DEPARTMENT OF ENERGY

10 CFR Part 430

[Docket No. EE–RM/TP–02–002]

RIN 1904–AB55

Energy Conservation Program for Consumer Products: Test Procedure for Residential Central Air Conditioners and Heat Pumps

AGENCY: Department of Energy.

ACTION: Final rule.

SUMMARY: The Department of Energy (DOE) is amending its test procedure for residential central air conditioners and heat pumps. This final rule implements test procedure changes for small-duct, high-velocity systems, two-capacity units, and updates references to the current American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) standards. Today's rule also clarifies issues associated with sampling tested systems and rating untested split-system combinations.

DATES: This rule is effective April 21, 2008. Incorporation by reference of certain publications in the final rule is approved by the Director of the Federal Register as of April 21, 2008.

ADDRESSES: You may review copies of all materials related to this rulemaking at the U.S. Department of Energy, Forrestal Building, Room 1J–018 (Resource Room of the Building Technologies Program), 1000 Independence Avenue, SW., Washington, DC, (202) 586–9127, between 9 a.m. and 4 p.m., Monday through Friday, except Federal holidays. Please call Ms. Brenda Edwards-Jones at the above telephone number for additional information regarding visiting the Resource Room. *Please note:* DOE's Freedom of Information Reading Room (formerly Room 1E–190 at the Forrestal Building) is no longer housing rulemaking materials.

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SUPPLEMENTARY INFORMATION:

I. Introduction

A. Authority

Part B of Title III of the Energy Policy and Conservation Act (EPCA) established the Energy Conservation Program for Consumer Products Other Than Automobiles (Program). (42 U.S.C. 6291 *et seq.*) The products currently subject to this Program (covered products) include central air conditioners and heat pumps, the subject of today's final rule.

Under EPCA, the Program consists of three parts: Testing, labeling, and the Federal energy conservation standards. DOE, in consultation with the National Institute of Standards and Technology (NIST), is authorized to establish or amend test procedures as appropriate for each of the covered products. (42 U.S.C. 6293) The purpose of these test procedures is to measure energy efficiency, energy use, or estimated annual operating cost of a covered product during a representative, average use cycle or period of use. The test procedure must not be unduly burdensome to conduct. (42 U.S.C. 6293(b)(3))

If a test procedure is amended, DOE is required to determine to what extent, if any, the proposed new test procedure would alter the measured energy efficiency of any covered product as determined under the existing test procedure. (42 U.S.C. 6293(e)(1)) If DOE determines that an amended test procedure would alter the measured energy efficiency of a covered product, DOE is required to amend the applicable energy conservation standard with respect to such test procedure. In determining any such amended energy conservation standard, DOE is required to measure the energy efficiency or energy use of a representative sample of covered products that minimally comply with the existing standard. The average efficiency or energy use of this representative sample, tested using the amended test procedure, constitutes the amended standard. (42 U.S.C. 6293(e)(2)) DOE has determined that today's amended test procedure does not alter the measured efficiency or measured energy use of minimally compliant central air conditioners and heat pumps.

Beginning 180 days after a test procedure for a covered product is prescribed, no manufacturer, distributor, retailer, or private labeler may make representations with respect to the energy use, efficiency, or cost of energy consumed by such product, except as reflected in tests conducted according to the DOE procedure. (42 U.S.C. 6293(c)(2)) Any manufacturer, distributor, retailer, or private labeler may petition the Secretary of Energy for an extension of not more than 180 days to test and make representations in accordance with the amended DOE test procedure. (42 U.S.C. 6293(c)(3)) In addition, all existing waivers concerning residential multi-split

systems terminate on the effective date of today's final rule.

B. Background

A final rule published on October 11, 2005, updated and completely re-organized the DOE residential central air conditioner and heat pump test procedure. 70 FR 59122. During this prior rulemaking, a few issues were identified too late in the process to allow them due consideration. DOE investigated these issues and considered additional topics that could further improve the testing and rating process. As a result of these efforts, DOE issued a Notice of Proposed Rulemaking on July 20, 2006 (hereafter referred to as the July 2006 proposed rule). 71 FR 41320. Although the majority of the proposed changes pertained to the test procedure set forth in appendix M to subpart B of Title 10, Code of Federal Regulations, Part 430 (10 CFR part 430), DOE also proposed revisions to sections of subparts B and F of 10 CFR part 430 that concern the sampling of tested units and the ratings of untested split-system combinations. 10 CFR 430.24 and 430.62. DOE held a public meeting on the July 2006 proposed rule on August 23, 2006.

On October 10, 2006, DOE published a **Federal Register** notice correcting two inadvertent omissions in the July 2006 proposed rule. 71 FR 59410. These omissions contained the regulatory language governing the criterion for using an air volume rate that is less than the manufacturer's specified value: One case covered air conditioners and heat pumps, the other case covered heating-only heat pumps. This change was described in the preamble of the July 2006 proposed rule, but was not included in the regulatory language. In addition to publishing the corrected regulatory language in the **Federal Register**, the omitted regulatory language was distributed at the August 23, 2006, public meeting.

C. Summary of the Test Procedure Revisions

The revisions adopted in today's final rule include the following changes to appendix M of Subpart B of 10 CFR part 430: (1) Adding new testing requirements for small-duct, high-velocity systems; (2) reinstating the optional testing to determine the cyclic-degradation coefficient (C_D) of a two-capacity unit when cycling on and off at high capacity; (3) shortening the maximum duration of the Frost Accumulation Tests; (4) allowing the use of default equations to approximate the capacity and power of a two-capacity unit when operating at low-capacity/stage and at an outdoor temperature of 35 degrees Fahrenheit (°F); (5) implementing modifications and additions that specifically address elements unique to testing and rating modulating multi-split systems; (6) allowing indoor capacities used in calculating Seasonal Energy Efficiency Ratio (SEER) and Heating Seasonal Performance Factor (HSPF) to be corrected for duct losses; (7) defining the term ''standard air;'' (8) changing the outdoor temperature conditions used for one of the low-capacity, steady-state, cooling mode tests on a two-capacity unit; (9) renaming ''Cooling and Heating Certified Air Volume Rates'' to ''Full-Load Air Volume Rates;'' (10) modifying the criterion for using an air volume rate less than the manufacturer's specified value; (11) updating the references to current versions of the Air-Conditioning and Refrigeration Institute (ARI) and ASHRAE standards; (12) adding language to better explain the SEER and HSPF calculation steps for variable-speed equipment; and (13) adding text to clarify the provision to use the default value of the cyclic-degradation coefficient if it is lower than the tested value.

Today's final rule also amends sections 430.2, 430.24 and 430.62 of 10 CFR part 430, as follows: (1) It expands the options for meeting the data submission requirements when verifying an alternative rating method (ARM); (2) it clarifies the sample population to be used to validate the rated SEER and rated HSPF of a heat pump; (3) it clarifies the definition of a ''highest-sales-volume combination'' (HSVC); (4) it clarifies DOE's role in verifying ratings for untested split system combinations; (5) it clarifies how to apply the ARM to obtain published ratings for untested, split-system combinations; (6) it adds the requirement that ratings for an air conditioner or heat pump tested with a furnace or similar ducted air mover include the model number of the air mover as part of the overall equipment model number; (7) it clarifies the responsibilities of private labelers; (8) it adds the statutory definition of ''private labeler;'' and (9) it adds definitions for terms, including ''indoor unit'', ''outdoor unit'', and ''ARM/simulation adjustment factor.''

II. Discussion of Comments

In addition to the comments received at the August 23, 2006, public meeting, DOE received written comments to the July, 2006 proposed rule from ARI, Nordyne, Mitsubishi, Fujitsu General Limited (Fujitsu), Carrier Corporation (Carrier), the American Council for an Energy-Efficient Economy (ACEEE), Sanyo Fisher Service Corporation (Sanyo), Lennox International (Lennox), and the China WTO/TBT National Notification and Enquiry Center (China). The comments and the DOE response to them are discussed below. References to section numbers within this document refer to the section numbers of Appendix M to Subpart B of 10 CFR part 430–Uniform Test Method for Measuring the Energy Consumption of Central Air Conditioners and Heat Pumps (Appendix M).

A. Frost Accumulation Test Duration

DOE proposed shortening the maximum test interval of a Frost Accumulation Test from 12 hours to 6 hours when testing a two-capacity heat pump at low capacity. ARI supported DOE's proposal to lessen the test burden, but recommended that the maximum duration be further shortened to 3 hours. (ARI, No. 21 at p. 2)[1] ARI stated that ''preliminary testing done by manufacturers shows a variation in HSPF of less than one tenth [2] when the test is reduced from 12 to 3 hours.'' (ARI, *Id.*) In a follow-up communication, ARI clarified that its 3-hour recommendation applies to all Frost Accumulation Tests, not just the test at low-capacity. (ARI, No. 25 at p. 2) ARI provided a table showing the percentage of the total interval allocated to defrosting for cycles lasting 6, 7, 8, 9, and 10 minutes; percentages were calculated for complete (frost + defrost) intervals ranging from 1 hour to 12 hours. As an example, for tests lasting 12, 6, and 3 hours, the percentages of time spent defrosting are 1.1, 2.2, and 4.4 percent, respectively, if the defrost lasts 8 minutes in all cases. (ARI, No. 25 at p. 3) In addition to recommending that any change be applied to all Frost Accumulation Tests, Nordyne and Carrier recommended manufacturers be given the option of using either the procedure specified in ASHRAE Standard 37 (which uses a maximum test interval of 3 hours) or the algorithm specified in the DOE test procedure. (Nordyne, No. 19 at p. 2; Carrier, No. 17

[1] A notation in the form ''ARI, No.21 at p. 2'' identifies a written comment the Department has received and has included in the docket of this rulemaking. This particular notation refers to a comment (1) by the Air-Conditioning and Refrigeration Institute (ARI), (2) in document number 21 in the docket of this rulemaking (maintained in the Resource Room of the Building Technologies Program), and (3) appearing on page 2 of document number 21. Likewise, ''Public Hearing Tr., p. 178,'' for example, would refer to page 178 of the transcript of the ''Public Meeting on Test Procedures for Central Air Conditioners'' held in Washington, DC, August 23, 2006.

[2] This means an absolute variation in HSPF of 0.1, such as between 8.1 and 8.2.

at p. 2) In summary, the stakeholders recommended applying changes to all Frost Accumulation Tests (not just to the one low-capacity test, as proposed), reducing the maximum duration to 3 hours instead of 6 hours, and adding an alternative test method.

DOE believes that if all three changes were adopted, the HSPF ratings of heat pumps would be changed, since the ASHRAE Standard 37 ''T'' Test Procedure may terminate after 0, 1, 2, or 3 complete cycles whereas the DOE Frost Accumulation Test is either 0 or 1 complete cycle. The different cycles in the ASHRAE and DOE test methods can yield different average heating capacity and power consumption results at the DOE-specified 35 °F dry-bulb/33 °F wet-bulb outdoor test conditions which would affect the HSPF rating. As for shortening the maximum test time to 3 hours, such a change may benefit heat pumps (i.e., give a higher average heating capacity) that initiate a defrost of the outdoor coils between 3 and 6 hours after the start of the test. In such cases, the heat pump's average heating capacity will not account for the energy used for defrosting. By not accounting for the defrost energy, the shorter test time would overstate the heating capacity and HSPF. Thus, DOE will not reduce the maximum test duration by the additional 3 hours or add the ASHRAE Standard 37 procedure as an alternate test method as part of this final rule.

DOE agrees with comments recommending the same maximum limit for all Frost Accumulation Tests. The low-capacity Frost Accumulation Test is projected to be the most likely of the 35 °F tests to approach the proposed 6-hour limit, followed by the required Frost Accumulation Test at the intermediate speed when testing a variable-speed heat pump. All other Frost Accumulation Tests are more likely to build frost and are likely to result in the unit defrosting in less time than it would at the intermediate speed. Thus, triggering the 6-hour limit is less likely when applied to these other cases. Finally, DOE concludes that 6 hours offers a sufficiently long duration for evaluating performance in all cases. As noted in the July 2006 proposed rule, if a heat pump has not defrosted in 6 hours, it is either not building frost or is completely frosted and probably has been so for more than half of the interval. In both cases, the benefits from continuing to run the test past 6 hours are minimal. Therefore, DOE reduces the maximum duration of all Frost Accumulation Tests from 12 hours to 6 hours. This change appears in section 3.9 of Appendix M.

B. Multiple-Split Systems

DOE received comments on issues related to the testing and rating of multiple-split air-conditioning systems (multi-split systems), including: (1) Rating multi-split systems based on SEER (if they compete primarily with ducted central air conditioners), or rating them based on EER (if they compete with room air conditioners) (SEER or EER); (2) adopting a separate test procedure for multi-split systems, such as Draft ARI Standard 1230 (ARI 1230); (3) allowing one or more indoor coils to turn off during any test, if representative of normal operation (Coils active during test); (4) allowing the manufacturer to specify the compressor speed used during the minimum-speed, intermediate-speed and maximum-speed tests (Compressor speed); (5) extending multi-split system test procedure changes to one-to-one ducted systems (One-to-one applicability); and (6) adding the term ''tested combination'' within 10 CFR 430.2 for determining the combination of indoor units to be tested when testing a multi-split outdoor unit, and the appropriate rating of the tested combination (Tested combination).

SEER or EER. DOE received several comments on whether multi-split systems compete primarily with ducted residential central air conditioners and heat pumps and as such, should be rated based on SEER and HSPF, or if they compete with room air conditioners and should be rated in terms of EER and COP. Trane argues that residential size multi-split systems compete for the same markets as ducted residential central systems: both serve multiple rooms, one ducts air whereas the second ''ducts'' refrigerant. (Public Hearing Tr., p. 178) Carrier and ACEEE support rating conventional central air conditioners and heat pumps and multi-split systems using the same descriptors. (Carrier, No. 17 at p. 1 and ACEEE, No. 16 at p. 3) According to Mitsubishi, ''ductless split-systems, including ductless multi-split systems, are used for room or spot cooling applications while the rest of the USE [unitary small equipment] equipment (i.e., central systems) is applied in a ducted environment for multiple rooms or whole houses.'' (Mitsubishi, No. 20 at p. 3) DOE believes residential-size multi-split systems compete with ducted central systems and that the consumer will be best served if multi-split systems can be compared with central air conditioners and central air-conditioning heat pumps. Therefore, DOE concludes that SEER and HSPF are better descriptors than EER and COP.

ARI 1230. ARI, Sanyo, Fujitsu, Mitsubishi, and Daikin AC (Americas), Inc. (Daikin) urged DOE to adopt Draft ARI Standard 1230, ''Performance Rating of Multi-Split Air-Conditioning and Heat Pump Equipment'' in lieu of the proposed rule. (ARI, No. 21 at p. 3; Sanyo, No. 15 at pp. 2–3; Fujitsu, No. 13 at p. 3; Mitsubishi, No. 20 at pp. 4–5; Public Hearing Tr., pp. 153–154) China recommends that DOE not cover multi-split systems within the residential central air conditioner and heat pump test procedure until all the technical issues have been resolved. (China, No. 14 at p. 1) Copeland recommends that DOE review and consider the approaches being taken by China and the European Union on how to test and rate multi-split systems. (Public Hearing Tr., p. 64) Nordyne supports the changes proposed in the July 2006 proposed rule to cover multi-split systems as an interim solution, but states that further study is needed for a long term solution. (Nordyne, No. 19 at p. 2) Lennox, on the other hand, believes that multi-split systems should be rated using the current test procedure for central air conditioners and central air conditioning heat pumps. (Lennox, No. 22 at p. 2) Sanyo and Fujitsu point out that the test procedure does not address units that can simultaneously cool and heat; the test procedure does not specify how many indoor units are turned off during a given test; and doubts whether the current DOE tests for variable-speed systems can approximate the unit's ''performance map.'' [3] (Sanyo, No. 15 at pp. 2–3; Fujitsu, No. 13 at pp. 2–3; Public Hearing Tr., pp. 94–95, 110)

DOE is not convinced that residential-size multi-split systems require a separate test procedure from the current test procedure found in Appendix M. While it is true that the current test procedure fails to account for the energy savings derived from a simultaneous cooling and heating mode, the current test procedure is adaptable and DOE believes the tests for variable-speed systems in Appendix M offer a reasonable starting point for producing energy efficiency and energy use estimates. Once data become available that provides insight as to the energy use and efficiency benefits of simultaneous cooling and heating, and alternative or additional tests to estimate these benefits are formulated, DOE will then consider further

[3] Performance map refers to a plot that shows the effect of compressor speed, number of indoor unit turned on versus off, and outdoor temperature conditions on the unit's space conditioning capacity and power consumption.

amendments to the test procedure. Accordingly, DOE is not adopting a new test procedure and energy efficiency and energy use ratings will continue to be based on the test procedure found in Appendix M.

Regarding the stakeholder recommendation to adopt draft ARI Standard 1230, the current draft (as distributed in June 2007), is less complete for residential multi-split systems than the DOE test procedure in today's final rule. For example, ARI Standard 1230 (June 2007 draft) lacks information on how to conduct intermediate speed tests, whether any indoor units are to be turned off for part-load tests, how to interpolate EER and COP in the intermediate speed range, and generally how to calculate SEER and HSPF. Furthermore, ARI has not finalized ARI Standard 1230 and, as such it cannot be incorporated by reference since it could be amended prior to being adopted in final form. Therefore, for the reasons discussed above, DOE is not adopting ARI Standard 1230 (June 2007 draft) in today's final rule.

As for considering changes that are modeled on the approaches taken in China and the European Union, DOE sees their potential use as limited given the current EPCA requirement to calculate annual measures of energy consumption. The European Union HVAC trade association, Eurovent, lists ratings for residential-size multi-splits that are based on full load EER and COP and their European SEER (ESEER) is thus far limited to liquid chilling packages, not unitary air conditioners (i.e., residential central air conditioners and central air conditioning heat pumps). The ESEER is actually a variation of ARI Standard 340/360's IPLV, which is used to quantify the part-load performance of larger, non-residential systems. An IPLV equivalent is also used in China. Neither international resource explicitly addresses the number of indoor units to be turned off during a given part-load test; such information would be necessary in order to get an accurate measure of equipment efficiency for comparison purposes.

Coils active during test. Concerning the issue of whether one or more indoor units should be turned off during any given test, Daikin commented that you cannot rely on the unit's controls to make the decision when operated in a laboratory environment. (Public Hearing Tr., p. 62) Given this, DOE offered, at the public meeting, an algorithm for specifying the number of indoor units that are turned on for a given test. This algorithm is shown in Table 1, below. To evaluate the effect of such an algorithm, Fujitsu conducted simulations in which it modeled the performance of a unit if operated at the DOE test procedure cooling mode conditions. Fujitsu considered cases where the number of indoor units turned on for the two minimum speed and one intermediate speed tests changed. Fujitsu reported results for three cases: the first case, all four indoor units are on for all tests; the second case, three indoor units are on for the intermediate speed test and two indoor units are on for the minimum speed tests; and the third case, two indoor units are on for the intermediate-speed test and one indoor unit is on for the minimum speed tests. (Fujitsu, No. 13 at pp. 1–2) Using the simulated data, Fujitsu reported that the first case yields the highest SEER. In comparison, Fujitsu reported that the SEER drops by 4.7 percent for the second case and by 11.6 percent for the third case. Fujitsu concluded that the number of operating indoor units may have a great impact on the result, and that the operating ranges in Table 1 were not appropriate.

