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September 23, 2016

Ms. Ashley Armstrong
U.S. Department of Energy
Building Technologies Office
950 L'Enfant Plaza, SW., Suite 600
Washington, DC, 20024
U.S. Department of Energy

Re: Energy Conservation Program: Test Procedures for Central Air Conditioners and Heat Pumps – Supplemental Notice of Proposed Rulemaking, Docket No. EERE–2016–BT–TP–0029

Dear Ms. Armstrong:

These comments are submitted by the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) in response to the U.S. Department of Energy's (DOE) supplemental notice of proposed rulemaking (SNOPR) regarding test procedures for central air conditioners and heat pumps (CAC) appearing in the *Federal Register* on August 24, 2016.

AHRI is the trade association representing manufacturers of heating, cooling, water heating, and commercial refrigeration equipment. More than 300 members strong, AHRI is an internationally recognized advocate for the industry, and develops standards for and certifies the performance of many of the products manufactured by our members. In North America, the annual output of the HVACR industry is worth more than $20 billion. In the United States alone, our members employ approximately 130,000 people, and support some 800,000 dealers, contractors, and technicians.

COMMENTS

Certification Requirements

1. Representation Accommodation

   With certain exceptions, as detailed below, AHRI supports the CAC/HP ECS Working Group recommendations regarding accommodations for representations for split systems, with a recommended compliance date of January 1, 2023, for representations based on Appendix M1.

2. Highest Sales Volume Requirement

AHRI would like to remind the department that the negotiated codification of the CAC/HP ECS ASRAC Working Group's recommendation regarding delayed implementation of testing to demonstrate compliance with amended energy conservation standards was made in the context of Appendix M1. In fact, all aspects of test procedure modifications were limited to Appendix M1 during ASRAC WG negotiations. (Sept. 10, 2015 ASRAC Working Group Meeting Transcript, 7:18-8:15). The proposed requirement for two-stage condensing units (other than condensing units for a 1-to-1 mini split) to be a coil-only combination and have at least one tested combination was negotiated for Appendix M1 and according to the term sheet is to be implemented in 2023. To implement this requirement before the effective date of the 2023 standard would be contradictory to the Working Group's recommendation. It is an excessive burden placed on manufacturers to retest products, specifically two-stage air conditioners, in a short period of time. AHRI requests that DOE modify the test procedure so this requirement is implemented January 1, 2023.

3. Determination of Certified Rating for Multi-Split, Multi-Circuit, and Multi-head Mini-Split Systems

AHRI supports DOE revising the requirement that a multi-split or multi-circuit split system's tested combination be a high sales volume combination; however, the Department included the multi-head mini-split systems into this section, but it does not belong here. By DOE's own definition, "multi-head mini-split system means a split system that has one outdoor unit and that has two or more indoor units connected with a single refrigeration circuit. The indoor units operate in unison in response to a single indoor thermostat." As multi-head mini-split systems operate as 1-to-1 combination, and adding these testing requirements here is not appropriate. These units simply would not be tested in the manner proposed in this section. It is not possible to turn off one indoor unit for testing as is possible for the multi-circuit, and multi-head mini-split systems. AHRI requests that DOE remove multi-head mini-split systems from non-applicable testing requirements. Additionally, the Department has conflated multi-head mini-split systems with multi-split and multi-circuit mini-split systems. For testing requirements on pages 58202 through 58304 of the SNOPR. Multi-head mini-split systems do not have ducted and non-ducted combinations and cannot be tested as such. As stated above, these systems need to be tested as a 1-to-1 combination. AHRI requests that DOE remove multi-head mini-split systems from non-applicable testing requirements and other sections and instead include multi-head mini-split in the line as "Single-Split-System" in the table on page 58202.

AHRI is also concerned with DOE's proposal to add low-static and mid-static testing requirements to Appendix M. This terminology and the associated testing requirements were negotiated was negotiated for Appendix M1 and according to the term sheet is to be implemented in 2023. To implement this

requirement before the effective date of the 2023 standard would not be in alignment with the Working Group's recommendation.

4. Service Coil Definition

AHRI supports DOE's proposal to make explicit certain provisions of the service coil definition. We agree with both the "labeling accordingly" provision of adding "for indoor coil replacement only" on nameplate and literature as well as implementing a model number which differentiates the service coil from an indoor unit.

5. Efficiency Representations of Split-Systems for Multiple Refrigerants

Issue 1: *DOE requests comment on its proposed certification requirements for outdoor units with no match. Also, DOE seeks comment on what fin style options should be considered as options for CCMS database data entry.*

AHRI agrees with, and fully supports, DOE's central premise that manufacturers should be required to certify efficiency ratings for all refrigerants that are compatible with equipment, if the manufacturer identifies the refrigerant on the equipment name plate, as required by safety standard UL 1995. This approach based upon the safety certifications will address DOE's concerns about the marketing and use of alternative refrigerants, including the uncertainty that may occur with "dry shipped" units, in a clear and objective manner. In addition to those benefits, such an approach would be within DOE's statutory authority, in contrast to DOE's proposed approach "dry-shipped" and R-407C products, as discussed more fully below.

In further support of DOE's goal that the test should produce measurements of energy efficiency during a representative average use cycle in the field, AHRI members have met to discuss and consider changes to the AHRI certification program that will support this goal, which the industry supports. AHRI strongly believes that these efforts will support DOE's goals as set forth in this test procedure, while setting a clear path forward that will enable industry to lay the groundwork regarding the Administration's push for lower GWP refrigerants, which may require dry-ship units in the future due to safety and transportation concerns with flammable refrigerants. AHRI will have meetings in the coming weeks to address this topic, for which we will seek DOE's participation and review.

This proposed approach will address DOE's and AHRI's concerns and avoid questions regarding the SNOPR's proposed certification requirements that exceed DOE's statutory authority, which arise in four areas: First, by imposing liability on manufacturers for the conduct of distributors, contractors and consumers, entities over which DOE has no authority; Second, by imposing design requirements on legal equipment that cannot be subject to design requirements; Third, by imposing multiple standards (efficiency and design) on legal products that

may only be subject to one efficiency standard; and Fourth, by effectively banning the sale of products using refrigerants that can be legally used with those products, which is the jurisdiction and authority of the Environmental Protection Agency (EPA).

