

April 16, 2019

Ms. Stephanie Johnson
Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585-0121

Re: AHRI Comments in Response to Department of Energy's Request for Information Regarding the Test Procedure for Automatic Commercial Ice Makers [*Docket Number EERE-2017-BT-TP-0006*]

Dear Ms. Johnson:

These comments are submitted by the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) in response to the U.S. Department of Energy's (DOE) request for information (RFI) regarding the test procedure for automatic commercial ice makers (ACIM) appearing in the *Federal Register* on March 19, 2019.

AHRI is the trade association representing manufacturers of heating, cooling, water heating, and commercial refrigeration equipment. More than 300 members strong, AHRI is an 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 and water heating industry is worth more than \$44 billion. In the United States alone, the HVACR and water heating industry supports 1.3 million jobs and \$256 billion in economic activity annually.

This RFI raises a number of complex questions about the relevant test procedure as well as the applicability of certain provisions. AHRI appreciates the opportunity to comment on behalf of AHRI's ACIM manufacturers.

Issues on Which DOE Seeks Comments

Scope and Definition

1. DOE requests comment on whether any modulating capacity ice makers are currently available in the market. If such products are currently available, DOE requests information on how such equipment functions, such as typical capacity ranges and the relative frequency of use at different capacity ranges, and how such equipment is currently tested.

- Response 1: AHRI is not aware of any modulating capacity ice makers in the marketplace today. If such equipment exists or becomes available, the equipment manufacturers will provide ASHRAE SPC 29 with information regarding any differences in equipment function or variances from the current method of test. ASHRAE SPC 29 is the standing committee charged with drafting the ASHRAE method of test for automatic commercial ice makers.

Test Procedure

2. DOE seeks comment on updating the DOE test procedure to incorporate by reference the latest industry standards: AHRI 810-2016 and ASHRAE 29-2015. Specifically, DOE requests comment on whether incorporating by reference these industry standards would more accurately reflect energy efficiency during a representative average use cycle or reduce testing burden. Additionally, DOE seeks comment on the benefits and burdens of adopting any industry/voluntary consensus based or other appropriate test procedure, without modification.
- Response 2: AHRI agrees that the DOE Test Procedure should be updated to incorporate the latest versions of industry consensus standards, ANSI/ASHRAE Standard 29-2015, *Method of Testing Automatic Ice Makers* and ANSI/AHRI Standard 810 -2016, *Performance Rating of Automatic Commercial Ice-makers*. ASHRAE 29 was recently reaffirmed in 2018 and AHRI Standard 810 was published in 2016. By incorporating these revised industry standards, DOE will capture the most accurate and repeatable energy usage of automatic commercial ice makers in the marketplace today. Industry standards are established and revised on a consensus basis and participation is open to all types of members, including DOE. Adopting appropriate industry procedures, without modification, ensures that the careful work of the consensus body is incorporated into the federal standard, and therefore the stakeholder will not incur undue burden resulting from a re-write of the voluntary consensus standard. Established OEMs and certification bodies are already successfully using these voluntary consensus standards today. The experience has been positive; stakeholders have determined that the updates to the consensus standards produce accurate results without unduly burdensome testing requirements for laboratories or manufacturers.
3. DOE requests comment on whether further instruction is necessary to achieve the required calorimeter constant as specified in ASHRAE 29-2009 and ASHRAE 29-2015. DOE also seeks information on how manufacturers and third-party labs are currently testing and measuring the calorimeter constant for the ice hardness adjustment factor and if there are any best practices to ensure the calorimeter constant remains in the required range. Alternatively, DOE requests feedback on whether a wider range of allowable calorimeter constant would allow for less burden on manufacturers while still accurately measuring energy use during a representative average use cycle.

- Response 3: Regarding the required calorimeter constant, additional instructions are not necessary; the standard sufficiently dictates how to complete the test. Manufacturers and third party labs who are currently testing in accordance with the updated standard have been able to achieve repeatable results and have not seen variance outside of the allowable range when using the updated testing methods. A change to the allowable calorimeter constant would likely have negligible results and would not reduce burden. Manufacturers already comply with the allowable constant and testing requirements today, and changing these metrics could possible increase testing burden for labs and manufacturers.