TABLE 1.—APPROACH TO REGULATING THE NUMBER OF ACTIVE INDOOR UNITS

(Example Case of a Multi-Split System Having 4 Identical Indoor Units)

Percentage output relative to full load capacity	Number of operating indoor units
75% to 100%	4
50% to 75%	3
25% to 50%	2
0% to 25%	1

(DOE, No. 12.3 at p. 12)

DOE recognizes that when field installed, a multi-split system will often operate with one or more of its indoor units turned off. In an effort to have the DOE test procedure capture this part-load operating mechanism, today's final rule requires that at least one indoor unit must be turned off for tests conducted at minimum compressor speed. In addition, the manufacturer may elect to have one or more indoor units turned off for tests conducted at the intermediate compressor speed. In all cases, the manufacturer specifies the particular indoor unit(s) that is turned off.

Compressor speed. ARI, Sanyo, Fujitsu, and Mitsubishi opposed DOE's proposed definition of maximum compressor speed. (ARI, No. 21 at p. 2; Sanyo, No. 15 at p. 2; Fujitsu, No. 13 at p. 2; Mitsubishi, No. 20 at p. 4) They recommended using the rated capacity or nominal rated speed because performance at that compressor speed is used in sizing and selling the product. ARI and Sanyo supported DOE's proposal to allow the manufacturer to specify the compressor speed used for the minimum-speed and intermediate-speed tests. (ARI, No. 21 at p. 2; Sanyo, No. 15 at p. 2) Sanyo and ARI, moreover, both believe that test laboratories must accept the task of providing test facilities that can maintain steady test room conditions and accurately measure capacity at very low loads. (ARI, No. 21 on pp. 2–3; Sanyo, No. 15 on p. 2)

Regarding the maximum and minimum compressor speed issue, DOE reviewed test procedure waivers processed in the 1980's, and the 1988 test procedure rulemaking that first added coverage for air conditioners and heat pumps having a variable-speed compressor. (53 FR 8304, March 14, 1988) None of these actions explicitly defined maximum and minimum compressor speed. Instead, the manufacturer was allowed to define these speeds for its particular units. The evolution to include maximum and minimum compressor speeds among those elements that are ''conducted in accordance with the manufacturer's instructions'' occurred because of the test laboratory's need for a mechanism to override the unit's normal controls, so that the compressor can be forced to operate at fixed speeds for the DOE-specified lab tests. As part of today's final rule, DOE considered adopting a specific definition for maximum speed and requiring additional lab verification tests, but has decided against it because there is no compelling technical argument for doing so. The current approach effectively allows the manufacturer to de-rate the unit's maximum capacity in order to raise its performance descriptor. As long as that de-rated capacity is used for sizing the particular multi-split combination, then the practice is acceptable. DOE, however, does not agree with substituting ''nominal'' or ''rated'' compressor speed for ''maximum'' compressor speed, as that will not allow for test results that can be used to generate a performance map representing how particular multi-split combinations will operate in the field.

The DOE test procedure will continue to require variable-speed systems to be tested at their minimum compressor speed. Manufacturers will be relied upon to provide the independent testing laboratory with a means for conducting tests at this speed. Minimum speed may not be the absolute minimum speed at which the compressor can operate, but

it is expected to be a speed below which the compressor would rarely operate. DOE concurs with Sanyo and ARI and expects test laboratories to measure performance over the wide modulation range that is characteristic of multi-splits. Thus, to the issue of what compressor speed to use when conducting minimum speed and maximum speed tests, DOE is maintaining the current test procedure language in sections 3.2.4 and 3.6.4 of Appendix M.

DOE adopts the July 2006 proposed change of allowing the manufacturer to specify the compressor speed used for the cooling and heating intermediate speed/capacity tests. This change provides the manufacturer an opportunity to select and verify the peak-efficiency of the unit being tested. Coupled with this change, and as also proposed in the July 2006 notice, steady-state efficiency (EER and COP) over the intermediate-speed range shall be calculated using piece-wise linear fits: a line connecting the minimum- and intermediate-speed balance points and a line connecting the intermediate- and maximum-speed balance points.

One-to-one applicability. Carrier noted the need for transparency in testing and manufacturer test results so that interested parties can verify the performance claims without having to consult the manufacturer. (Carrier, No. 17 at p. 2) Trane and ARI pointed out that any steps introduced to facilitate testing and rating modulating multi-split systems should also be allowed for modulating one-to-one ducted systems to promote comparability. (Public Hearing Tr., pp. 87 and 118; ARI, No. 21 at p. 3) With respect to Carrier's comment, variable-speed systems do not lend themselves to being tested by a third party who does not have the cooperation of the outdoor unit manufacturer. Third-party certification programs thus become especially important as they offer the primary pathway for independent verification. For those multi-split products that are not covered by a third-party certification program, DOE can request from the manufacturer the information needed to conduct such testing along with reviewing the lab test results maintained by the manufacturer, that substantiate the multi-split system's ratings. 10 CFR 430.62(d).

Of the changes being implemented today to allow testing and rating of residential modulating multi-split systems, two changes could be applied to variable-speed one-to-one units. Together, these two changes would allow the manufacturer to specify the compressor speed used for the intermediate-speed tests and then use linear fits for calculating COP and EER within the intermediate-speed operating range. Adopting these two changes for variable-speed one-to-one units would create a second compliance path that would likely cause different SEER and HSPF ratings than the current test procedure. Therefore, in adopting these changes, DOE is not extending them to variable-speed one-to-one units. Although DOE expects the current test procedure to yield the higher ratings for one-to-one units, it will rely on the waiver process if any manufacturer seeks to adopt these two multi-split test procedure changes for use in rating variable-speed one-to-one units.

Tested combination. On the issue of the ''tested combination''—the equipment configuration that can be tested in the laboratory and thereby provide a common basis for comparison—Sanyo, Fujitsu, Mitsubishi, and ARI recommended deleting the requirement that the selected indoor units ''represent the highest-sales-volume type models'' and replacing it with ''represent the highest sales model family.'' (Sanyo, No. 15 at p. 3; Fujitsu, No. 13 at p. 4; Mitsubishi, No. 20 at pp. 5 and 6; ARI, No. 21 at p. 6) In addition, Sanyo, Fujitsu, Mitsubishi, and ARI recommended that provisions be made in the event that five of the largest model indoor coils from the selected model family cannot provide a cumulative indoor capacity that is more than 95 percent of the outdoor unit's nominal capacity. As to references in the proposed definition that a manufacturer will know the capacity of each indoor unit and each outdoor unit, Copeland Corporation (Copeland) questioned how the manufacturer would determine component capacities. (Public Hearing Tr., pp. 217–221) Finally, with regard to the proposal that all of the tested indoor units ''have the same external static pressure,'' Trane asked how to interpret that requirement if testing a ducted multi-split system having indoor units that have different minimum external static pressure requirements. (Public Hearing Tr., p. 229)

DOE accepts the stakeholder recommendation of substituting the phrase ''represent the highest sales model family'' for the originally proposed wording, ''represent the highest sales volume type models,'' because it has essentially the same meaning, but is clearer. Although it is more an issue with commercial multi-split systems, DOE accepts the proposed wording to clarify the tested combination since it is more important to obtain a cumulative indoor capacity that matches the outdoor unit than it is to restrict selection to units from the highest sales model family, for cases where both criteria cannot be met. As for Copeland's statement that the definition includes references to the capacity of the outdoor unit and the cumulative capacities of the indoor units even though no prescriptions are given to evaluate these capacities, DOE agrees but nonetheless will allow their use in this particular definition. Manufacturers are able to estimate the rated capacities of the separate components without conducting the rigorous testing associated with ARI Standards 410 (''Forced-Circulation Air-Cooling and Air-Heating Coils'') and 540 (''Performance Rating of Positive Displacement Refrigerant Compressors and Compressor Units'') on each new model. Finally, the last element of the proposed definition of ''tested combination'' will be changed from ''all have the same external static pressure'' to ''all be subject to the same minimum external static pressure requirement (i.e., 0 inches of water column for non-ducted, see Table 2 in Appendix M for ducted indoor units) while being configurable to produce the same static pressure at the exit of each outlet plenum when manifolded as per section 2.4.1 of Appendix M.'' This additional information is provided so that the test laboratory may conduct the lab testing by manifolding the outlets of all the indoor units together and using one airflow measuring apparatus to determine the cumulative air volume rate.

At the August 23, 2006, public meeting, DOE restated its proposed interim solution for assigning SEER and HSPF ratings for untested multi-split combinations. This interim solution—to assign the rating measured for the tested combination to every other combination using the same outdoor unit—was included as part of the March 24, 2006, **Federal Register** notice that published a petition for waiver from the residential package air conditioner and heat pump test procedures that was received from Mitsubishi Electric and Electronics USA, Inc. (Case No. CAC–012). 71 FR 14858. This provision was not in the July 2006 proposed rule, but was discussed at the public meeting and relevant comments were received in the course of the waiver process. Lennox and Copeland commented that the rated system's combination of indoor units could be very different from those in the tested system, and the ratings agreement would be poor in this case. (Public Hearing Tr., pp. 245–246)

Because of the difficulty of prescribing similarity of indoor unit

combinations, and with the belief that a rating that reflects the ''highest sales model family'' is better than no rating, DOE is including this ratings provision in the final rule, with the additional stipulation that multi-split manufacturers must test two or more combinations with each outdoor unit unless they have an approved ARM (in which case, they only need to test one combination). 10 CFR 430.24(m)(2). One system shall be tested using only non-ducted indoor units that meet the definition of a tested combination. The second system shall be tested using only ducted indoor units that meet the definition of a tested combination. The rating given to any untested multi-split system combination having the same outdoor unit and all non-ducted indoor units shall be set equal to the rating of the tested system having all non-ducted indoor units. The rating given to any untested multi-split system combination having the same outdoor unit and all ducted indoor units shall be set equal to the rating of the tested system having all ducted indoor units. Finally, the rating given to any untested multi-split system combination having the same outdoor unit and a mix of non-ducted and ducted indoor units shall be set equal to the average of the ratings for the two required tested combinations. 10 CFR 430.24(m)(2)(ii). Furthermore, DOE notes that it is including a provision for the use of an alternate rating method. While DOE is not aware of any algorithms appropriate for rating the energy efficiency of untested multi-split system combinations, DOE expects that as more laboratory test data and field use data become available, such algorithms will be developed.

Today's final rule contains a minor update that was introduced in the July 2006 proposed rule, removing the limit on having only one indoor test room. No comments were received on this proposed change.

Today's final rule sufficiently addresses issues that led to the requesting and granting of test procedure waivers for several models of residential multi-split systems. Therefore, all existing waivers concerning *residential* modulating multi-split systems terminate on the effective date of today's final rule. Multi-split manufacturers may use the waiver process described in 10 CFR 430.27 to petition for modification of today's test procedure, if necessary.

C. Defining ''Repeatable'' for Cyclic Tests

The July 2006 proposed rule contained two provisions that further defined repeatable performance during cyclic tests. One was the requirement that the time-integrated air temperature difference across the indoor unit for consecutive ''on'' cycles must change by 0.05 °F hr or less while the other was for the average system power consumption for the complete ''OFF/ON'' interval to change by 10 watts or less from one cycle to the next.

ARI, Sanyo, Carrier, and Nordyne commented that repeatability should be addressed by ASHRAE's Standards Project Committee (SPC) 116, ''Method of Testing for Rating Seasonal Efficiency of Unitary Air Conditioners and Heat Pumps,'' not by the DOE test procedure (ARI, No. 21 at p. 3; Sanyo, No. 15 at p. 5; Carrier, No. 17 at p. 2; Nordyne, No. 19 at p. 2) Finally, ACEEE supports DOE's efforts to capture the essence of industry best practices for cyclic testing. (ACEEE, No. 16 at p. 4)

DOE recognizes that variability is inherent in testing products for energy efficiency, including central air conditioners and central air conditioning heat pumps. In order to reduce test variability and increase repeatability of test results, DOE has set specific requirements for test set-up and measurement to reduce variability. However, even with these requirements, test variability remains. Furthermore, DOE notes that the less repeatable the test, either more units need to be tested to support an energy efficiency rating that is representative of the units true energy efficiency or, if less testing is done, the product must be rated conservatively (i.e., lower energy efficiency rating).[4] Test variability can be further reduced by, for example, including more specific requirements in the DOE test procedures as well as through industry actions, such as ASHRAE Standard 116. However, changes to the DOE test procedures to deal with test variability could increase the burden and cost of testing. Since the purpose of this requirement was to reduce variability and there are alternative approaches manufacturers can take to reduce variability, DOE is not adopting the cyclic changes proposed. Therefore, as part of today's final rule, DOE makes no changes on defining repeatability during cyclic tests.

D. Outdoor Air Test Conditions for Units Having a Two-Capacity Compressor

The July 2006 proposed rule included provisions that dealt with the outdoor test conditions for three low-capacity cooling mode tests. The three low-capacity tests are conducted at different outdoor dry bulb temperatures (i.e., steady-state, wet-coil test at 95 °F outdoor dry bulb temperature (the A_1 Test); the steady-state, dry-coil test at 82 °F (the C_1 Test); and the cyclic, dry-coil test at 82 °F (the D_1 Test)). The July 2006 proposal was to have all three of these tests replaced by equivalent tests conducted at an outdoor dry bulb temperature of 67 °F.

ARI, Carrier, and Nordyne supported replacing the A_1 Test with the steady-state, wet-coil, F_1 Test at 67 °F because the change will close a potential loophole in the current test procedure. (ARI, No. 21 at p. 3; Carrier, No. 17 at p. 2; Nordyne, No. 19 at p. 2) This loophole allowed manufacturers a way to increase the measured SEER by disproportionately increasing the electrical power consumption during the A_1 Test. ACEEE supported the change in the temperature in the A_1 test, but expressed its concern that the change may downgrade the importance of high temperature performance. (ACEEE, No. 16 at p. 4) ARI, Carrier, and Nordyne commented that the change in the C_1 and D_1 tests is unnecessary since these tests are optional and the changes will do very little to improve the accuracy of SEER. (ARI, No. 21 at p. 3; Carrier, No. 17 at p. 2; Nordyne, No. 19 at p. 2) Carrier also expressed its concern that products designed and tested under the current methodology may have to be re-rated as a result of the proposal. (Carrier, No. 17 at p. 2) In terms of the test procedure, Carrier is concerned that a different cyclic-degradation coefficient (C_D) may result from replacing the C_1 and D_1 Tests with equivalent tests at 67°F.

Collectively, the three proposed changes make the test conditions for two-capacity units consistent with the test conditions specified for variable-speed systems. Implementing all three changes would result in a more normal test progression for most two-capacity units: all wet coil tests followed by the dry coil test; start with high capacity tests and end with the low capacity tests; and start at 95 °F, progress to 82 °F, and then end with 67 °F. These benefits, however, cannot be realized because of the possibility of causing a change in the SEER ratings of some two-capacity units. Thus, DOE agrees with the general position of the comments that the proposal to change the outdoor test conditions for the two optional dry-coil C_D tests (C_1 and D_1 tests) is not warranted.

[4] SEER and HSPF values, per the sampling plan in 10 CFR 430.24, are to be based on the lower 90 percent confidence limit of the true mean divided by 0.95 (as opposed to the sample mean), thus the more variability in test results, the more likely that a product's SEER and HSPF ratings will have to be reduced from the true mean.

Therefore, today's final rule replaces the A_1 Test with the F_1 Test, as proposed. The F_1 Test requires an outdoor dry bulb temperature of 67 °F, and for those few cases where it applies, an outdoor wet bulb temperature of 53.5 °F. The amendments discussed above are found in sections 3.2.3 and 4.1.3 of Appendix M.

E. Air Volume Rate Less Than Manufacturer's Specified Value

In the July 2006 proposed rule, and the October 10, 2006, correction notice, DOE proposed modifications to the criteria for using an air volume rate that is less than the manufacturer's specified value. The proposal was made to account for the variability in fan motors, housings, and wheels. In brief, the proposed set-up process for the test procedure provides for making incremental adjustments in the indoor fan speed until the indoor unit provides an external static pressure that is equal to or greater than the applicable DOE minimum (i.e., 0.1, 0.15, or 0.20 inch of water column, if a non-small-duct, high-velocity (SDHV) system), while operating at the manufacturer-specified air volume rate or, if needed, at the air volume rate between 95 percent and 100 percent that produces the corresponding DOE minimum static pressure value. For comparison, the current algorithm in the DOE test procedure does not allow the air volume rate to be reduced from 100 percent for the case where the external static pressure is less than specified by the test procedure. The proposed criteria apply to all ducted blower-coil systems, except those having a variable-speed motor that is controlled based on maintaining a constant air volume rate. The proposed criteria include two cases where the test laboratory is instructed to operate at an air volume rate less than that specified by the manufacturer: (1) If the highest indoor fan speed setting cannot yield the DOE-specified external static pressure minimum while supplying the manufacturer-specified air volume rate, and (2) if the manufacturer's specified air volume rate yields a ratio higher than 37.5 standard cubic feet per minute (scfm) per 1000 Btu/h.

Nordyne, Carrier and Rheem supported the proposed criteria for using an air volume rate that is less than the manufacturer's specified value. (Nordyne, No. 19 at p. 2; Carrier, No. 17 at p. 3; Public Hearing Tr., p. 135; and Public Hearing Tr., pp. 134–135) ACEEE commented that since the proposed language specified which product designs would be subject to this requirement, they recommended that the wording for the types of indoor blowers that are affected by this change be as generic as possible so as not to impede product innovation. (Public Hearing Tr., pp. 132–133)

DOE agrees with ACEEE that the proposed language could limit innovation since the proposed amendment was intended to apply to designs that are not adequately addressed by the current air volume requirements. Since it is impossible to predict what product designs may enter the marketplace, specifying the designs subject to the new provisions may, in fact, limit innovation. Therefore, in response to ACEEE's comment, DOE restructured the air volume criteria to indicate that the change applies to all designs, except variable-speed, constant-air-volume-rate blowers. In this way, the variable-speed, constant-volume-rate blowers, which the existing test procedure adequately addresses, continue to be subject to the existing requirement.

