AIR-CONDITIONING, HEATING, & REFRIGERATION INSTITUTE

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January 7, 2014

Ms. Brenda Edwards
U.S. Department of Energy
Building Technologies Program, EE-2J
1000 Independence Avenue, S.W.
Washington, D.C. 20585-0121

Re: NOPR Test Procedures for Direct Heating Equipment, and Pool Heaters
Docket No. EERE-2013-BT-TP-0004

Dear Ms. Edwards:

The Air-Conditioning, Heating, and Refrigeration Institute (AHRI) is the trade association representing manufacturers of air conditioning, space heating, water heating and commercial refrigeration equipment. AHRI's 315 member companies include all the major manufacturers of pool heaters, and most of the major manufacturers of gas-fired direct heating equipment doing business in the U.S. We submit the following comments in response to the Notice of Proposed Rulemaking (NOPR) issued in the October 24, 2013, Federal Register. The NOPR identified five issues on which DOE seeks comments. These comments address those issues in the order in which they were listed in the NOPR.

1. Are the proposed provisions for testing vented heaters that are capable of condensing operation appropriate and sufficient?

We agree with the basic concept of the provisions to test condensing vented heaters. However, there are some specific details the require modification.

Section 3.8.1 should be modified to specify the collection of the condensate during the steady-state testing conducted per 3.1 rather than after the testing. Testing techniques have evolved such that the condensate can be collected during the steady state test to provide an accurate measurement of the condensate generated during operation of the unit. This change will simplify the testing without any reduction in the accuracy of the AFUE measurement.

A provision should be added to Section 2 to specify the accuracy of the scale used to measure the mass of the condensate ($M_{c,ss}$). The DOE test procedures for residential furnaces and boilers specifies that the error of a measurement of mass shall not be more than ±0.5% of the quantity measured.

The determination of the off-cycle flue gas draft factor (D_F) should be modified for power burner, direct vent, condensing heaters with no off period flue losses to add the optional default value of 0.05. This option is available for residential furnaces and boilers and is described in Section 9.10 of ASHRAE Standard 103. Models of condensing vented heaters do employ designs that result in no flow through the unit in the off cycle. In such cases a 0.05 value for D_F is appropriate. The test procedure should be revised to address this situation.

The calculation for $M_{s,off}$ in Section 4.3.3 has a typographical error. The value "100" should be C_T*. The text below the equation notes that C_T* is the general term and 100 is the value for this term only in the specific case that a single component gas is used for the tracer gas. The same error exists in the calculation for $M_{F(off)}(T_{F(off)})$ in Section 4.5.1.

The variable D_s is used in the AFUE calculation in Section 4.1.17 for all system numbers. But Table 1 does not specify any value for D_s for systems 9 through 12. Based on similar coverage in the DOE test procedures for residential furnaces and boilers, it appears that D_s should not be a part of the AFUE calculation for systems 9 thru 12. Accordingly, we recommend that the Ds value in Table 1 for systems 9 through 12 be specified as "0".

2. Are the updates to the material incorporated by reference into the direct heating equipment test procedure appropriate and sufficient?

We do not agree with some of the updates to the material incorporated by reference. Specifically we do not support the changes in 2.1.3 to reference a standard for oil-fired room heaters to describe the test setup for gas-fired vented room heaters. As noted in the NOPR, DOE had received a comment suggesting that the safety standard for gas-fired room heaters be referenced In response DOE has proposed to reference the current standard Z21.86, Vented Gas-Fired Space Heating Appliances, for purposes of specifying the test procedures related to circulation air and the location of temperature measuring instrumentation. The fact that the Z21.86 standard does not include more detailed instructions for setting up a vented room heater in the test facility is not a shortcoming of that standard. Rather it reflects the fact that further detailed instructions are unnecessary for the testing of these products. This is further supported by the nearly 30 years of experience conducting the current DOE efficiency test procedures for direct heating equipment. In the case of vented room heaters, the requirement is that the unit be installed in accordance with the manufacturer's installation instructions. This has proven to be adequate. Vented room heaters are free standing appliances. There is no special setup required to measure the efficiency of these products. The units only need to be connected to the appropriate vent and not placed too close to combustible construction. For efficiency testing this means that the unit is placed somewhere in the center of the test room. Instructions on how to do this are provided in the manufacturer's installation instructions.

