpart F of part 431 (except for critical parameters, which must operate automatically from the system controls and must not be controlled or adjusted at any point during the CVP).

DOE has tentatively concluded that these proposals would ensure the consistency and objectivity of the CVP. Furthermore, these proposals are consistent with AHRI 1230–2021, because they ensure the manufacturer's representative cannot set or adjust any parameters in the CVP that AHRI 1230–2021 specifies shall operate under commands from system controls during the CVP. Additionally, the proposed language to set control settings for the CVP (except critical parameters) in accordance with section 5.1 of appendix D1 to subpart F of part 431 ensures that the same control settings (except critical parameters) are used between the CVP and IEER cooling tests, without requiring IEER cooling tests to be conducted before a CVP.

*Issue 16:* DOE seeks comment on its proposal to establish in 10 CFR 429.134(s)(2) provisions regarding allowable manufacturer involvement during assessment and enforcement testing, which are consistent with AHRI 1230–2021. DOE also seeks comment on its proposal for allowable manufacturer involvement during the CVP.

5. Certified Critical Parameter Operational Settings

As described in section III.J.2.b of this NOPR, DOE is proposing to require that manufacturers certify in the STI the operational settings for all critical parameters to be manually controlled for each of the four IEER cooling test conditions and for the COP heating test. Because the control settings for critical parameters affect the operating state of the VRF multi-split system, the measured performance is likely to vary significantly based on the critical parameter settings selected. For example, in preliminary testing, DOE determined that a 10 percent change in compressor speed resulted in an average difference of approximately 5 EER points (in Btu/W*hr) at each IEER load point. (EERE–2018–BT–STD–0003–0063 at p. 15). Due to the relationship of critical parameter operational settings to the measured performance of VRF multi-split systems, DOE is making several proposals related to the certified critical parameters.

As discussed in section III.H.5, DOE is proposing to use the CVP during assessment and enforcement testing to verify that the certified critical parameter values for IEER cooling tests are valid. The certified critical parameter values used for the heating test are not subject to validation from a CVP, as the CVP is applicable only for cooling operation. In addition to its proposals governing the use of the CVP, DOE is proposing to add a certification reporting provision specific to VRF multi-split systems in § 429.43(b)(5). This proposal specifies that if a manufacturer becomes aware that any of the certified operational settings for the critical parameters are determined to be invalid according to the results of a CVP, whether that CVP be performed by the manufacturer or another party, the manufacturer would be required to re-certify the operational settings of those critical parameters for all affected basic models, as well as re-rate and re-certify the affected basic models. Notably, DOE is not proposing a requirement that

manufacturers conduct the CVP as part of certification to DOE.

In addition to its proposal to require re-certification and re-rating of VRF multi-split systems in the event a manufacturer becomes aware that any of its certified operational settings for critical parameters are invalid according to a CVP, DOE also proposes to amend the enforcement testing requirements at § 429.110(a) to state that DOE may initiate enforcement testing for VRF multi-split systems if DOE has reason to believe that the model is not in compliance, has invalid certified operational settings for critical parameter values, or has an otherwise invalid certified rating. Under this proposal DOE may initiate enforcement testing to investigate the certified critical parameter values and the associated IEER rating for VRF multi-split systems based on any of the following events:

1. DOE conducts CVP during assessment testing that results in invalidated operational settings for critical parameters for a basic model;

2. DOE conducts assessment testing for IEER and COP that creates reason to believe the basic model would be non-compliant with energy conservation standards or have an otherwise invalid rating;

3. Another party conducts a CVP that results in invalidated operational settings for critical parameters for a basic model and the manufacturer fails to recertify that basic model;

4. A CVP is conducted (by DOE or another party) that results in invalidated operational settings for critical parameters for a basic model, and DOE finds that a similar basic model from the same manufacturer relies on similar certified operational settings for critical parameters.

DOE may examine multiple sources including, but not limited to, publicly available information and the STI when determining whether there is reason to proceed to enforcement testing. DOE notes that upon initiation of enforcement testing, DOE will issue a test notice to the manufacturer to acquire the selected models and means of control, and will conduct a CVP on the certified operational settings of critical parameters before proceeding to IEER testing.

*Issue 17:* DOE requests comment on its proposed approaches for certification and for enforcement testing in the event that a VRF multi-split system has invalid certified operational settings for critical parameter values.

6. Enforcement Sampling Plan

DOE's regulations at § 429.110(e) include provisions for selection of units for enforcement testing. Specifically, § 429.110(e)(2) states that for commercial air conditioners and heat pumps (which includes VRF multi-split systems), DOE will use an initial sample size of not more than four (4) units when determining a basic model's compliance with applicable energy conservation standards. As described in section III.J.1.b of this NOPR, DOE has tentatively determined that the testing of VRF multi-split systems is significantly more involved than the testing of other commercial HVAC equipment. The proposed test procedure would incorporate instructions for setting the positions of multiple critical parameters during testing, which requires additional setup as compared to other kinds of commercial HVAC equipment. DOE estimates the cost to test VRF multi-split systems to be between $7,500 and $27,000, depending on size and configuration of the system (not including costs of copper piping or refrigerant). Additionally, DOE is proposing in this NOPR to incorporate the CVP into its enforcement regulations for VRF multi-split systems at § 429.134(s), which would add approximately eight hours of test time at each of the four IEER load conditions during enforcement testing.

Because of the involved nature of testing VRF multi-split systems, it would be unlikely that DOE would conduct assessment testing or enforcement testing on the maximum number of units currently specified (*i.e.,* four). In order to reflect what would be the expected practice, DOE proposes to amend its enforcement sampling plan requirements specific to VRF multi-split systems to require a sample size of two VRF multi-split systems. The process for determining compliance with energy conservation standards would be unchanged in this proposal, *i.e.,* a compliance determination would be made for VRF multi-split systems using the sampling plan found in appendix B to subpart C of part 429 with a first sample size of $n_1 = 2$ VRF multi-split systems.

*Issue 18:* DOE requests comment on its proposed enforcement sampling plan for VRF multi-split systems.

*K. Test Procedure Costs*

EPCA requires that the test procedures for commercial package air conditioning and heating equipment, which includes VRF multi-split systems, be those generally accepted industry testing procedures or rating procedures developed or recognized by AHRI or by ASHRAE, as referenced in ASHRAE Standard 90.1. (42 U.S.C. 6314(a)(4)(A)) Further, if such an industry test procedure is amended, DOE must amend its test procedure to be consistent with the amended industry test procedure, unless DOE determines, by rule published in the **Federal Register** and supported by clear and convincing evidence, that such amended test procedure would not meet the requirements in 42 U.S.C. 6314(a)(2) and (3) related to representative use and test burden. (42 U.S.C. 6314(a)(4)(B)) In this NOPR, DOE proposes to amend the current test procedure for VRF multi-split systems at § 431.96 by (1) incorporating by reference AHRI 1230–2021 and ANSI/ASHRAE 37–2009; and (2) establishing provisions for determining IEER for VRF multi-split systems. DOE also proposes to amend its certification, compliance, and enforcement (''CCE'') provisions for VRF multi-split systems to provide information that is necessary for testing VRF multi-split systems consistent with the updated industry test procedure AHRI 1230–2021. Most significantly, these proposed changes include the incorporation of the CVP from AHRI 1230–2021 into DOE's product-specific enforcement provisions at § 429.134, as well as accompanying certification requirements at § 429.43.

DOE has tentatively determined that these proposed amended test procedures would be representative of an average use cycle and would not be unduly burdensome for manufacturers to conduct. The proposed appendix D, measuring EER and COP per ANSI/AHRI 1230–2010, does not contain any changes from the current Federal test procedure, and, therefore, would not require retesting solely as a result of DOE's adoption of this proposed amendment to the test procedure, if made final. The proposed test procedure in appendix D1, measuring IEER and COP per AHRI 1230–2021, would lead to an increase in cost from appendix D testing. DOE estimates that the cost for third-party lab testing according to the proposed appendix D1 for measuring IEER and COP to be $7,500—$27,000 per VRF multi-split heat pump system, depending on size and configuration.

As discussed in section II, the proposed test procedure provisions regarding IEER would not be mandatory unless DOE amends the energy conservation standards for VRF multi-split systems based on IEER. But, DOE has tentatively determined that the proposed test procedure amendments would not be expected to increase the testing burden on VRF multi-split

system manufacturers. All VRF multi-split system manufacturers are AHRI members; DOE is referencing the prevailing industry test procedure that was established for use in AHRI's certification program (which DOE presumes will be updated to include IEER in terms of the latest industry test procedure AHRI 1230–2021). Therefore, DOE expects that manufacturers will begin testing using the test methods in AHRI 1230–2021, and the testing burden will already be incurred from AHRI members participating in AHRI's certification program. Additionally, DOE has tentatively determined that the test procedure amendments, if finalized, would not require manufacturers to redesign any of the covered equipment, would not require changes to how the equipment is manufactured, and would not impact the utility of the equipment.

*Issue 19:* DOE requests comment on its understanding of the impact of the test procedure proposals in this NOPR, specifically DOE's initial conclusion that the proposed DOE test procedure amendments, if finalized, would not increase testing burden on VRF multi-split system manufacturers, compared to current industry practice as indicated by AHRI 1230–2021.

### *L. Reserved Appendices for Test Procedures for Commercial Air Conditioning and Heating Equipment*

DOE is proposing to relocate and centralize the current test procedures for VRF multi-split systems to a new appendix D to subpart F of part 431. As proposed, appendix D would not amend the current test procedures. Appendix D would continue to reference ANSI/AHRI 1230–2010 and provide instructions for determining EER and COP. Correspondingly, DOE is proposing to update the existing incorporation by reference of ANSI/AHRI 1230–2010 at § 431.95 so that the incorporation by reference applies to appendix D. Appendix D would also centralize the additional test provisions currently applicable under § 431.96—§ 431.96(c) through (f). VRF multi-split systems would be required to be tested according to appendix D, absent amendments to the applicable energy conservation standards to rely on the IEER metric.

DOE also proposes to adopt the updated version of AHRI 1230, AHRI 1230–2021, including the IEER metric in a new appendix D1 to subpart F of part 431. VRF multi-split systems would not be required to test according to appendix D1 until compliance is required with amended energy conservation standards that rely on the IEER metric, should DOE adopt such standards.

### *M. Compliance Date*

EPCA prescribes that, if DOE amends a test procedure, all representations of energy efficiency and energy use, including those made in the context of certification and on marketing materials and product labels, must be made in accordance with that amended test procedure, beginning 360 days after publication of such a test procedure final rule in the **Federal Register**. (42 U.S.C. 6314(d)(1))

EPCA also provides an allowance for individual manufacturers to petition DOE for an extension if the manufacturer may experience undue hardship in meeting the deadline. (42 U.S.C. 6314(d)(2)) To receive such an extension should DOE finalize an amended test procedure, petitions must be filed with DOE no later than 60 days before the end of the 360-day period and must detail how the manufacturer will experience undue hardship. (*Id.*)

## IV. Procedural Issues and Regulatory Review

### *A. Review Under Executive Order 12866*

The Office of Management and Budget (''OMB'') has determined that this test procedure rulemaking does not constitute a ''significant regulatory action'' under section 3(f) of Executive Order (''E.O.'') 12866, Regulatory Planning and Review, 58 FR 51735 (Oct. 4, 1993). Accordingly, this action was not subject to review under the Executive order by the Office of Information and Regulatory Affairs (''OIRA'') in OMB.

### *B. Review Under the Regulatory Flexibility Act*

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of an initial regulatory flexibility analysis (''IRFA'') for any rule that by law must be proposed for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by Executive Order 13272, ''Proper Consideration of Small Entities in Agency Rulemaking,'' 67 FR 53461 (August 16, 2002), DOE published procedures and policies on February 19, 2003, to ensure that the potential impacts of its rules on small entities are properly considered during the DOE rulemaking process. 68 FR 7990. DOE has made its procedures and policies available on the Office of the General Counsel's website: *www.energy.gov/gc/office-general-counsel.*

DOE reviewed this proposed rule under the provisions of the Regulatory Flexibility Act and the procedures and policies published on February 19, 2003. DOE certifies that the proposed rule, if adopted, would not have significant economic impact on a substantial number of small entities. The factual basis of this certification is set forth in the following paragraphs.