F. Updating References to Industry Standards

The July 2006 proposed rule included updates to references to current industry test standards, including ASHRAE Standard 23–2005, ''Methods of Testing for Rating Positive Displacement Refrigerant Compressors and Condensing Units,'' ASHRAE Standard 37–2005, ''Methods of Testing for Rating Electrically Driven Unitary Air-Conditioning and Heat Pump Equipment,'' and ASHRAE Standard 116–1995 (RA2005), ''Methods of Testing for Rating Seasonal Efficiency of Unitary Air Conditioners and Heat Pumps.'' Nordyne commented in support of this proposal. (Nordyne, No. 19 at p. 2)

In addition, subsequent to the publication of the July 2006 proposed rule, ARI released an updated version of ARI Standard 210/240, ''Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.'' The updated version of ARI Standard 210/240 included references to the DOE test procedure as amended by the final rule published on October 11, 2005. This latest version of ARI Standard 210/240 had not been released at the time that the content of the July 2006 proposed rule had been finalized. Since the updated test procedures do not affect the measure of efficiency and provide manufacturers with current test standards, DOE moves today to adopt the 2006 version of ARI Standard 210/240.

G. Maximum and Minimum Speed Values for Calculating N_Q and N_E

Rheem inquired as to whether the minimum and maximum speed quantities needed to evaluate Appendix M equations 4.1.3–1 and 4.1.3–3 are to be determined directly from additional lab testing or from interpolating data from required tests lab tests at 67 °F, 82 °F, and 95 °F. (NIST, No. 24 at p. 2) In response, for cooling performance, DOE modified section 4.1.4 to explicitly state that the capacities and $\dot{Q}_c^{k=1}$ (87) and $\dot{Q}_c^{k=2}$ (87), which are used as part of the algorithm for approximating the slope of the intermediate compressor speed (k=v) capacity curve, are determined by evaluating equations 4.1.3–1 and 4.1.3–3, respectively, for $T_j = 87$. Similar direction is provided for determining the power consumption quantities $\dot{E}_c^{k=1}$ (87) and $\dot{E}_c^{k=2}$ (87) that appear within the section 4.1.4 equation for N_E. For heating performance, such direction already exists within the section on calculating the HSPF for a variable-speed heat pump, with regard to the source of the minimum speed quantities at 35 °F.

This change does not affect the calculated SEER. The revised text is found following the equation for N_E in section 4.1.4 of Appendix M.

H. Using the Default or Tested Value of Cyclic-Degradation Coefficient

Carrier asked if the manufacturer elects to run the optional tests, and the resulting C_D exceeds the 0.25 default value, is the manufacturer obligated to use the tested value. (Public Hearing Tr., p. 31) The current test procedure addresses this scenario for most cases where a C_D is used in the SEER and HSPF calculations. Specifically, sections 4.1.1, 4.1.2.1, 4.1.3.1, 4.1.4.1, 4.2.1, and 4.2.3.1, direct that if the optional test(s) are not conducted, the cooling (heating) cyclic-degradation coefficient, C_D^c (C_D^h), is to be set to the default value of 0.25. If the optional test(s) are conducted, C_D^c (C_D^h) must to be set to the lower of: the value calculated per the test or the default value of 0.25. In response to Carrier's comment, DOE has added similar wording to sections 4.1.3.3 and 4.2.3.3, the only sections that did not include the clarifying language found in the sections referenced above.

Furthermore, in reviewing the organization of the current test procedure while considering this update, DOE found that the information would be better placed in the earlier sections (within section 3) with the instructions as to which tests to conduct based on the type of equipment (i.e.,

single-speed, two-capacity, variable-speed, etc). Therefore, language has been added in the test procedure to clarify that if the tested cyclic-degradation coefficient is higher than the default value, the default value is to be used to calculate SEER and HSPF. (see sections 3.2.1, 3.2.2.1, 3.2.3, 3.2.4, 3.5.3, 3.6.1, 3.6.2, 3.6.3, 3.6.4, 3.8.1, 4.1.3.3, and 4.2.3.3).

I. Guidance on the Inclusion of Pre-Production Units in the Sample Population

As part of the July 2006 proposed rule, DOE proposed that only pre-production units fabricated using the same tooling used for the eventual full-production units could be used as part of the tested sample population to obtain the certified ratings of full-production units.

ARI, Nordyne, and Carrier commented that the proposed wording is too narrow, and recommended that the current regulatory language not be changed. (ARI, No. 21 at p. 4; Nordyne, No. 19 at p. 3; Carrier, No. 17 at p. 2) ARI and Trane explained that the tooling used for pre-production units is often different than that used for production units. (Public Hearing Tr., pp. 192–193) Trane stated that pre-production units must have the same configuration as the production unit to be included in the sample population, while Carrier suggested using wording such as that in the ARI Certification Program Operational Manual to define the configuration (e.g., same compressor, same air flow, etc.). (Public Hearing Tr., pp. 192, 198–199) Rheem commented that the ARI internal process handles ratings derived from pre-production units by making the model subject to certification testing immediately after production starts. (Public Hearing Tr., p. 202)

DOE agrees that the proposed criterion is too narrow, and that different tooling can yield equivalent machinery. Moreover, DOE believes that spot checks conducted under an industry certification program, such as the ARI Certification Program, provide a safeguard against the performance of the production unit deviating appreciably from ratings derived from testing pre-production units. For these reasons, DOE is not amending the existing requirements and will continue to allow manufacturers to test pre-production units.

J. Clarification of the Sample Population Used To Validate the Rated Seasonal Energy Efficiency Ratio and Heating Seasonal Performance Factor of Heat Pumps

DOE proposed that a manufacturer must include the cooling and heating results from each heat pump of the sample population when obtaining the certified SEER and HSPF ratings. This requirement disallows testing multiple heat pumps and then using a subset of results for assigning the certified SEER rating and a different subset of results for determining the certified HSPF rating. The proposal provided one exception, which would allow additional testing in just one mode, cooling or heating, if the manufacturer elected to discontinue testing in the other mode at some point in the sample sequence.

ACEEE, Nordyne, and Carrier supported the intent of clarifying the sample population used for determining heat pump ratings. (ACEEE, No. 16 at p. 5; Nordyne, No. 19 at p. 3; Carrier, No. 17 at p. 2) Carrier and the ACEEE, however, recommended deleting the exception, noting that additional testing is insignificant as compared to the potential for misrepresented ratings. (Carrier, No. 17 at p. 2; ACEEE, No. 16 at p. 5)

DOE is aware of the testing burden on manufacturers, but agrees with Carrier and the ACEEE that this particular attempt at marginally reducing the test burden is not worthwhile. Thus, today's final rule adopts the proposal that all units of the sample population must be tested in both the cooling and heating modes and the results used for determining the heat pump's certified SEER and HSPF ratings without adopting the proposed exception for additional testing.

K. Clarification of the Definition of a ''Highest-Sales-Volume Combination''

DOE proposed amendments to the definition of the Highest-Sales-Volume Combination (HSVC) to require that a single-speed, split-system air conditioner must include the coil-only indoor unit likely to have the largest volume of retail sales with the particular model of outdoor unit. Proposed 10 CFR 430.24(m)(2). In addition, DOE proposed exceptions to this requirement to provide for equipment designed exclusively for blower-coil installations: mini-splits; multi-splits; small-duct, high-velocity systems; through-the-wall units; and condensing units having features (e.g., proprietary interfaces) that prevent their installation with third-party, coil-only indoor units. This proposal was made in recognition that coil-only units represent the overwhelming majority of installations of central air conditioners and, as such, the highest-sales-volume should reflect standard practice. The proposal also minimizes instances where the highest-sales volume combination of a split-system air conditioner could be defined as one with a ''blower-coil'' in order to meet Federal minimum energy efficiency standards and then have the outdoor unit combined with coil-only indoor units where the combination would not meet the Federal energy efficiency standards.

ACEEE, Carrier and ARI agreed that some clarification to the test procedure was needed in order to avoid such situations. (ACEEE, No. 16 at p. 5; ARI, No. 21 at p. 4; Public Hearing Tr., pp. 208–209) ACEEE supported the goal of not having outdoor units installed with coil-only indoor units where the combination does not meet the energy efficiency standard. (ACEEE, No. 16 at p. 5) Instead of the proposed text, ARI and Carrier recommended that DOE adopt the wording from the *2006 ARI Certification Program Operational Manual for Unitary Air Conditioners & Air-Source Unitary Heat Pumps (Rated Below 65,000 Btu/h Cooling)*. (ARI, No. 21 at p. 4; Public Hearing Tr., pp. 208–209) Carrier and ARI commented that the proposed exception for outdoor units that prevent installations with coil-only units with a proprietary interface should be eliminated because it is not enforceable. Nordyne strongly objected to the entire proposal, stating that it restricts a manufacturer's use of technology. (Nordyne, No. 19 at pp. 3–4) Moreover, to implement such a change, Nordyne asserted that DOE needs to analyze the impact of minimally compliant units. Nordyne, however, did note its support for the proposed exception for blower coils having a proprietary interface.

ARI and Carrier recommended the following alternative text to the July 2006 proposed rule:

HSVTC, Highest-sales-volume Tested Combination. For Unitary Air-Conditioners below 14 SEER, the HSVTC must be an RCU-A-C combination, except for through-the-wall and ductless equipment (RCU-A-CBO). For Unitary Air-Conditioners 14 SEER and above, every outdoor model number must have a coil-only rating. Coil-only ratings offered for sale must be publicly viewable. Coil-only ratings not offered for sale are viewable only to ARI staff. Non-viewable ratings fall under all compliance guidelines except the challenge procedure. If a non-publicly viewable rating falls below NAECA minimum, then the manufacturer must submit a coil-only rating that meets NAECA minimum and is verified through ARI testing.

Until then, the Basic Model Group ratings will not be listed in the ARI directory.

Historically, the highest sales volume combination for most split-system air conditioners has had a coil-only indoor unit. Both the June 2006 proposed rule and the ARI alternative maintain this historical practice. DOE, however, believes ARI's approach is arbitrary and results in uncertainties to manufacturers. Furthermore, DOE believes it would be difficult to implement the above ARI algorithm. With the ARI approach, the manufacturer may have to re-test in a coil-only configuration after having tested in a blower-coil configuration, if the expected SEER of 14 or higher is not realized in laboratory testing. In addition, if DOE were to adopt the ARI alternative and the minimum energy efficiency standards were amended, DOE would have to modify the requirement, since the new minimum could be higher than the 14 SEER requirement in the ARI alternative. Conversely, in formulating the approach proposed in the July 2006 proposed rulemaking, DOE first considered requiring that all split-system air conditioners be tested with a coil-only indoor unit. DOE recognized, however, that in addition to the exceptions such as equipment designed exclusively for blower-coil installations, other exceptions would have to be recognized. These other exceptions include two-capacity and variable-speed units, because they are always much more efficient than 14 SEER, and do not risk having a coil-only combination that would not meet the DOE efficiency standards. Therefore, DOE applied the coil-only requirement only to split system air conditioners having a single-speed compressor.

Returning to the issue of listed exceptions, DOE agrees with ARI and Carrier that the proposed exception for combinations that prevent applications with third-party coil-only indoor units would be prohibitively difficult to define, verify, and enforce. DOE believes that its proposal to substitute the words ''mini-splits'' and ''multi-splits'' for ''ductless equipment,'' is somewhat more comprehensive because it includes ducted multi-split systems. Finally, SDHV manufacturers, at present, only manufacture indoor coils and do not manufacture outdoor units. Since SDHV manufacturers do not offer for sale complete systems, they are not subject to specifying HSVC's. Thus, SDHV systems do not need to be included as an exception.

As to Nordyne's objections, DOE stands by its position as stated in the July 2006 proposed rule. DOE believes that its proposal, which is adopted in today's final rule, increases the likelihood that the outdoor unit, in combination with any compatible indoor unit, will meet the federal energy efficiency standards. This is because the proposal which is adopted today ensures that the tested combinations, upon which most ratings are based, reflect the outdoor-indoor combinations most likely to be sold. Furthermore, this language does not limit technology options to manufacturers, since the test procedure allows for representations of other than the highest-sales-volume combination.

With regard to Nordyne's comment that DOE needs to analyze the impact of the clarifications on minimally compliant units, DOE fails to see how the clarification in the definition will alter the rating of a particular split-system air conditioner. The clarification ensures that the highest-sales-volume split-system air conditioner—which is subject to testing—yields ratings reflective of the outdoor-indoor combinations most likely to be sold. For split-system air conditioners ''representative'' and ''highest sales'' historically equate to coil-only indoor units. Only mini-splits, multi-splits, and through-the-wall units can currently argue for an exception, since, in these cases, the outdoor units would be sold in combination with specific indoor units which would include a fan and a coil.

Therefore, DOE is adopting the language of the July 2006 proposed rule, to require that the highest sales volume combination of a single-speed, split-system air conditioner must include the coil-only indoor unit likely to have the largest volume of retail sales with the particular model of outdoor unit. The only change from the proposed rule is to limit the exceptions to mini-splits, multi-splits, and through-the-wall units.

L. Upper Limit on the Difference Between Calculated and Tested Seasonal Energy Efficiency Ratio and Heating Seasonal Performance Factor Values

DOE proposed setting a 5 percent limit on the amount that a rating for an untested split-system combination could exceed the rating of the corresponding HSVC. 71 FR 41330, July 20, 2006. The proposed limit only applied to applications where both combinations used coil-only indoor units. Ratings based on testing are not subject to the 5 percent limit. Manufacturers seeking a rating that exceeds the 5 percent limit can do so by testing the particular coil-only combination. The proposed approach applied to untested combinations offered by system manufacturers and by independent coil manufacturers (ICM's).

ACEEE commented in support of the proposal to limit the difference between calculated and tested SEER and HSPF values. (ACEEE, No. 16 at p. 5) Carrier and Nordyne also supported the DOE proposal for SEER ratings but Carrier does not believe a similar cap is required for HSPF ratings. (Carrier, No. 17 at p. 3; Nordyne, No. 19 at p. 4) Using data from the September 2006 ARI Online Directory, Carrier found that the proposed 5 percent SEER limit would affect the ratings of 1.05 percent of OEM coil-only combinations and 13.87 percent of ICM coil-only combinations. (Carrier, No. 17 at p. 4) At the public meeting, Carrier offered similar statistics to show that ICM's, in general, rate condenser-coil combinations employing the same condenser at higher efficiencies than the OEM's. Carrier also offered statistics to show that a small number of ICM's provide most of the ratings that are more than 5 percent higher than the OEM rating for the highest-sales combination. (Public Hearing Tr., p. 265) Carrier also cites the September 2006 NIST ''Survey of SEER Ratings for Independent Coil Manufacturer Mixed Systems'' as demonstrating the need to address the issue. (Carrier, No. 17 at p. 3)

Lennox disagrees with the June 2006 proposal. Lennox points out that the proposed 5 percent limit is not technically supported and that the practical limit is more likely 13 percent than 5 percent. Lennox notes that the NIST report referenced above states that ''maximum gains in SEER associated with coil capacity and improved expansion devices are approximately 10 percent and 2.5 percent, respectively.'' (Lennox, No. 22 at p. 1) Lennox reports that an independent laboratory tested two different condensing units having 13 SEER HSVC ratings with an alternate, non-HSVC, evaporator coil. According to Lennox, the non-HSVC tested combinations produced SEER ratings 7.9 and 11.8 percent higher than the 13.0 SEER rating of the HSVC units. Lennox argues that data analysis conducted by Carrier is incomplete and that having to test combinations that are projected to exceed the 5 percent limit will be overly burdensome. Lennox further stated that the combination of DOE approval of the ARM, governmentally enforceable penalties for overrating, and an industry-sponsored certification program ''ensure a reasonable level of rating integrity and result in a full availability of cost

effective, higher efficiency combinations for consumers.'' (Lennox, No. 22 at p. 2)

ARI commented that the DOE proposed 5 percent upper limit is arbitrary and will unduly penalize manufacturers who participate in the ARI certification program. Furthermore, ARI commented that inconsistent ratings for untested split-system combinations have been discussed at length with the appropriate ARI committees for quite some time, and, based on these discussions, significant changes were made to strengthen the credibility of the ARI certification program. (ARI, No. 21 at p. 5) For example, ARI commented that coil-only combinations (system manufacturers and ICMs) with SEER ratings that are 6 percent above the SEER rating of the highest-sales-volume tested combination are automatically subject to testing as part of the ARI certification program. (ARI, No. 21 at p. 5)

The analysis conducted by Carrier and NIST certainly justifies further scrutiny of ratings of untested combinations of split-system central air conditioners. The SEER ratings reported by Lennox raise a few questions, while suggesting that the proposed mechanism and 5 percent limit may not be adequate, but Lennox doesn't offer an alternative. For example, how much of the ratings difference is a result of the better performance of the mixed system indoor units? How much of the ratings difference results from the HSVC rating being conservative '' *i.e.*, although rated at 13.0, the tested SEER of the HSVCs is likely higher? If the percent differences reported by Lennox had been based on the measured SEER of the HSVC, the respective magnitudes would likely have been less, possibly much less.

As for Lennox's comment that the NIST report supports a higher percentage, DOE notes that the NIST analysis only commented on the effect of increased coil capacity and an improved expansion device, two factors that increase SEER. The impact of the larger coil on compressor power consumption, however, was believed negligible even though it too would typically increase. Thus, for the nominal case where a power increase accompanies the capacity gain, the maximum SEER increase predicted by the long-standing NIST ARM is in the 9 to 10 percent range, higher than the 5 percent limit proposed in the NOPR, but less than the maximum increase stated by Lennox.

Upon consideration of the above comments, DOE believes that its 5 percent limit, as proposed, is deficient. DOE still believes that more scrutiny of untested combination ratings is warranted. However, DOE finds, from a review of the data and comments received, that the ratings of some non-HSVCs are higher that what would seem warranted. DOE supports the steps recently implemented by ARI's certification program to more frequently check combinations having suspect ratings. Moreover, DOE is amending the test procedure to emphasize its right to obtain information that is the basis for any manufacturer's rating. DOE will require documentation to justify ratings more than 6 percent higher that the rated efficiency of the HSVC unit. If DOE questions the rating, the manufacturer will be responsible for verifying the ARM, and supplying to DOE the ARM used and furnishing the specific input parameters used for each condenser-evaporator combination, the energy efficiency rating of the HSVC, the energy efficiency results of the ARM, and the rated energy efficiency of the units in question. Furthermore, the manufacturer must be prepared to provide the information source and/or justification for any input parameter.

In summary, DOE is not adopting the proposed 5 percent limit on the maximum amount that a rating for an untested coil-only split-system can exceed the rating of the HSVC. Instead, DOE will evaluate the improvements available through using new and improved ARMs and the results from internal changes made as part of the ARI Certification Program. DOE will give follow-up priority to individual combinations having questionably high ratings (for example, a coil-only system having a rating that exceeds the rating of a coil-only highest sales volume combination by more than 6 percent). The text that sets forth DOE's authority to examine ratings for untested split system combinations is found in 10 CFR 430.24(m)(5) of today's rule.