DOE has authority to enforce standards and certification only over manufacturers, and thus the responsibility for compliance with DOE standards, test procedures and certification must be tied to the conduct of the manufacturer.[1] DOE cannot expand that authority to make the manufacturer selling a legal product vicariously liable for the conduct of a distributor, contractor or individual consumer, other than where explicitly allowed under EPCA.[2] Thus, it is the conduct of the manufacturer that must be the basis of DOE's requirements, such as AHRI's proposal that if the manufacturer lists a product as compatible with different refrigerants on the equipment nameplate, the manufacturer is responsible for providing certified ratings to DOE of the product with those refrigerants. In addition to being outside DOE's statutory authority, and attempt to impose liability based on the conduct of an entity other than the manufacturer would be unworkable in terms of DOE proving subjective intent of the manufacturer and third-parties. Use of an objective standard, such as the equipment nameplate, will capture the conduct through which the manufacturer is distributing in commerce and marketing the equipment, and will provide an easily verifiable action easily reviewed by DOE that could be the basis of DOE's certification and enforcement requirements.

Additionally, DOE's authority is limited to "energy conservation standards" as specifically defined under EPCA. 42 U.S.C. § 6291(6) defines such a standard as a performance standard prescribing a minimum level of efficiency or maximum quantity, as determined in accordance with applicable test procedures, *or* for certain products other than CAC/HP, a design requirement. DOE does not have, and nowhere cites the authority for, imposing a design requirement on a central air conditioner, that is otherwise permissible to distribute in commerce, using legal refrigerants,[3] let alone imposing both an efficiency standard and a design requirement when EPCA clearly states that it may be one "or" the other (but only for certain listed products, not including CAC).[4] The fact that this design requirement is in the test procedure is a distinction without a difference. When the use of a component with specific design requirements is a requirement of the test

[1] 42 U.S.C. §§ 6296 and 62302(a)
[2] *See, e.g.,* 42 U.S.C.6302(a)(6), which specifically bases manufacturer liability to certain conduct by a distributor, contractor, or dealer.
[3] In the November 19, 2007 Residential Boilers Energy Conservation Standard Final Rule, DOE stated: "DOE cannot promulgate design requirements for unspecified products: The plain language of section 321(6)(B) of EPCA limits design requirements to only those products for which design requirements are specified in the statute. (42 U.S.C. 6291(6)(b))".
[4] By prescribing fin surface area, and limiting available alternative designs, DOE is proposing to regulate both the design and the energy efficiency of a legal product – something by DOE's own admission it cannot do: "pursuant to EPCA, DOE can establish energy conservation standards that set either a single performance standard or a single design requirement, not both." 81 Fed. Reg. 34,477 (May 31, 2016). in

procedure, it is in fact a design requirement for the product, since that test procedure must be used to determine the product's efficiency.

AHRI's concerns with DOE's statutory authority on this issue are only with products that can be legally sold using the identified refrigerants. That is not the case for R-22, as sale of those systems has been prohibited by EPA and cannot be certified to DOE using R-22 refrigerant. DOE's proposal for outdoor units with no match also for products that may be legally sold for use with the applicable refrigerant would be an expansion into technical and policy issues that are outside of DOE's authority under EPCA, were not within Congress' intent in granting DOE authority over energy efficiency standards, and are the jurisdiction of the EPA. The proposed approach, which AHRI acknowledges is intended to address issues arising out of EPA's ban on prohibited R-22 systems, is overbroad and could be used to address any product that can be legally sold for use with a specified refrigerant. The proposed approach would effectively ban that products' sale by requiring the no match testing. The agency with authority to prohibit the sale of systems using delisted refrigerants is EPA, under specific statutory authority granted by the Clean Air Act.[5] The proposed approach would create both market and consumer confusion, as one federal agency has determined that a product using a certain refrigerant is acceptable for use, and can be sold into commerce, but DOE in fact determined, by imposing the no-match requirement, that those products cannot.

AHRI understands DOE's concerns regarding the use of R-22, in light of the EPA's actions, or inactions, on such systems. While it may be the case today that outdoor units with no match (OUWNM) are typically a result of the phase-out of R-22 refrigerant, the longer view will address both DOE's immediate concerns, the Administration's goals regarding the use of lower GWP refrigerants, and industries' needs. Though it is understood that complete R-22 systems can no longer be distributed, DOE established test procedure requirements for outdoor units that have "no match," or are not sold with a matching indoor unit, which includes those units designed to use R-22. To ensure compliance, DOE established indoor unit specifications that are representative of a less efficient unit (representative of units on the market at the time of the change in EPA regulations) that could be paired with the given outdoor unit with no match. In addition to the statutory issues noted above, there are several technical and market problems with this approach.

First, it will not always be the case that OUWNM are typically a result of the phase-out of R-22 refrigerant. In the future there will be a transition between non-flammable and mildly flammable refrigerants. This is in fact a priority of the current Obama Administration, as the use of these alternative refrigerants, with lower GWPs, are a key element of the initiatives to combat climate change. As part of this initiative, when higher GWP refrigerants, such as R-410Aare phased out, there will likely be a period of time where R-410Acondensing units will be sold as OUWNM, which will be shipped dry. While a normalized gross indoor fin surface

[5] 42 U.S.C. §7401 *et. seq.* (1970)

(NGIFS) no higher than 1.0 square inches per British thermal unit per hour (sq. in./Btu/hr) may be representative of R-22 units circa 2006, NGIFS of 1.0 makes no sense for R-410a. The end result will be energy measurements that are not representative of the unit in the field, which directly undermines DOE's stated goal in the SNOPR. Another concern is that the NGIFS limitation of 1.0 as finalized in the June Final Rule is only applicable to 3/8" coil and is not applicable to either microchannel, 5/16", or 7mm diameter tube, or any other diameter coils. There is significant concern with a test procedure requirement which is not flexible enough to account for different coil technology and refrigerants. While it is possible to do a fin surface calculation to determine the testing combination there is concern that these calculations do not take some surfaces properly into account.

If a unit is compatible with more than one refrigerant, and is marketed that way, it should be rated with all applicable refrigerants. DOE could make such a determination in an easily verifiable and objective way by including a requirement that if a manufacturer approves an air conditioner or heat pump for multiple refrigerant as compatible with the product by listing it on the name plate in accordance with UL 1995 or UL 60335-2-40, such a product is subject to DOE certification and enforcement requirements for each approved refrigerant. Manufacturers should have the option to rate all compatible refrigerants as one Basic Model with the same efficiency rating, or to list different efficiencies for different refrigerants as separate basic models. The rating of different efficiency ratings for different refrigerants should be allowed to be develop through testing, or the appropriate use of AEDMs.