DOE is proposing amendments to the test procedures for VRF multi-split systems to satisfy its statutory requirements under EPCA to remain consistent with updates to the applicable industry test procedure and to re-evaluate its test procedures at least once every 7 years. (42 U.S.C. 6314(a)(4)(A) and (B); 42 U.S.C. 6314(1)(A))

DOE proposes to update § 431.96 ''Uniform test method for the measurement of energy efficiency of commercial air conditioners and heat pumps,'' as follows: (1) Incorporate by reference AHRI 1230–2021 and ANSI/ASHRAE 37–2009 (including Errata Sheet issued October 3, 2016); and (2) establish provisions for determining IEER for VRF multi-split systems. DOE proposes to add new appendices D and D1 to subpart F of part 431, both entitled ''Uniform test method for measuring the energy consumption of variable refrigerant flow multi-split air conditioners and heat pumps (other than air-cooled with rated cooling capacity less than 65,000 Btu/h),'' (''appendix D'' and ''appendix D1'', respectively). The current DOE test procedure for VRF multi-split systems would be relocated to appendix D without change, and the new test procedure adopting AHRI 1230–2021 would be established in appendix D1 for determining IEER. Compliance with appendix D1 would not be required until compliance is required with amended energy conservation standards for VRF multi-split systems that rely on IEER, should DOE adopt such standards.

DOE also proposes to update its certification, compliance, and enforcement (''CCE'') provisions for VRF multi-split systems to provide information that is necessary for testing VRF multi-split systems consistent with the updated industry test procedure AHRI 1230–2021. Most significantly, these proposed changes include the incorporation of the controls verification procedure (''CVP'') from AHRI 1230–2021 into DOE's product-specific enforcement provisions at § 429.134, as well as accompanying certification requirements at § 429.43. DOE is also proposing to amend the sampling size requirements for enforcement from ''a maximum of not

more than four units'' to specifying testing of two units.

The proposed rule, if adopted, would not have significant economic impact on a substantial number of small entities. For manufacturers of VRF multi-split systems, the Small Business Administration (''SBA'') has set a size threshold, which defines those entities classified as ''small businesses'' for the purposes of the statute. In 13 CFR 121.201, the SBA sets a threshold of 1,250 employees or fewer for an entity to be considered as a small business for this category. The equipment covered by this rule is classified under North American Industry Classification System (''NAICS'') code 333415,[24] ''Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.'' DOE used the SBA's small business size standards to determine whether any small entities would be subject to the requirements of the rule. DOE identified manufacturers using DOE's Compliance Certification Database[25] and the AHRI database.[26] DOE identified ten original equipment manufacturers (''OEMs'') of the covered equipment.

In reviewing the ten OEMs, DOE did not identify any companies that met the SBA criteria for a small entity because they surpassed the SBA's employee threshold. Therefore, DOE tentatively concludes that the proposed rule would not have a significant economic impact on a substantial number of small entities. DOE welcomes public comment on this certification conclusion.

*Issue 20:* DOE requests comment on its assessment that there are no small businesses that are OEMs of VRF multi-split systems.

*Issue 21:* DOE requests comment on its conclusion that the proposed rule would not have significant impacts on a substantial number of small manufacturers.

DOE has submitted a certification and supporting statement of factual basis to the Chief Counsel for Advocacy of the Small Business Administration for review under 5 U.S.C. 605(b).

### *C. Review Under the Paperwork Reduction Act of 1995*

Manufacturers of VRF multi-split systems must certify to DOE that their products comply with any applicable energy conservation standards. To certify compliance, manufacturers must first obtain test data for their products according to the DOE test procedure, including any amendments adopted for that test procedure. DOE has established regulations for the certification and recordkeeping requirements for all covered consumer products and commercial equipment, including VRF multi-split systems. (*See generally* 10 CFR part 429.) The collection-of-information requirement for the certification and recordkeeping is subject to review and approval by OMB under the Paperwork Reduction Act (''PRA''), and has been approved by OMB under OMB control number 1910–1400. Public reporting burden for the certification is estimated to average 35 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

Under EPCA, DOE's energy conservation program consists essentially of four parts: (1) Testing, (2) labeling, (3) Federal energy conservation standards, and (4) certification and enforcement procedures. For covered equipment, relevant provisions of the Act include definitions (42 U.S.C. 6311), energy conservation standards (42 U.S.C. 6313), test procedures (42 U.S.C. 6314), labeling provisions (42 U.S.C. 6315), and the authority to require information and reports from manufacturers (42 U.S.C. 6316).

DOE's certification and compliance activities ensure accurate and comprehensive information about the energy and water use characteristics of covered products and covered equipment sold in the United States. Manufacturers of all covered products and covered equipment must submit a certification report before a basic model is distributed in commerce, annually thereafter, and if the basic model is redesigned in such a manner to increase the consumption or decrease the efficiency of the basic model such that the certified rating is no longer supported by the test data. Additionally, manufacturers must report when production of a basic model has ceased and is no longer offered for sale as part of the next annual certification report following such cessation. DOE requires the manufacturer of any covered product or covered equipment to establish, maintain, and retain the records of certification reports, of the underlying test data for all certification testing, and of any other testing conducted to satisfy the requirements of 10 CFR part 429, and 10 CFR part 431. Certification reports provide DOE and consumers with comprehensive, up-to date efficiency information and support effective enforcement.

DOE requires manufacturers or their party representatives to prepare and submit certification reports and compliance statements using DOE's electronic Web-based tool, the CCMS, which is the primary mechanism for submitting certification reports to DOE. CCMS currently has product and equipment specific templates which manufacturers are required to use when submitting certification data to DOE. DOE believes the availability of electronic filing through the CCMS system reduces reporting burdens, streamlines the process, and provides DOE with needed information in a standardized, more accessible form. This electronic filing system also ensures that records are recorded in a permanent, systematic way.

DOE is proposing to amend the reporting requirements for VRF multi-split systems as discussed in section III.J.2. DOE sent a revised information collection approval to OMB under the existing Control Number 1910–1400. The revision only reflects the changes proposed in this rulemaking as an amendment to the existing information collection.

DOE is proposing that respondents must submit electronic forms using DOE's online CCMS. DOE's CCMS is publicly accessible at *www.regulations.doe.gov/ccms,* and includes instructions for users, registration forms, and the product-specific reporting templates required for use when submitting information to CCMS.

DOE has tentatively determined that the proposed amendments would not impose additional costs for manufacturers of VRF multi-split systems because manufacturers of this equipment are already submitting certification reports to DOE and as part of testing to the proposed amended test procedure (which references the updated industry test procedure AHRI 1230–2021) should have readily available the information that DOE is proposing to collect as part of this rulemaking. DOE also tentatively determines that manufacturers would rely on existing record keeping systems to maintain the additional information reported.

*Issue 22:* DOE invites public comment on: (1) Whether the proposed information collection requirements are necessary for the performance of DOE's functions, including whether the information will have practical utility;

[24] The size standards are listed by NAICS code and industry description and are available at: *www.sba.gov/document/support--table-size-standards* (Last accessed on July 16, 2021).

[25] DOE's Compliance Certification Database is available at: *www.regulations.doe.gov/ccms* (last accessed May 10, 2021).

[26] The AHRI Database is available at: *https://www.ahridirectory.org/* (last accessed May 10, 2021).

(2) the accuracy of DOE's estimates of the burden of the proposed information collection requirements; (3) ways to enhance the quality, utility, and clarity of the information to be collected; and (4) ways to minimize the burden of the information collection requirements on respondents.

Comments should be addressed to the Department of Energy Desk Officer, Office of Information and Regulatory Affairs, OMB, 725 17th Street NW, Washington, DC 20503. Persons submitting comments to OMB also are requested to send a copy to the contact person at the address given in the **FOR FURTHER INFORMATION CONTACT** section of this notice of proposed rulemaking. Interested persons may obtain a copy of the DOE's Paperwork Reduction Act Submission to OMB from the contact person named in this notice of proposed rulemaking. Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the PRA, unless that collection of information displays a currently valid OMB Control Number.

*D. Review Under the National Environmental Policy Act of 1969*

In this NOPR, DOE proposes test procedure amendments that it expects will be used to develop and implement future energy conservation standards for VRF multi-split systems. DOE has determined that this rule falls into a class of actions that are categorically excluded from review under the National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq.*) and DOE's implementing regulations at 10 CFR part 1021. Specifically, DOE has determined that adopting test procedures for measuring energy efficiency of consumer products and industrial equipment is consistent with activities identified in 10 CFR part 1021, appendix A to subpart D, A5 and A6. Accordingly, neither an environmental assessment nor an environmental impact statement is required.

*E. Review Under Executive Order 13132*

Executive order 13132, ''Federalism,'' 64 FR 43255 (Aug. 4, 1999) imposes certain requirements on agencies formulating and implementing policies or regulations that preempt State law or that have federalism implications. The Executive order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. DOE has examined this proposed rule and has determined that it would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the products that are the subject of this proposed rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297(d)) No further action is required by Executive order 13132.

*F. Review Under Executive Order 12988*

Regarding the review of existing regulations and the promulgation of new regulations, section 3(a) of Executive Order 12988, ''Civil Justice Reform,'' 61 FR 4729 (Feb. 7, 1996), imposes on Federal agencies the general duty to adhere to the following requirements: (1) Eliminate drafting errors and ambiguity, (2) write regulations to minimize litigation, (3) provide a clear legal standard for affected conduct rather than a general standard, and (4) promote simplification and burden reduction. Section 3(b) of Executive Order 12988 specifically requires that executive agencies make every reasonable effort to ensure that the regulation (1) clearly specifies the preemptive effect, if any, (2) clearly specifies any effect on existing Federal law or regulation, (3) provides a clear legal standard for affected conduct while promoting simplification and burden reduction, (4) specifies the retroactive effect, if any, (5) adequately defines key terms, and (6) addresses other important issues affecting clarity and general draftsmanship under any guidelines issued by the Attorney General. Section 3(c) of Executive Order 12988 requires executive agencies to review regulations in light of applicable standards in sections 3(a) and 3(b) to determine whether they are met or it is unreasonable to meet one or more of them. DOE has completed the required review and determined that, to the extent permitted by law, the proposed rule meets the relevant standards of Executive Order 12988.

*G. Review Under the Unfunded Mandates Reform Act of 1995*

Title II of the Unfunded Mandates Reform Act of 1995 (''UMRA'') requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Public Law 104–4, sec. 201 (codified at 2 U.S.C. 1531). For a proposed regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed ''significant intergovernmental mandate,'' and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect small governments. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820; also available at *www.energy.gov/gc/office-general-counsel.* DOE examined this proposed rule according to UMRA and its statement of policy and determined that the rule contains neither an intergovernmental mandate, nor a mandate that may result in the expenditure of $100 million or more in any year, so these requirements do not apply.

*H. Review Under the Treasury and General Government Appropriations Act, 1999*

Section 654 of the Treasury and General Government Appropriations Act, 1999 (Pub. L. 105–277) requires Federal agencies to issue a Family Policymaking Assessment for any rule that may affect family well-being. This proposed rule would not have any impact on the autonomy or integrity of the family as an institution. Accordingly, DOE has concluded that it is not necessary to prepare a Family Policymaking Assessment.

*I. Review Under Executive Order 12630*

DOE has determined, under Executive Order 12630, ''Governmental Actions and Interference with Constitutionally Protected Property Rights'' 53 FR 8859

(March 18, 1988), that this proposed regulation would not result in any takings that might require compensation under the Fifth Amendment to the U.S. Constitution.

*J. Review Under Treasury and General Government Appropriations Act, 2001*

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516 note) provides for agencies to review most disseminations of information to the public under guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). Pursuant to OMB Memorandum M–19–15, Improving Implementation of the Information Quality Act (April 24, 2019), DOE published updated guidelines which are available at *www.energy.gov/sites/prod/files/2019/12/f70/DOE%20Final%20Updated%20IQA%20Guidelines%20Dec%202019.pdf.* DOE has reviewed this proposed rule under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

*K. Review Under Executive Order 13211*

Executive Order 13211, ''Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use,'' 66 FR 28355 (May 22, 2001), requires Federal agencies to prepare and submit to OMB, a Statement of Energy Effects for any proposed significant energy action. A ''significant energy action'' is defined as any action by an agency that promulgated or is expected to lead to promulgation of a final rule, and that (1) is a significant regulatory action under Executive Order 12866, or any successor order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (3) is designated by the Administrator of OIRA as a significant energy action. For any proposed significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use should the proposal be implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

The proposed regulatory action to amend the test procedure for measuring the energy efficiency of VRF multi-split systems is not a significant regulatory action under Executive Order 12866. Moreover, it would not have a significant adverse effect on the supply, distribution, or use of energy, nor has it been designated as a significant energy action by the Administrator of OIRA. Therefore, it is not a significant energy action, and, accordingly, DOE has not prepared a Statement of Energy Effects.