Test Setup and Equipment Configuration

Temporary Baffles

4. DOE is considering amending the ACIM test procedure to explicitly state that temporary baffles may not be used for testing, unless the baffle is (a) part of the ice maker or (b) shipped with the ice maker to be installed according to manufacturers' installation instructions. DOE requests comment on whether manufacturers and test laboratories currently test consistent with the 2013 baffle guidance and whether any further instructions are needed.
- Response 4: AHRI agrees with DOE's suggestion to amend the ACIM test procedure to explicitly state that temporary baffles may not be used for testing, unless the baffle is (a) part of the ice maker or (b) shipped with the ice maker to be installed according to manufacturers' installation instructions. Standard practice dictates that if baffles are used, then manufacturers include baffles in product marketing, with the unit during shipment, and in the installation instructions. Third party test facilities use the baffles during testing only when these requirements are met and the baffles are installed in accordance with manufacturer's installation instructions; in all other cases baffles should not be used during testing. AHRI recommends that DOE include this amendment to the test procedure.

Purge Settings

5. DOE requests comment on whether purge settings affect measured energy use during a representative average use cycle. If purge settings do affect measured energy use, DOE also requests comment on (1) what purge settings should be considered for testing for ACIM equipment with multiple or automatic purge settings, and (2) whether any ACIM models exist that have automatic purge settings but do not have a fixed purge 20 setting appropriate for "normal" water hardness and, if such a unit exists, how it should be tested.
- Response 5: Purge cycles and their frequency can affect the sensible heat involved during the test and therefore influence the energy use. As indicated by the current

standards, all ACIM units should be tested with the factory default settings employed. Introducing additional requirements to require a purge cycle during the test or initiate control sequences to control purge, will introduce additional burden to the manufacturers. Different amounts of purge water or different frequencies of purge cycles may be required in certain applications. The voluntary consensus standard and current federal test captures average operation of the ice maker and illustrates average representative energy consumption. Established certification bodies have shown that this testing is accurate while also being consistent and repeatable. Units with automatic purge settings should still be tested at the default settings whether these include the automatic purge or not. If needed for a specific application, the settings would be adjusted upon installation to produce better ice.

6. DOE requests comment on the presence and frequency of any “additional” or “increased-water” purge cycles and their impact on energy and potable water use and/or condenser water use. DOE also requests comment on how the test procedure could be modified, if necessary, to more accurately measure this energy use during a representative average use cycle.
 - Response 6: AHRI maintains that any test procedure modifications should first be proposed to the voluntary consensus bodies who draft the industry standard and method of test: ASHRAE 29 and AHRI 810. These committees can consider changes for testing. At present, AHRI members do not have data to show the impact of any “additional” or “increased-water” purge cycles and their impact on energy and potable water use and/or condenser water use. Importantly, any modifications to the test procedure, without proper vetting, require retesting of currently certified equipment and introduce additional burden to the OEMs, test laboratories and certification bodies. AHRI recommends DOE adopt the harmonized industry standards as written today and engage with the consensus bodies to recommend changes at that forum.

Remote Condensing Ice Makers

7. DOE requests comment on whether the current test procedure could be improved to more accurately measure energy use during a representative average use cycle for remote condensing ice makers with dedicated condensing units. For example, DOE requests feedback on whether default refrigerant charging and line set specifications would be necessary absent manufacturer recommendations. DOE also seeks information on whether any additional test instructions would be needed for remote condensing ice makers.
8. DOE also requests comment on the appropriate test approach for those ice makers intended to be installed without a dedicated condensing unit. DOE seeks feedback on what types of these units are available on the market (i.e., batch vs. 22 continuous), whether an enthalpy test approach similar to that used for commercial refrigeration equipment would be appropriate for testing these ice makers, and if so, any additional instructions that would be needed for such testing.