While DOE has expressed concern that the lack of explicit indication that a unit is acceptable for use with R-22 may not prevent installation of such units with the refrigerants, as discussed above, DOE does not have statutory authority over the conduct of installers other than where it is specifically granted under EPCA. If in fact the "use" of a particular refrigerant is a concern, it is for the EPA to determine whether the policy goals and statutory requirements of the Clean Air Act are met, including whether reasonable alternatives are available, and to develop an appropriate phase-out timeline for that refrigerant in its entirety. It is not within DOE's authority to pick winners and losers for refrigerants by: (1) setting different requirements for one of the 20 refrigerants currently approved as legal for use by the EPA as a replacement for R-22 and (2) to make proposals outside its statutory authority and (3) without a strong record of the facts proving the policy problem it is attempting to resolve.

Further, the DOE's categorization of dry-ship units is overly-broad and does not necessarily equate to OUWNM. Units with long line set require more than one pound of charge to be added in the field. It is also very realistic that manufacturers will not be able to ship units with mildly flammable refrigerants factory charged which will require adding refrigerants in the field during installation.

In response to DOE seeking comment on what fin style options should be considered as options for CCMS database data entry, which was also raised in Issue 1, as previously stated, AHRI does not support DOE's OUWNM proposal, but would like to note that the following fin styles are available as options in the AHRI Directory: flat corrugated, high performance, lanced, louvered, and N/A.

6. Representation Limitations for Independent Coil Manufacturers

Issue 2: *DOE requests comment on its proposed language in 429.16 related to allowable ICM ratings and compliance with regional standards.*

AHRI supports DOE's proposal to remove the sentence: "An ICM cannot certify a basic model containing a representative value that is more efficient than any combination certified by an OUM containing the same outdoor unit." and replace it with the following language in 429.16(a)(4)(i): "An ICM cannot certify an individual combination with a rating that is compliant with a regional standard if the individual combination includes a model of outdoor unit that the OUM has certified with a rating that is not compliant with a regional standard. Conversely, an ICM cannot certify an individual combination with a rating that is not compliant with a regional standard if the individual combination includes a model of outdoor unit that an OUM has certified with a rating that is compliant with a regional standard."

7. Reporting of Low-capacity Lockout for Air Conditioners and Heat Pumps with Two-capacity Compressors

AHRI not opposed to the requirement for manufacturers to certify lockout information; however, low-capacity lockout for air conditioners and heat pumps with two-capacity compressors is considered intellectual property and should not be reported publicly information. Typically, such information is limited to manufacturer distributors and contractors, and is not made generally publicly available (and therefore is not made available to competitors). Manufacturers are concerned about the possibility of reverse engineering products if this information is publicly reported.

8. Represented Values of Cooling Capacity

Issue 3: *DOE requests comment on its proposal to allow a one-sided tolerance on represented values of cooling and heating capacity that allows underrating of any amount but only overrating up to 5 percent.*

AHRI is strongly against DOE's proposal to allow a one-sided tolerance on represented values of cooling and heating capacity that allows underrating of any amount but only overrating up to 5 percent. The same rules that apply to efficiency should be applied to capacity. Manufacturers should be permitted to rate cooling and heating capacity only as high as the tested value or AEDM.

Appendix M

1. Measurement of Off Mode Power Consumption: Time Delay for Units with Self-Regulating Crankcase Heaters

> Issue 4: *DOE seeks comments from interested parties about its proposal to impose time delays to allow approach to equilibrium for measurements of off-mode power for units with self-regulating crankcase heaters. DOE requests comment regarding the 4-hour and 8-hour delay times proposed for units without and with compressor sound blankets, respectively.*

AHRI generally supports the establishment of a 4-hour or 8-hour delay time before the power measurement for units that require the outdoor temperature setting to reach thermal equilibrium; however, there is concern regarding the time to implement this requirement. Industry estimates that it would take at least six additional months to test and rates units with self-regulating crankcase heaters or crankcase heating systems in which the heater control temperature sensor is affected by the heater.

This issue brings to light general concern with the implementation of new provisions to Appendix M. While DOE has stated that all legacy ratings should be revised by December 2016 as a result of the June 2016 Final Rule, given the changes that DOE is proposing in the SNOPR, manufacturers appear to be required to retest all units again within 180-day from when this rule is finalized. Having two revisions to Appendix M within such a short period of time presents a significant and unnecessary testing burden for the manufacturers. Given the close timing and extensive nature of the sequential changes, manufacturers should only be required to retest for ratings once. Either Appendix M modifications presented in the June 2016 Final Rule and in this rule should be effective within 180-day from when this rule is finalized. Alternately, the Appendix M modifications presented in this SNOPR should be moved to Appendix M1.

2. Refrigerant Pressure Measurement Instructions for Cooling and Heating Heat Pumps

> Issue 5: *DOE requests comment on its proposal to limit the internal volume of pressure measurement systems for cooling/heating heat pumps where the pressure measurement location may switch from liquid to vapor state when changing operating modes and for all systems undergoing cyclic tests. DOE also requests comment specifically on (a) the proposed 0.25 cubic inch per 12,000 Btu/h maximum internal volume for such systems, and (b) the proposals for default internal volumes to assign to pressure transducers and gauges of 0.1 and 0.2 cubic inches, respectively.*

While AHRI generally supports the concept of a limit on the internal volume of lines and devices connected to measure pressure at refrigerant circuit locations

where the refrigerant state can switch from liquid to vapor for different test operating conditions, there is confusion regarding DOE's proposal and differences between development tests and audit testing which need to be addressed prior to implementation.

First, AHRI would like clarification on "locations where the refrigerant state changes from liquid to vapor for different parts of the test." During the development cycle, it is standard industry practice to place pressure taps (with capillary tubes) at the compressor discharge, liquid service valve, indoor coil inlet, indoor coil outlet, common suction port, and compressor suction in order to evaluate the performance of both the individual components and the system as a whole.

Table 1, below, outlines the refrigerant state (liquid, vapor, or two-phase mix) for the various operational modes; cooling steady state, cooling transient (startup), heating steady state, and heating transient (startup) when the cooling mode restrictor is located in the indoor unit. The only time the refrigerant changes states is during the off-cycle when the refrigerant in all transducers (and capillary tubes) is likely to be two-phase. Otherwise, the refrigerant state is the same for both cooling and heating. That is, during steady state operation, a pressure tap that contains liquid in the cooling mode will also contain liquid in the heating mode.

Table 1. Refrigerant States for Systems with Cooling Mode Restrictors Located in the Indoor Unit

Pressure Tap Location	Cooling Steady State	Cooling Transient (Start Up)	Heating Steady State *	Heating Transient (Start Up) *
Compressor Discharge	Vapor	2-Phase	Vapor	2-Phase
Liquid Service Valve	Liquid	2-Phase	Liquid	2-Phase
Indoor Coil Inlet	Liquid	2-Phase	Liquid	2-Phase
Indoor Coil Outlet	Vapor	2-Phase	Vapor	2-Phase
Common Suction Port *	Vapor	2-Phase	Vapor	2-Phase
Compressor Suction	Vapor	2-Phase	Vapor	2-Phase

* Note: Heat pumps only.