M. Clarification of the Published Ratings for Untested Split-System Combinations

DOE proposed amendments to 10 CFR 430.24(m)(4) to require published ratings for an untested split-system combination to be equal to, or lower than, the value calculated using the DOE-approved ARM. 71 FR 41336. The proposed language specifically recognized that a manufacturer may use laboratory data from the HSVC testing to adjust or ''tune'' its ARM, or a simulation subcomponent, when calculating the ratings for untested combinations that use the same outdoor unit. Under the proposal, the amount of adjustment is limited to a 5 percent increase in the calculated rating compared to the rating obtained using the ARM without the adjustment/tuning factor. The purpose is to limit the amount of manufacturer's ''tuning'' of ARMs, without resubmitting the ARM for DOE review in accordance with 10 CFR 430.24(m)(5). DOE is concerned that the ''tuned'' ARMs will result in a different model than the one the Department had reviewed and approved under 10 CFR 430.24(m)(5). The changes were proposed to improve the current regulatory language that states the ARM must be used to obtain ''representative values of the measures of energy consumption.'' 10 CFR 430.24(m)(2)(ii).

ARI commented that ''untested'' combinations are subject to verification testing in the ARI Certification Program and so placing a limit on the adjustment factor is unwarranted for combinations listed in the ARI directory. (ARI, No. 21 at p. 5) Carrier commented that any adjustment based on actual testing to be not only allowable but desirable. (Carrier, No. 17 at p. 3) Nordyne was willing to consider the concept of a maximum allowable adjustment but stated that the exact values and the specific wording needed further review. (Nordyne, No. 19 at p. 4)

In reviewing its files of ARMs that DOE has approved, DOE finds that none reference an ARM/simulation adjustment factor, or equivalent. Yet, the use of such adjustment factors appears to be common. This situation, along with the fact that most manufacturers' ARMs have not been updated in many years, and that most, if not all, of the models upon which the ARMs were based have been removed from the marketplace because they did not meet the 13 SEER standard leads DOE to conclude that it is likely some ARMs need the adjustment factor in order to correctly predict the efficiency of untested combinations.

In view of the foregoing, DOE is amending 10 CFR 430.24(m)(5) to require published ratings for an untested split-system combination to be equal to, or lower than, the value calculated using the DOE-approved ARM. The practice of ''tuning'' an ARM or computer simulation by using laboratory data from tests on the HSVC or any other split-system combination tested in accordance with the sample plan of 10 CFR 430.24(m), and then using the tuned ARM to calculate the ratings for untested combinations that use the same outdoor unit, is now referenced in 10 CFR 430.24(m)(4). DOE, however, is not adopting a limit on how much the SEER/HSPF rating, calculated using an ARM, may exceed the rating obtained without using the adjustment factor.

N. Ratings That Are Based on Using a Particular Furnace or Ducted Air Mover

DOE proposed having manufacturers document those published ratings that are based on a complete system consisting of a coil-only air conditioner or heat pump and a particular model of furnace. The model number of the furnace would be published, most likely in addition to the indoor unit model number.

ACEEE supported the measure, as originally proposed. (ACEEE, No. 16 at p. 5) Nordyne and ARI also supported the measure but suggest replacing the word ''furnace'' with a more generic term so that the requirement is extended to all indoor air movers. (Nordyne, No. 19 at p. 4; ARI, No. 21 at p. 6) Nordyne suggests using ''indoor blower'' and ARI suggests ''ducted air mover.''

DOE accepts the recommendation of using generic wording to clearly convey the equipment components that contribute to the published rating, and selects the description ''ducted air mover.'' DOE adopts revised text for 10 CFR 430.62(a)(4)(i) and (ii) that explicitly states that the model number of the ducted air mover, if applicable, must be included among the manufacturer's model numbers submitted on the certification report to DOE. Compared to the wording proposed in the July 2006 proposed rule, today's revision is simpler, in that it does not repeat text from 10 CFR 430.62(a)(4) in sections 430.62(a)(4)(i) and (a)(4)(ii).

O. Revisions to the Definition of ''Coil Family''

DOE proposed minor modifications to the existing definition of ''coil family,'' to improve its readability and make it easier to understand. 71 FR 41335. Nordyne and Rheem asked for clarifications to the proposed language. (Nordyne, No. 19 at p. 4)

Concerning Nordyne's comment, DOE had no intention other than to offer a few editorial improvements, and to heighten awareness of the definition among stakeholders, given the related discussion of ARMs. As proposed, DOE viewed the substantive content of the definition as adequate for the purpose of designating what split systems may be used for verifying an ARM. There was no change proposed to the definition of ''coil family'' with respect to coil circuitry. In both the current and proposed test procedures, ''coil circuitry'' is included in a list of design features that affect heat exchanger performance. In responding to the question raised by Rheem, NIST asked attendees at the public meeting how to define coil circuitry. Trane responded that if this coil differentiating feature were deleted then it wouldn't have to be defined. (Public Hearing Tr., p. 297)

In considering the comments received, DOE finds the proposed amendments to the definition cause more confusion than the existing definition, therefore, DOE is not amending the definition of coil circuitry at this time.

III. Summary of Other Additions, Changes, and Corrections to the Department of Energy Residential Central Air Conditioner and Heat Pump Test Procedure

The following discussion summarizes revisions that were proposed in the July 2006 proposed rule and received no substantive comments.

Small-duct, high-velocity (SDHV) systems. Today's final rule adopts the following five changes that apply exclusively to small-duct, high-velocity (SDHV) systems:

—The minimum external-static-pressure levels that must be equaled or exceeded during the first test on any SDHV system will be 1.0 inches of water column higher than the minimum that is required of non-SDHV units. For example, for equipment having rated cooling capacities from 29,000 to 42,500 Btu/h, the minimum external static pressure is 1.15 inches of water column for SDHV systems, compared to 0.15 inches of water column for conventional blower-coil systems. This change is found in section 3.1.4.1.1 of Appendix M.

—All balance dampers or restrictor devices on or inside the unit must be set fully open or on the lowest restriction setting. This change is found in section 2.2 of Appendix M.

—The size of the duct connected to the outlet of the indoor unit must not exceed prescribed limits. This change is found in section 2.4.1 of Appendix M.

—When a closed-loop, air-enthalpy test apparatus is used on the indoor side, the test laboratory must limit the airflow resistance on the inlet-side of the indoor blower-coil to a maximum value of 0.1 inches of water column. The balance of the airflow resistance must be imposed on the outlet-side of the indoor blower. This change is found in section 3.1.4.1.1 of Appendix M.

—The test setup must include an adjustable air damper that is positioned immediately upstream of the airflow measuring apparatus that limits the differential pressure between the inside of the duct and the surrounding ambient to 0.5 inches of water column or less. If the particular test setup permits, the outlet air damper box used for cyclic tests can double as the adjustable air damper. This change is found in section 2.5.4.3 of Appendix M.

Optional high-capacity cyclic-degradation coefficient (C_D). Today's final rule reinstates the optional high-capacity cyclic-degradation coefficient (C_D) testing for two-capacity units that lock out low-capacity operation at outdoor temperatures where the unit is otherwise projected to modulate between low and high capacities/compressor stages. In lieu of testing, the default value for the high-capacity C_D will be the value of the low-capacity C_D. The specific change is reflected in sections 3.2.3, 3.4, 3.5, 3.5.3, 3.6.3, 3.8, 3.8.1, 4.1.3.3, and 4.2.3.3 of Appendix M.

Two-capacity heat pump default equations. Instead of conducting the laboratory test, default equations are now provided to approximate the performance of a two-capacity heat pump operating at low capacity and 35 °F outdoor temperature. The default equations appear in section 3.6.3 of Appendix M.

Duct loss correction. Except as noted below, DOE adopts the practice of applying a duct loss correction to the cooling and heating capacities determined using the indoor air enthalpy method. The losses occur within the section of insulated duct that extends between the outlet of the indoor unit and the test facility's outlet temperature grid. The correction, however, does not apply to the two indoor capacities used for calculating a cyclic-degradation coefficient, C_D. The change affects sections 3.3, 3.4, 3.7, 3.9.1, and 3.11 of Appendix M and is implemented by referencing sections 7.3.3.3 and 7.3.4.3 of ASHRAE Standard 37–2005 for cooling and heating tests, respectively.

Air volume. DOE adopts the definition of ''standard air'' as given in ASHRAE Standard 37–2005. This change affects section 1.37 of Appendix M and causes standard air volume rates to be expressed in terms of dry air, not moist air. DOE replaces the proper names containing the words ''Certified Air Volume Rate'' with ''Full-load Air Volume Rate.'' The change will eliminate confusion over whether the air volume rates specified in the test procedure are certified values, which they are not. This change appears in numerous places within the DOE test procedure, mostly in section 3 and

Tables 3 to 6 and Tables 9 to 12 of Appendix M.

ARMs. DOE adopts revised language for 10 CFR 430.24(m)(6) that describes the specific information the manufacturer must include in its submittal when requesting DOE's approval of the manufacturer's ARM. The revision expands the options regarding the data used to evaluate and verify the ARM and provides a compliance path for manufacturers who offer indoor units from only one coil family.

Definitions. DOE incorporates the definition for ''private labelers'' from EPCA, 42 U.S.C. 6291(15) into 10 CFR 430.2. Definitions for the terms ''indoor unit,'' ''outdoor unit,'' and ''ARM/simulation adjustment factor'' have also been added. Under 10 CFR 430.24(m)(5), DOE adopts revised language to specify that the requirements also apply to private labelers, and not just to manufacturers. For example, private labelers, like manufacturers, are responsible for ensuring that reported ratings for untested split-system combinations are based on a DOE-approved ARM.

October 2005 final rule. In addition, DOE is correcting two errors that were mistakenly introduced in the test procedure final rule published on October 11, 2005. 70 FR 59122. The October 2005 final rule incorrectly specifies the outdoor test conditions used for the optional low-capacity heating-mode cyclic test for two-capacity heat pumps. The temperatures for this test are incorrectly specified in the October 2005 final rule as 62 °F db/56.5°F wb. These temperatures should have remained as they were, with the values 47°F db/43°F wb. This error was unfortunately not discovered until after the final rule became effective on April 10, 2006. DOE has been informed that several new models of two-capacity heat pumps have been rated for HSPF based on conducting the low-capacity heating mode cyclic test at 62 °F db/56.5 °F wb. In implementing the test condition correction, DOE will not require that these affected models of two-capacity heat pumps be retested and rerated since the difference in energy efficiency is very slight, (i.e., tenths of HSPF). This correction appears in section 3.6.3b and Table 11 of Appendix M.

The second correction affects two equations used for calculating the HSPF of a variable-speed heat pump. Within section 4.2.4 of Appendix M of the final rule published on October 11, 2005, the terms N_Q and N_E are incorrectly positioned within the equations for M_Q and M_E, respectively. M_Q and M_E correspond to the slopes of the capacity and power curves when the heat pump is operated at the intermediate compressor speed, k = v. These intermediate speed slopes are derived from the slopes of the minimum and maximum speed curves, weighting each accordingly. The terms N_Q and N_E are the weighting factors for the maximum speed slopes.

In the October 2005 final rule, section 4.2.4 of Appendix M, the equations for M_Q and M_E each consist of the sum of two expressions in square brackets. In the right-hand bracketed expression of both equations, the divisor line is too long. It should not extend under N_Q in the equation for M_Q, nor should it extend under N_E in the equation for M_E. The divisor line is being shortened so that the equation returns to its format established in the 1988 revision of the test procedure. (53 FR 8304, March 14, 1988). The same misprint did not occur within the comparable cooling mode equations.

IV. Effect of Test Procedure Revisions on Compliance With Standards

In amending a test procedure, section 323(e) of EPCA directs DOE to determine to what extent, if any, the test procedure would alter the measured energy efficiency of the covered product and if the amended test procedure alters the measured efficiency, the Secretary is to amend the applicable energy conservation standard to the extent the amended test procedure changes the energy efficiency of products that minimally comply with the existing standard. (42 U.S.C. 6293(e)) In recognition of this requirement, the July 2006 proposed rule requested comments on whether any of the proposed changes would affect the measures of energy efficiency, and, if so, to what extent, when tested under the current test procedure. DOE received no comments in response. The issue was also raised at the public hearing, and DOE again received no comments that any models would fail to meet the standard when tested using the new test procedure. Since DOE did not receive comments on this issue, and based on the discussion below, DOE concludes that the amendments to the central air conditioner and central air conditioning test procedures adopted in today's final rule do not change the measure of energy efficiency of central air conditioners and central air conditioning heat pumps that minimally comply with the existing standard. Therefore, amendments to the existing energy efficiency standard are not required.

Some revisions in today's final rule are expected to slightly change the ratings of two-capacity systems. Since two-capacity systems are inherently more energy efficient, DOE concludes that these amendments would only affect higher efficiency systems and, therefore, not require DOE to amend its energy conservation standards.

The change to allow the use of default equations instead of conducting a low-capacity Frost Accumulation Test will negatively impact the measured HSPF. DOE estimates that the HSPF could be as much as 0.3 point lower if the default equations are used to obtain the value corresponding to climate Region IV and the minimum design-heating requirement instead of testing. This change will not affect the HSPF of a currently rated heat pump because use of the default equations is optional and DOE understands manufacturers test products instead of using the default value and, therefore, there is no change as a result of today's revisions.

Changing the maximum duration of all Frost Accumulation Tests from 12 hours to 6 hours is expected to only affect the average space heating capacity and power at 35 °F by causing a minimal, systematic increase in the derived HSPF for the rare case where the heat pump remains completely frosted beyond 6 hours. DOE believes such a situation is extremely unlikely, especially for tests at full-load.

DOE does not expect that adopting the practice of applying a duct loss correction to the cooling and heating capacities determined using the indoor air enthalpy method to cause an increase in SEER or HSPF. This is because the test procedure is simply catching up with current practice.

Making the definition of ''standard air'' consistent with the definition in ASHRAE Standard 37–2005 will have no effect on the SEER and HSPF as calculated using the October 2005 final rule. 70 FR 59122 (October 11, 2005).

Finally, changing the one steady-state, low-capacity cooling-mode test condition from 95 °F to 67 °F for two-capacity units is projected to change the calculated SEER very minimally—within ± 0.1 SEER point—in most cases. However, the reduction in SEER could be very considerable if the power consumption during the 95 °F test at low capacity is increased in an effort to obtain lower estimates, through extrapolation, of the power consumption for low-capacity at temperatures less than 82 °F. In general, the impact of the change will be measurable if the unit's electrical power draw increases atypically at higher outdoor temperatures when operating at low capacity. However, two-capacity compressors are inherently more energy

efficient and are not used in minimally compliant units, and, therefore, DOE concludes that this amendment to the test procedure will not change the energy efficiency of marginally compliant units.

V. Procedural Requirements

A. Review Under Executive Order 12866

Today's regulatory action is not a ''significant regulatory action'' under section 3(f) of Executive Order 12866, Regulatory Planning and Review, 58 FR 51735 (October 4, 1993). Accordingly, this action was not subject to review under the Executive Order by the Office of Information and Regulatory Affairs in the Office of Management and Budget.

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 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 rulemaking process. (68 FR 7990) The DOE procedures and policies are available on the Office of General Counsel's Web site: *http://www.gc.doe.gov*.

DOE reviewed today's final rule under the provisions of the Regulatory Flexibility Act and the procedures and policies published on February 19, 2003. 68 FR 7990. DOE certified in the July 20, 2006, proposed rule that the proposed rule would not impose a significant economic impact on a substantial number of small entities. (66 FR 6780) DOE received no comments on this issue, and after considering the potential small entity impact of this final rule, DOE affirms the certification that this rule will not have a significant economic impact on a substantial number of small entities.

C. Review Under the Paperwork Reduction Act of 1995

This rulemaking imposes no new information or record keeping requirements. Accordingly, Office of Management and Budget (OMB) clearance is not required under the Paperwork Reduction Act. (44 U.S.C. 3501 *et seq.*)

D. Review Under the National Environmental Policy Act of 1969

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. This rule amends an existing rule without changing its environmental effect, and, therefore, is covered by the Categorical Exclusion in paragraph A5 to subpart D, 10 CFR part 1021. 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 (August 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 examined this final rule and determined that it does 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. Executive Order 13132 requires no further action.

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 (February 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; and (3) provide a clear legal standard for affected conduct rather than a general standard and 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 section 3(a) and section 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, this 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 (Pub. L. 104–4) (UMRA) requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. For a proposed regulatory action that may result in the expenditure by State, local and Tribal governments, in the aggregate, or by the private sector of $100 million or more (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish estimates of the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a),(b)) 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 *http://www.gc.doe.gov*). The rule published today contains neither an intergovernmental mandate, nor a mandate that may result in an 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 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 regulation would not result in any takings which might require compensation under the Fifth Amendment to the United States Constitution.

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

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516 note) requires 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 (February 22, 2002), and DOE's guidelines were published at 67 FR 62446 (October 7, 2002). DOE has reviewed today's notice 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 OIRA, 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. Today's regulatory action would not have a significant adverse effect on the supply, distribution, or use of energy and, therefore, is not a significant energy action. 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), the Department of Energy must comply with section 32 of the Federal Energy Administration Act of 1974 (FEAA), as amended by the Federal Energy Administration Authorization Act of 1977. (15 U.S.C. 788) Section 32 provides in essence that, where a proposed rule contains or involves use of commercial standards, the notice of proposed rulemaking must inform the public of the use and background of such standards. This final rule updates references to the most recent versions of four commercial standards, as discussed in section II.F of this preamble.

The Department 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., that they were developed in a manner which fully provides for public participation, comment and review. As required by section 32(c) of the FEAA, the Department has consulted with the Attorney General and the Chairman of the Federal Trade Commission concerning the impact of these four standards on competition, and neither recommended against incorporation of these standards.

M. Congressional Notification

As required by 5 U.S.C. 801, DOE will report to Congress on the promulgation of today's rule prior to its effective date. The report will state that it has been determined that the rule is not a ''major rule'' as defined by 5 U.S.C. 804(2).

VI. Approval of the Office of the Secretary

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

List of Subjects in 10 CFR Part 430

Administrative practice and procedure, Energy conservation, Household appliances, Incorporation by reference.

Issued in Washington, DC, on September 27, 2007.

Alexander A. Karsner,

Assistant Secretary, Energy Efficiency and Renewable Energy.

For the reasons set forth in the preamble, Part 430 of Chapter II of Title 10, Code of Federal Regulations is amended as set forth below:

PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

■ 1. The authority citation for part 430 continues to read as follows:

Authority: 42 U.S.C. 6291–6309; 28 U.S.C. 2461 note.

■ 2. Section 430.2 is amended in subpart A by adding definitions of ''ARM/simulation adjustment factor,'' ''indoor unit,'' ''outdoor unit,'' ''private labeler,'' and ''tested combination,'' in alphabetical order, to read as follows:

§ 430.2 Definitions.

* * * * *

ARM/simulation adjustment factor means a factor used as part of a DOE-approved alternative rating method (ARM) to improve the accuracy of the calculated ratings for untested split-system central air conditioners or heat pumps. The adjustment factor associated with each outdoor unit must be set such that it reduces the difference between the SEER (HSPF) determined using the ARM and a split-system combination tested in accordance with § 430.24(m)(1). The ARM/simulation adjustment factor is an integral part of the ARM and must be a DOE-approved element in accordance with 10 CFR 430.24(m)(4) to (m)(6).