*L. Review Under Section 32 of the Federal Energy Administration Act of 1974*

Under section 301 of the Department of Energy Organization Act (Pub. L. 95–91; 42 U.S.C. 7101), DOE must comply with section 32 of the Federal Energy Administration Act of 1974, as amended by the Federal Energy Administration Authorization Act of 1977. (15 U.S.C. 788; ''FEAA'') Section 32 essentially provides in relevant part that, where a proposed rule authorizes or requires use of commercial standards, the notice of proposed rulemaking must inform the public of the use and background of such standards. In addition, section 32(c) requires DOE to consult with the Attorney General and the Chairman of the Federal Trade Commission (''FTC'') concerning the impact of the commercial or industry standards on competition.

The proposed modifications to the test procedure for VRF multi-split systems would incorporate testing methods contained in certain sections of the following commercial standards: AHRI 1230–2021, ASHRAE 37–2009. DOE has evaluated these standards and is unable to conclude whether they fully comply with the requirements of section 32(b) of the FEAA (*i.e.,* whether they were developed in a manner that fully provides for public participation, comment, and review). DOE will consult with both the Attorney General and the Chairman of the FTC concerning the impact of this test procedure on competition, prior to prescribing a final rule.

*M. Description of Materials Incorporated by Reference*

In this NOPR, DOE proposes to incorporate by reference the following test standards:

(1) The test standard published by AHRI titled ''2021 Standard for Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment,'' AHRI Standard 1230–2021. AHRI Standard 1230–2021 is an industry-accepted test procedure for measuring the performance of VRF multi-split systems. AHRI Standard 1230–2021 is available on AHRI's website *www.ahrinet.org/search-standards.aspx.*

(2) The test standard published by ASHRAE, titled ''Methods of Testing for Rating Electrically Driven Unitary Air-Conditioning and Heat Pump Equipment,'' ANSI/ASHRAE Standard 37–2009 (including Errata Sheet issued October 3, 2016). ANSI/ASHRAE Standard 37–2009 is an industry-accepted test procedure that provides a method of test for many categories of air conditioning and heating equipment. ANSI/ASHRAE Standard 37–2009 is available on ANSI's website at *webstore.ansi.org/RecordDetail.aspx?sku=ANSI%2FASHRAE+Standard+37–2009.*

(3) The test standard published by AHRI titled, ANSI/AHRI Standard 1230–2010, ''2010 Standard for Performance Rating of Variable Refrigerant Flow (VRF) Multi-split Air-Conditioning and Heat Pump Equipment,'' approved August 2, 2010 and updated by addendum 1 in March 2011. ANSI/AHRI Standard 1230–2010 is an industry-accepted test procedure for measuring the performance of VRF multi-split systems. ANSI/AHRI Standard 1230–2010 is available on AHRI's website *www.ahrinet.org/search-standards.aspx.*

## V. Public Participation

*A. Participation in the Webinar*

The time and date of the webinar are listed in the **DATES** section at the beginning of this document. If no participants register for the webinar, it will be cancelled.

Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's website: *https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=71&action=viewlive.* Participants are responsible for ensuring their systems are compatible with the webinar software.

Procedure for Submitting Prepared General Statements for Distribution

Any person who has an interest in the topics addressed in this notice, or who is representative of a group or class of persons that has an interest in these issues, may request an opportunity to make an oral presentation at the webinar. Such persons may submit to *ApplianceStandardsQuestions@ee.doe.gov.* Persons who wish to speak should include with their request a computer file in WordPerfect, Microsoft Word, PDF, or text (ASCII) file format that briefly describes the nature of their interest in this rulemaking and the topics they wish to discuss. Such persons should also provide a daytime telephone number where they can be reached.

Persons requesting to speak should briefly describe the nature of their interest in this rulemaking and provide a telephone number for contact. DOE requests persons selected to make an oral presentation to submit an advance copy of their statements at least two weeks before the webinar. At its discretion, DOE may permit persons who cannot supply an advance copy of their statement to participate, if those persons have made advance alternative arrangements with the Building Technologies Office. As necessary, requests to give an oral presentation should ask for such alternative arrangements.

*B. Conduct of the Webinar*

DOE will designate a DOE official to preside at the webinar/public meeting and may also use a professional facilitator to aid discussion. The meeting will not be a judicial or evidentiary-type public hearing, but DOE will conduct it in accordance with section 336 of EPCA (42 U.S.C. 6306). A court reporter will be present to record the proceedings and prepare a transcript. DOE reserves the right to schedule the order of presentations and to establish the procedures governing the conduct of the webinar/public meeting. There shall not be discussion of proprietary information, costs or prices, market share, or other commercial matters regulated by U.S. anti-trust laws. After the webinar/public meeting and until the end of the comment period, interested parties may submit further comments on the proceedings and any aspect of the rulemaking.

The webinar/public meeting will be conducted in an informal, conference style. DOE will present a summary of the proposals, allow time for prepared general statements by participants, and encourage all interested parties to share their views on issues affecting this rulemaking. Each participant will be allowed to make a general statement (within time limits determined by DOE), before the discussion of specific topics. DOE will permit, as time permits, other participants to comment briefly on any general statements.

At the end of all prepared statements on a topic, DOE will permit participants to clarify their statements briefly. Participants should be prepared to answer questions by DOE and by other participants concerning these issues. DOE representatives may also ask questions of participants concerning other matters relevant to this rulemaking. The official conducting the webinar/public meeting will accept additional comments or questions from those attending, as time permits. The presiding official will announce any further procedural rules or modification of the above procedures that may be needed for the proper conduct of the webinar/public meeting.

A transcript of the webinar/public meeting will be included in the docket, which can be viewed as described in the Docket section at the beginning of this notice. In addition, any person may buy a copy of the transcript from the transcribing reporter.

*C. Submission of Comments*

DOE will accept comments, data, and information regarding this proposed rule no later than the date provided in the **DATES** section at the beginning of this proposed rule. Interested parties may submit comments using any of the methods described in the **ADDRESSES** section at the beginning of this document.

*Submitting comments via www.regulations.gov.* The *www.regulations.gov* web page will require you to provide your name and contact information. Your contact information will be viewable to DOE Building Technologies staff only. Your contact information will not be publicly viewable except for your first and last names, organization name (if any), and submitter representative name (if any). If your comment is not processed properly because of technical difficulties, DOE will use this information to contact you. If DOE cannot read your comment due to technical difficulties and cannot contact you for clarification, DOE may not be able to consider your comment.

However, your contact information will be publicly viewable if you include it in the comment or in any documents attached to your comment. Any information that you do not want to be publicly viewable should not be included in your comment, nor in any document attached to your comment. Persons viewing comments will see only first and last names, organization names, correspondence containing comments, and any documents submitted with the comments.

Do not submit to *www.regulations.gov* information for which disclosure is restricted by statute, such as trade secrets and commercial or financial information (hereinafter referred to as Confidential Business Information (''CBI''). Comments submitted through *www.regulations.gov* cannot be claimed as CBI. Comments received through the website will waive any CBI claims for the information submitted. For information on submitting CBI, see the Confidential Business Information section.

DOE processes submissions made through *www.regulations.gov* before posting. Normally, comments will be posted within a few days of being submitted. However, if large volumes of comments are being processed simultaneously, your comment may not be viewable for up to several weeks. Please keep the comment tracking number that *www.regulations.gov* provides after you have successfully uploaded your comment.

*Submitting comments via email.* Comments and documents submitted via email also will be posted to *www.regulations.gov.* If you do not want your personal contact information to be publicly viewable, do not include it in your comment or any accompanying documents. Instead, provide your contact information on a cover letter. Include your first and last names, email address, telephone number, and optional mailing address. The cover letter will not be publicly viewable as long as it does not include any comments.

Include contact information each time you submit comments, data, documents, and other information to DOE. No faxes will be accepted.

Comments, data, and other information submitted to DOE electronically should be provided in PDF (preferred), Microsoft Word or Excel, WordPerfect, or text (ASCII) file format. Provide documents that are not secured, written in English and free of any defects or viruses. Documents should not contain special characters or any form of encryption and, if possible, they should carry the electronic signature of the author.

*Campaign form letters.* Please submit campaign form letters by the originating organization in batches of between 50 to 500 form letters per PDF or as one form letter with a list of supporters' names compiled into one or more PDFs. This reduces comment processing and posting time.

*Confidential Business Information.* Pursuant to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email two well-marked copies: One copy of the document marked confidential including all the information believed to be confidential, and one copy of the document marked non-confidential with the information believed to be confidential deleted. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

It is DOE's policy that all comments may be included in the public docket, without change and as received, including any personal information provided in the comments (except information deemed to be exempt from public disclosure).

*D. Issues on Which DOE Seeks Comment*

Although DOE welcomes comments on any aspect of this proposal, DOE is particularly interested in receiving comments and views of interested parties concerning the following issues:

*Issue 1:* DOE requests feedback on its proposal to adopt IEER as determined under AHRI 1230–2021 in the Federal test procedure for VRF multi-split systems. DOE also seeks comment on its proposed amendment to the definition for IEER at § 431.92 to distinguish between the test procedures for ACUACs and VRF multi-split systems.

*Issue 2:* DOE requests comment on its proposals in Appendix D1, section 429.43, and section 429.134 regarding specific components.

*Issue 3:* DOE requests comment on its proposed definition for ''Critical Parameter(s)'', which specifies the three parameters that can be manually controlled in testing per Section 5.1.2.1 of AHRI 1230–2021—compressor speed(s), outdoor fan speed(s), and outdoor variable valve position(s).

*Issue 4:* DOE seeks comment on its proposal for adding provisions at 10 CFR 429.134(s)(3)(ii) to clarify the language in Sections C6.1.2 and C6.1.3 of AHRI 1230–2021 for validating critical parameters during a CVP, particularly pertaining to the duration of the measurement period used for validating critical parameters.

*Issue 5:* DOE seeks comment on its proposal to specify at 10 CFR 429.134(s)(3)(iii)(B) how, in the event of a CVP that has invalidated the critical parameter settings, alternate critical parameters would be determined to use as initial control inputs during the corresponding IEER full- or part-load cooling test. DOE requests feedback on the proposed method for selecting a measurement period on the basis of minimized average RSS points total, and also on its proposal for using an average of critical parameter measurements over the selected measurement period to calculate alternate critical parameters. DOE will further consider any alternate approaches suggested by comments in developing any final rule.

*Issue 6:* DOE requests comment on its proposal to incorporate the CVP into its product-specific enforcement provisions for VRF multi-split systems at 10 CFR 429.134(s) instead of the test procedure for VRF multi-split systems in the proposed appendix D1.

*Issue 7:* DOE requests comment on its proposed approach for conducting the CVP during enforcement testing. Specifically, DOE requests comment on the proposal that DOE would conduct the CVP for a single system during enforcement testing in order to validate the certified critical parameters. If commenters believe conducting the CVP on a single system as part of enforcement testing is insufficient, DOE requests test data demonstrating any issues with repeatability and reproducibility of the CVP that would indicate that the 70-point budget for critical parameter variation included in the industry consensus test procedure AHRI 1230–2021 is insufficient.

*Issue 8:* DOE seeks comment on its proposed provisions (to clarify similar provisions in AHRI 1230–2021) in section 4 of the proposed appendix D1 to subpart F of part 431 that specify allowable adjustments to critical parameters for IEER tests. Specifically, DOE requests feedback on its proposal to specify, for IEER tests for which the tested capacity is above the target capacity, calculation of normalized critical parameter variation during the adjustment process (similar to the calculation specified for the CVP in Section C4.4.2.3 of AHRI 1230–2021).

*Issue 9:* DOE seeks comment on the proposed provisions at § 429.134(s)(3)(iii)(B)(3) regarding allowable adjustment (to meet tolerances for capacity and SHR limits for an IEER test) of alternate critical parameter values determined by DOE in the event of a CVP that has invalidated the critical parameter settings.

*Issue 10:* DOE requests comment on its proposals for determining represented values for VRF multi-split system basic models with different indoor unit combinations. In particular, DOE seeks feedback on its proposal to allow for optional mixed representations of any two required representations (*i.e.,* ducted, non-ducted, and/or SDHV) for a basic model by calculating the mean of the two required representations.

*Issue 11:* DOE requests comment on its proposal regarding representations for VRF multi-split system basic models approved for use with multiple refrigerants.

*Issue 12:* DOE requests comment on its proposed certification reporting requirements for VRF multi-split systems.

*Issue 13:* DOE requests comment on its proposed STI reporting requirements for VRF multi-split systems.

*Issue 14:* DOE requests comment on its proposal to amend its requirements for AEDM validation for VRF multi-split systems.

*Issue 15:* DOE seeks comment on its proposal to require a means of control to be provided by the manufacturer for assessment and enforcement testing.