Similarly, Table 2, below, outlines the refrigerant state for the various operational modes when the cooling mode restrictor is located in the outdoor unit. The refrigerant changes states during the off-cycle when the refrigerant in all transducers (and capillary tubes) is likely to be two-phase. This result is the same as systems with the cooling mode restrictor located in the indoor unit. However, unlike systems with the cooling mode restrictor in the indoor unit, the refrigerant

also changes states at the liquid service valve and indoor coil inlet between cooling mode (two-phase) and heating mode (liquid). These differences are shown by the blue highlighting in Table 2, below.

Table 2. Refrigerant States for Systems with Cooling Mode Restrictors Located in the Outdoor Unit

Pressure Tap Location	Cooling Steady State	Cooling Transient (Start Up)	Heating Steady State *	Heating Transient (Start Up) *
Compressor Discharge	Vapor	2-Phase	Vapor	2-Phase
Liquid Service Valve	2-Phase	2-Phase	Liquid	2-Phase
Indoor Coil Inlet	2-Phase	2-Phase	Liquid	2-Phase
Indoor Coil Outlet	Vapor	2-Phase	Vapor	2-Phase
Common Suction Port	Vapor	2-Phase	Vapor	2-Phase
Compressor Suction	Vapor	2-Phase	Vapor	2-Phase

* Note: Heat pumps only.

One member provided the average internal volume of each pressure transducer / capillary tube combinations is 0.91 in^3. Based on this value and the 0.25 in^3 restriction proposed by DOE, this manufacturer would only be permitted the following number of transducers by nominal tonnage:

Table 3. Transducers by Tonnage

Capacity	Transducers
12000	0
18000	0
24000	0
30000	0
36000	0
42000	1
48000	1
60000	1

Based on the information above, DOE's proposed average internal volume of 0.25 in^3 is both unjustified and unnecessary. Further, the state change that occurs during transient startup happens so quickly that the effects (if any) will be within the tolerance of the measuring equipment. For those systems with the cooling mode restrictor located in the outdoor unit, there are at most two pressure transducers where the refrigerant will change state between the heating and cooling modes. For those two transducers combined, and assuming transducer volume of 0.91 in^3, the charge weight difference between cooling and heating would be on the order of 1.3 oz (0.08 lbs) using R-410A liquid at a density of 0.045

lb_m/in^3 (corresponding to 0°F). This charge weight delta between cooling and heating is extremely small (particularly considering standard charging conditions in the field), and would have a negligible effect on the system performance.

AHRI requests that DOE eliminate restrictions on pressure transducer internal volume or increase them significantly in order to ensure proper system analysis can be conducted during the development and auditing process.

3. Revised EER and COP Interpolation Method for Units Equipped with Variable Speed Compressors

Issue 6: *DOE requests comment on the proposal to require the use of a bin-by-bin method to calculate EER and COP for intermediate-speed operation for SEER and HSPF calculations for variable-speed units.*

AHRI supports DOE's proposal to require bin-by-bin EER and coefficient of performance (COP) interpolations for all variable speed units, to calculate performance at intermediate compressor speeds; however, the alternative interpolation methods for calculating SEER and HSPF for variable-speed CAC/HPs will change the ratings for these products. AHRI is concerned that DOE has proposed implementing a change to the test procedure which will impact ratings. These changes will most definitely change the certified ratings for these products, and as such this change should be implemented as part of Appendix M1, effective January 1, 2023.

AHRI's members are in the process of collecting data on the impact of calculating SEER and HSPF for variable-speed CAC/HPs using the proposed alternative interpolation methods and will provide this information to the Department within 30 days.

4. Outdoor Air Enthalpy Method Test Requirements

Issue 7: *DOE requests comment on its proposed modifications to requirements when using the outdoor air enthalpy method as the secondary test method, including its proposal that the official test be conducted without the outdoor air-side test apparatus connected*.

AHRI supports requiring a 30-minute test without the outside-air apparatus connected (a "non-ducted" or "free air" test) to be the official test as part of all cooling and heating mode tests which use the outdoor air enthalpy method as the secondary measurement; however, we believe the both the free air and the closed duct should have "official" 30-minute test period, with both "free air" and "closed duct" having a 30minute stabilization period. A comparison between the 30-minute free air test and the 30-minute closed duct test to confirm steady state operation is all that should be required, with evaluation of the average values from each 30-minute test as the official comparison. AHRI suggests DOE eliminate the five

consecutive readings, as is required for the current test, to verify the primary capacity measurements. Further, AHRI suggests that the refrigerant enthalpy method should similarly only require balance checks at the A2 and H12 (H1N) conditions and consider all other conditions optional due to potential loss of subcooling or superheat at the other test conditions for all system types (single stage, two stage, and variable speed).

5. Certification of Fan Delay for Coil-only Units

> Issue 8: *DOE requests comments on its proposal to require certification reports for coil-only units to indicate whether testing was conducted using a time-delay relay to provide an off-cycle time delay, and the duration of the time delay.*

AHRI does not oppose the certification of the indoor fan off delay timing information used for coil-only tests; however, the timing is manufacturer-specific, and therefore intellectual property: it should not be public information.

6. Normalized Gross Indoor Fin Surface (NGIFS) Area Requirements for Split Systems

> Issue 9: *DOE requests comment on its proposal to limit the NGIFS of tested coil-only single-split systems to 2.0 sq.in/Btu/hr.*

AHRI opposes DOE's proposal to limit the normalized gross indoor fin surface (NGIFS) for the indoor unit used for single-split-system coil-only tests be no greater than 2.0 square inches per British thermal unit per hour (sq.in./Btu/hr). As discussed, above, in the certification reporting requirements section, *Efficiency Representations of Split-Systems for Multiple Refrigerants*, DOE does not have the authority to regulate the design of residential central air-conditioners and heat pumps. Excluding Outdoor Units with No Match (i.e. R-22 condensing units), all NGIFS restrictions should be removed from both Appendix M and M1.

While DOE may not be able to develop a solution due to legal restrictions, as noted above, there is broad industry support to ensure that listings be representative of field installations. AHRI shares DOE's concerns of a "golden blower" and would like to aid the Department to address this issue in a way which does not put restrictions on design and is both refrigerant and technology neutral, in order to address current concerns and facilitate the eventual move to lower GWP refrigerants. This promotes the goals of the AHRI certification program, which has more flexibility than DOE's statutory constraints. Our members propose to develop a solution to finding an appropriate balance between indoor and outdoor unit sizing for listings in the AHRI Directory within 30 days of the close of the comment period for this SNOPR. This solution should not restrict manufacturers from optimizing units for the Southwest and should correctly address both microchannel coils and mildly flammable refrigerants.