* * * * *

Indoor unit means a component of a split-system central air conditioner or heat pump that is designed to transfer heat between the refrigerant and the indoor air, and which consists of an indoor coil, a cooling mode expansion device, and may include an air moving device.

* * * * *

Outdoor unit means a component of a split-system central air conditioner or heat pump that is designed to transfer heat between the refrigerant and the outdoor air, and which consists of an outdoor coil, compressor(s), an air moving device, and in addition for heat pumps, a heating mode expansion device, reversing valve, and defrost controls.

* * * * *

Private labeler means an owner of a brand or trademark on the label of a consumer product which bears a private

label. A consumer product bears a private label if:

(1) Such product (or its container) is labeled with the brand or trademark of a person other than a manufacturer of such product;

(2) The person with whose brand or trademark such product (or container) is labeled has authorized or caused such product to be so labeled; and

(3) The brand or trademark of a manufacturer of such product does not appear on such label.

* * * * *

Tested combination means a multi-split system with multiple indoor coils having the following features:

(1) The basic model of a system used as a tested combination shall consist of one outdoor unit, with one or more compressors, that is matched with between 2 and 5 indoor units; for multi-split systems, each of these indoor units shall be designed for individual operation.

(2) The indoor units shall—

(i) Represent the highest sales model family, or another indoor model family if the highest sales model family does not provide sufficient capacity (see ii);

(ii) Together, have a nominal capacity that is between 95% and 105% of the nominal capacity of the outdoor unit;

(iii) Not, individually, have a capacity that is greater than 50% of the nominal capacity of the outdoor unit;

(iv) Operate at fan speeds that are consistent with the manufacturer's specifications; and

(v) All be subject to the same minimum external static pressure requirement (i.e., 0 inches of water column for non-ducted, see Table 2 in Appendix M to Subpart B of this part for ducted indoor units) while being configurable to produce the same static pressure at the exit of each outlet plenum when manifolded as per section 2.4.1 of Appendix M.

* * * * *

§ 430.22 [Amended]

■ 3. Section 430.22 is amended as follows:

■ a. Paragraph (b)(5)2. is amended by removing ''23–1993'' and adding in its place ''23–2005.''

■ b. Paragraph (b)(5)3. is amended by removing ''37–1988'' and adding in its place ''37–2005.''

■ c. Paragraph (b)(5)8. is amended by removing ''116–1995'' and adding in its place ''116–1995 (RA 2005).''

■ d. Paragraph (b)(8) is amended by removing ''210/240–2003'' and adding in its place ''210/240–2006.''

■ 4. Section 430.23 is amended in subpart B by revising paragraph (m)(5) to read as follows:

§ 430.23 Test procedures for the measurement of energy and water consumption.

* * * * *

(m) * * *

(5) All measures of energy consumption must be determined by the test method as set forth in appendix M to this subpart; or by an alternative rating method set forth in § 430.24(m)(4) as approved by the Assistant Secretary for Energy Efficiency and Renewable Energy in accordance with § 430.24(m)(5).

* * * * *

■ 5. Section 430.24 is amended in subpart B by revising paragraph (m) to read as follows:

§ 430.24 Units to be tested.

* * * * *

(m)(1) For central air conditioners and heat pumps, each single-package system and each condensing unit (outdoor unit) of a split-system, when combined with a selected evaporator coil (indoor unit) or a set of selected indoor units, must have a sample of sufficient size tested in accordance with the applicable provisions of this subpart. The represented values for any model of single-package system, any model of a tested split-system combination, any model of a tested mini-split system combination, or any model of a tested multi-split system combination must be assigned such that —

(i) Any represented value of estimated annual operating cost, energy consumption or other measure of energy consumption of the central air conditioner or heat pump for which consumers would favor lower values must be no less than the higher of:

(A) The mean of the sample; or

(B) The upper 90-percent confidence limit of the true mean divided by 1.05;

(ii) Any represented value of the energy efficiency or other measure of energy consumption of the central air conditioner or heat pump for which consumers would favor higher values must be no greater than the lower of:

(A) The mean of the sample; or

(B) The lower 90-percent confidence limit of the true mean divided by 0.95;

(iii) For heat pumps, all units of the sample population must be tested in both the cooling and heating modes and the results used for determining the heat pump's certified SEER and HSPF ratings in accordance with paragraph (m)(1)(ii) of this section.

(2) For split-system air conditioners and heat pumps, the condenser-evaporator coil combination selected for tests pursuant to paragraph (m)(1) of this section shall include the evaporator coil that is likely to have the largest volume of retail sales with the particular model of condensing unit. For mini-split condensing units that are designed to always be installed with more than one indoor unit, a ''tested combination'' as defined in 10 CFR 430.2 shall be used for tests pursuant to paragraph (m)(1) of this section. For multi-split systems, each model of condensing unit shall be tested with two different sets of indoor units. For one set, a ''tested combination'' composed entirely of non-ducted indoor units shall be used. For the second set, a ''tested combination'' composed entirely of ducted indoor units shall be used. Components of similar design may be substituted without requiring additional testing if the represented measures of energy consumption continue to satisfy the applicable sampling provisions of paragraphs (m)(1)(i) and (m)(1)(ii) of this section. However, for any split-system air conditioner having a single-speed compressor, the condenser-evaporator coil combination selected for tests pursuant to paragraph (m)(1) of this section shall include the indoor *coil-only* unit that is likely to have the largest volume of retail sales with the particular model of outdoor unit. This *coil-only* requirement does not apply to split-system air conditioners that are only sold and installed with *blower-coil* indoor units, specifically mini-splits, multi-splits, and through-the-wall units. This coil-only requirement does not apply to any split-system heat pumps. For every other split-system combination that includes the same model of condensing unit but a different model of evaporator coil and for every other mini-split and multi-split system that includes the same model of condensing unit but a different set of evaporator coils, whether the evaporator coil(s) is manufactured by the same manufacturer or by a component manufacturer, either—

(i) A sample of sufficient size, comprised of production units or representing production units, must be tested as complete systems with the resulting ratings for the outdoor unit-indoor unit(s) combination obtained in accordance with paragraphs (m)(1)(i) and (m)(1)(ii) of this section; or

(ii) The representative values of the measures of energy efficiency must be assigned as follows,

(A) Using an alternative rating method (ARM) that has been approved by DOE in accordance with the provisions of paragraphs (m)(4) through (m)(6) of this section; or

(B) For multi-split systems composed entirely of non-ducted indoor units, set equal to the system tested in accordance

with paragraph (m)(1) of this section whose tested combination was entirely non-ducted indoor units;

(C) For multi-split systems composed entirely of ducted indoor units, set equal to the system tested in accordance with paragraph (m)(1) of this section whose tested combination was entirely ducted indoor units; and

(D) For multi-split systems having a mix of non-ducted and ducted indoor units, set equal to the mean of the values for the two systems — one having the tested combination of all non-ducted units and the second having the tested combination of all ducted indoor units — tested in accordance with paragraph (m)(1) of this section.

(3) Whenever the representative values of the measures of energy consumption, as determined by the provisions of paragraph (m)(2)(ii) of this section, do not agree within 5 percent of the representative values of the measures of energy consumption as determined by actual testing, the representative values determined by actual testing must be used to comply with section 323(c) of the Act or to comply with rules under section 324 of the Act.

(4) The basis of the ARM referred to in paragraph (m)(2)(ii) of this section must be a representation of the test data and calculations of a mechanical vapor-compression refrigeration cycle. The major components in the refrigeration cycle must be modeled as ''fits'' to manufacturer performance data or by graphical or tabular performance data. Heat transfer characteristics of coils may be modeled as a function of face area, number of rows, fins per inch, refrigerant circuitry, air-flow rate and entering-air enthalpy. Additional performance-related characteristics to be considered may include type of expansion device, refrigerant flow rate through the expansion device, power of the indoor fan and cyclic-degradation coefficient. Ratings for untested combinations must be derived from the ratings of a combination tested in accordance with paragraph (m)(1) of this section. The seasonal energy efficiency ratio (SEER) and/or heating seasonal performance factor (HSPF) ratings for an untested combination must be set equal to or less than the lower of the SEER and/or HSPF calculated using the applicable DOE-approved alternative rating method (ARM). If the method includes an ARM/simulation adjustment factor(s), determine the value(s) of the factors(s) that yield the best match between the SEER/HSPF determined using the ARM versus the SEER/HSPF determined from testing in accordance with paragraph (m)(1) of this section. Thereafter, apply the ARM using the derived adjustment factor(s) only when determining the ratings for untested combinations having the same outdoor unit.

(5) Manufacturers or private labelers who elect to use an ARM for determining measures of energy consumption under paragraphs (m)(2)(ii)(A) and (m)(4) of this section must submit a request for DOE to review the ARM. Send the request to the Assistant Secretary of Energy Efficiency and Renewable Energy, 1000 Independence Avenue, SW., Washington, DC 20585–0121. Approval must be received from the Assistant Secretary to use the ARM before the ARM may be used for rating split-system central air conditioners and heat pumps. If a manufacturer has a DOE-approved ARM for products also distributed in commerce by a private labeler, the ARM may also be used by the private labeler for rating these products. Once an ARM is approved, DOE may contact a manufacturer to learn if their ARM has been modified in any way and to verify that the ARM is being applied as approved. DOE will give follow-up priority to individual combinations having questionably high ratings (e.g., a coil-only system having a rating that exceeds the rating of a coil-only highest sales volume combination by more than 6 percent).

(6) Each request to DOE for approval of an alternative rating method must include:

(i) The name, mailing address, telephone number, and e-mail address of the official representing the manufacturer.

(ii) Complete documentation of the alternative rating method to allow DOE to evaluate its technical adequacy. The documentation must include a description of the methodology, state any underlying assumptions, and explain any correlations. The documentation should address how the method accounts for the cyclic-degradation coefficient, the type of expansion device, and, if applicable, the indoor fan-off delay. The requestor must submit any computer programs—including spreadsheets—having less than 200 executable lines that implement the ARM. Longer computer programs must be identified and sufficiently explained, as specified above, but their inclusion in the initial submittal package is optional. Applicability or limitations of the ARM (e.g., only covers single-speed units when operating in the cooling mode, covers units with rated capacities of 3 tons or less, not applicable to the manufacturer's product line of non-ducted systems, etc.) must be stated in the documentation.

(iii) Complete test data from laboratory tests on four mixed (i.e., non-highest-sales-volume combination) systems per each ARM.

(A) The four mixed systems must include four different indoor units and at least two different outdoor units. A particular model of outdoor unit may be tested with up to two of the four indoor units. The four systems must include two low-capacity mixed systems and two high-capacity mixed systems. The low-capacity mixed systems may have any capacity. The rated capacity of each high-capacity mixed system must be at least a factor of two higher than its counterpart low-capacity mixed system. The four mixed systems must meet the applicable energy conservation standard in § 430.32(c) in effect at the time of the rating.

(B) The four indoor units must come from at least two different coil families, with a maximum of two indoor units coming from the same coil family. Data for two indoor units from the same coil family, if submitted, must come from testing with one of the ''low-capacity mixed systems'' and one of the ''high capacity mixed systems.'' A mixed system indoor coil may come from the same coil family as the highest-sales-volume-combination indoor unit (i.e., the ''matched'' indoor unit) for the particular outdoor unit. Data on mixed systems where the indoor unit is now obsolete will be accepted towards the ARM-validation submittal requirement if it is from the same coil family as other indoor units still in production.

(C) The first two sentences of paragraph (m)(6)(iii)(B) of this section do not apply if the manufacturer offers indoor units from only one coil family. In this case only, all four indoor coils must be selected from this one coil family. If approved, the ARM will be specifically limited to applications for this one coil family.

(iv) All product information on each mixed system indoor unit, each matched system indoor unit, and each outdoor unit needed to implement the proposed ARM. The calculated ratings for the four mixed systems, as determined using the proposed ARM, must be provided along with any other related information that will aid the verification process.

(v) If request for approval is for an updated ARM, manufacturers must identify modifications made to the ARM since the last submittal, including any ARM/simulation adjustment factor(s) added since the ARM was last approved by DOE.

(7) Manufacturers that elect to use an alternative rating method for determining measures of energy consumption under paragraphs (m)(2)(ii)(A) and (m)(4) of this section must either subject a sample of their units to independent testing on a regular basis, e.g., through a voluntary certification program, or have the representations reviewed and certified by an independent state-registered professional engineer who is not an employee of the manufacturer. The registered professional engineer is to certify that the results of the alternative rating procedure accurately represent the energy consumption of the unit(s). The manufacturer is to keep the registered professional engineer's certifications on file for review by DOE for as long as said combination is made available for sale by the manufacturer. Any proposed change to the alternative rating method must be approved by DOE prior to its use for rating.

(8) Manufacturers who choose to use computer simulation or engineering analysis for determining measures of energy consumption under paragraphs (m)(2)(ii)(A) and (m)(4) through (m)(7) of this section must permit representatives of the Department of Energy to inspect for verification purposes the simulation method(s) and computer program(s) used. This inspection may include conducting simulations to predict the performance of particular outdoor unit '' indoor unit combinations specified by DOE, analysis of previous simulations conducted by the manufacturer, or both.

* * * * *

Appendix M—[Amended]

■ 6. Appendix M to subpart B of part 430 is amended:

■ a. In section 1. Definitions:

■ 1. Section 1.3 is amended by removing ''210/240–2003'' and adding in its place ''210/240–2006''; and by removing ''2003'' and adding in its place ''2006.''

■ 2. Section 1.5 is amended by removing ''23–93'' and adding in its place ''23–2005''; and by removing ''1993'' and adding in its place ''2005.''

■ 3. Section 1.6 is amended by removing ''37–88'' and adding in its place ''37–2005''; and by removing ''1988'' and adding in its place ''2005.''

■ 4. Section 1.12 is amended by adding ''RA(05)'' after ''116–95''; and adding ''and reaffirmed in 2005'' after ''1995.''

■ 5. Section 1.35 is amended by removing ''certified'' and adding in its place ''full-load.''

■ 6. Section 1.37 is revised to read as set forth below.

■ b. In section 2, Testing Conditions:

■ 1. Sections 2.1a, 2.2a, 2.2b, 2.2.3, 2.2.5, 2.4.1, and 2.4.2 are revised to read as set forth below.

■ 2. Section 2.3.1b is amended by removing ''Certified'' and adding in its place ''Full-load.''

■ 3. Section 2.5.3 is amended by revising the first sentence to read as set forth below.

■ 4. New section 2.5.4.3 is added to read as set forth below.

■ 5. Section 2.6a is amended by adding in the first sentence ''(RA05)'' after ''116–95.''

■ 6. Section 2.6b is amended in the second sentence, and in the last sentence, by removing ''37–88'' and adding in its place ''37–2005;'' and by removing ''ARI Standard 210/240–2003'' and adding in its place ''ARI Standard 210/240–2006'' in the second sentence.

■ 7. Section 2.7 is amended by removing ''ARI Standard 210/240–2003'' and adding in its place ''ARI Standard 210/240–2006.''

■ 8. Section 2.10.2 is amended in the third and fourth sentences, by removing ''37–88'' and adding in its place ''37–2005.''

■ 9. Section 2.10.3 is amended in the second sentence, by removing ''7.6.2,'' and adding in its place ''7.5.2,'' and by removing ''37–88'' and adding in its place ''37–2005'' in the second and third sentences.

■ 10. Section 2.11a is amended in the first sentence, by removing ''37–88'' and adding in its place ''37–2005.''

■ 11. Section 2.13 is amended in the second sentence, by removing ''37–88'' and adding in its place ''37–2005.''

■ c. In section 3, Testing Procedures:

■ 1. Section 3.1.1 is amended by revising the seventh sentence to read as set forth below.

■ 2. Section 3.1.3 is amended by removing ''ARI Standard 210/240–2003'' and adding in its place ''ARI Standard 210/240–2006.''

■ 3. Section 3.1.4.1 is amended by removing ''Certified'' and adding in its place ''Full-load.''

■ 4. Section 3.1.4.1.1, from its title to the end of paragraph a., and Table 2, are revised to read as set forth below.

■ 4a. Section 3.1.4.1.1b is amended by revising the first sentence to read as set forth below.

■ 5. Amend sections 3.1.4.1.1b and 3.1.4.1.1c by removing ''Certified'' and adding in its place ''Full-load.''

■ 6. Section 3.1.4.1.2 is amended by removing ''Certified'' and adding in its place ''Full-load'' in two locations.

■ 7. Section 3.1.4.2a is amended by revising the ''Cooling Minimum Air Vol. Rate'' equation to read as set forth below.

■ 8. Section 3.1.4.2b is amended by revising the equation for minimum external static pressure to read as set forth below.

■ 9. Section 3.1.4.2c is amended by removing ''Certified'' and adding in its place ''Full-load.''

■ 10. Section 3.1.4.3a is amended by revising the ''Cooling Intermediate Air Volume Rate'' equation to read as set forth below.

■ 11. Section 3.1.4.3b is amended by revising the ''E_v Test ΔP_{st} '' equation to read as set forth below.

■ 12. Section 3.1.4.4 is amended by removing ''Certified'' and adding in its place ''Full-load.''

■ 13. Section 3.1.4.4.1 is amended by removing ''Certified'' and adding in its place ''Full-load'' in three locations.

■ 14. Section 3.1.4.4.2 is amended by removing ''Certified'' and adding in its place ''Full-load'' and revising the ''Heating Certified Air Volume Rate'' equation to read as set forth below.

■ 14a. Section 3.1.4.4.2a is amended by removing ''Certified'' and adding in its place ''Full-load.''

■ 15. Section 3.1.4.4.2b is amended by removing ''Certified'' and adding in its place ''Full-load'' in three locations, and revising the ''Heating Certified ΔP_{st}'' equation to read as set forth below.

■ 16. Section 3.1.4.4.2c is amended by removing ''Certified'' and adding in its place ''Full-load'' in three locations.

■ 17. Sections 3.1.4.4.3 and 3.1.4.4.3a are revised to read as set forth below.

■ 17a. Sections 3.1.4.4.3b is amended by revising the first sentence to read as set forth below.

■ 18. Amend sections 3.1.4.4.3b, 3.1.4.4.3c and 3.1.4.4.4 by removing ''Certified'' and adding in its place ''Full-load.''

■ 19. Section 3.1.4.5a is amended by revising the ''Heating Minimum Air Volume Rate'' equation to read as set forth below.

■ 20. Section 3.1.4.5b is amended by revising the ''$H0_1$, $H1_1$, $H2_1$, $H3_1$, Test ΔP_{st}'' equation to read as set forth below.

■ 21. Section 3.1.4.5d is amended by removing Certified and adding in its place Full-load in two locations.

■ 22. Section 3.1.4.6a is amended by revising the ''Heating Intermediate Air Volume Rate'' equation to read as set forth below.

■ 23. Section 3.1.4.6b is amended by revising the ''$H2_v$ Test ΔP_{st}'' equation to read as set forth below.

■ 24. Section 3.1.4.7 is amended by revising the ''Heating Nominal Air Volume Rate'' equation and the ''$H1_N$ Test ΔP_{st}'' equation to read as set forth below.