The proposal to reference a test enclosure specified in a standard for oil-fired room heaters makes no improvement to the current test procedure. The key role of this test enclosure in the UL standard is to provide a structure to evaluate clearances from combustible construction. Figure 5 in the Z21.86 standard specifies a test enclosure for vented room heaters for the same purpose. As we have explained, a detailed description of a test enclosure for gas vented room heaters is not needed. However, if such a specification is added to the DOE test procedure, it should reference Figure 5 of ANSI Z21.86-2008.

Also, the proposed reference to ASHRAE 103-2007 in Section 2.3.3 should be replaced with a reference to Table IV in ANSI Z21.86-2008. The Z21 series of safety standards are the source documents for general specifications on the gases used during the testing of gas-fired appliances. Table 1 in ASHRAE Standard 103 is just a version of Table XI in the ANSI Z21.47 gas furnace standard. Accordingly, rather than reference a derivative version of these specifications, the reference in Section 2.3.3 should continue to cite the relevant gas appliance standard. In this case it is Table IV of ANSI Z21.86-2008.

3. Is the assignment of a 1-percent default jacket loss in lieu of testing for vented floor furnaces appropriate?

We agree with this proposed change.

4. Are the proposed provisions to allow testing of electric resistance and heat pump pool heaters appropriate and sufficient?

We agree with the basic concept of the provisions to add test procedures for electric resistance and heat pump pool heaters. However, there is one significant issue that must be corrected.

The burner operating hours (BOH) value of 104 is specific to gas-fired pool heaters. That value cannot be applied to estimate the average annual operating hours of either type of electric pool heaters. The 104 hours value was developed from a study that only investigated the field usage of gas-fired pool heaters. The average input of those pool heaters was at least 250,000 Btu/h and the average thermal efficiency was at least 75%. Using these average values, the energy delivered to the pool in the 104 hours was 19.5 million Btus. The input of electric pool heaters is less than 250,000 Btu/h and the efficiency is higher than 75%; these characteristics also differ between electric resistance pool heaters and electric heat pump pool heaters. If the gas pool heater BOH value is considered to reflect the typical heating load for all pool heaters, then corresponding average annual operating hours can be calculated for electric resistance and electric heat pump pool heaters using appropriate average efficiency and hourly input rate values. We are currently working with our members that manufacturer heat pump pool heaters to develop a recommendation for an appropriate "BOH" value for these products.

5. What are the impacts of this proposed rule on small business entities?

We have encouraged our members to comment directly on this issue.

<u>Other Issues</u>

There is another evolution in the design of direct heating equipment that should be addressed in the revised efficiency test procedures. Gas-fired models are available today that are equipped with controls that allow the consumer to select the operating mode, manual or automatic, of the heater. This may be done buy a switch on the unit or by a remote control device. But the consumer can select the operating mode at any time and may change it from one usage period to the next. Since the operational mode of the model does affect the AFUE rating, we recommend that DOE add a provision specifying that models that provide consumers with the capability to operate the heater in more than one mode of operation be tested for the AFUE rating in the mode that represents the least efficient operation of the model.

The addition of test procedures for electric heat pump pool heaters underscores the problems that are caused by the introduction of the integrated thermal efficiency metric (TE_I). We have previously submitted comments expressing our concerns with, and opposition to, the integrated thermal efficiency metric. (The relevant excerpt from comments submitted by AHRI on November 15, 2010 is attached for your reference.) At the most fundamental level, converting the COP of a heat pump pool heater to a thermal efficiency is a contrivance driven by the requirement to determine TE_I.