7. Modification to the Test Procedure for Variable-Speed Heat Pumps

> Issue 10: *DOE requests comments on its proposal to require that full-speed tests conducted in 17 °F and 35 °F ambient temperatures use the maximum compressor speed at which the system controls would operate the compressor in normal operation in a 17 °F ambient temperatures. DOE requests comment on the proposed approach of using standardized slope factors for calculation of representative performance at 47 °F ambient temperature for heat pumps for which the 47 °F full-speed test cannot be conducted at the same speed as the 17 °F full-speed test. Further, DOE requests comment on the specific slope factors proposed, and/or data to show that different slope factors should be used.*

Overall, AHRI supports the modifications DOE has proposed to the test procedure for variable-speed heat pumps; however, manufacturers are concerned that these changes will substantially impact the ratings for these units. There is also a significant testing burden associated with the DOE proposal. It should be noted that just because the proposed change may not eliminate minimum efficiency product, does not mean that ratings will not be impacted. This proposal to run the equipment at high speed is significantly different that current procedure and impacts higher efficiency products with substantial testing burden and ratings changes. This procedure is being used for complex systems (up to four additional) indoor units, which require even more testing and development. AHRI strongly recommends moving this proposal to Appendix M1.

Further, we suggest that a procedure similar to triple-capacity heat pumps be made an optional procedure for variable speed heat pumps, in which two tests are performed at minimum speed, two tests are performed at full speed, and two tests are performed at “boost” speed (each giving a linear performance for the given compressor speed), as well as the singular intermediate speed test. The minimum speed would be tested at 62 ºF and 47 ºF, the full speed at 47 ºF and 17 ºF, and the boost speed at 17 ºF and 5 ºF. Bin calculations would be performed for the speed at which the compressor would be operating in each bin, with the existing process for intermediate speed used between minimum speed and full speed bin calculations.

8. Clarification of the Requirements of Break-in Periods Prior to Testing

> Issue 12: *DOE requests comments on its clarifications regarding use of break-in, including use of the certified break-in period for each compressor of the unit, regardless of who conducts the test, prior to any test period used to measure performance.*

AHRI continues to disagree with DOE’s proposal to limit the optional break-in period to 20 hours. Industry has major concerns of how this will affect new

product development testing, specifically in that compressor change outs will be required between development testing and ratings testing in order to meet the 20-hour limit.

Further, two compressor manufacturers supplied data for scroll compressors, shown in Figure 1, below. Testing to collect this data was conducted at ambient temperature.

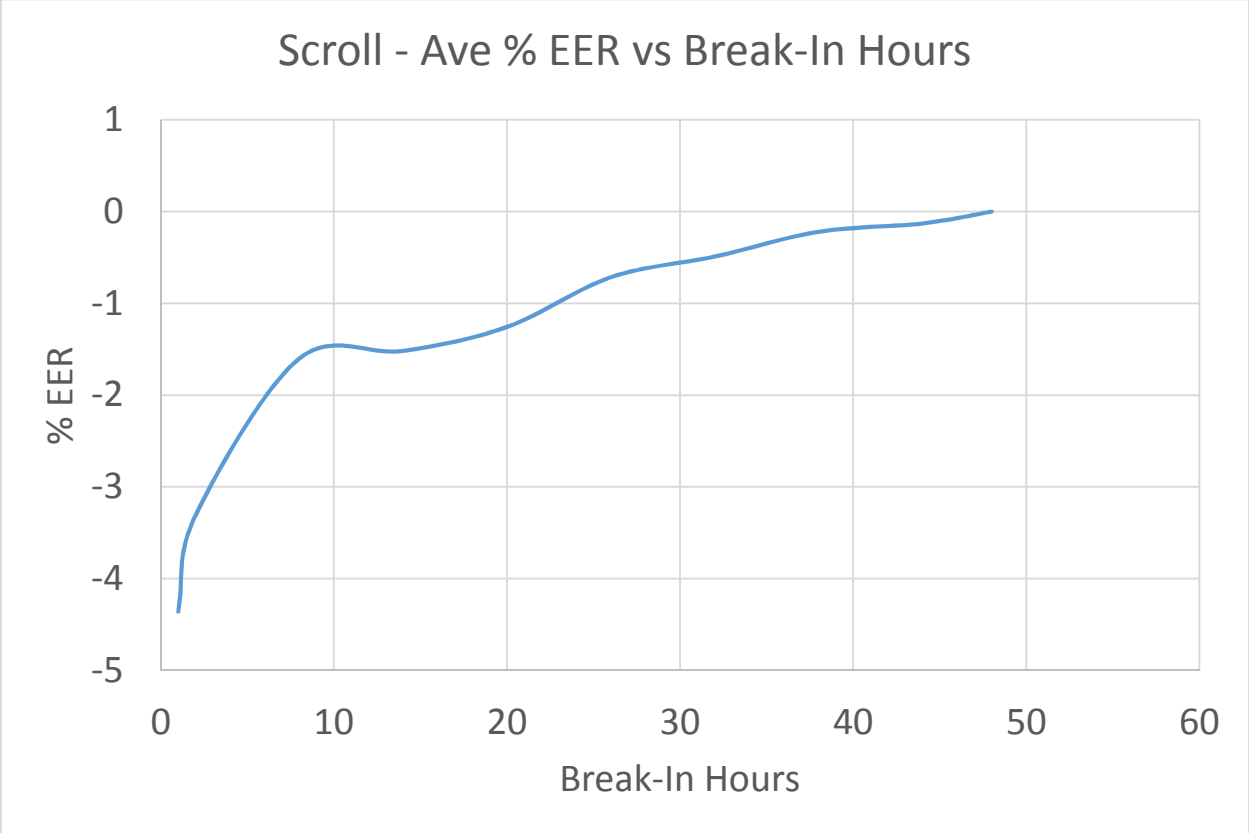

Figure 1

While the above data shows that full performance was reached after 50 hours, all of the discussions regarding break in been focused on the rating point of the compressor, but at lower load points the run-in can be longer. For small unitary SEER rating, capacity is determined at full load, but the EER for SEER is measured at the low load point. In fact, one manufacturer provided data for a smaller, but standard, scroll compressor that would typically be used in a 3-ton CAC, Figure 2, below, that even after 250 hours did not reach full performance. The data, taken from tests of 3 compressors, is from calorimeter testing at 45 ºF evaporating temperature at dew point, 100 ºF condensing temperature at dew point, 20 ºF superheat, and 15 ºF subcooling reflects typical conditions where the EER rating of small unitary equipment is measured.