■ 25. Section 3.1.5 is amended in the first sentence by removing ''37–88'' and adding in its place ''37–2005.''

■ 26. Section 3.1.6 is amended in the first and second sentences, by removing ''7.8.3.1 and 7.8.3.2'' and adding in its place ''7.7.2.1 and 7.7.2.2,'' and in the first sentence, by removing ''37–88'' and adding in its place ''37–2005,'' and by adding a new sentence after the second sentence, to read as set forth below.
■ 27. Section 3.1.7 is amended by removing ''certified'' and adding in its place ''Full-load'' in four locations.
■ 28. Section 3.1.9 is amended by removing ''Certified'' and adding in its place ''Full-load.''
■ 28a. Section 3.2.1 is amended by revising the fourth sentence to read as set forth below.
■ 29. Table 3 to Section 3.2.1 is amended by removing ''certified'' and adding in its place ''full-load'' in three locations in the last column.
■ 29a. Section 3.2.2.1 is amended by revising the third sentence to read as set forth below.
■ 30. Table 4 to Section 3.2.2.1 is amended by removing ''certified'' and adding in its place ''full-load'' in two locations in the last column.
■ 31. Section 3.2.2.2 is amended by removing ''Certified'' and adding in its place ''Full-load.''
■ 32. Sections 3.2.3a is revised as set forth below.
■ 33. Section 3.2.3b is amended by removing ''Certified'' and adding in its place ''Full-load.''
■ 34. Section 3.2.3d is revised as set forth below.
■ 35. Table 5 to section 3.2.3 is revised as set forth below.
■ 36. Section 3.2.4.a is amended by revising the third sentence to read as set forth below.
■ 37. Section 3.2.4b is amended by removing ''Certified'' and adding in its place ''Full-load.''
■ 38. Table 6 to section 3.2.4 is revised as set forth below.
■ 39. Section 3.2.4 is amended by adding a new paragraph (c) as set forth below.
■ 40. Section 3.3b is amended in both the first and second sentences, by removing ''Table 5,'' and adding in its place ''Table 3,'' and in the first sentence by removing ''37–88'' and adding in its place ''37–2005.''
■ 41. Section 3.3c is amended in the first sentence by removing ''section 7.3.3.1 of ASHRAE Standard 37–88,'' and adding in its place ''sections 7.3.3.1 and 7.3.3.3 of ASHRAE Standard 37–2005.''
■ 42. The titles of sections 3.4 and 3.5 are revised as set forth below.
■ 43. Section 3.4b is revised to read as set forth below.
■ 44. Section 3.5.3 is amended by revising the introductory text to read as set forth below.
■ 45. Section 3.6.1 is amended by revising the second, third, and fourth sentences to read as set forth below.
■ 46. Table 9 to Section 3.6.1 is amended by removing ''Certified'' and adding in its place ''Full-load'' in three locations.
■ 47. Section 3.6.2 is amended by revising the introductory text to read as set forth below.
■ 48. Table 10 to Section 3.6.2 is amended by removing ''Certified'' and adding in its place ''Full-load'' in three locations.
■ 49. Section 3.6.3 is revised as set forth below.
■ 50. Table 11 to section 3.6.3 is revised as set forth below.
■ 51. Section 3.6.4 is amended by revising the third, fourth, and fifth sentences of paragraph a. and adding a new paragraph c. to read as set forth below.
■ 52. Table 12 to section 3.6.4 is revised to read as set forth below.
■ 53. Section 3.7a is amended in the fifth sentence by removing ''Table 5 of ASHRAE Standard 37–88'' and adding in its place ''Table 3 of ASHRAE Standard 37–2005,'' and in the sixth sentence, by removing ''Table 5'' and adding in its place ''Table 3.''
■ 54. Section 3.7b is amended by revising the first sentence to read as set forth below.
■ 55. The title of section 3.8 is revised to read as set forth below.
■ 56. The introductory text and the first equation of section 3.8.1 are revised to read as set forth below.
■ 57. Section 3.9c is revised to read as set forth below.
■ 58. Section 3.9f is amended by revising the fifth sentence and adding a parenthetical immediately following it to read as set forth below.
■ 59. Section 3.9.1a is amended by adding a new sentence at the end of the section directly before section 3.9.1.b to read as set forth below.
■ 60. Section 3.9.2b is amended by replacing ''Certified'' with ''Full-load.''
■ 61. Section 3.11 is amended by removing the introductory text following the paragraph heading, which is republished below.
■ 62. Section 3.11.1.3b is revised to read as set forth below.
■ 63. Section 3.11.2a is amended by revising the seventh sentence to read as set forth below.
■ 64. Section 3.11.2b is revised to read as set forth below.
■ 65. Section 3.11.3 is revised to read as set forth below.
■ d. In section 4, CALCULATIONS OF SEASONAL PERFORMANCE DESCRIPTORS:
■ 1. Sections 4.1.2.1a and 4.1.2.1d are amended by removing ''Certified'' and adding in its place ''Full-load.''
■ 2. Section 4.1.3 is amended by revising the introductory text, equations 4.1.3–1 and 4.1.3–2, the paragraph preceding equation 4.1.3–3, and equation 4.1.3–3 to read as set forth below.
■ 3. Section 4.1.3.3 is amended by revising the equation for PLF_j and the text following the equation to read as set forth below.
■ 4. Section 4.1.4 is amended by revising everything except for the equations for calculating M_Q and M_E, to read as set forth below.
■ 5. Section 4.1.4.1 is amended by revising the second sentence after the explanation of terms in the equations (''Use Equations 4.1.3–1 and 4.1.3–2, respectively, to evaluate $\dot{Q}_c^{k=1}(T_j)$'' and $\dot{E}_c^{k=1}(T_j)$ to read as set forth below.
■ 6. Section 4.1.4.2 is amended by revising the equation numbers referenced in the descriptions of the quantities T_1 and T_v, revising the equation numbers referred to in the equations for $EER^{k=1}(T_1)$ and $EER^{k=v}(T_v)$, and adding text at the end of the section to read as set forth below.
■ 7. Section 4.2.3.3 is amended by revising the equation for PLF_j and the text following the equation to read as set forth below.
■ 8. The Section 4.2.4 equations for M_Q and M_E are revised to read as set forth below.
■ 9. Section 4.2.4.2 is amended by adding text at the end of the section to read as set forth below.

The additions and revisions read as follows:

Appendix M to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Central Air Conditioners and Heat Pumps

* * * * *

1. Definitions

* * * * *

1.37 Standard air means dry air having a mass density of 0.075 lb/ft^3.

* * * * *

2. Testing Conditions

* * * * *

2.1 Test room requirements. a. Test using two side-by-side rooms, an indoor test room and an outdoor test room. For multiple-split air conditioners and heat pumps (see Definition 1.30), however, use as many available indoor test rooms as needed to accommodate the total number of indoor units. These rooms must comply with the requirements specified in sections 8.1.2 and 8.1.3 of ASHRAE Standard 37–2005

(incorporated by reference, see § 430.22).

* * * * *

2.2 Test unit installation requirements. a. Install the unit according to section 8.2 of ASHRAE Standard 37–2005 (incorporated by reference, see § 430.22). With respect to interconnecting tubing used when testing split systems, however, follow the requirements given in section 6.1.3.5 of ARI Standard 210/240–2006 (incorporated by reference, see § 430.22). When testing triple-split systems (see Definition 1.44), use the tubing length specified in section 6.1.3.5 of ARI Standard 210/240–2006 (incorporated by reference, see § 430.22) to connect the outdoor coil, indoor compressor section, and indoor coil while still meeting the requirement of exposing 10 feet of the tubing to outside conditions. When testing split systems having multiple indoor coils, connect each indoor fan-coil to the outdoor unit using: (a) 25 feet of tubing, or (b) tubing furnished by the manufacturer, whichever is longer. If they are needed to make a secondary measurement of capacity, install refrigerant pressure measuring instruments as described in section 8.2.5 of ASHRAE Standard 37–2005 (incorporated by reference, see § 430.22). Refer to section 2.10 of this Appendix to learn which secondary methods require refrigerant pressure measurements. At a minimum, insulate the low-pressure line(s) of a split-system with insulation having an inside diameter that matches the refrigerant tubing and a nominal thickness of 0.5 inch.

b. For units designed for both horizontal and vertical installation or for both up-flow and down-flow vertical installations, the manufacturer must specify the orientation used for testing. Conduct testing with the following installed:

(1) the most restrictive filter(s);

(2) supplementary heating coils; and

(3) other equipment specified as part of the unit, including all hardware used by a heat comfort controller if so equipped (see Definition 1.28). For small-duct, high-velocity systems, configure all balance dampers or restrictor devices on or inside the unit to fully open or lowest restriction.

* * * * *

2.2.3 Special requirements for multi-split air conditioners and heat pumps, and systems composed of multiple mini-split units (outdoor units located side-by-side) that would normally operate using two or more indoor thermostats. For any test where the system is operated at part load (i.e., one or more compressors ''off'', operating at the intermediate or minimum compressor speed, or at low compressor capacity), the manufacturer shall designate the particular indoor coils that are turned off during the test. For variable-speed systems, the manufacturer must designate at least one indoor unit that is turned off for all tests conducted at minimum compressor speed. For all other part-load tests, the manufacturer shall choose to turn off zero, one, two, or more indoor units. The chosen configuration shall remain unchanged for all tests conducted at the same compressor speed/capacity. For any indoor coil that is turned off during a test, take steps to cease forced airflow through this indoor coil and block its outlet duct. Because these types of systems will have more than one indoor fan and possibly multiple outdoor fans and compressor systems, references in this test procedure to a single indoor fan, outdoor fan, and compressor means all indoor fans, all outdoor fans, and all compressor systems that are turned on during the test.

* * * * *

2.2.5 Additional refrigerant charging requirements. Charging according to the ''manufacturer's published instructions,'' as stated in section 8.2 of ASHRAE Standard 37–2005 (incorporated by reference, see § 430.22), means the manufacturer's installation instructions that come packaged with the unit. * * *

* * * * *

2.4.1 Outlet plenum for the indoor unit. a. Attach a plenum to the outlet of the indoor coil. (**NOTE:** for some packaged systems, the indoor coil may be located in the outdoor test room.)

b. For systems having multiple indoor coils, attach a plenum to each indoor coil outlet. Connect two or more outlet plenums to a single common duct so that each indoor coil ultimately connects to an airflow measuring apparatus (section 2.6). If using more than one indoor test room, do likewise, creating one or more common ducts within each test room that contains multiple indoor coils. At the plane where each plenum enters a common duct, install an adjustable airflow damper and use it to equalize the static pressure in each plenum. Each outlet air temperature grid (section 2.5.4) and airflow measuring apparatus are located downstream of the inlet(s) to the common duct.

c. For small-duct, high-velocity systems, install an outlet plenum that has a diameter that is equal to or less than the value listed below. The limit depends only on the cooling Full-Load Air Volume Rate (see section 3.1.4.1.1) and is effective regardless of the flange dimensions on the outlet of the unit (or an air supply plenum adapter accessory, if installed in accordance with the manufacturer's installation instructions).

d. Add a static pressure tap to each face of the (each) outlet plenum, if rectangular, or at four evenly distributed locations along the circumference of an oval or round plenum. Create a manifold that connects the four static pressure taps. Figure 1 shows two of the three options allowed for the manifold configuration; the third option is the broken-ring, four-to-one manifold configuration that is shown in Figure 7a of ASHRAE Standard 37–2005 (incorporated by reference, see § 430.22). See Figures 7a, 7b, 7c, and 8 of ASHRAE Standard 37–2005 (incorporated by reference, see § 430.22) for the cross-sectional dimensions and minimum length of the (each) plenum and the locations for adding the static pressure taps for units tested with and without an indoor fan installed.

Cooling full-load air volume rate (scfm)	Maximum diameter* of outlet plenum (inches)
≤500	6
501 to 700	7
701 to 900	8
901 to 1100	9
1101 to 1400	10
1401 to 1750	11

*If the outlet plenum is rectangular, calculate its equivalent diameter using *(4A)/P,* where *A* is the area and *P* is the perimeter of the rectangular plenum, and compare it to the listed maximum diameter.

2.4.2 Inlet plenum for the indoor unit. Install an inlet plenum when testing a coil-only indoor unit or a packaged system where the indoor coil is located in the outdoor test room. Add static pressure taps at the center of each face of this plenum, if rectangular, or at four evenly distributed locations along the circumference of an oval or round plenum. Make a manifold that connects the four static-pressure taps using one of the three configurations specified in section 2.4.1. See Figures 7b, 7c, and Figure 8 of ASHRAE Standard 37–2005 (incorporated by reference, see § 430.22) for cross-sectional dimensions, the minimum length of the inlet plenum, and the locations of the static-pressure taps. When testing a ducted unit having an indoor fan (and the indoor coil is in the indoor test room), the manufacturer has the option to test with or without an inlet plenum installed. Space limitations within the test room may dictate that the manufacturer choose the latter option. If used, construct the inlet plenum and add the four static-pressure taps as shown in Figure 8 of ASHRAE Standard 37–2005 (incorporated by reference, see § 430.22). Manifold the four static-pressure taps using one of the three configurations specified in section 2.4.1. Never use an inlet plenum when testing a non-ducted system.

* * * * *

2.5.3 Section 6.5.2 of ASHRAE Standard 37–2005 (incorporated by reference, see § 430.22) describes the method for fabricating static-pressure taps. * * *

* * * * *

2.5.4.3 Minimizing air leakage. For small-duct, high-velocity systems, install an air damper near the end of the interconnecting duct, just prior to the transition to the airflow measuring apparatus of section 2.6. To minimize air leakage, adjust this damper such that the pressure in the receiving chamber of the airflow measuring apparatus is no more than 0.5 inch of water higher than the surrounding test room ambient. In lieu of installing a separate damper, use the outlet air damper box of sections 2.5 and 2.5.4.1 if it allows variable positioning. Also apply these steps to any conventional indoor blower unit that creates a static pressure within the receiving chamber of the airflow measuring apparatus that exceeds the test room ambient pressure by more than 0.5 inches of water column.

* * * * *

3. Testing Procedures

* * * * *

3.1.1 Primary and secondary test methods. * * *

For this capacity comparison, use the Indoor Air Enthalpy Method capacity that is calculated in section 7.3 of ASHRAE Standard 37–2005 (incorporated by reference, see § 430.22) (and, if testing a coil-only unit, do not make the after-test fan heat adjustments described in section 3.3, 3.4, 3.7, and 3.10 of this Appendix). * * *

* * * * *

3.1.4.1.1 Cooling Full-Load Air Volume Rate for Ducted Units. The manufacturer must specify the Cooling Full-load Air Volume Rate. Use this value as long as the following two requirements are satisfied. First, when conducting the A or A_2 Test (exclusively), the measured air volume rate, when divided by the measured indoor air-side total cooling capacity must not exceed 37.5 cubic feet per minute of standard air (scfm) per 1000 Btu/h. If this ratio is exceeded, reduce the air volume rate until this ratio is equaled. Use this reduced air volume rate for all tests that call for using the Cooling Full-load Air Volume Rate. The second requirement is as follows:

a. For all ducted units tested with an indoor fan installed, except those having a variable-speed, constant-air-volume-rate indoor fan. The second requirement applies exclusively to the A or A_2 Test and is met as follows.

1. Achieve the Cooling Full-load Air Volume Rate, determined in accordance with the previous paragraph;

2. Measure the external static pressure;

3. If this pressure is equal to or greater than the applicable minimum external static pressure cited in Table 2, this second requirement is satisfied. Use the current air volume rate for all tests that require the Cooling Full-load Air Volume Rate.

4. If the Table 2 minimum is not equaled or exceeded,

4a. reduce the air volume rate until the applicable Table 2 minimum is equaled or

4b. until the measured air volume rate equals 95 percent of the air volume rate from step 1, whichever occurs first.

5. If the conditions of step 4a occur first, this second requirement is satisfied. Use the step 4a reduced air volume rate for all tests that require the Cooling Full-load Air Volume Rate.

6. If the conditions of step 4b occur first, make an incremental change to the set-up of the indoor fan (e.g., next highest fan motor pin setting, next highest fan motor speed) and repeat the evaluation process beginning at above step 1. If the indoor fan set-up cannot be further changed, reduce the air volume rate until the applicable Table 2 minimum is equaled. Use this reduced air volume rate for all tests that require the Cooling Full-load Air Volume Rate.

b. For ducted units that are tested with a variable-speed, constant-air-volume-rate indoor fan installed. * * *

* * * * *

TABLE 2.—MINIMUM EXTERNAL STATIC PRESSURE FOR DUCTED SYSTEMS TESTED WITH AN INDOOR FAN INSTALLED

Rated Cooling [1] or Heating [2] Capacity (Btu/h)	Minimum external resistance [3] (Inches of water)	
	All other systems	Small-duct, high-velocity systems [4,5]
Up Thru 28,800	0.10	1.10
29,000 to 42,500	0.15	1.15
43,000 and Above	0.20	1.20

[1] For air conditioners and heat pumps, the value cited by the manufacturer in published literature for the unit's capacity when operated at the *A* or A_2 Test conditions.

[2] For heating-only heat pumps, the value the manufacturer cites in published literature for the unit's capacity when operated at the *H1* or $H1_2$ Test conditions.

[3] For ducted units tested without an air filter installed, increase the applicable tabular value by 0.08 inch of water.

[4] See Definition 1.35 to determine if the equipment qualifies as a small-duct, high-velocity system.

[5] If a closed-loop, air-enthalpy test apparatus is used on the indoor side, limit the resistance to airflow on the inlet side of the indoor blower coil to a maximum value of 0.1 inch of water. Impose the balance of the airflow resistance on the outlet side of the indoor blower.

* * * * *

3.1.4.2 Cooling Minimum Air Volume Rate. a. * * *

$$\text{Cooling Minimum Air Vol. Rate} = \text{Cooling Full-load Air Vol. Rate} \times \frac{\text{Cooling Minimum Fan Speed}}{\text{A}_2\text{Test Fan Speed}},$$

* * * b. * * *

$$\text{A}_1,\ \text{B}_1,\ \text{C}_1,\ \text{F}_1,\ \&\ \text{G}_1\ \text{Test}\ \Delta P_{st} = \Delta P_{st,\ A_2} \times \left[\frac{\text{Cooling Minimum Air Volume Rate}}{\text{Cooling Full-load Air Volume Rate}}\right]^2,$$

* * * * *

3.1.4.3 Cooling Intermediate Air Volume Rate. a. * * *

$$\text{Cooling Intermediate Air Vol. Rate} = \text{Cooling Full-load Air Vol. Rate} \times \frac{\text{E}_V\text{Test Fan Speed}}{\text{A}_2\text{Test Fan Speed}},$$

* * * b. * * *

$$\text{E}_V\text{Test}\ \Delta P_{st} = \Delta P_{st,\ A_2} \times \left[\frac{\text{Cooling Intermediate Air Volume Rate}}{\text{Cooling Full-load Air Volume Rate}}\right]^2,$$

* * * * *

3.1.4.4.2 Ducted heat pumps where the Heating and Cooling Full-load Air Volume Rates are different due to indoor fan operation. a. * * *

$$\text{Heating Full-load Air Volume Rate} = \text{Cooling Full-load Air Volume Rate} \times \frac{\text{H1 or H1}_2\ \text{Test Fan Speed}}{\text{A or A}_2\ \text{Test Fan Speed}},$$

* * * b. * * *

$$\text{Heating Full-load}\ \Delta P_{st} = \text{Cooling Full-load}\ \Delta P_{st} \times \left[\frac{\text{Heating Full-load Air Volume Rate}}{\text{Cooling Full-load Air Volume Rate}}\right]^2,$$

* * * * *

3.1.4.4.3 Ducted heating-only heat pumps. The manufacturer must specify the Heating Full-load Air Volume Rate.

a. For all ducted heating-only heat pumps tested with an indoor fan installed, except those having a variable-speed, constant-air-volume-rate indoor fan. Conduct the following steps only during the first test, the H1 or $H1_2$ Test.