*Issue 16:* DOE seeks comment on its proposal to establish in 10 CFR 429.134(s)(2) provisions regarding allowable manufacturer involvement during assessment and enforcement testing, which are consistent with AHRI 1230–2021. DOE also seeks comment on its proposal for allowable manufacturer involvement during the CVP.

*Issue 17:* DOE requests comment on its proposed approaches for certification and for enforcement testing in the event that a VRF multi-split system has invalid certified operational settings for critical parameter values.

*Issue 18:* DOE requests comment on its proposed enforcement sampling plan for VRF multi-split systems.

*Issue 19:* DOE requests comment on its understanding of the impact of the test procedure proposals in this NOPR, specifically DOE's initial conclusion that the proposed DOE test procedure amendments, if finalized, would not increase testing burden on VRF multi-split system manufacturers, compared to current industry practice as indicated by AHRI 1230–2021.

*Issue 20:* DOE requests comment on its assessment that there are no small businesses that are OEMs of VRF multi-split systems.

*Issue 21:* DOE requests comment on its conclusion that the proposed rule would not have significant impacts on a substantial number of small manufacturers.

*Issue 22:* DOE invites public comment on: (1) Whether the proposed information collection requirements are necessary for the performance of DOE's functions, including whether the information will have practical utility; (2) the accuracy of DOE's estimates of the burden of the proposed information collection requirements; (3) ways to enhance the quality, utility, and clarity of the information to be collected; and (4) ways to minimize the burden of the information collection requirements on respondents.

## VI. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this proposed rule.

**List of Subjects**

*10 CFR Part 429*

Administrative practice and procedure, Confidential business

information, Energy conservation, Household appliances, Imports, Incorporation by reference, Intergovernmental relations, Reporting and recordkeeping requirements, Small businesses.

*10 CFR Part 431*

Administrative practice and procedure, Confidential business information, Energy conservation test procedures, Incorporation by reference, and Reporting and recordkeeping requirements.

**Signing Authority**

This document of the Department of Energy was signed on November 29, 2021, by Kelly J. Speakes-Backman, Principal Deputy Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE **Federal Register** Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the **Federal Register**.

Signed in Washington, DC, on November 30, 2021.

**Treena V. Garrett,**

*Federal Register Liaison Officer, U.S. Department of Energy.*

For the reasons stated in the preamble, DOE is proposing to amend parts 429 and 431 of chapter II, of title 10, Code of Federal Regulations as set forth below:

## PART 429—CERTIFICATION, COMPLIANCE, AND ENFORCEMENT FOR CONSUMER PRODUCTS AND COMMERCIAL AND INDUSTRIAL EQUIPMENT

■ 1. The authority citation for part 429 continues to read as follows:

**Authority:** 42 U.S.C. 6291–6317; 28 U.S.C. 2461 note.

■ 2. Amend § 429.4 by:

■ a. Revising paragraph (a); and

■ b. Redesignating paragraph (c)(2) as paragraph (c)(3) and adding new paragraph (c)(2).

The revision and addition read as follows.

**§ 429.4 Materials incorporated by reference.**

(a) Certain material is incorporated by reference into this subpart with the approval of the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. To enforce any edition other than that specified in this section, DOE must publish a document in the **Federal Register** and the material must be available to the public. All approved material is available for inspection at the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, [Building Technologies Program], Sixth Floor, 950 L'Enfant Plaza SW, Washington, DC 20024, (202)–586–9127, *Buildings@ee.doe.gov, https://www.energy.gov/eere/buildings/building-technologies-office,* and may be obtained from the other sources in this section. It is also available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, email: *fr.inspection@nara.gov,* or go to: *www.archives.gov/federal-register/cfr/ibr-locations.html.*

* * * * *

(c) * * *

(2) AHRI Standard 1230–2021, (''AHRI 1230–2021''), 2021 Standard for Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment, IBR approved for §§ 429.43 and 429.134.

* * * * *

■ 3. Amend § 429.43 by:

■ a. Revising the introductory text of paragraphs (a), (a)(1)(ii)(A), and (a)(1)(ii)(B);

■ b. Adding paragraphs (a)(3) through (5);

■ c. Revising paragraphs (b)(2)(xi) and (xii);

■ d. Removing paragraph (b)(2)(xiii);

■ e. Redesignating paragraphs (b)(2)(xiv) and (xv) as (b)(2)(xiii) and (xiv), respectively;

■ f. Revising paragraphs (b)(4)(vii) and (viii);

■ g. Removing paragraph (b)(4)(ix);

■ h. Redesignating paragraphs (b)(4)(x) through (b)(4)(xiv) as (b)(4)(ix) through (b)(4)(xiii), respectively;

and

■ i. Adding paragraph (b)(5).

The revisions and additions read as follows.

**§ 429.43 Commercial heating, ventilating, air conditioning (HVAC) equipment.**

(a) Determination of represented values. Manufacturers must determine the represented values, which include the certified ratings, for each basic model of commercial HVAC equipment either by testing, in conjunction with the applicable sampling provisions, or by applying an AEDM.

(1) * * *

(ii) * * *

(A) Any represented value of energy consumption or other measure of energy use of a basic model, or of a tested combination for variable refrigerant flow multi-split air conditioners and heat pumps certified to standards in terms of IEER as provided at paragraph (a)(3)(iv)(B) of this section, for which consumers would favor lower values shall be greater than or equal to the higher of:

* * * * *

(B) Any represented value of energy efficiency or other measure of energy consumption of a basic model, or of a tested combination for variable refrigerant flow multi-split air conditioners and heat pumps certified to standards in terms of IEER as provided at paragraph (a)(3)(iv)(B) of this section, for which consumers would favor higher values shall be less than or equal to the lower of:

* * * * *

(3) *Product-specific provisions for determination of represented values.*

(i)—(iii) [Reserved]

(iv) Variable refrigerant flow multi-split air conditioners and heat pumps (other than air-cooled with cooling capacity less than 65,000 btu/h). When certifying to standards in terms of IEER, the following provisions apply.

(A) If a basic model is distributed in commerce and approved for use with multiple refrigerants, a manufacturer must determine all represented values for that basic model (for example, IEER, COP, cooling capacity, and heating capacity) based on the refrigerant that results in the lowest cooling efficiency. A refrigerant is considered approved for use if it is listed on the nameplate of the outdoor unit. Per the definition of basic model in 10 CFR 431.92, use of a refrigerant that requires different hardware (*i.e.,* compressors, heat exchangers, or air moving systems that are not the same or comparably performing), would represent a different basic model, and separate representations would be required for each basic model.

(B) Represented values for different indoor unit combinations must be determined per the following provisions.

(*1*) If a basic model includes only one type of indoor unit combination (*i.e.,* ducted, non-ducted, or SDHV), a manufacturer must determine the represented values for that basic model in accordance with the sampling plan

set forth in § 429.11 and paragraph (a)(1) of this section if the represented values are determined through testing, or in accordance with the provisions for applying an AEDM set forth in paragraph (a)(2) of this section and § 429.70.

(*2*) If a basic model includes more than one type of indoor unit combination (*i.e.,* ducted, non-ducted, and/or SDHV), a manufacturer must determine separate represented values for each type of indoor unit combination. If the represented values are determined through testing, a manufacturer must test, at a minimum, a single tested combination for each type of indoor unit combination included in that basic model. A manufacturer may alternatively determine separate represented values through application of an AEDM as set forth in paragraph (a)(2) of this section and § 429.70. A manufacturer may also determine optional ''mixed'' representations by calculating the mean value across any two required representations described in this paragraph (*i.e.,* a representation for ''mixed ducted/non-ducted'' would be determined by averaging the ducted representation and the non-ducted representation, a representation for ''mixed ducted/SDHV'' would be determined by averaging the ducted representation and the SDHV representation, and a representation for ''mixed non-ducted/SDHV'' would be determined by averaging the non-ducted representation and the SDHV representation).

(4) *Determination of represented values for individual models with specific components for VRF multi-split systems.*

(i) If a manufacturer distributes in commerce indoor unit model(s) in a tested combination within a basic model with one of the components listed in the following table, determination of represented values is dependent on the selected grouping of individual indoor unit models into a tested combination within a basic model, as indicated in paragraphs (a)(4)(ii) through (v) of this section. For the purposes of this paragraph, ''otherwise identical'' means differing only in the presence of specific components listed in table 1 to paragraph (a)(4)(i).

TABLE 1 TO PARAGRAPH (a)(4)(i)

| Component | Description |
|---|---|
| Air economizers | An automatic system that enables a cooling system to supply and use outdoor air to reduce or eliminate the need for mechanical cooling during mild or cold weather. |
| Dehumidification Components | An assembly that reduced the moisture content of the supply air through moisture transfer with solid or liquid desiccants. |

(ii) If the indoor unit model(s) in a tested combination within a basic model include only individual indoor unit models distributed in commerce without a specific component listed in paragraph (a)(4)(i) of this section, the manufacturer must determine represented values for the tested combination based on performance of individual indoor unit models distributed in commerce without the component.

(iii) If the indoor unit model(s) in a tested combination within a basic model include only individual indoor unit models distributed in commerce with a specific component listed in paragraph (a)(4)(i) of this section, the manufacturer must determine represented values for the tested combination based on performance of individual indoor unit models with the component present (and consistent with any component-specific test provisions specified in section 6 of appendix D1 to subpart F of part 431).

(iv) If the indoor unit model(s) in a tested combination within a basic model—

(A) Include both individual indoor unit models distributed in commerce with a specific component listed in paragraph (a)(4)(i) of this section and individual indoor unit models distributed in commerce without that specific component, and

(B) None of the individual indoor unit models distributed in commerce without the specific component are otherwise identical to any individual indoor unit model distributed in commerce with that specific component, the manufacturer must consider the performance of individual indoor unit models with the component present when determining represented values for the tested combination within a basic model (and consistent with any component-specific test provisions specified in section 6 of appendix D1 to subpart F of part 431).

(v) If the indoor unit model(s) in a tested combination within a basic model—

(A) Include both individual indoor unit models distributed in commerce with a specific component listed in paragraph (a)(4)(i) of this section and individual indoor unit models distributed in commerce without that specific component, and

(B) At least one of the individual indoor unit models distributed in commerce without the specific component is otherwise identical to any given individual indoor unit model distributed in commerce with the specific component, the manufacturer may determine represented values for the tested combination within a basic model either:

(*1*) Based on performance of individual indoor unit models distributed in commerce without the specific component, or

(*2*) Based on performance of individual indoor unit models with the specific component present (and consistent with any component-specific test provisions specified in section 6 of appendix D1 to subpart F of part 431).

(vi) In any of the cases specified in paragraphs (a)(4)(ii) through (v) of this section, the represented values for a tested combination within a basic model must be determined in accordance with paragraph (a)(3) of this section, through either testing or an AEDM.

(5) *Heat Recovery.* For basic models of VRF multi-split systems distributed in commerce with heat recovery components, the manufacturer must determine represented values for the basic model based on performance of an individual model distributed in commerce with heat recovery components.

(b) * * *

(2) * * *

(xi) Variable refrigerant flow multi-split air-cooled air conditioners (except those with rated cooling capacity less than 65,000 Btu/h):

(A) When certifying compliance with an EER standard: The energy efficiency ratio (EER in British thermal units per Watt-hour (Btu/Wh)), rated cooling capacity in British thermal units per hour (Btu/h), and the type(s) of heating

used by the basic model (*e.g.,* electric, gas, hydronic, none).

(B) When certifying compliance with an IEER standard, the following must be certified for each tested combination as required under paragraph (a)(3)(iv)(B) of this section: The integrated energy efficiency ratio (IEER) in British thermal units per Watt-hour (Btu/Wh)); the rated cooling capacity in British thermal units per hour (Btu/h); whether the represented values are for a non-ducted, ducted, or SDHV tested combination, or for a mixed representation of any two of the tested combinations; and the outdoor unit(s) and indoor units identified in the tested combination. The following must be certified for each basic model: The type(s) of heating used (*i.e.,* electric, gas, hydronic, none); and the refrigerant used to determine the represented values.

(xii) Variable refrigerant flow multi-split heat pumps (other than air-cooled with rated cooling capacity less than 65,000 btu/h):

(A) When certifying compliance with an EER standard: The energy efficiency ratio (EER in British thermal units per Watt-hour (Btu/Wh)), the coefficient of performance (COP), rated cooling capacity in British thermal units per hour (Btu/h), and the type(s) of heating used by the basic model (*e.g.,* electric, gas, hydronic, none).