- Response 7 and 8: Regarding average use cycles - average use cycles vary greatly per applications based on water and ambient temperatures. The test procedure was developed to average outside variable conditions into a snapshot of the unit's performance under normal operating conditions. Test results provide comparable representation of energy consumption among products. Generally, ice makers do not run continuously, but it is possible for the equipment to be installed in restaurant kitchens or hotels where they could be used for an extended period of peak time. Because of the variations in application, attempting to introduce an average use cycle beyond what is in the test procedure today would be nearly impossible.

Remote condensing ice makers connected to a rack are outside the scope of AHRI Standard 810 and ASHRAE Standard 29. Ice makers that are typically connected to a rack compressor system are not included because they do not have an average performance single condensing unit. AHRI is only aware of continuous type ice makers marketed for use with racks. Importantly, continuous-type ice makers represent a very small portion of the ice maker market today. The small market segment and relative burden to laboratory and manufacturers to include ice makers with rack systems have kept racks from being added to the industry standards. Any changes to the standards to incorporate these systems in the future should be suggested to the ASHRAE SPC for consideration and validation.

Remote condensing ice makers with a single condenser or condensing unit are within scope of the voluntary consensus standards and test methods and should be testing accordingly. As noted by DOE, AHRI Standard 810 included requirements to address these systems and currently provides sufficient specific instructions. If the unit is meant to be installed with a specific condenser or condensing unit, the manufacturer installation and operation instructions will provide the appropriate requirements for the setup and testing of the unit. All refrigeration lines and charging by a third party lab should be executed in accordance with these instructions. Testing conducted in AHRI's ACIM certification program run to these specifications has not produced any situation where this was unable to provide accurate results.

Test Conditions

Relative Humidity

9. DOE requests comment on (1) how moisture content of ambient air impacts ACIM performance, and (2) the burden of specifying a humidity range during testing
- Response 9: Members' experience is that the moisture content of the ambient air has little to no impact on the ice maker performance test results. The compressor and condenser assembly will operate at temperatures well above the ambient and

wet bulb temperatures of the surrounding air thus having minimal impact on the test room conditions. Unlike refrigeration equipment, during ice maker testing, the evaporator section of the unit is running at close to 100% humidity as liquid runs over the plate and freezer assembly. This means the wet bulb condition will have no impact in this area and relative humidity will not impact the performance. Implementing a tolerance for relative humidity would be at significant cost without benefit. This change would require all OEMs and third party testing labs to update test room equipment and climate control systems without adding value to the test.

Water Hardness

10. DOE requests information regarding (1) the impact of total dissolved solids and ion concentration on measured energy and water use during the limited operation associated with testing during a representative average use cycle (i.e., before significant scaling of solids onto ice maker surfaces has occurred), (2) any experience manufacturers have testing ACIM equipment with prepared solutions of known water hardness, and (3) the effect a water hardness test condition would have on testing burden.

- Response 10: The amount of total dissolved solids (TDS) can have an impact on unit energy and water consumption, but the level of impact can be difficult to ascertain. The impact is most likely insignificant when the evaporator surface is clean and freezing of water considered to be potable. Implementing a water hardness standard for testing automatic commercial ice makers would be onerous. AHRI suggests further investigation into the average TDS levels used during test today, and determination of the impact on test results. Analysis is necessary prior to discussing whether prepared solutions or the effect of water hardness on testing burden and results should further be considered. Using a prepared solution or TDS level requirement during testing will ultimately come with major cost and burden. Most OEMs and labs use municipal water supply today as the amount of water needed for each test is significant.

Ambient and Inlet Water Temperatures

11. DOE requests comment on whether the ambient air temperature and water supply temperature specified in AHRI 810-2016, and in the current DOE test procedures, are appropriately representative of those temperatures during an average use cycle or whether different temperature specifications should be considered. In particular, DOE requests data and information describing the ambient air temperature and supply water temperature of different applications at which ACIM equipment are operated.