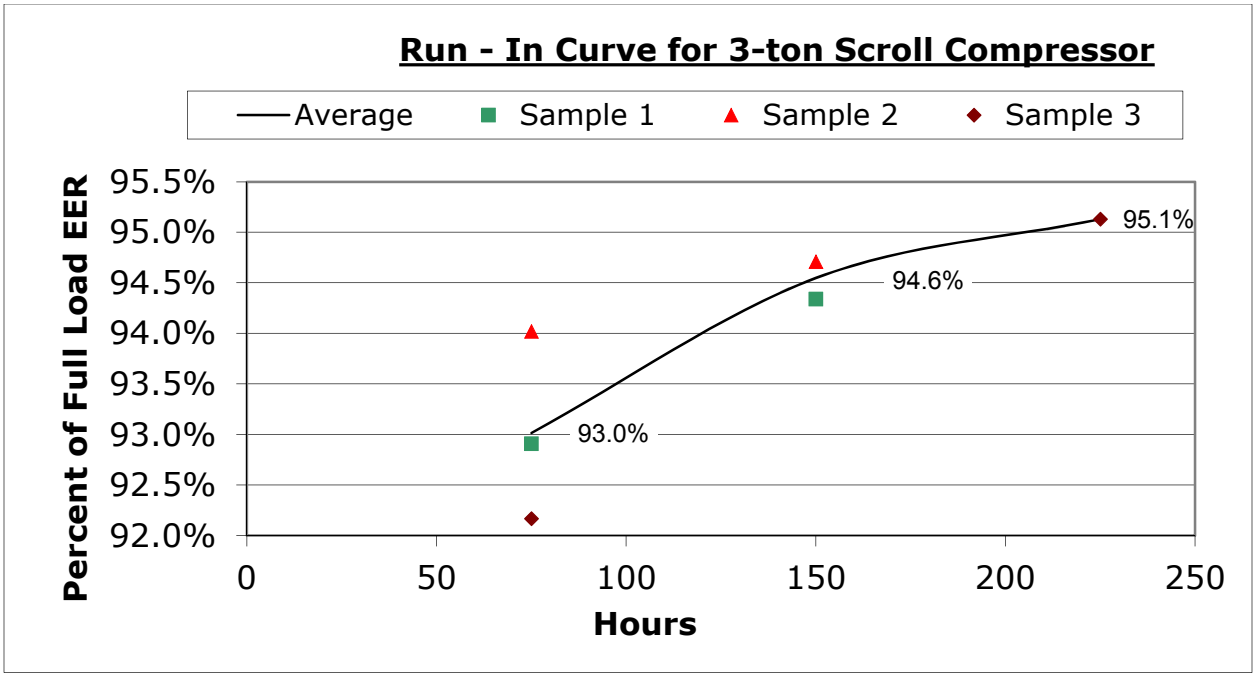

Figure 2

Another benefit to extending the time allowed for compressor break in is to reduce the standard deviation of the data, a very important feature to providing customers with accurate performance ratings. AHRI would like to remind the Department that manufacturers also need to be able to manage non-standard components, including compressors, for certain products.

AHRI suggests that DOE extend the break-in period to 72 hours to allow for accurate EER ratings and permit the break-in to be conducted at ambient conditions, outside the test cell. Not all manufacturers will request a 72-hour break-in period, but the option should be available for those manufacturers who need this time.

We note that in the negotiated rulemaking, DOE estimates in the TSD from August 2015 that air conditioner product life is approximately 18 years in the hot-humid south and 24 years in the north. Given approximate operating hours per year this results in about 25,000 hours of product life. AHRI's proposed 72-hour break-in period is only 0.029% of a typical air conditioners product life. As DOE is statutorily required to have test procedures that a representative of actual operation in the field, it is very to permit a 72-hour break-in period. This means that, in order to accurately represent the performance of the unit for the nearly 100% of the average use cycle, which is DOE's stated goal in the SNOPR, the longer break-in period should be an option for product testing.

9. Modification to the Part Load Testing Requirement of VRF Multi-Split Systems

   Issue 13: DOE requests comments on removing from section 2.2.3.a of Appendix M the 5 percent tolerance for part load operation when comparing the sum of nominal capacities of the indoor units and the intended system part load capacity.

   AHRI supports DOE's proposal to remove from section 2.2.3.a of Appendix M the 5 percent tolerance for part load operation when comparing the sum of nominal capacities of the indoor units and the intended system part load capacity. AHRI also supports the proposal to modify section 2.2.c of Appendix M to remove restriction of sealing ductwork to cased coil cabinet. These modifications correct previously noted concerns.

10. Modification to the Test Unit Installation Requirement of Cased Coil Insulation and Sealing

    Issue 14: *DOE requests comment on whether removing the statement about insulating or sealing cased coils in Appendix M, section 2.2.c would be sufficient to avoid confusion regarding whether sealing of duct connections is allowed.*

    AHRI agrees that removing the statement about insulating or sealing cased coils in Appendix M, section 2.2.c would be sufficient to avoid confusion regarding whether sealing of duct connections is allowed

Appendix M1

1. Minimum External Static Pressure Requirements

   Issue 15: *DOE requests comments on the proposed minimum external static pressure requirements.*

   Issue 16: *DOE requests comment on the proposed definitions for kinds of CAC/HP associated with administering minimum external static pressure requirements.*

   AHRI supports DOE's proposed new higher external static pressure requirements and definitions for all units, including unique minimum external static pressure requirements for mobile home systems, ceiling-mount and wall-mount systems, low and mid-static multi-split systems, space-constrained systems, and small-duct, high-velocity systems.

   While this was largely consistent with WG negotiations, AHRI is concerned with DOE's proposal to modify the external static pressure requirements when space-constrained outdoor units are paired with conventional indoor units. first,

there is no definition of a "space-constrained, indoor unit" (air handler). it would be difficult, if not impossible, for a space-constrained condensing unit manufacturer to rate with a conventional air handler at 0.5 in. wc and to meet existing efficiency standards. The restrictions of a space-constrained condensing unit's efficiency require rating with an efficient conventional air handler as a matched system. By definition, space-constrained condensing units, are all under 30,000 Btu/h, with limited applications. The minimum external static pressure requirement for space-constrained systems recommended by the CAC/HP Working Group, 0.30 in. wc. are not only appropriate for these installations, they are required in order for manufacturers to offer these niche products.