(B) When certifying compliance with an IEER standard, the following must be certified for each tested combination as required under paragraph (a)(3)(iv)(B) of this section: The integrated energy efficiency ratio (IEER) in British thermal units per Watt-hour (Btu/Wh)); the coefficient of performance (COP); the rated cooling capacity in British thermal units per hour (Btu/h); the rated heating capacity (Btu/h); whether the represented values are for a non-ducted, ducted, or SDHV tested combination, or for a mixed representation of any two of the tested combinations; and the outdoor unit(s) and indoor units identified in the tested combination. The following must be certified for each basic model: the type(s) of heating used (*i.e.,* electric, gas, hydronic, none); and the refrigerant used to determine the represented values.

* * * * *

(4) * * *

(vii) Variable refrigerant flow multi-split air-cooled air conditioners (except those with rated cooling capacity less than 65,000 Btu/h):

(A) When certifying compliance with an EER standard: The nominal cooling capacity in British thermal units per hour (Btu/h); outdoor unit(s) and indoor units identified in the tested combination; components needed for heat recovery, if applicable; rated airflow in standard cubic feet per minute (scfm) for each indoor unit; rated static pressure in inches of water; compressor frequency set points; required dip switch/control settings for step or variable components; a statement whether the model will operate at test conditions without manufacturer programming; any additional testing instructions if applicable; if a variety of motors/drive kits are offered for sale as options in the basic model to account for varying installation requirements, the model number and specifications of the motor (to include efficiency, horsepower, open/closed, and number of poles) and the drive kit, including settings, associated with that specific motor that were used to determine the certified rating; and which, if any, special features were included in rating the basic model. Additionally, upon DOE request, the manufacturer must provide a layout of the system set-up for testing including charging instructions consistent with the installation manual.

(B) When certifying compliance with an IEER standard (for requirements in this list pertaining to or affected by indoor units, the requirements must be certified for each tested combination as required under paragraph (a)(3)(iv)(B) of this section): The nominal cooling capacity in British thermal units per hour (Btu/h) for each indoor and outdoor unit; identification of the indoor units to be thermally active for each IEER test point; the rated indoor airflow for the full-load cooling and all part-load cooling tests (for each indoor unit) in standard cubic feet per minute (scfm); the indoor airflow-control setting to be used in the full-load cooling test (for each indoor unit); system start-up or initialization procedures, including conditions and duration; compressor break-in period duration; the frequency of oil recovery cycles; operational settings for all critical parameters to be controlled at each of the four IEER cooling test conditions; required dip switch/control settings; identification of any system control device required for testing; a hierarchy of instructions for adjustment of critical parameters to reduce cooling capacity during IEER cooling tests (to be used if, using initial critical parameter settings, the measured cooling capacity is more than 3 percent above the target cooling capacity); any additional testing instructions if applicable; and if a variety of motors/drive kits are offered for sale as options in the basic model to account for varying installation requirements, the model number and specifications of the motor (to include efficiency, horsepower, open/closed, and number of poles) and the drive kit, including settings, associated with that specific motor that were used to determine the certified rating. Instructions for conducting a controls verification procedure (as described in Appendix C of AHRI 1230–2021, (incorporated by reference, see § 429.4)) at each of the four IEER cooling test conditions must also be provided, including: The required thermostat setpoints to ensure control for 80 °F dry-bulb temperature when accounting for set point bias, the starting indoor dry-bulb temperature, and the indoor dry-bulb temperature ramp rate (R2). Additionally, the manufacturer must provide a layout of the system set-up for testing (including a piping diagram, a power wiring diagram, a control wiring diagram, and identification of the location of the component(s) corresponding to each critical parameter to be controlled), setup instructions for indoor units and outdoor units, and charging instructions consistent with the installation manual. Also, the manufacturer must certify for which, if any, specific components (as listed in paragraph (a)(4)(i) of this section) the following provisions are applicable:

(*1*) The indoor unit model(s) in a tested combination within a basic model include both individual indoor unit models distributed in commerce with the specific component and individual indoor unit models distributed in commerce without the specific component;

(*2*) At least one of the individual indoor unit models distributed in commerce without the specific component is otherwise identical to any given individual indoor unit model distributed in commerce with the specific component; and

(*3*) Represented values for the tested combination are based on performance of individual indoor unit models distributed in commerce without the specific component.

(viii) Variable refrigerant flow multi-split heat pumps (other than air-cooled with rated cooling capacity less than 65,000 btu/h):

(A) When certifying compliance with an EER standard: The nominal cooling capacity in British thermal units per hour (Btu/h); rated heating capacity in British thermal units per hour (Btu/h); outdoor unit(s) and indoor units identified in the tested combination; components needed for heat recovery, if applicable; rated airflow in standard cubic feet per minute (scfm) for each indoor unit; water flow rate in gallons

per minute (gpm) for water-cooled units only; rated static pressure in inches of water; compressor frequency set points; required dip switch/control settings for step or variable components; a statement whether the model will operate at test conditions without manufacturer programming; any additional testing instructions if applicable; if a variety of motors/drive kits are offered for sale as options in the basic model to account for varying installation requirements, the model number and specifications of the motor (to include efficiency, horsepower, open/closed, and number of poles) and the drive kit, including settings, associated with that specific motor that were used to determine the certified rating; and which, if any, special features were included in rating the basic model. Additionally, upon DOE request, the manufacturer must provide a layout of the system set-up for testing including charging instructions consistent with the installation manual.

(B) When certifying compliance with an IEER standard (for requirements in this list pertaining to or affected by indoor units, the requirements must be certified for each tested combination as required under paragraph (a)(3)(iv)(B) of this section): The nominal cooling capacity in British thermal units per hour (Btu/h) for each indoor and outdoor unit; the nominal heating capacity (Btu/h) for each indoor and outdoor unit; components needed for heat recovery, if applicable; identification of the indoor units to be thermally active for each IEER test point; the rated indoor airflow for the full-load cooling, full-load heating, and all part-load cooling tests (for each indoor unit) in standard cubic feet per minute (scfm); the indoor airflow-control setting to be used in the full-load cooling test (for each indoor unit); the airflow-control setting to be used in the full-load heating test (for each indoor unit); for water-cooled units—the rated water flow rate in gallons per minute (gpm); system start-up or initialization procedures, including conditions and duration; compressor break-in period duration; the frequency of oil-recovery cycles; operational settings for all critical parameters to be controlled at each of the four IEER cooling test conditions; operational settings for all critical parameters to be controlled for the heating test; required dip switch/control settings; identification of any system control device required for testing; a hierarchy of instructions for adjustment of critical parameters to reduce cooling capacity during IEER cooling tests (to be used if, using initial critical parameter settings, the measured cooling capacity is more than 3 percent above the target cooling capacity); any additional testing instructions if applicable; and if a variety of motors/drive kits are offered for sale as options in the basic model to account for varying installation requirements, the model number and specifications of the motor (to include efficiency, horsepower, open/closed, and number of poles) and the drive kit, including settings, associated with that specific motor that were used to determine the certified rating. Instructions for conducting a controls verification procedure (as described in Appendix C of AHRI 1230–2021) at each of the four IEER cooling test conditions must also be provided, including the required thermostat setpoints to ensure control for 80 °F dry-bulb temperature when accounting for set point bias, the starting indoor dry-bulb temperature, and the indoor dry-bulb temperature ramp rate (R2). Additionally, the manufacturer must provide a layout of the system set-up for testing (including a piping diagram, a power wiring diagram, a control wiring diagram, and identification of the location of the component(s) corresponding to each critical parameter to be adjusted), setup instructions for indoor units and outdoor units, and charging instructions consistent with the installation manual. Also, the manufacturer must certify for which, if any, specific components (as listed in paragraph (a)(4)(i) of this section) the following provisions are applicable:

(*1*) The indoor unit model(s) in a tested combination within a basic model include both individual indoor unit models distributed in commerce with the specific component and individual indoor unit models distributed in commerce without the specific component;

(*2*) At least one of the individual indoor unit models distributed in commerce without the specific component is otherwise identical to any given individual indoor unit model distributed in commerce with the specific component; and

(*3*) Represented values for the tested combination are based on performance of individual indoor unit models distributed in commerce without the specific component.

* * * * *

(5) For variable refrigerant flow multi-split air conditioners and heat pumps (other than air-cooled with rated cooling capacity less than 65,000 btu/h), if a manufacturer has knowledge that any of its certified operational settings for critical parameters to be controlled during IEER tests (per paragraphs (b)(4)(vii)(B) or (b)(4)(viii)(B) of this section) are invalid according to the results of a controls verification procedure appropriately conducted according to § 429.134(s)(3), then the manufacturer must re-certify valid operational settings for critical parameters for all affected basic models, and re-rate and re-certify all affected basic models.

* * * * *

■ 4. Amend § 429.70 by revising paragraph (c)(2)(i) to read as follows:

**§ 429.70 Alternative methods for determining energy efficiency and energy use.**

* * * * *

(c) * * *

(2) * * *

(i) The manufacturer must select at least the minimum number of basic models for each validation class specified in paragraph (c)(2)(iv) of this section to which the particular AEDM applies. Using the AEDM, calculate the energy use or efficiency for each of the selected basic models.

(A) Except for variable refrigerant flow multi-split air conditioners and heat pumps (other than air-cooled with rated cooling capacity less than 65,000 btu/h) when certifying to standards in terms of IEER, test a single unit of each selected basic model in accordance with paragraph (c)(2)(iii) of this section. Compare the results from the single unit test and the AEDM energy use or efficiency output according to paragraph (c)(2)(ii) of this section. The manufacturer is responsible for ensuring the accuracy and reliability of the AEDM.

(B) For variable refrigerant flow multi-split air conditioners and heat pumps (other than air-cooled with rated cooling capacity less than 65,000 btu/h) when certifying to standards in terms of IEER, the following provisions apply.

(*1*) If a manufacturer makes representations for a single type of indoor unit combination (*i.e.,* only ducted, non-ducted, or SDHV indoor unit combinations) across all the basic models for which an AEDM applies, the manufacturer must test at least a single tested combination of that type of indoor unit combination for each selected basic model in accordance with paragraph (c)(2)(iii) of this section.

(*2*) If a manufacturer makes representations for two types of indoor unit combinations (*i.e.,* ducted, non-ducted, and/or SDHV) within or across all the basic models for which the AEDM applies, the manufacturer must test at least a single tested combination

of a selected basic model as the first of those two types of indoor unit combination, and at least a single tested combination of a different selected basic model as the second of those two types of indoor unit combination, each in accordance with paragraph (c)(2)(iii) of this section.

(*3*) If a manufacturer makes representations for all three types of indoor unit combinations (*i.e.,* ducted, non-ducted, and SDHV) within or across basic models for which the AEDM applies, the manufacturer must test at least a single tested combination of a selected basic model as a non-ducted tested combination and a single tested combination of a different selected basic model as a ducted tested combination, each in accordance with paragraph (c)(2)(iii) of this section.

(4) In all cases, compare the results from each tested basic model and the AEDM energy use or efficiency output according to paragraph (c)(2)(ii) of this section. The manufacturer is responsible for ensuring the accuracy and reliability of the AEDM.

* * * * *

■ 5. Section 429.104 is revised to read as follows:

**§ 429.104 Assessment testing.**

(a) DOE may, at any time, test a basic model to assess whether the basic model is in compliance with the applicable energy conservation standard(s).

(b) For variable refrigerant flow multi-split air conditioners and heat pumps (other than air-cooled with rated cooling capacity less than 65,000 btu/h) DOE may require that the manufacturer of a basic model ship or cause to be shipped from a retailer or distributor at its expense the means of control associated with the basic model, if applicable.

■ 6. Amend § 429.110 by:

■ a. Redesignating paragraphs (a)(2) and (3) as paragraphs (a)(3) and (4), respectively;

■ b. Adding new paragraph (a)(2);

■ c. Revising paragraph (b)(1)(iv);

■ d. Revising paragraph (e)(2);

■ e. Redesignating paragraphs (e)(3) through (9) as (e)(4) through (10), respectively;

■ f. Adding new paragraph (e)(3);

■ g. In newly designated paragraph (e)(4), remove the words ''(e)(1) or (2) of this section'' and add in its place the words, ''(e)(1), (2) or (3) of this section'';

■ h. In newly designated paragraph (e)(8), remove the words ''(e)(1) through (6)'' and add in its place the words ''(e)(1) through (7)''; and

■ i. In newly designated paragraph (e)(9), remove the words ''paragraph (e)(7)'' and ''paragraphs (e)(1) through (6)'' and add in their place the words ''paragraph (e)(8)'' and ''paragraphs (e)(1) through (7)'', respectively;

The additions and revisions read as follows.

**§ 429.110 Enforcement testing.**

(a) * * *

(2) For variable refrigerant flow multi-split air conditioners and heat pumps (other than air-cooled with rated cooling capacity less than 65,000 Btu/h) determining compliance with an energy conservation standard based on IEER, DOE may test for enforcement if DOE has reason to believe that a basic model is not in compliance, has invalid certified operational settings for critical parameter values, or has an otherwise invalid certified rating.