1. Achieve the Heating Full-load Air Volume Rate.

2. Measure the external static pressure.

3. If this pressure is equal to or greater than the Table 2 minimum external static pressure that applies given the heating-only heat pump's rated heating capacity, use the current air volume rate for all tests that require the Heating Full-load Air Volume Rate.

4. If the Table 2 minimum is not equaled or exceeded,

4a. reduce the air volume rate until the applicable Table 2 minimum is equaled or

4b. until the measured air volume rate equals 95 percent of the manufacturer-specified Full-load Air Volume Rate, whichever occurs first.

5. If the conditions of step 4a occurs first, use the step 4a reduced air volume rate for all tests that require the Heating Full-load Air Volume Rate.

6. If the conditions of step 4b occur first, make an incremental change to the set-up of the indoor fan (e.g., next highest fan motor pin setting, next highest fan motor speed) and repeat the evaluation process beginning at above step 1. If the indoor fan set-up cannot be further changed, reduce the air volume rate until the applicable Table 2 minimum is equaled. Use this reduced air volume rate for all tests that require the Heating Full-load Air Volume Rate.

b. For ducted heating-only heat pumps that are tested with a variable-speed, constant-air-volume-rate indoor fan installed. * * *

* * * * *

3.1.4.5 Heating Minimum Air Volume Rate. a. * * *

$$\text{Heating Minimum Air Vol. Rate} = \text{Heating Full-load Air Vol. Rate} \times \frac{\text{Heating Minimum Fan Speed}}{\text{H1}_2\text{ Test Fan Speed}},$$

* * * b. * * *

$$\text{H0}_1,\ \text{H1}_1,\ \text{H2}_1,\ \text{H3}_1,\ \text{Test } \Delta P_{st} = \Delta P_{st,\ H1_2} \times \left[\frac{\text{Htg Minimum Air Vol. Rate}}{\text{Htg Full-load Air Vol. Rate}}\right]^2,$$

* * * * * 3.1.4.6 Heating Intermediate Air Volume Rate. a. * * *

$$\text{Heating Intermediate Air Volume Rate} = \text{Heating Full-load Air Volume Rate} \times \frac{\text{H2}_V\text{ Test Fan Speed}}{\text{H1}_2\text{ Test Fan Speed}},$$

* * * b. * * *

$$\text{H2}_V\ \text{Test } \Delta P_{st} \Delta P_{st,\ H1_2} \times \left[\frac{\text{Heating Intermediate Air Volume Rate}}{\text{Heating Full-load Air Volume Rate}}\right]^2,$$

* * * * * 3.1.4.7 Heating Nominal Air Volume Rate. * * *

$$\text{Heating Nominal Air Volume Rate} = \text{Heating Full-load Air Volume Rate} \times \frac{\text{H1}_N\text{ Test Fan Speed}}{\text{H1}_2\text{ Test Fan Speed}},$$

$$\text{H1}_N\ \text{Test } \Delta P_{st} = \Delta P_{st,\ H1_2} \times \left[\frac{\text{Heating Nominal Air Volume Rate}}{\text{Heating Full-load Air Volume Rate}}\right]^2,$$

* * * * *

3.1.6 * * * (Note: In the first printing of ASHRAE Standard 37–2005, the second IP equation for Q_{mi} should read,

$$1097CA_n\sqrt{P_v v'_n}.)***$$

* * *

* * * * *

3.2.1 * * * If the two optional tests are conducted but yield a tested $C_D{}^c$ that exceeds the default $C_D{}^c$ or if the two optional tests are not conducted, assign $C_D{}^c$ the default value of 0.25. * * *

* * * * *

3.2.2.1 * * * If the two optional tests are conducted but yield a tested $C_D{}^c$ that exceeds the default $C_D{}^c$ or if the two optional tests are not conducted, assign $C_D{}^c$ the default value of 0.25.

* * *

* * * * *

3.2.3 Tests for a unit having a two-capacity compressor. (See Definition 1.45.)

a. Conduct four steady-state wet coil tests: the A_2, B_2, B_1, and F_1 Tests. Use the two optional dry-coil tests, the steady-state C_1 Test and the cyclic D_1 Test, to determine the cooling-mode cyclic-degradation coefficient, $C_D{}^c$. If the two optional tests are conducted but yield a tested $C_D{}^c$ that exceeds the default $C_D{}^c$ or if the two optional tests are not conducted, assign $C_D{}^c$ the default value of 0.25. Table 5 specifies test conditions for these six tests.

* * * * *

d. If a two-capacity air conditioner or heat pump locks out low-capacity operation at higher outdoor temperatures, then use the two optional dry-coil tests, the steady-state C_2 Test and the cyclic D_2 Test, to determine the cooling-mode cyclic-degradation coefficient that only applies to on/off cycling from high capacity, $C_D{}^c(k=2)$. If the two optional tests are conducted but yield a tested $C_D{}^c(k=2)$ that exceeds the default $C_D{}^c(k=2)$ or if the two optional tests are not conducted, assign $C_D{}^c(k=2)$ the default value. The default $C_D{}^c(k=2)$ is the same value as determined or assigned for the low-capacity cyclic-degradation coefficient, $C_D{}^c$ [or equivalently, $C_D{}^c(k=1)$].

TABLE 5.—COOLING MODE TEST CONDITIONS FOR UNITS HAVING A TWO-CAPACITY COMPRESSOR

Test description	Air entering indoor unit temperature (°F)		Air entering outdoor unit temperature (°F)		Compressor capacity	Cooling air volume rate
	Dry bulb	Wet bulb	Dry bulb	Wet bulb		
A_2 Test—required (steady, wet coil)	80	67	95	[1] 75	High	Cooling Full-Load.[2]
B_2 Test—required (steady, wet coil)	80	67	82	[1] 65	High	Cooling Full-Load.[2]
B_1 Test—required (steady, wet coil)	80	67	82	[1] 65	Low	Cooling Minimum.[3]
C_2 Test—optional (steady, dry-coil)	80	([4])	82		High	Cooling Full-Load.[2]
D_2 Test—optional (cyclic, dry-coil)	80	([4])	82		High	([5])
C_1 Test—optional (steady, dry-coil)	80	([4])	82		Low	Cooling Minimum.[3]
D_1 Test—optional (cyclic, dry-coil)	80	([4])	82		Low	([6])
F_1 Test—required (steady, wet coil)	80	67	67	[1] 53.5	Low	Cooling Minimum.[3]

[1] The specified test condition only applies if the unit rejects condensate to the outdoor coil.
[2] Defined in section 3.1.4.1.
[3] Defined in section 3.1.4.2.
[4] The entering air must have a low enough moisture content so no condensate forms on the indoor coil. DOE recommends using an indoor air wet-bulb temperature of 57 °F or less.
[5] Maintain the airflow nozzle(s) static pressure difference or velocity pressure during the ON period at the same pressure or velocity as measured during the C_2 Test.
[6] Maintain the airflow nozzle(s) static pressure difference or velocity pressure during the ON period at the same pressure or velocity as measured during the C_1 Test.

3.2.4 Tests for a unit having a variable-speed compressor. a. * * * If the two optional tests are conducted but yield a tested $C_D{}^c$ that exceeds the default $C_D{}^c$ or if the two optional tests are not conducted, assign $C_D{}^c$ the default value of 0.25. * * *

c. For multiple-split air conditioners and heat pumps (except where noted), the following procedures supersede the above requirements: For all Table 6 tests specified for a minimum compressor speed, at least one indoor unit must be turned off. The manufacturer shall designate the particular indoor unit(s) that is turned off. The manufacturer must also specify the compressor speed used for the Table 6 E_V Test, a cooling-mode intermediate compressor speed that falls within ¼ and ¾ of the difference between the maximum and minimum cooling-mode speeds. The manufacturer should prescribe an intermediate speed that is expected to yield the highest EER for the given E_V Test conditions and bracketed compressor speed range. The manufacturer can designate that one or more indoor units are turned off for the E_V Test.

* * * * *

TABLE 6.—COOLING MODE TEST CONDITION FOR UNITS HAVING A VARIABLE-SPEED COMPRESSOR

Test description	Air entering indoor unit temperature (°F)		Air entering outdoor unit temperature (°F)		Compressor speed	Cooling air volume rate
	Dry bulb	Wet bulb	Dry bulb	Wet bulb		
A_2 Test—required (steady, wet coil)	80	67	95	[1] 75	Maximum	Cooling Full-Load[2]
B_2 Test—required (steady, wet coil)	80	67	82	[1] 65	Maximum	Cooling Full-Load[2]
E_V Test—required (steady, wet coil)	80	67	87	[1] 69	Intermediate	Cooling Intermediate[3]
B_1 Test—required (steady, wet coil)	80	67	82	[1] 65	Minimum	Cooling Minimum[4]
F_1 Test—required (steady, wet coil)	80	67	67	[1] 53.5	Minimum	Cooling Minimum[4]
G_1 Test[5]—optional (steady, dry-coil)	80	([6])	67		Minimum	Cooling Minimum[4]
I_1 Test[5]—optional (cyclic, dry-coil)	80	([6])	67		Minimum	([6])

[1] The specified test condition only applies if the unit rejects condensate to the outdoor coil.
[2] Defined in section 3.1.4.1.
[3] Defined in section 3.1.4.3.
[4] Defined in section 3.1.4.2.
[5] The entering air must have a low enough moisture content so no condensate forms on the indoor coil. DOE recommends using an indoor air wet bulb temperature of 57°F or less.
[6] Maintain the airflow nozzle(s) static pressure difference or velocity pressure during the ON period at the same pressure difference or velocity pressure as measured during the G_1 Test.

* * * * *

3.4 Test procedures for the optional steady-state dry-coil cooling-mode tests (the C, C_1, C_2, and G_1 Tests).

* * * * *

b. Denote the resulting total space cooling capacity and electrical power derived from the test as $\dot{Q}_{ss,dry}$ and $\dot{E}_{ss,dry}$. With regard to a section 3.3 deviation, do not adjust $\dot{Q}_{ss,dry}$ for duct losses (i.e., do not apply section 7.3.3.3 of ASHRAE Standard 37–2005 (incorporated by reference, see § 430.22)). In preparing for the section 3.5 cyclic tests, record the average indoor-side air volume rate, $\bar{V}$, specific heat of the air, Cp,a (expressed on dry air basis), specific volume of the air at the nozzles, v'_n, humidity ratio at the nozzles, W_n, and either pressure difference or velocity pressure for the flow nozzles. For units having a variable-speed indoor fan (that provides either a constant or variable air volume rate) that will or may be tested during the cyclic dry coil cooling mode test with the indoor fan turned off (see section 3.5), include the electrical power used by the indoor fan motor among the recorded parameters from the 30-minute test.

3.5 Test procedures for the optional cyclic dry-coil cooling-mode tests (the D, D_1, D_2, and I_1 Tests).

* * * * *

3.5.3 Cooling-mode cyclic-degradation coefficient calculation. Use the two optional dry-coil tests to determine the cooling-mode cyclic-degradation coefficient, C_D^c. Append ''(k=2)'' to the coefficient if it corresponds to a two-capacity unit cycling at high capacity. If the two optional tests are conducted but yield a tested C_D^c that exceeds the default C_D^c or if the two optional tests are not conducted, assign C_D^c the default value of 0.25. The default value for two-capacity units cycling at high capacity, however, is the low-capacity coefficient, i.e., $C_D^c(k=2)=C_D^c$. Evaluate C_D^c using the above results and those from the section 3.4 dry-coil steady-state test.

* * * * *

3.6.1 * * * Conduct the optional High Temperature Cyclic (H1C) Test to determine the heating mode cyclic-degradation coefficient, C_D^h. If this optional test is conducted but yields a tested C_D^h that exceeds the default C_D^h or if the optional test is not conducted, assign C_D^h the default value of 0.25. Test conditions for the four tests are specified in Table 9. * * *

* * * * *

3.6.2 Tests for a heat pump having a single-speed compressor and a variable-speed, variable-air-volume-rate indoor fan: capacity modulation correlates with outdoor dry bulb temperature. Conduct five tests: two High Temperature Tests ($H1_2$ and $H1_1$), one Frost Accumulation Test ($H2_2$), and two Low Temperature Tests ($H3_2$ and $H3_1$). Conducting an additional Frost Accumulation Test ($H2_1$) is optional. Conduct the optional High Temperature Cyclic ($H1C_1$) Test to determine the heating mode cyclic-degradation coefficient, C_D^h. If this optional test is conducted but yields a tested C_D^h that exceeds the default C_D^h or if the optional test is not conducted, assign C_D^h the default value of 0.25. Test conditions for the seven tests are specified in Table 10. If the optional $H2_1$ Test is not performed, use the following equations to approximate the capacity and electrical power of the heat pump at the $H2_1$ test conditions:

* * * * *

3.6.3 Tests for a heat pump having a two-capacity compressor (see Definition 1.45), including two-capacity, northern heat pumps (see Definition 1.46). a. Conduct one Maximum Temperature Test ($H0_1$), two High Temperature Tests ($H1_2$ and $H1_1$), one Frost Accumulation Test ($H2_2$), and one Low Temperature Test ($H3_2$). Conduct an additional Frost Accumulation Test ($H2_1$) and Low Temperature Test ($H3_1$) if both of the following conditions exist:

1. Knowledge of the heat pump's capacity and electrical power at low compressor capacity for outdoor temperatures of 37°F and less is needed to complete the section 4.2.3 seasonal performance calculations; and

2.The heat pump's controls allow low-capacity operation at outdoor temperatures of 37°F and less.

If the above two conditions are met, an alternative to conducting the $H2_1$ Frost Accumulation is to use the following equations to approximate the capacity and electrical power:

$$\dot{Q}_h^{k=1}(35) = 0.90 \cdot \left\{ \dot{Q}_h^{k=1}(17) + 0.6 \cdot \left[\dot{Q}_h^{k=1}(47) - \dot{Q}_h^{k=1}(17) \right] \right\}$$

$$\dot{E}_h^{k=1}(35) = 0.985 \cdot \left\{ \dot{E}_h^{k=1}(17) + 0.6 \cdot \left[\dot{E}_h^{k=1}(47) - \dot{E}_h^{k=1}(17) \right] \right\}$$

Determine the quantities $\dot{Q}_h^{k=1}$ (47) and $\dot{E}_h^{k=1}$ (47) from the $H1_1$ Test and evaluate them according to Section 3.7. Determine the quantities $\dot{Q}_h^{k=1}$ (17) and $\dot{E}_h^{k=1}$ (17) from the $H3_1$ Test and evaluate them according to Section 3.10.

b. Conduct the optional High Temperature Cyclic Test ($H1C_1$) to determine the heating-mode cyclic-degradation coefficient, C_D^h. If this optional test is conducted but yields a tested C_D^h that exceeds the default C_D^h or if the optional test is not conducted, assign C_D^h the default value of 0.25. If a two-capacity heat pump locks out low capacity operation at lower outdoor temperatures, conduct the optional High Temperature Cyclic Test ($H1C_2$) to determine the high-capacity heating-mode cyclic-degradation coefficient, C_D^h (k=2). If this optional test at high capacity is conducted but yields a tested C_D^h (k=2) that exceeds the default C_D^h (k=2) or if the optional test is not conducted, assign C_D^h the default value. The default C_D^h (k=2) is the same value as determined or assigned for the low-capacity cyclic-degradation coefficient, C_D^h [or equivalently, C_D^h (k=1)]. Table 11 specifies test conditions for these nine tests.

TABLE 11.—HEATING MODE TEST CONDITIONS FOR UNITS HAVING A TWO-CAPACITY COMPRESSOR

Test description	Air entering indoor unit temperature (°F)		Air entering outdoor unit temperature (°F)		Compressor capacity	Heating air volume rate
	Dry bulb	Wet bulb	Dry bulb	Wet bulb		
H0$_1$ Test (required, steady)	70	60(max)	62	56.5	Low	Heating Minimum.[1]
H1$_2$ Test (required, steady)	70	60(max)	47	43	High	Heating Full-Load.[2]

TABLE 11.—HEATING MODE TEST CONDITIONS FOR UNITS HAVING A TWO-CAPACITY COMPRESSOR—Continued

Test description	Air entering indoor unit temperature (°F)		Air entering outdoor unit temperature (°F)		Compressor capacity	Heating air volume rate
	Dry bulb	Wet bulb	Dry bulb	Wet bulb		
$H1C_2$ Test (optional, cyclic)	70	60(max)	47	43	High	(3)
$H1_1$ Test (required)	70	60(max)	47	43	Low	Heating Minimum.[1]
$H1C_1$ Test (optional, cyclic)	70	60(max)	47	43	Low	(4)
$H2_2$ Test (required)	70	60(max)	35	33	High	Heating Full-Load.[2]
$H2_1$ Test[5,6] (required)	70	60(max)	35	33	Low	Heating Minimum.[1]
$H3_2$ Test (required, steady)	70	60(max)	17	15	High	Heating Full-Load.[2]
$H3_1$ Test[5] (required, steady)	70	60(max)	17	15	Low	Heating Minimum.[1]

[1] Defined in section 3.1.4.5.
[2] Defined in section 3.1.4.4.
[3] Maintain the airflow nozzle(s) static pressure difference or velocity pressure during the ON period at the same pressure or velocity as measured during the $H1_2$ Test.
[4] Maintain the airflow nozzle(s) static pressure difference or velocity pressure during the ON period at the same pressure or velocity as measured during the $H1_1$ Test.
[5] Required only if the heat pump's performance when operating at low compressor capacity and outdoor temperatures less than 37°F is needed to complete the section 4.2.3 *HSPF* calculations.
[6] If table note #5 applies, the section 3.6.3 equations for $\dot{Q}_h^{k=1}$ (35) and $\dot{E}_h^{k=1}$ (17) may be used in lieu of conducting the $H2_1$ Test.