Imposing the thermal efficiency metric on heat pump pool heaters will only disrupt the marketing of these products and confuse consumers. An efficiency claim of 400% or 432% or 500% for a heat pump pool heater will be considered by some consumers as an inflated claim that is not credible; others may accept the value but will not understand how to put it into perspective with the efficiency of other types of pool heaters; and a small segment of consumers may understand a 400% efficiency rating but the context of that understanding will be that it is really a COP of 4.0. This change also distorts the relevance of thermal efficiency ratings. In the case of gas fired pool heaters a one point change in thermal efficiency is relevant. In the case of heat pump pool heaters, a one point change in thermal efficiency is considered irrelevant. Based on the COP, differences in efficiency only become significant when the change hits 10%.

A primary feature of gas-fired pool heaters is that they can heat a pool quickly because of their high input. The unit's efficiency, while good from the perspective of gas-fired equipment, is lower than that of a heat pump pool heater. A primary feature of heat pump pool heaters is that they operate very efficiently. The rate at which the unit heats the pool is slower than a gas-fired pool heater. When both fuels are available, the decision by a consumer to use either a gas-fired pool heater or a heat pump pool heater is a choice of fast heating with lower efficiency or slower heating with high efficiency. Because of this significant difference in the performance characteristics of gas-fired and electric heat pump pool heaters, the parameter that should be used as the basis to compare these different products is the estimated annual energy consumption. With this approach, heating efficiencies could continue to be presented with the same metrics that have been used, and which are understood by consumers, and a distinct, common energy consumption metric could be specified to provide a basis of comparison that has a greater probability of being understood and used by consumers. We urge DOE to delete the integrated thermal efficiency metric and replace it with an annual consumption metric.

We appreciate this opportunity to provide comments and participate in this rulemaking.

Respectfully submitted,

Frank A Stanonik

Frank A. Stanonik
Chief Technical Advisor

(Excerpt AHRI November 15, 2010 Comments Docket No. EERE–2009–BT-TP–0013.)

Pool Heaters

We have no comments on the technical changes to add measurements of standby and off mode energy consumption for pool heaters. We agree with the proposal to update the reference to ANSI Z21.56 to the 2006 edition.

We do not support the introduction of the integrated thermal efficiency descriptor, TE_I. This proposed descriptor distorts the term thermal efficiency and undermines the value and significance of that term that has been in use for over 50 years. It also fails to provide a measure that distinctly identifies the amount of standby or off mode consumption, rendering it a term that will not be useful in effectively regulating standby or off mode consumption or conveying information about that consumption to consumers.

The 2007 amendments to the Energy Policy and Conservation Act (EPCA) allow DOE latitude and discretion to prescribe a separate standby mode and off mode energy use test procedure and a separate standard for standby mode and off mode energy consumption. See sections 325 (gg)(2)(A)(ii) and (3)(B) of EPCA, as amended, 42 U.S.C. §§ 6295(gg)(2)(A)(ii) and (3)(B). Section 325(gg)(2)(A) requires that test procedures be amended to include standby and off mode consumption and that such energy consumption be integrated into the overall energy efficiency, energy consumption or other energy descriptor (emphasis added) for each covered product unless the conditions of clauses (i) or (ii) apply. Subsection 325 (gg)(2)(A)(ii) addresses the technical feasibility of an integrated test procedure, not an integrated descriptor. Is it technically feasible to incorporate a procedure for measuring standby and off mode consumption into the existing DOE pool heater efficiency test procedure? Yes, but DOE may integrate that measurement into the overall energy efficiency or the energy consumption or other energy descriptor as it so chooses. There is no mandate that DOE must integrate the standby and off mode consumption into the thermal efficiency, if technically feasible. This is further supported by Sections 325 (gg)(3)(B) which requires the standby and off mode consumption to be incorporated into a single standard , if feasible. In this case there is another efficiency descriptor that is a much better candidate.