* * * * *

(b) * * *

(1) * * *

(iv) DOE may require in the test notice that the manufacturer of a basic model ship or cause to be shipped from a retailer or distributor at its expense the requested number of units of a basic model specified in such test notice to the testing laboratory specified in the test notice. The manufacturer shall ship the specified initial test unit(s) of the basic model and to the testing laboratory within 5 working days from the time unit(s) are selected. For variable refrigerant flow multi-split air conditioners and heat pumps (other than air-cooled with rated cooling capacity less than 65,000 btu/h) the manufacturer shall also ship any means of control necessary for conducting testing in accordance with appendix D1 to part 431 of this subchapter. The manufacturer shall ship the means of control, if applicable, with the system(s) selected for testing.

* * * * *

(e) * * *

(2) For automatic commercial ice makers; commercial refrigerators, freezers, and refrigerator-freezers; refrigerated bottled or canned vending machines; commercial air conditioners and heat pumps except variable refrigerant flow multi-split air conditioners and heat pumps (other than air-cooled with rated cooling capacity less than 65,000 btu/h); commercial packaged boilers; commercial warm air furnaces; commercial water heating equipment; and walk-in cooler and walk-in freezer refrigeration systems, DOE will use an initial sample size of not more than four units and follow the sampling plans in appendix B of this subpart (Sampling Plan for Enforcement Testing of Covered Equipment and Certain Low-Volume Covered Products).

(3) For variable refrigerant flow multi-split air conditioners and heat pumps (other than air-cooled with rated cooling capacity less than 65,000 btu/h).

(i) For determining compliance with an energy conservation standard based on EER, DOE will use an initial sample size of not more than four units and follow the sampling plans in appendix B of this subpart (Sampling Plan for Enforcement Testing of Covered Equipment and Certain Low-Volume Covered Products).

(ii) For determining compliance with an energy conservation standard based on IEER, DOE will use an initial sample size of two units and follow the sampling plans in appendix B of this subpart (Sampling Plan for Enforcement Testing of Covered Equipment and Certain Low-Volume Covered Products).

* * * * *

■ 7. Amend § 429.134 by adding paragraph (s) to read as follows:

**§ 429.134 Product-specific enforcement provisions.**

* * * * *

(s) *Variable refrigerant flow multi-split air conditioners and heat pumps (other than air-cooled with rated cooling capacity less than 65,000 btu/h).* The following provisions apply for assessment and enforcement testing of models subject to standards in terms of IEER:

(1) *Specific Components.* If the indoor unit model(s) in a tested combination within a basic model include individual indoor unit models distributed in commerce with any of the specific components listed at § 429.43(a)(4)(i), the following provisions apply. For the purposes of this paragraph, ''otherwise identical'' means differing only in the presence of specific components listed at § 429.43(a)(4)(i).

(i) If the manufacturer does not certify in accordance with § 429.43(b)(4) that—

(A) Indoor unit model(s) in a tested combination within a basic model include both individual indoor unit models distributed in commerce with a specific component and otherwise identical individual indoor unit models distributed in commerce without the specific component, and

(B) Represented values for the tested combination are based on performance of individual indoor unit models distributed in commerce without the specific component, DOE may test the tested combination with individual indoor unit models with the component present (and consistent with any component-specific test provisions specified in section 6 of appendix D1 to subpart F of part 431).

(ii) If the manufacturer certifies in accordance with § 429.43(b)(4) that—

(A) Indoor unit model(s) in a tested combination within a basic model include both individual indoor unit models distributed in commerce with a specific component and otherwise identical individual indoor unit models distributed in commerce without the specific component, and

(B) Represented values for the tested combination are based on performance of individual indoor unit models distributed in commerce without the specific component, DOE will test the tested combination with otherwise identical indoor unit model(s) within the tested combination within a basic model that do not include the component, except in either of the following situations. In either of the following situations, DOE may test the tested combination with individual indoor unit models with the specific component present (and consistent with any component-specific test provisions specified in section 6 of appendix D1 to subpart F of part 431).

(*1*) DOE is not able, through documented reasonable effort, to obtain individual indoor unit models for testing that do not include the component.

(*2*) DOE becomes aware that the manufacturer's certification in accordance with § 429.43(b)(4) regarding specific components is invalid.

(2) *Manufacturer involvement in assessment or enforcement testing.* A manufacturer's representative will be allowed to support commissioning and witness assessment and/or enforcement testing for variable refrigerant flow multi-split air conditioners and heat pumps, including during the controls verification procedures (CVPs), specified in paragraph (s)(3) of this section, with allowance for additional involvement as described in the following provisions.

(i) Manufacturer involvement in CVP—Control settings must be set by a member of the third-party laboratory and per the provisions in section 5.1 of appendix D1 to subpart F of part 431. Critical parameters must operate automatically from the system controls and must not be manually controlled or adjusted at any point during the CVP. The manufacturer's representative must not make any adjustments to the VRF multi-split system for a CVP.

(ii) Manufacturer involvement in heating tests and IEER cooling tests—All control settings other than critical parameters must be set by a member of the third-party laboratory, following the provisions of section 5.1 of appendix D1 to subpart F of part 431. Critical parameters may be manually controlled by a manufacturer's representative, including initial setting to the certified values and additional adjustments (as described in sections 5.1 and 5.2 of appendix D1 to subpart F of part 431, respectively). Setting and adjustment of critical parameters by a manufacturer's representative must be monitored by third-party laboratory personnel using a service tool. The manufacturer's representative must not make any other adjustments to the VRF multi-split system under test. If a manufacturer's representative is not present for testing, a member of the third-party laboratory must set and adjust critical parameters using the provided means of control described in § 429.110(b)(1)(iv) for enforcement testing and § 429.104 for assessment testing.

(3) *Controls Verification Procedure (CVP).* This procedure validates the certified values of critical parameters for which positions may be manually set during the full- and part-load IEER cooling test conditions specified at appendix D1 to subpart F of part 431. The CVP will only be conducted for a single system.

(i) *Conducting the CVP*—The CVP will be conducted at all of the four IEER cooling test conditions as specified in appendix D1 to subpart F of part 431; the CVP is not applicable for any heating test conditions. The CVP will first be performed at the full-load cooling condition before being conducted at part-load cooling conditions and must be conducted per Appendix C of AHRI 1230–2021 (incorporated by reference, see § 429.4).

(ii) *Validating Critical Parameters*—At each load point, certified critical parameter values will be validated or invalidated according to Section C6 of AHRI 1230–2021 with the following amendments:

(A) The duration of the period used for validating certified critical parameter values must be whichever of the following is longer: Three minutes, or the time period needed to obtain five sample readings while meeting the minimum data collection interval requirements of Table C2 of AHRI 1230–2021.

(B) If at least one measurement period with duration identified in paragraph (s)(3)(ii)(A) of this section exists before $t_{OFF}$ that has an average root-sum-square (''RSS'') points total (as defined in Section 3.26 of AHRI 1230–2021) over the measurement period that is less than or equal to 70 points, the certified critical parameter values are valid.

(C) If no measurement period with duration identified in paragraph (s)(3)(ii)(A) of this section exists before $t_{OFF}$ that has an average RSS points total over the measurement period that is less than or equal to 70 points, the certified critical parameter values are invalid.

(iii) *Determining critical parameters for use in steady-state IEER cooling tests*—If, following a CVP, IEER testing is conducted per appendix D1 to subpart F of part 431, the following provisions apply:

(A) *Validated critical parameter settings.* At each load point, if certified critical parameter values are found to be valid according to the results of the CVP, initially set critical parameters to their certified values for the IEER test at the corresponding full- or part-load cooling condition. Perform additional adjustments to critical parameters as described in section 5.2 of appendix D1 to subpart F of part 431.

(B) *Invalidated critical parameter settings.* At each load point, if certified 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 (as specified in appendix D1 to subpart F of part 431). Determine alternate critical parameter values from the CVP results of the single system described in paragraph (s)(3) of this section as follows:

(*1*) Select the CVP measurement period—this period must have duration determined per paragraph (s)(3)(ii)(A) of this section and must be the period where the RSS points total has a lower average value over the measurement period than over any other time period in the CVP of the same duration. If multiple periods exist with the same RSS points total, select the measurement period closest to but before the time that the first indoor unit switches to thermally inactive (denoted as ''$t_{off}$'' in AHRI 1230–2021).

(*2*) Determine alternate critical parameters—calculate the average position for each critical parameter during the measurement period selected in paragraph (s)(3)(iii)(B)(*1*) of this section. When initially setting critical parameters per section 5.1 of appendix D1 to subpart F of part 431, instead of using the certified critical parameter values, use the alternate critical parameter values as control inputs. The same initial alternate critical parameter values must be used for all systems in the assessment/enforcement sample (though critical parameter adjustments as needed to achieve target capacity or sensible heat ratio (SHR) limits are made independently for each tested system, per paragraph (s)(3)(iii)(B)(*3*) of this section.

(*3*) For each system, determine whether critical parameter adjustments

are needed to achieve the target capacity or sensible heat ratio (SHR) limit for an IEER cooling test. Perform critical parameter adjustments independently on each system as described in section 5.2 of appendix D1 to subpart F of part 431, with the following exceptions:

(*i*) Replace all references to ''certified critical parameter values'' with ''alternate critical parameter values'' as determined in paragraph (s)(3)(iii)(B) of this section.

(*ii*) 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 AHRI 1230–2021. If multiple components corresponding to a single parameter are present, determine $CP_{Max}$ at the point during the R2 period at which the average value across all components corresponding to that critical parameter is maximized.

## PART 431—ENERGY EFFICIENCY PROGRAM FOR CERTAIN COMMERCIAL AND INDUSTRIAL EQUIPMENT

■ 8. The authority citation for part 431 continues to read as follows:

**Authority:** 42 U.S.C 6291–6317; 28 U.S.C 2461 note.

■ 9. Section 431.92 is amended by revising the definition of ''Integrated energy efficiency ratio, or IEER'' to read as follows:

### § 431.92 Definitions concerning commercial air conditioners and heat pumps.

* * * * *

*Integrated energy efficiency ratio, or IEER,* means a weighted average calculation of mechanical cooling EERs determined for four load levels and corresponding rating conditions, expressed in Btu/watt-hour. IEER is measured per appendix A of this subpart for air-cooled small (≥65,000 Btu/h), large, and very large commercial package air conditioning and heating equipment and measured per appendix D1 of this subpart for variable refrigerant flow multi-split air conditioners and heat pumps (other than air-cooled with rated cooling capacity less than 65,000 Btu/h).

* * * * *

■ 10. Amend § 431.95 by:

■ a. Revising paragraph (a);

■ b. Revising paragraph (b)(6);

■ c. Adding paragraph (b)(7); and

■ d. Revising paragraph (c)(2).

The revisions and addition read as follows:

### § 431.95 Materials incorporated by reference.

(a) Certain material is incorporated by reference into this subpart with the approval of the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. To enforce any edition other than that specified in this section, DOE must publish a document in the **Federal Register** and the material must be available to the public. All approved material is available for inspection at the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, Sixth Floor, 950 L'Enfant Plaza SW, Washington, DC 20024, (202) 586–9127, *Buildings@ee.doe.gov, https://www.energy.gov/eere/buildings/building-technologies-office,* and may be obtained from the other sources in this section. It is also available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, email: *fr.inspection@nara.gov,* or go to: *www.archives.gov/federal-register/cfr/ibr-locations.html.*

(b) * * *

(6) ANSI/AHRI Standard 1230–2010, ''2010 Standard for *Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment,*'' approved August 2, 2010 and updated by addendum 1 in March 2011 (AHRI 1230–2010), IBR approved for § 431.96 and appendix D of this subpart.

(7) AHRI Standard 1230–2021, ''Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment'', published in 2021 (AHRI 1230–2021), IBR approved for appendix D1 of this subpart.

(c) * * *

(2) ANSI/ASHRAE Standard 37–2009, (''ANSI/ASHRAE 37–2009''), ''Methods of Testing for Rating Electrically Driven Unitary Air-Conditioning and Heat Pump Equipment'', (including Errata Sheet issued October 3, 2016), ASHRAE approved June 24, 2009, IBR approved for § 431.96 and appendices A and D1 of this subpart.

* * * * *

■ 11. Amend § 431.96 by:

■ a. Revising paragraph (b)(1);

■ b. Redesignating table 1 to paragraph (b)(2) as table 1 to § 431.96; and

■ c. Revising newly redesignated table 1 to § 431.96.