3.6.4 Tests for a heat pump having a variable-speed compressor. a. * * * Conduct the optional Maximum Temperature Cyclic ($H0C_1$) Test to determine the heating mode cyclic-degradation coefficient, C_D^h. If this optional test is conducted but yields a tested C_D^h that exceeds the default C_D^h or if the optional test is not conducted, assign C_D^h the default value of 0.25. Test conditions for the eight tests are specified in Table 12. * * *

c. For multiple-split heat pumps (only), the following procedures supersede the above requirements. For all Table 12 tests specified for a minimum compressor speed, at least one indoor unit must be turned off. The manufacturer shall designate the particular indoor unit(s) that is turned off. The manufacturer must also specify the compressor speed used for the Table 12 $H2_V$ Test, a heating-mode intermediate compressor speed that falls within ¼ and ¾ of the difference between the maximum and minimum heating-mode speeds. The manufacturer should prescribe an intermediate speed that is expected to yield the highest COP for the given $H2_V$ Test conditions and bracketed compressor speed range. The manufacturer can designate that one or more specific indoor units are turned off for the $H2_V$ Test.

* * * * *

TABLE 12.—HEATING MODE TEST CONDITIONS FOR UNITS HAVING A VARIABLE-SPEED COMPRESSOR

Test description	Air entering indoor unit temperature (°F)		Air entering outdoor unit temperature (°F)		Compressor speed	Heating air volume rate
	Dry bulb	Wet bulb	Dry bulb	Wet bulb		
$H0_1$ Test (required, steady)	70	60(max)	62	56.5	Minimum	Heating Minimum.[1]
$H0C_1$ Test (optional, steady)	70	60(max)	62	56.5	Minimum	(2)
$H1_2$ Test (required, steady)	70	60(max)	47	43	Maximum	Heating Full-Load.[3]
$H1_1$ Test (required, steady)	70	60(max)	47	43	Minimum	Heating Minimum.[1]
$H1_N$ Test (optional, steady)	70	60(max)	47	43	Cooling Mode Maximum	Heating Nominal.[4]
$H2_2$ Test (optional)	70	60(max)	35	33	Maximum	Heating Full-Load.[3]
$H2_V$ Test (required)	70	60(max)	35	33	Intermediate	Heating Intermediate.[5]
$H3_2$ Test (required, steady)	70	60(max)	17	15	Maximum	Heating Full-Load.[3]

[1] Defined in section 3.1.4.5.
[2] Maintain the airflow nozzle(s) static pressure difference or velocity pressure during an ON period at the same pressure or velocity as measured during the $H0_1$ Test.
[3] Defined in section 3.1.4.4.
[4] Defined in section 3.1.4.7.
[5] Defined in section 3.1.4.6.

* * * * *

3.7 Test procedures for steady-state Maximum Temperature and High Temperature heating mode tests (the $H0_1$, H1, $H1_2$, $H1_1$, and $H1_N$ Tests). a. * * *

b. Calculate indoor-side total heating capacity as specified in sections 7.3.4.1 and 7.3.4.3 of ASHRAE Standard 37–2005 (incorporated by reference, see § 430.22). * * *

* * * * *

3.8 Test procedures for the optional cyclic heating mode tests (the $H0C_1$, H1C, $H1C_1$ and $H1C_2$ Tests).

* * * * *

3.8.1 Heating mode cyclic-degradation coefficient calculation. Use the results from the optional cyclic test and the required steady-state test that were conducted at the same test conditions to determine the heating-mode cyclic-degradation coefficient C_D^h. Add ''(k=2)'' to the coefficient if it corresponds to a two-capacity unit cycling at high capacity. For the below calculation of the heating mode cyclic degradation coefficient, do not include the duct loss correction from section 7.3.3.3 of ASHRAE Standard 37–2005 (incorporated by reference, see § 430.22) in determining $\dot{Q}_h^k(T_{cyc})$ (or q_{cyc}). If the optional cyclic test is conducted but yields a tested C_D^h that exceeds the default C_D^h or if the optional test is not conducted, assign C_D^h the default value of 0.25. The default value for two-capacity units cycling at high capacity, however, is the low-capacity coefficient, i.e., C_D^h (k=2) = C_D^h. The tested C_D^h is calculated as follows:

$$C_D^h = \frac{1 - \frac{COP_{cyc}}{COP_{ss}\left(T_{cyc}\right)}}{1 - HLF}$$

* * *

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3.9 * * *

c. The official test period begins when the preliminary test period ends, at defrost termination. The official test period ends at the termination of the next occurring automatic defrost cycle. When testing a heat pump that uses a time-adaptive defrost control system (see Definition 1.42), however, manually initiate the defrost cycle that ends the official test period at the instant indicated by instructions provided by the manufacturer. If the heat pump has not undergone a defrost after 6 hours, immediately conclude the test and use the results from the full 6-hour period to calculate the average space heating capacity and average electrical power consumption.

For heat pumps that turn the indoor fan off during the defrost cycle, take steps to cease forced airflow through the indoor coil and block the outlet duct whenever the heat pump's controls cycle off the indoor fan. If it is installed, use the outlet damper box described in section 2.5.4.1 to affect the blocked outlet duct.

* * * * *

f. * * * Sample measurements used in calculating the air volume rate (refer to sections 7.7.2.1 and 7.7.2.2 of ASHRAE Standard 37–2005 (incorporated by reference, see § 430.22)) at equal intervals that span 10 minutes or less. (Note: In the first printing of ASHRAE Standard 37–2005, the second IP equation for Q_{mi} should read: .)

$$1097 C A_n \sqrt{P_v v'_n}\ .) * * *$$

* * * * *

3.9.1 Average space heating capacity and electrical power calculations.

a. * * *

To account for the effect of duct losses between the outlet of the indoor unit and the section 2.5.4 dry-bulb temperature grid, adjust $\dot{Q}_h^k(35)$ in accordance with section 7.3.4.3 of ASHRAE Standard 37–2005 (incorporated by reference, see § 430.22).

* * * * *

3.11 Additional requirements for the secondary test methods.

3.11.1 If using the Outdoor Air Enthalpy Method as the secondary test method.

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3.11.1.3 Official test.

* * * * *

b. For space cooling tests, calculate capacity from the outdoor air-enthalpy measurements as specified in sections 7.3.3.2 and 7.3.3.3 of ASHRAE Standard 37–2005 (incorporated by reference, see § 430.22). Calculate heating capacity based on outdoor air-enthalpy measurements as specified in sections 7.3.4.2 and 7.3.3.4.3 of the same ASHRAE Standard. Adjust the outdoor-side capacity according to section 7.3.3.4 of ASHRAE Standard 37–2005 (incorporated by reference, see § 430.22) to account for line losses when testing split systems. Use the outdoor unit fan power as measured during the official test and not the value measured during the preliminary test, as described in section 8.6.2 of ASHRAE Standard 37–2005 (incorporated by reference, see § 430.22), when calculating the capacity.

3.11.2 If using the Compressor Calibration Method as the secondary test method.

a. * * * Otherwise, conduct the calibration tests according to ASHRAE Standard 23–05 (incorporated by reference, see § 430.22), ASHRAE Standard 41.9–2000 (incorporated by reference, see § 430.22), and section 7.4 of ASHRAE Standard 37–2005 (incorporated by reference, see § 430.22).

b. Calculate space cooling and space heating capacities using the compressor calibration method measurements as specified in section 7.4.5 and 7.4.6 respectively, of ASHRAE Standard 37–2005 (incorporated by reference, see § 430.22).

3.11.3 If using the Refrigerant-Enthalpy Method as the secondary test method. Conduct this secondary method according to section 7.5 of ASHRAE Standard 37–2005 (incorporated by reference, see § 430.22). Calculate space cooling and heating capacities using the refrigerant-enthalpy method measurements as specified in sections 7.5.4 and 7.5.5, respectively, of the same ASHRAE Standard.

* * * * * *

4. Calculations of Seasonal Performance Descriptors

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4.1.3 SEER calculations for an air conditioner or heat pump having a two-capacity compressor. Calculate SEER using Equation 4.1–1. Evaluate the space cooling capacity, $\dot{Q}_c^{k=1}(T_j)$, and electrical power consumption, $\dot{E}_c^{k=1}(T_j)$, of the test unit when operating at low compressor capacity and outdoor temperature T_j using,

$$\dot{Q}_c^{k=1}(T_j) = \dot{Q}_c^{k=1}(67) + \frac{\dot{Q}_c^{k=1}(82) - \dot{Q}_c^{k=1}(67)}{82 - 67} \cdot (T_j - 67) \qquad (4.1.3\text{-}1)$$

$$\dot{E}_c^{k=1}(T_j) = E_c^{k=1}(67) + \frac{E_c^{k=1}(82) - E_c^{k=1}(67)}{82 - 67} \cdot (T_j - 67) \qquad (4.1.3\text{-}2)$$

where $\dot{Q}_c^{k=1}$ (82) and $\dot{E}_c^{k=1}$ (82) are determined from the B_1 Test, $\dot{Q}_c^{k=1}$ (67) and $\dot{E}_c^{k=1}$ (67) are determined from the F_1 Test, and all four quantities are calculated as specified in section 3.3. Evaluate the space cooling capacity, $\dot{Q}_c^{k=2}(T_j)$, and electrical power consumption, $\dot{E}_c^{k=2}(T_j)$, of the test unit when operating at high compressor capacity and outdoor temperature T_j using,

$$\dot{Q}_c^{k=2}(T_j) = \dot{Q}_c^{k=2}(82) + \frac{\dot{Q}_c^{k=2}(95) - \dot{Q}_c^{k=2}(82)}{95 - 82} \cdot (T_j - 82) \qquad (4.1.3\text{-}3)$$

* * * * *

4.1.3.3 * * *

$$PLF_j = 1 - C_D^c(k=2) \cdot \left[1 - X^{k=2}(T_j)\right],$$

the part load factor, dimensionless.

Obtain the fraction bin hours for the cooling season,

$$\frac{n_j}{N},$$

from Table 16. Use Equations 4.1.3–3 and 4.1.3–4, respectively, to evaluate $\dot{Q}_c^{k=2}(T_j)$ and $\dot{E}_c^{k=2}(T_j)$. If the optional C_2 and D_2 Tests described in section 3.2.3 and Table 5 are not conducted, set C_D^c (k=2) equal to the default value specified in section 3.5.3. If these optional tests are conducted, set C_D^c (k=2) to the lower of:

a. the C_D^c (k=2) value calculated as per section 3.5.3; or

b. the section 3.5.3 default value for C_D^c (k=2) .

* * * * *

4.1.4 SEER calculations for an air conditioner or heat pump having a variable-speed compressor. Calculate SEER using Equation 4.1–1. Evaluate the space cooling capacity, $\dot{Q}_c^{k=1}(T_j)$, and electrical power consumption $\dot{E}_c^{k=1}(T_j)$, of the test unit when operating at minimum compressor speed and outdoor temperature T_j. Use Equations 4.1.3–1 and 4.1.3–2, respectively, where $\dot{Q}_c^{k=1}$ (82) and $\dot{E}_c^{k=1}$ (82) are determined from the B_1 Test, $\dot{Q}_c^{k=1}$ (67) and $\dot{E}_c^{k=1}$ (67) are determined from the F_1 Test, and all four quantities are calculated as specified in section 3.3. Evaluate the space cooling capacity, $\dot{Q}_c^{k=2}(T_j)$, and electrical power consumption, $\dot{E}_c^{k=2}(T_j)$, of the test unit when operating at maximum compressor speed and outdoor temperature T_j. Use Equations 4.1.3–3 and 4.1.3–4, respectively, where $\dot{Q}_c^{k=2}$ (95) and $\dot{E}_c^{k=2}$ (95) are determined from the A_2 Test, $\dot{Q}_c^{k=2}$ (82) and $\dot{E}_c^{k=2}$ (82) are determined from the B_2 Test, and all four quantities are calculated as specified in section 3.3. Calculate the space cooling capacity, $\dot{Q}_c^{k=v}(T_j)$, and electrical power consumption, $\dot{E}_c^{k=v}(T_j)$, of the test unit when operating at outdoor temperature T_j and the intermediate compressor speed used during the section 3.2.4 (and Table 6) E_V Test using,

$$\dot{Q}_c^{k=v}(T_j) = \dot{Q}_c^{k=v}(87) + M_Q \cdot (T_j - 87) \qquad (4.1.4\text{-}1)$$

$$\dot{E}_c^{k=v}(T_j) = \dot{E}_c^{k=v}(87) + M_E \cdot (T_j - 87) \qquad (4.1.4\text{-}2)$$

where $\dot{Q}_c^{k=v}$ (87) and $\dot{E}_c^{k=v}$ (87) are determined from the E_v Test and calculated as specified in section 3.3.

Approximate the slopes of the k = v intermediate speed cooling capacity and electrical power input curves, M_Q and M_E, as follows: * * *

where,

$$N_Q = \frac{\dot{Q}_c^{k=v}(87) - \dot{Q}_c^{k=1}(87)}{\dot{Q}_c^{k=2}(87) - \dot{Q}_c^{k=1}(87)}, \text{ and } N_E = \frac{\dot{E}_c^{k=v}(87) - \dot{E}_c^{k=1}(87)}{\dot{E}_c^{k=2}(87) - \dot{E}_c^{k=1}(87)}.$$

Use Equations 4.1.3–1 and 4.1.3–2 for T_j = 87°F to determine $\dot{Q}_c^{k=1}$ (87) and $\dot{E}_c^{k=1}$ (87), respectively. Use Equations 4.1.3–3 and 4.1.3–4 for T_j = 87°F to determine $\dot{Q}_c^{k=2}$ (87) and $\dot{E}_c^{k=2}$ (87), respectively.

Calculating Equation 4.1–1 quantities

$$\frac{q_c(T_j)}{N} \text{ and } \frac{e_c(T_j)}{N}$$

differs depending upon whether the test unit would operate at minimum speed (section 4.1.4.1), operate at an intermediate speed (section 4.1.4.2), or operate at maximum speed (section 4.1.4.3) in responding to the building load. Use Equation 4.1–2 to calculate the building load, $BL(T_j)$, for each temperature bin.

4.1.4.1 * * * Use Equations 4.1.3–1 and 4.1.3–2, respectively, to evaluate $\dot{Q}_c^{k=1}(T_j)$ and $\dot{E}_c^{k=1}(T_j)$.

4.1.4.2 * * *

$$A = EER^{k=2}(T_2) - B \cdot T_2 - C \cdot T_2^2$$

where,

T_1 = the outdoor temperature at which the unit, when operating at minimum compressor speed, provides a space cooling capacity that is equal to the building load ($\dot{Q}_c^{k=1}(T_1) = BL(T_1)$), °F. Determine T_1 by equating Equations 4.1.3–1 and 4.1–2 and solving for outdoor temperature. T_v = the outdoor temperature at which the unit, when operating at the intermediate compressor speed used during the section 3.2.4 E_V Test, provides a space cooling capacity that is equal to the building load ($\dot{Q}_c^{k=v}(T_v) = BL(T_v)$), °F. Determine T_v by equating Equations 4.1.4–1 and 4.1–2 and solving for outdoor temperature. * * *

$$EER^{k=1}(T_1) = \frac{\dot{Q}_c^{k=1}(T_1)\left[\text{Eqn. 4.1.3-1, substituting } T_1 \text{ for } T_j\right]}{\dot{E}_c^{k=1}(T_1)\left[\text{Eqn. 4.1.3-2, substituting } T_1 \text{ for } T_j\right]}, \text{ Btu/h per W.}$$

$$EER^{k=v}(T_v) = \frac{\dot{Q}_c^{k=v}(T_v)\left[\text{Eqn. 4.1.4-1, substituting } T_v \text{ for } T_j\right]}{\dot{E}_c^{k=v}(T_v)\left[\text{Eqn. 4.1.4-2, substituting } T_v \text{ for } T_j\right]}, \text{ Btu/h per W.}$$

* * * * *

For multiple-split air conditioners and heat pumps (only), the following procedures supersede the above requirements for calculating $EER^{k=i}(T_j)$. For each temperature bin where $T_1 < T_j < T_v$,

$$EER^{k=i}(T_j) = EER^{k=1}(T_1) + \frac{EER^{k=v}(T_v) - EER^{k=1}(T_1)}{T_v - T_1} \cdot (T_j - T_1).$$

* * * * *

4.2.3.3 * * *

$$PLF_j = 1 - C_D^h(k=2) \cdot \left[1 - X^{k=2}(T_j)\right].$$

If the optional $H1C_2$ Test described in section 3.6.3 and Table 11 is not conducted, set C_D^h (k=2) equal to the default value specified in section 3.8.1. If this optional test is conducted, set C_D^h (k=2) to the lower of:

a. the C_D^h (k=2) value calculated as per section 3.8.1; or

b. the section 3.8.1 default value for C_D^h (k=2).

Determine the low temperature cut-out factor, $\delta(T_j)$, using Equation 4.2.3–3.

* * * * *

4.2.4 * * *

$$M_Q = \left[\frac{\dot{Q}_h^{k=1}(62) - \dot{Q}_h^{k=1}(47)}{62-47} \cdot \left(1 - N_Q\right)\right] + \left[N_Q \cdot \frac{\dot{Q}_h^{k=2}(35) - \dot{Q}_h^{k=2}(17)}{35-17}\right]$$

$$M_E = \left[\frac{\dot{E}_h^{k=1}(62) - \dot{E}_h^{k=1}(47)}{62-47} \cdot \left(1 - N_E\right)\right] + \left[N_E \cdot \frac{\dot{E}_h^{k=2}(35) - \dot{E}_h^{k=2}(17)}{35-17}\right]$$

* * * * *

4.2.4.2 * * *

For multiple-split heat pumps (only), the following procedures supersede the above requirements for calculating $COP_h^{k=i}(T_j)$. For each temperature bin where $T_3 > T_j > T_{vh}$,

$$COP_h^{k=i}(T_j) = COP_h^{k=1}(T_3) + \frac{COP_h^{k=v}(T_{vh}) - COP_h^{k=1}(T_3)}{T_{vh} - T_3} \cdot (T_j - T_3).$$

For each temperature bin where $T_{vh} \geq T_j > T_4$,

$$COP_h^{k=i}\left(T_j\right) = COP_h^{k=v}\left(T_{vh}\right) + \frac{COP_h^{k=2}\left(T_4\right) - COP_h^{k=v}\left(T_{vh}\right)}{T_4 - T_{vh}} \cdot \left(T_j - T_{vh}\right).$$ ”

* * * * *

■ 7. Section 430.62 is amended in subpart F by revising paragraphs (a)(4)(i) and (ii) to read as follows:

§ 430.62 Submission of data.

(a) * * *

(4) * * *

(i) Central air conditioners, the seasonal energy efficiency ratio. For central air conditioners whose seasonal energy efficiency ratio is based on an installation that includes a particular model of ducted air mover (e.g., furnace, air handler, blower kit, etc.), the model number of this ducted air mover must be included among the model numbers listed on the certification report.

(ii) Central air conditioning heat pumps, the seasonal energy efficiency ratio and heating seasonal performance factor. For central air conditioning heat pumps whose seasonal energy efficiency ratio and heating seasonal performance factor are based on an installation that includes a particular model of ducted air mover (e.g., furnace, air handler, blower kit, etc.), the model number of this ducted air mover must be included among the model numbers listed on the certification report.

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