> Issue 17: *DOE requests comments on not including a reduced minimum external static pressure requirement for blower coil or single-package systems tested with a condensing furnace.*

2. Default Fan Power for Rating Coil-Only Units

> Issue 18: *DOE requests comment on the proposed default fan power value for coil-only mobile home systems. DOE also requests mobile home indoor fan performance data for units of all capacities and that use all available motor technologies in order to allow confirmation that the proposed default value is a good representation for mobile home units.*

AHRI supports DOE's proposal to use a default value of 441 W/1000 scfm for split-system air conditioner, coil-only tests. AHRI also supports a unique default fan power for rating mobile home coil-only units of 406 W/1000 scfm. The value for split-system air conditioner, coil-only tests and the concept of an alternative default fan power for rating mobile home air conditioner coil-only units based on the minimum external static pressure requirement for blower coil mobile home units (0.30 in. wc.) are consistent with the CAC/HP ECS Working Group Term Sheet.

> Issue 19: *DOE requests comments on its proposed definition for mobile home coil-only unit.*

3. Revised Heating Load Line Equation

> Issue 20: *DOE requests comments on the adjustments to the proposals for calculating HSPF for heat pumps and SEER for variable-speed heat pumps.*

While model differentiation is not an EPCA requirement for test procedures, it is important that test procedures reflect field performance of products, as noted on page 58170 of the SNOPR, as well as are not unduly burdensome to manufacturers. A single correction factor to improve correlation between measured and calculated building load of 1.02 is appropriate and technically sound for all products. There should be only one load line, as building load is independent

of the installed system. AHRI has always advocated for technically sound approaches for testing products and for differentiating performance between products. No sound technical reason has been provided in DOE's analysis to change the HSPF calculation from the amount of heating delivered being equal to the heating load. AHRI does not agree with DOE's stated logic of product sizing affecting the building load to justify varying heating load correction factors. AHRI understands creating a heating load line equation slope factor of 1.15 for single- and two-stage heat pumps versus 1.07 was done at the request of industry's comment there should be more differentiation between these products in the certified HSPF rating, and we appreciate such efforts. But, as EPCA requires test procedures to be representative of the covered product's average use cycle we do not support the proposed changes as these changes are based solely on computer modeling. Further, DOE's proposal to change the zero load point of 65 ºF ambient was also based solely on computer modeling. AHRI members submitted real world data from across the entire country during the negotiations to support our position. The data included performance measurements required to calculate HSPF using the current and the proposed test procedures, for a number of two stage and variable speed heat pumps. Based on that data and figures from the May 2006 Northeast Energy Efficiency Partnerships Strategies to Increase Residential HVAC Efficiency in the Northeast Final Report, which show heating into the upper 60's, AHRI recommends keeping the existing a zero intercept of 65 ºF zero-load temperature and a *single* heating load line for all products with a 1.02 slope factor.

> Issue 21: *DOE requests comments on the adjusted values of minimum HSPF based on the HSPF efficiency levels recommended by the CAC/HP ECS Working Group.*

AHRI appreciates DOE's efforts to create a crosswalk from HSPF to HSPF2; however, there are concerns with the level set for single-package, single and two-stage product heat pumps. Based on an evaluation of six products, five indicate that 8.0 HSPF for single package heat pumps would not cross-walk to a 6.8 HSPF2 value (including the new external static pressure). The three units, one two-ton, one three-ton, and one five-ton, which would be obsolete by this proposal were not minimally compliant units and have an HSPF between 8.2 and 8.25. The delta between HSPF and HSPF2 is likely even greater than what our evaluation showed as we used more conservative, published, ratings in the data review. Therefore, AHRI believes 6.8 is not an appropriate HSPF level for single-package products.

AHRI is collecting further data from members and will provide a suggestion for an appropriate crosswalk, with data, within 30-days of the comment submittal deadline.

> Issue 22: *DOE requests comment on its proposal to require use of an alternative HSPF rating approach (for heat pumps that raise minimum compressor speed in ambient temperatures that impact the HSPF calculation) that estimates minimum-speed performance (a) between 35 °F*

and 47 °F using the intermediate-speed frosting-operation test at 35 °F and the minimum-speed test at 47 °F, and (b) below 35 °F assuming that minimum-speed and intermediate-speed performance are the same. In addition, DOE requests comment on including in certification reports for variable-speed heat pumps whether this alternative approach was used to determine the rating. Finally, DOE requests comment on whether any of the additional tests that could be used to further improve the accuracy of variable-speed heat pump performance estimates should be required in the test procedure.

AHRI supports these proposals and agrees with them being made as part of Appendix M1.

4. Revised Heating Mode Test Procedure for Units Equipped with Variable Speed Compressors

Issue 23: *DOE requests comment on the proposals for evaluation of heat pump capacity and power input as a function of ambient temperature based on test measurements, both for cases where a 5 °F test is conducted and where it isn't.*

Issue 24: *DOE requests comment on the target wet bulb temperature for the 5 °F test.*

Rather than a target wet bulb temperature of 3.5 °F for the optional 5 °F test, AHRI recommends that DOE specify a maximum 3.0 °F for wet bulb temperature and any measurement lower than 3.0 °F wet bulb is acceptable.

Issue 25: *DOE requests general comments regarding its proposal to adopt an optional 5°F test and regarding any other details of the related amendments proposed for calculation of HSPF.*

AHRI supports the optional 5 °F full-speed test (to be designated $H4_2$) be conducted, full-speed performance for ambient temperatures between 5 °F and 17 °F and would be calculated using interpolation between full-speed test measurements conducted at these two temperatures, rather than the current approach, which uses extrapolation of performance measured at 17 °F and 47 °F ambient temperatures. For all heat pumps for which the 5 °F full-speed test is not conducted, the extrapolation approach would still be used to represent performance for all ambient temperatures below 17 °F.

Issue 26: *DOE requests comments on whether the very-low-temperature heating mode test for triple-capacity northern heat pumps should be changed to a 5 °F test for consistency with the proposed 5 °F variable-speed test.*

AHRI does agrees with DOE's proposal to change the very-low-temperature heating mode test for triple-capacity northern heat pumps to a 5 °F test. In fact, as indicated previously, AHRI suggests that DOE modify the test procedure for triple-capacity northern heat pumps, and allow variable-speed heat pumps to be tested like the triple-capacity northern heat pumps in heating mode. Manufacturers appreciate allowing for two different ways to generate HSPF rating. AHRI agrees that Manufacturers should specify in certification reports whether the 5 °F full-speed test was conducted so that DOE enforcement testing could be conducted in the same manner.

Additional Comments on Appendix M

Further Change Requests and Compliance Issues

AHRI comments in this section address request for further changes to the test procedure and/or challenges in meeting compliance with the DOE Final Rule on Uniform Test Method for Measuring the Energy Consumption of Central Air Conditioners and Heat Pumps.