The revisions read as follows:

### § 431.96 Uniform test method for the measurement of energy efficiency of commercial air conditioners and heat pumps.

* * * * *

(b) *Testing and calculations.* (1) Determine the energy efficiency of each type of covered equipment by conducting the test procedure(s) listed in table 1 to this section along with any additional testing provisions set forth in paragraphs (c) through (g) of this section and appendices A through D1 of this subpart, that apply to the energy efficiency descriptor for that equipment, category, and cooling capacity. The omitted sections of the test procedures listed in table 1 to this section must not be used. For equipment with multiple appendices listed in table 1 to this section, consult the notes at the beginning of those appendices to determine the applicable appendix to use for testing.

(2) * * *

TABLE 1 TO § 431.96—TEST PROCEDURES FOR COMMERCIAL AIR CONDITIONERS AND HEAT PUMPS

| Equipment type | Category | Cooling capacity | Energy efficiency descriptor | Use tests, conditions, and procedures [1] in | Additional test procedure provisions as indicated in the listed paragraphs of this section |
|---|---|---|---|---|---|
| Small Commercial Package Air-Conditioning and Heating Equipment. | Air-Cooled, 3-Phase, AC and HP. | <65,000 Btu/h ..... | SEER and HSPF .... | AHRI 210/240–2008 (omit section 6.5). | None. |
| | Air-Cooled AC and HP. | ≥65,000 Btu/h and <135,000 Btu/h. | EER, IEER, and COP. | Appendix A of this subpart. | None. |
| | Water-Cooled and Evaporatively-Cooled AC. | <65,000 Btu/h ..... | EER ..... | AHRI 210/240–2008 (omit section 6.5). | Paragraphs (c) and (e). |

TABLE 1 TO § 431.96—TEST PROCEDURES FOR COMMERCIAL AIR CONDITIONERS AND HEAT PUMPS—Continued

| Equipment type | Category | Cooling capacity | Energy efficiency descriptor | Use tests, conditions, and procedures [1] in | Additional test procedure provisions as indicated in the listed paragraphs of this section |
|---|---|---|---|---|---|
| | | ≥65,000 Btu/h and <135,000 Btu/h. | EER | AHRI 340/360–2007 (omit section 6.3). | Paragraphs (c) and (e). |
| | Water-Source HP | <135,000 Btu/h | EER and COP | ISO Standard 13256–1 (1998). | Paragraph (e). |
| Large Commercial Package Air-Conditioning and Heating Equipment. | Air-Cooled AC and HP. | ≥135,000 Btu/h and <240,000 Btu/h. | EER, IEER and COP. | Appendix A to this subpart. | None. |
| | Water-Cooled and Evaporatively-Cooled AC. | ≥135,000 Btu/h and <240,000 Btu/h. | EER | AHRI 340/360–2007 (omit section 6.3). | Paragraphs (c) and (e). |
| Very Large Commercial Package Air-Conditioning and Heating Equipment. | Air-Cooled AC and HP. | ≥240,000 Btu/h and <760,000 Btu/h. | EER, IEER and COP. | Appendix A to this subpart. | None. |
| | Water-Cooled and Evaporatively-Cooled AC. | ≥240,000 Btu/h and <760,000 Btu/h. | EER | AHRI 340/360–2007 (omit section 6.3). | Paragraphs (c) and (e). |
| Packaged Terminal Air Conditioners and Heat Pumps. | AC and HP | <760,000 Btu/h | EER and COP | Paragraph (g) of this section. | Paragraphs (c), (e), and (g). |
| Computer Room Air Conditioners. | AC | <65,000 Btu/h | SCOP | ASHRAE 127–2007 (omit section 5.11). | Paragraphs (c) and (e). |
| | | ≥65,000 Btu/h and <760,000 Btu/h. | SCOP | ASHRAE 127–2007 (omit section 5.11). | Paragraphs (c) and (e). |
| Variable Refrigerant Flow Multi-split Systems. | AC | <65,000 Btu/h (3-phase). | SEER | ANSI/AHRI 1230–2010 (omit sections 5.1.2 and 6.6). | Paragraphs (c), (d), (e), and (f). |
| Variable Refrigerant Flow Multi-split Systems, Air-cooled. | HP | <65,000 Btu/h (3-phase). | SEER and HSPF | ANSI/AHRI 1230–2010 (omit sections 5.1.2 and 6.6). | Paragraphs (c), (d), (e), and (f). |
| Variable Refrigerant Flow Multi-split Systems, Air-cooled. | AC and HP | ≥65,000 Btu/h and <760,000 Btu/h. | EER and COP | Appendix D of this subpart [2]. | None. |
| | | ≥65,000 Btu/h and <760,000 Btu/h. | IEER and COP | Appendix D1 of this subpart [2]. | None. |
| Variable Refrigerant Flow Multi-split Systems, Water-source. | HP | <760,000 Btu/h | EER and COP | Appendix D of this subpart [2]. | None. |
| | | <760,000 Btu/h | IEER and COP | Appendix D1 of this subpart [2]. | None. |
| Single Package Vertical Air Conditioners and Single Package Vertical Heat Pumps. | AC and HP | <760,000 Btu/h | EER and COP | AHRI 390–2003 (omit section 6.4). | Paragraphs (c) and (e). |

[1] Incorporated by reference; see § 431.95.
[2] For equipment with multiple appendices listed in this table 1, consult the notes at the beginning of those appendices to determine the applicable appendix to use for testing.

* * * * *

**Appendix B to Subpart F of Part 431 [Reserved]**

■ 12. Add and reserve appendix B to subpart F of part 431.

**Appendix C to Subpart F of Part 431 [Reserved]**

■ 13. Add and reserve appendix C to subpart F of part 431.

■ 14. Add appendix D to subpart F of part 431 to read as follows:

**Appendix D to Subpart F of Part 431—Uniform Test Method for Measuring the Energy Consumption of Variable Refrigerant Flow Multi-Split Air Conditioners and Heat Pumps (Other Than Air-Cooled With Rated Cooling Capacity Less Than 65,000 BTU/H)**

**Note:** Manufacturers must use the results of testing under this appendix to determine compliance with the relevant standard from § 431.97 as that standard appeared in the January 1, 2021 edition of 10 CFR parts 200–499. Specifically, before [Date 360 days after publication of the final rule in the **Federal Register**] representations must be based upon results generated either under this appendix or under 10 CFR 431.96 as it appeared in the 10 CFR parts 200–499 edition revised as of January 1, 2021.

For any amended standards for variable refrigerant flow multi-split air conditioners and heat pumps that rely on integrated

energy efficiency ratio (IEER) published after January 1, 2021, manufacturers must use the results of testing under appendix D1 of this subpart to determine compliance. Representations related to energy consumption must be made in accordance with the appropriate appendix that applies (*i.e.,* appendix D or appendix D1) when determining compliance with the relevant standard.

1. *Incorporation by Reference.*

DOE incorporated by reference in § 431.95, the entire standard for ANSI/AHRI 1230–2010. However, only enumerated provisions of that document apply to this appendix, as set forth in paragraph (1) of this section. To the extent there is a conflict, the language of the test procedure in this appendix takes precedence over the referenced test standard.

(1) ANSI/AHRI 1230–2010:

(i) Section 5.1.2—Manufacturer involvement is inapplicable as specified in section 2.1 of this appendix.

(ii) Section 6.6—Verification testing and uncertainty is inapplicable as specified in section 2.2 of this appendix.

2. *General.* Determine the energy efficiency ratio (EER) and coefficient of performance (COP) (as applicable) in accordance with ANSI/AHRI 1230–2010; however, the following enumerated provisions of that document are not applicable.

(i) Section 5.1.2—Manufacturer involvement

(ii) Section 6.6—Verification testing uncertainty

Sections 3 through 6 of this appendix provide additional instructions for determining EER and COP.

3. *Optional break-in period.* Manufacturers may optionally specify a ''break-in'' period, not to exceed 20 hours, to operate the equipment under test prior to conducting the test method specified in this appendix. A manufacturer who elects to use an optional compressor break-in period in its certification testing should record this period's duration as part of the information in the supplemental testing instructions under 10 CFR 429.43.

4. *Refrigerant line length corrections.* For test setups where it is physically impossible for the laboratory to use the required line length listed in Table 3 of the ANSI/AHRI 1230–2010, then the actual refrigerant line length used by the laboratory may exceed the required length and the following cooling capacity correction factors are applied:

| Piping length beyond minimum, X (ft) | Piping length beyond minimum, Y (m) | Cooling capacity correction (%) |
|---|---|---|
| 0 > X ≤ 20 | 0 > Y ≤ 6.1 | 1 |
| 20 > X ≤ 40 | 6.1 > Y ≤12.2 | 2 |
| 40 > X ≤ 60 | 12.2 > Y ≤ 18.3 | 3 |
| 60 > X ≤ 80 | 18.3 > Y ≤ 24.4 | 4 |
| 80 > X ≤ 100 | 24.4 > Y ≤ 30.5 | 5 |
| 100 > X ≤ 120 | 30.5 > Y ≤ 36.6 | 6 |

5. *Additional provisions for equipment set-up.* The only additional specifications that may be used in setting up the basic model for test are those set forth in the installation and operation manual shipped with the unit. Each unit should be set up for test in accordance with the manufacturer installation and operation manuals. Sections 5.1 through 5.3 of this appendix provide specifications for addressing key information typically found in the installation and operation manuals.

5.1. If a manufacturer specifies a range of superheat, sub-cooling, and/or refrigerant pressure in its installation and operation manual for a given basic model, any value(s) within that range may be used to determine refrigerant charge or mass of refrigerant, unless the manufacturer clearly specifies a rating value in its installation and operation manual, in which case the specified rating value must be used.

5.2. The airflow rate used for testing must be that set forth in the installation and operation manuals being shipped to the commercial customer with the basic model and clearly identified as that used to generate the DOE performance ratings. If a rated airflow value for testing is not clearly identified, a value of 400 standard cubic feet per minute (scfm) per ton must be used.

5.3. The test set-up and the fixed compressor speeds (*i.e.,* the maximum, minimum, and any intermediate speeds used for testing) should be recorded and maintained as part of the test data underlying the certified ratings that is required to be maintained under 10 CFR 429.71.

6. *Manufacturer involvement in assessment or enforcement testing.* A manufacturer's representative will be allowed to witness assessment and/or enforcement testing for variable refrigerant flow multi-split air conditioners and heat pumps. The manufacturer's representative will be allowed to inspect and discuss set-up only with a DOE representative. During testing, the manufacturer's representative may adjust only the modulating components that are necessary to achieve steady-state operation in the presence of a DOE representative. Only previously documented specifications for set-up as specified under sections 4 and 5 of this appendix will be used.

■ 15. Add appendix D1 to subpart F of part 431 to read as follows:

## Appendix D1 to Subpart F of Part 431—Uniform Test Method for Measuring the Energy Consumption of Variable Refrigerant Flow Multi-Split Air Conditioners and Heat Pumps (Other Than Air-Cooled With Rated Cooling Capacity Less Than 65,000 BTU/H)

**Note:** Manufacturers must use the results of testing under this appendix to determine compliance with any amended standards for variable refrigerant flow multi-split air conditioners and heat pumps provided in § 431.97 that are published after January 1, 2021, and that rely on integrated energy efficiency ratio (IEER). Representations related to energy consumption must be made in accordance with the appropriate appendix that applies (*i.e.,* appendix D or appendix D1) when determining compliance with the relevant standard.

1. *Incorporation by Reference.*

DOE incorporated by reference in § 431.95, the entire standard for AHRI Standard 1230–2021, and ANSI/ASHRAE Standard 37–2009. However, only enumerated provisions of these documents apply to this appendix, as set forth in paragraphs (1) and (2) of this section. To the extent there is a conflict, the language of the test procedure in this appendix takes precedence over the referenced test standards.

(1) AHRI 1230–2021:

(i) Section 3—Definitions, except section 3.10, is applicable as specified in section 2.1.1 of this appendix,

(ii) Section 5—Test Requirements, except section 5.1.2, is applicable as specified in section 2.1.2 of this appendix,

(iii) Section 6—Rating Requirements, except sections 6.3.3 and 6.5, is applicable as specified in section 2.1.3 of this appendix,

(iv) Section 11—Calculations is applicable as specified in section 2.1.4 of this appendix,

(v) Section 12—Symbols, Subscripts and Superscripts is applicable as specified in section 2.1.5 of this appendix,

(vi) Appendix E—ANSI/ASHRAE Standard 37–2009 Clarifications/Exceptions—Normative is applicable as specified in section 2.1.6 of this appendix,

(2) ANSI/ASHRAE 37–2009 (including Errata Sheet issued October 3, 2016):

(i) Section 1—Purpose is inapplicable as specified in section 2.2.1 of this appendix,

(ii) Section 2—Scope is inapplicable as specified in section 2.2.2 of this appendix, and

(iii) Section 4—Classification is inapplicable as specified in section 2.2.3 of this appendix.