The current DOE pool heater test procedure contains the metric EFFYHS as a measurement of heating seasonal efficiency. In concept, this descriptor considers the output of the pool heater compared to the total consumption of the pool heater. This descriptor already includes the pilot light consumption during standby and is ideally suited for modification to include the standby mode and off mode electrical energy consumption. In fact the calculation of EFFYHS is the same as the calculation for the proposed integrated thermal efficiency. The values for the terms in the calculation are different but the basic calculation is the same. This descriptor also has the benefit of being unknown; it has little historical significance or current use for pool heaters. Proposing a modified EFFYHS eliminates the concerns about burdening the industry and confusing the public associated with an altered thermal efficiency descriptor. A redefined EFFYHS provides a descriptor that can be used by DOE to establish an efficiency standard for pool heaters that includes standby mode and off mode energy consumption, when that need arises. DOE should determine that it is infeasible to incorporate standby mode and off mode electrical consumption into the thermal efficiency of pool heaters for the following reasons:

(1) Thermal efficiency is an efficiency metric. It reflects the percentage of energy put into the pool water compared to the total energy consumed by the pool heater when it is heating. In the case of pool heaters this includes all electrical energy consumed by the heater during the active mode. The standby

mode and off mode measurements are consumption values. Incorporating these consumption values, which by their nature provides no heating benefit, unreasonably distorts the thermal efficiency measure.

(2) The thermal efficiency is currently considered in the context of hourly operation. It is an important value used for sizing pool heaters. It is commonly understood that a pool heater with an input of 300,000 Btu/h operating at 80% thermal efficiency will provide 240,000 Btus of heat to the pool water in an hour. Once the volume of the pool is known and the desired temperature rise specified, the appropriate size pool heater can be selected. Introducing an integrated thermal efficiency, which can not be used for sizing but still looks like thermal efficiency will only cause confusion.

(3) If DOE were to prescribe TEI as the new efficiency descriptor for pool heaters, an enormous and needless burden on manufacturers and disruption of the marketplace would ensue. The distribution network, utilities, contractors and consumers now understand the meaning of thermal efficiency (which has been and still is designated as Et) and they would have to be reeducated. Manufacturers would have to revise their literature and re-test their products.

(4) The fact that the current efficiency descriptor is thermal efficiency does not mandate that thermal efficiency must forever be the descriptor for a DOE efficiency standard. The fact that the National Appliance Energy Conservation Act (NAECA) specified the pool heater efficiency standard as a minimum thermal efficiency merely reflects the use of the testing standard that existed at that time. DOE clearly has the authority to amend the efficiency test procedures and amend efficiency standards. It logically follows if such amended test procedures would result in an amended efficiency descriptor that is part of an amended efficiency standard, then such change is allowed by that authority. In fact the proposed integrated thermal efficiency illustrates this. Even though it shares common words the integrated thermal efficiency is in no way, shape or form the same as thermal efficiency. Unlike thermal efficiency, integrated thermal efficiency is not a measure of how well the pool heater delivers heat in the active mode, it is not representative of hourly operation and it is not a measure that can be used for sizing pool heaters.

When considering the use of a single descriptor to regulate the standby and off mode consumption, whatever it may be called, DOE needs to recognize the relative effect of this consumption. Pool heater models made by a single manufacturer will use the same controls to the fullest extent possible. Thus the standby and off mode energy consumption generally will be constant across the various models in a product line. As the calculation of TE_I is defined, this constant consumption value will have an inequitable, larger effect on models with smaller inputs since those models have smaller annual fuel consumptions. If the standby and off mode electrical consumption was 15 watts the 4360 hours of standby would represent only about 1% of the annual gas consumption of a pool heater firing at 200,000 Btu/h; only about 0.7% of the annual gas consumption of a pool heater firing at 300,000 Btu/h; and only about 0.5% of the annual gas consumption of a pool heater firing at 400,000 Btu/h. Since a single descriptor proposes to combine a very small electrical consumption with a fuel efficiency that estimates comparatively very large energy consumption, it invites trading between heating efficiency and standby and off mode consumption. A one percent increase in the thermal efficiency, as currently defined, will provide more than a 1% increase in the single seasonal efficiency descriptor. This is more than the boost in this descriptor that would result from completely eliminating the 15 watts consumption of our example. The real effect of using any single efficiency descriptor will be that there is no specific standard or limit on standby and off mode electrical consumption and consumers will have no specific information on the electricity usage of the pool heater in the standby and off modes. The better solution may be to incorporate the standby and off mode electrical consumption into the EAE calculation.