1. Multi-Split Ratings for Ducted and Non-Ducted Tested Combinations in a Basic Model

   DOE has clarified the "tested combination" for Multi-Split, Multi-Circuit, or Multi-Heat Mini-Split Split Systems that, at a minimum, a "tested combination" is composed entirely of non-ducted indoor units, of which two samples must be tested. For any models of outdoor units also sold with models of ducted indoor units, two samples of ducted indoor unit "tested combination" must also be tested (in addition to the non-ducted combination). This would require manufacturers test at least two samples of a "tested combination" for non-ducted indoor units and at least another two samples of a "tested combination" for ducted indoor units. As an AEDM cannot be used to rate a Basic Model, this causes more burden on the multi-split manufacturer than the non-multi-split manufacturer, and is not in line with the fact that other products can have two samples of a single tested combination tested with unlimited number of non-tested combinations rated by AEDM. Performing all required tests in six months is not achievable by some manufacturers. AHRI requests that DOE reconsider the option to apply the AEDM for multi-splits < 65,000 Btu/h in the same manner as applied for VRFs ≥ 65,000 Btu/h.

2. Barometric Pressure

   The test procedure, as well as ASHRAE Standard 37 and AHRI 210/240, has a fundamental flaw in that it does not account for barometric pressure differences. The test procedure is silent on this very important issue that can cause variability from laboratory to laboratory. While ASHRAE Standard 16, as adopted by DOE, and other AHRI standards allow for correction of varying barometric

pressure test conditions, we do not ask or expect that DOE will adopt barometric pressure corrections in to this test procedure immediately. We simply note, for the record, that we expect ASHRAE will conduct research on this topic as part of the ongoing revision to ASHRAE Standard 37 which could be adopted upon completion.

3. Inlet Duct

Page 37067 of the Final Rule (Section 2.4.2) states that an inlet plenum is now required to be installed when testing coil-only, ducted blower coil indoor unit, or single package systems. ASHRAE 37-2009, figures 7b and 7c are then referenced for blower coil indoors and single package systems, and figure 8 is referenced for coil only indoors. All of the referenced figures show a 1.5*Sqrt(C*D) length dimension.

The primary concern around this requirement is around the ducted blower coil indoor unit. Given that a fan coil indoor unit can be roughly 60” tall with a 30” 90° transition from the inlet damper box, a 40” leaving ASHRAE duct, a 30” 90° transition into the leaving damper box, and now a 31” inlet ASHRAE duct, this results in an overall height of 191” or roughly 16 feet which is in excess of the height of many manufacturer’s and third party certification laboratory’s psychrometric rooms. Considering the difficulty in retrofitting or building new psychrometric rooms that would be capable of meeting this requirement, AHRI is asking DOE to consider allowing alternative measurement approaches that would accommodate the limitations of existing psychrometric infrastructure.

Specifically, as part of ASHRAE research project (RP) 1581 (see attached research report), an ASHRAE project specifically targeted at alternate guidelines for the ASHRAE 37 duct requirements has proposed, for ducted blower coil indoor units, the use of a 6” tall skirt with an integrated pressure ring mounted after the damper box, but before the indoor coil. In addition, the report details the evaluation of various methods for using the required leaving duct, but with a 90° elbow that dramatically reduces the height requirements with little impact to the results. In the previous example given, the 6” skirt and the horizontal duct would result in a height of 126”, or 10.5 feet.

AHRI would request that DOE approve the use of the 6” skirt coupled with the 90° square vane elbow and the appropriate leaving duct as being an alternative to the configuration outlined in the final rule. ASHRAE Standards Policy Committee (SPC) is currently working to add the details of RP 1581 to the standard and has a Work Statement for a project investigating the damper box/inlet duct to provide an improved recommendation for that as well.

4. Off Mode Power Consumption Measurement

Page 37069 of the Final Rule, Column 3 (Section 2.8) requires an accuracy of 0.5% for all Watt-Hour measurements. This is a fundamental problem as specifying only a percent tolerance will not be feasible when some measurements can be very close to zero.

Page 37095 and 37096 Sections 3.13.1 and 3.13.2 round all measurements to nearest watt. So it seems unnecessary to have an accuracy better than 0.5 W.

Manufacturers and third party certification laboratories cannot meet the requirement in Section 2.8 as written. They can meet the revised specification but may still need to make some changes to shift the measurement system to a lower range during off cycle testing. The measurements sections and procedures do not require an accuracy better than 0.5 W so we suggest that the requirement in Section 2.8 be to an accuracy of 0.5% or 0.5 W, whichever is greater. This would make the requirement the same for all measurements except when making measurements below 100 Watts.

5. Definition for Multiple-split System

DOE had previously agreed to remove coil-only from the multi-split definition, however, the final definition has listed on page 37039 of the Final Rule still includes coil-only.

Regulatory Issues

1. Reporting Requirements and Compliance

On page 37052 of the Final Rule under the section discussing certification reports, DOE has required manufacturers to certify certain data and information that had not been previously required. The information must be collected in a manner designed to minimize unnecessary burdens on manufacturers. Some of the required information, such as compressor frequency set points, is proprietary and submission to the DOE could place manufacturers at significant risk of exposing trade secrets and incurring significant financial harm or damage to market share.

Our interpretation of the reporting requirements, based on the first note of Appendix M on page 37058, is that existing and new products can be reported using either the current templates (Consumer Products and Commercial and Industrial Equipment Certification Template for Residential Central Air Conditioners and Heat Pumps, v4.4) or the revised templates (to be released by DOE) until December 5, 2016, after which all reporting will be using the revised templates.

Additionally, the new reporting requirements will require major revisions to the data collection templates AHRI uses to collect data from the manufacturers.

As these changes take time for developers to implement, we request a grace period to implement submissions via the revised templates to the later of December 5, 2016, or 90 days after the new templates are available from DOE, whichever is later.

2. Supplemental Testing Instructions for variable-speed multi-split systems

AHRI requests that manufacturers of variable-speed multi-split systems be permitted to submit supplemental testing instructions for each basic model data in pdf similarly to the requirement for VRF systems over 65,000 Btu/h. Variable-speed multi-split systems are complex and there is important information for testing that is not contained in the installation and operation manual such as instructions for proper setup of up to five indoor units. Directions on how to set the compressor speed, which may be done through the remote control device, dip switches or an operations simulation program with an interface device between a PC and the outdoor unit, is another critical piece of information which is not included in the installation and operation manual.

Conclusion

AHRI appreciates the opportunity to provide these comments. If you have any questions regarding this submission, please do not hesitate to contact me.

Sincerely,

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