(2) *General.* Determine IEER and coefficient of performance (COP) (as applicable) in accordance with AHRI 1230–2021 and ANSI/ASHRAE 37–2009 (including Errata Sheet issued on October 3, 2016; however, only the following enumerated provisions of those documents apply.

2.1. *Applicable Sections of AHRI 1230–2021*

2.1.1. Section 3—Definitions (Except Section 3.10—Definition of *Critical Parameter(s)*),

2.1.2. Section 5—Test Requirements (Except Sections 5.1.2.1, 5.1.2.2, and 5.1.2.3—Control Settings),

2.1.3. Section 6—Rating Requirements (Except Section 6.3.3—Allowable Critical Parameter Adjustments and Section 6.5—Simultaneous Cooling and Heating Efficiency and Capacity Ratings),

2.1.4. Section 11—Calculations,

2.1.5. Section 12—Symbols, Subscripts and Superscripts,

2.1.6. Appendix E—ANSI/ASHRAE 37–2009 Clarifications/Exceptions—Normative

*Note:* The controls verification procedure specified in Appendix C of AHRI 1230–2021 is referenced as part of DOE's certification provisions at § 429.43(b) and product-specific enforcement provisions located at § 429.134(s)(3).

2.2. Excepted sections of ANSI/ASHRAE 37–2009 (including Errata Sheet issued October 3, 2016)

2.2.1. Section 1—Purpose

2.2.2. Section 2—Scope

2.2.3. Section 4—Classifications

Sections 3 through 5 of this appendix provide additional instructions for determining IEER and COP. In cases where there is a conflict, the language of this appendix takes highest precedence, followed by AHRI 1230–2021, followed by ANSI/ASHRAE 37–2009 (including Errata Sheet issued October 3, 2016).

3. *Definitions*

3.1. *Critical Parameter(s)* are the following settings of modulating components of variable refrigerant flow multi-split air conditioners and heat pumps: compressor speed(s), outdoor fan speed(s) and outdoor variable valve position(s).

4. *Test Conditions*

4.1 *Test Conditions for air-cooled VRF multi-split systems with rated cooling capacity greater than 65,000 Btu/h.* When testing to certify to the energy conservation standards in § 431.97, test using the ''Standard Rating Conditions, Cooling'' and ''Standard Rating Part-Load Conditions (IEER)'' conditions for cooling mode tests and ''Standard Rating Conditions (High Temperature Steady-state Test for Heating)'' conditions for heat pump heating mode tests, as specified in Table 9 of AHRI 1230–2021.

4.1.1 Representations of COP for air-cooled VRF multi-split systems with rated cooling capacity greater than 65,000 Btu/h made using the ''Low Temperature Operation, Heating'' condition specified in Table 9 of AHRI 1230–2021 are optional.

4.2 *Test Conditions for water-source VRF multi-split systems.* When testing to certify to the energy conservation standards in § 431.97, test using the ''Part-load Conditions (IEER)'' conditions specified for ''Water Loop Heat Pumps'' in Table 10 of AHRI 1230–2021 for cooling mode tests and the ''Standard Rating Test'' conditions specified for ''Water Loop Heat Pumps'' in Table 11 of AHRI 1230–2021 for heat pump heating mode tests.

4.2.1 For water-source VRF multi-split systems, representations of EER made using the ''Standard Rating Test'' conditions specified for ''Ground-loop Heat pumps'' in Table 10 of AHRI 1230–2021 and representations of COP made using the ''Standard Rating Test'' conditions specified for ''Ground-loop Heat Pumps'' in Table 11 of AHRI 1230–2021 are optional.

5. *Test Procedure*

5.1 *Control Settings.* Control settings must be set in accordance with sections 5.1.3, 5.1.4, 5.1.5, and 5.2 of AHRI 1230–2021. For units equipped with head pressure controls, the head pressure controls must be set per manufacturer installation instructions or per factory settings if no instructions are provided. Indoor airflow-control settings must be set in accordance with Section 6.3.1 of AHRI 1230–2021. At each load point, critical parameters must be set to the values certified in the STI. In cases where a certified 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 5.2 of this appendix).

5.2 *Allowable Critical Parameter Adjustments for IEER cooling tests.* The following sections describe allowable adjustments to critical parameters after the initial system setup (during which all control settings, including certified critical parameters, are set). Adjust critical parameters in order to achieve full- and part-load cooling capacity targets and SHR limits.

5.2.1 *Critical Parameter Adjustments for Meeting Cooling Capacity Targets.* Once critical parameters have been set to the values certified in the STI, 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%, or 25% load) or within 3% of the certified cooling capacity for a 100% full-load cooling test), manually-controlled critical parameters must be adjusted according to the following provisions:

5.2.1.1. *Cooling Capacity is Below Lower Tolerance.* If, for any test, the cooling capacity operates below the lower tolerance for the target cooling capacity, increase the compressor speed(s) beyond the STI-certified value(s) until the cooling capacity operates within 3% of the target cooling capacity. If multiple compressors are present in the system, increase compressor speed by the same absolute increment in RPM or Hz for each compressor for which the following conditions apply:

(1) The STI specifies a non-zero compressor speed for the compressor for that test and

(2) The compressor has not yet reached its maximum capable operating speed. The compressor speed(s) must not be less than the STI-certified value(s) at any point during the test. Upward adjustments to compressor speed are not constrained by a budget on RSS Points Total (See section 5.2.1.2.1 of this appendix).

5.2.1.2 *Cooling Capacity is Above Upper Tolerance.* If, for any test, the cooling capacity operates above the upper tolerance for the target cooling capacity, adjust any manually-controlled critical parameters per the STI. If the STI does not include a hierarchy of instructions for adjustment of critical parameters to reduce cooling capacity during IEER cooling tests, then reduce only the compressor speed(s) to reduce cooling capacity. If multiple compressors are present in the system, decrease compressor speed by the same absolute increment for each compressor for which the following conditions apply:

(1) The STI specifies a non-zero compressor speed for the compressor for that test and

(2) The compressor has not yet reached minimum speed. Continue reducing cooling capacity in this manner until one of the following occurs:

(i) The unit operates within 3% of the target cooling capacity; or

(ii) The RSS point total reaches a budget of 70 points (See section 5.2.1.2.1 of this appendix). For the 75%, 50% and 25% part-load cooling test points, if the RSS point total reaches 70 during critical parameter adjustments before the capacity operates within 3% of the target cooling capacity, stop adjustment and follow cyclic degradation procedures in accordance with Section 11.2.2.1 of AHRI 1230–2021.

5.2.1.2.1 *Measuring Critical Parameter Variation During Adjustment Period.* When adjusting critical parameters to reduce cooling capacity, critical parameter variation must be calculated each time the critical parameters are adjusted, using the following equations:

First, use equation 5.2–1 to calculate the absolute parameter percent difference ($PPD_i$) between each adjusted critical parameter and the value for that parameter certified in the supplemental testing instructions provided by the manufacturer pursuant to § 429.43(b)(4) of this chapter (STI).

Equation 5.2-1

$$PPD_i = \left| \frac{CP_{i,Adj} - CP_{i,STI}}{CP_{Max}} \right| \times 100$$

Where:

''i'' identifies the critical parameter—either compressors speed(s), outdoor fan speed(s), or outdoor variable valve position(s)

$CP_{i,Adj}$ = The adjusted position of critical parameter ''i'', recorded at each measurement interval. If multiple components corresponding to a single parameter are present (*e.g.,* multiple compressors), calculate the average position across all components corresponding to that parameter at each

measurement interval when determining $CP_{i,adj}$ .

$CP_{i,STI}$ = The position of critical parameter ''i'' as certified in the STI. If multiple components corresponding to a single parameter are present, calculate the average position across all components corresponding to that parameter at each measurement interval when determining $CP_{i,STI}$ .

$CP_{Max}$ = The maximum operating position for Critical Parameter ''i'', as certified in the STI for the 100% load condition. If multiple components corresponding to a single parameter are present, calculate as the average value across all components corresponding to that critical parameter certified in the STI for the 100% load condition.

Next, use equation 5.2–2 to determine the accrued points for each critical parameter:

Equation 5.2-2 $$Points_i = PPD_i \times NPV_i$$

Where:

''i'' identifies the critical parameter—either compressors speed(s), outdoor fan speed(s), or outdoor variable valve position(s)

*NPVi* = the nominal point value for critical parameter ''i'', as follows:

TABLE 5.1—CRITICAL PARAMETER NOMINAL POINT VALUES

| Critical parameter | Nominal point value |
|---|---|
| Compressor Speed(s) ..... | 13 |
| Outdoor Fan Speed(s) ..... | 7 |
| Outdoor Variable Valve position(s) ..... | 1 |

Finally, use equation 5.2–3 to calculate the root-sum-squared (RSS) Points Total across all critical parameters.

Equation 5.2-3 $$RSS\ Points = \sqrt{(Points_{Compressors})^2 + (Points_{Fans})^2 + (Points_{Valves})^2}$$

5.2.2 *Critical Parameter Adjustments for Meeting SHR Limits.* The SHR for the 100% load test point and the 75% part-load test point must not be higher than 0.82 and 0.85, respectively (measured to the nearest hundredth). If the SHR is above the allowable limit, increase the compressor speed(s) until either the SHR is less than or equal to the allowable limit or the cooling capacity reaches 3% greater than the target cooling capacity for that test, whichever happens first. If multiple compressors are present in the system, increase compressor speed by the same absolute increment for each compressor for which the following conditions apply:

(1) The STI specifies a non-zero compressor speed for the compressor for that test and

(2) The compressor has not yet reached maximum speed. Upwards adjustments to compressor speed are not constrained by a budget on RSS Points Total. Should the SHR remain above the maximum limit when the cooling capacity reaches its upper 3% tolerance, no further compressor adjustments must be made, and the calculation procedures specified in Section 11.2.2.2 of AHRI 1230–2021 must be applied using the adjusted SHR value obtained after increasing the compressor speed(s).

6. *Set-Up and Test Provisions for Specific Components.* When testing a VRF multi-split system that includes any of the specific components listed in Table 6.1, test in accordance with the set-up and test provisions specified in Table 6.1.

TABLE 6.1—TEST PROVISIONS FOR SPECIFIC COMPONENTS

| Component | Description | Test provisions |
|---|---|---|
| Desiccant Dehumidification Components. | An assembly that reduces the moisture content of the supply air through moisture transfer with solid or liquid desiccants. | Disable desiccant dehumidification components for testing. |
| Air Economizers ..... | An automatic system that enables a cooling system to supply outdoor air to reduce or eliminate the need for mechanical cooling during mid or cold weather. | For any air economizer that is factory-installed, place the economizer in the 100% return position and close and seal the outside air dampers for testing. For any modular air economizer shipped with the unit but not factory-installed, do not install the economizer for testing. |
| Fresh Air Dampers ..... | An assembly with dampers and means to set the damper position in a closed and one open position to allow air to be drawn into the equipment when the indoor fan is operating. | For any fresh air dampers that are factory-installed, close and seal the dampers for testing. For any modular fresh air dampers shipped with the unit but not factory-installed, do not install the dampers for testing. |
| Hail Guards ..... | A grille or similar structure mounted to the outside of the unit covering the outdoor coil to protect the coil from hail, flying debris and damage from large objects. | Remove hail guards for testing. |
| Low Ambient Cooling Dampers. | An assembly with dampers and means to set the dampers in a position to recirculate the warmer condenser discharge air to allow for reliable operation at low outdoor ambient conditions. | Remove low ambient cooling dampers for testing. |
| Power Correction Capacitors | A capacitor that increases the power factor measured at the line connection to the equipment. These devices are a requirement of the power distribution system supplying the unit. | Remove power correction capacitors for testing. |

TABLE 6.1—TEST PROVISIONS FOR SPECIFIC COMPONENTS—Continued

| Component | Description | Test provisions |
|---|---|---|
| Ventilation Energy Recovery Systems (VERS). | An assembly that preconditions outdoor air entering the equipment through direct or indirect thermal and/or moisture exchange with the exhaust air, which is defined as the building air being exhausted to the outside from the equipment. | For any VERS that is factory-installed, place the VERS in the 100% return position and close and seal the outside air dampers and exhaust air dampers for testing, and do not energize any VERS subcomponents (*e.g.,* energy recovery wheel motors). For any VERS module shipped with the unit but not factory-installed, do not install the VERS for testing. |

[FR Doc. 2021–26288 Filed 12–9–21; 8:45 am]

**BILLING CODE 6450–01–P**