- Response 11: The current ambient air temperature and water supply temperature specified in AHRI 810-2016, and in the current DOE test procedures, are

appropriately representative of those temperatures during an average use cycle. The temperatures used for rating ice makers were determined for comparable performance testing of ice makers in average temperature settings. While true that the equipment will be installed in a variation of applications at differing ambient temperatures—as with all standards—the rating points are carefully selected for fair and repeatable measurement of average performance. These rating points are vital to ensuring that performance can be determined without requiring the limitless variety of conditions seen in field operation. The specified ambient air and water temperatures are representative of average installed conditions for all ice makers.

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Ambient Temperature Gradient

12. DOE requests comment on how manufacturers are demonstrating compliance with the temperature gradient requirements of section 5.1.1 of ASHRAE 29-2015. DOE seeks feedback on whether updates consistent with the temperature gradient requirements for consumer refrigeration products would be appropriate for the ACIM test procedure, and whether such updates would reduce test variability and testing burden.

- OEMs today confirm compliance of test rooms or cells used for testing with all standards requirements. The standard committee and OEMs deemed the requirements within the method of test adequate. Any suggested changes to testing requirements should be verified by the ASHRAE 29 committee for consideration.

Weighting of Ambient Temperature Measuring Instruments

13. DOE requests comment on whether manufacturers typically use weighted or unweighted temperature measurement instruments to measure ambient temperatures during ice maker testing. In addition, DOE requests comment on reduction in fluctuation 27 when using weighted temperature measurement instruments compared to unweighted temperature measurement instruments. DOE also seeks comment and data on benefit and burdens of using unweighted temperature measurement instruments compared to weighted temperature measurement instruments.

- Issue 13: DOE requested comment whether manufacturers typically use weighted or unweighted temperature measurement instruments to measure ambient temperatures during ice maker testing. The manufacturers and third party testing bodies currently use unweighted temperature measurement instruments to record ambient temperature readings during testing. These unweighted temperature measurement instruments can exhibit some fluctuation during readings but are quick to react to change. This instrumentation sufficiently meets the tolerances and

requirements set forth in the test procedures and does not increase testing time or instrumentation cost as weighted temperature sensors would. Requiring this change would be a cost burden to OEMs and testing labs alike without providing value to the end users.

Test Accuracy and Repeatability

14. DOE requests comment on the potential improvement in testing accuracy and increase in testing burden and costs associated with tightening the tolerances and increasing the instrumentation accuracies specified by the current ACIM test procedure.

- Response 14: With each iteration of industry testing and rating standards, the committee must weigh the potential improvement in testing accuracy and increase in testing burden and costs associated with tightening the tolerances and increasing the instrumentation accuracies specified by the current ACIM test procedure. As these balanced committees continue to pursue new technologies or address variations in testing, the tolerances will be addressed within the standards to address any discrepancies while also considering the financial impact and renovations or upgrades necessary for testing parties to comply. Increase of cost of the instrumentation regarding for testing will, of course, always impact smaller companies to a greater degree than large companies. The current process was determined to identify all of these factors for inclusion when considering each individual change to the standard.

Industry Test Method Harmonization

15. DOE requests comment and information on the relationship between potable water use and energy use, including data quantifying the relationship. Additionally, DOE requests comment and information on any potential impact that this relationship has on possible consumer utility.

- Response 15: Testing has indicated a correlation between potable water usage and the unit's energy consumption. In the commercial ice maker market, customers value clear and consistent ice. Depending on the water quality at a specific installation location or application, the reduction in water usage can be in direct conflict with characteristics critical to the customers' needs and desired quality. This requirement for quality should be weighed heavily in any discussion regarding potable water as it is ultimately the need that OEMs must comply with in order to produce desirable equipment and meet the marketplace needs.

Standby Energy Use

16. DOE requests data and information on the magnitude of energy use associated with standby energy use, as well as the relationship of such values to daily energy consumption of ACIM equipment.

- Response 16: Both air cooled and water cooled automatic commercial ice makers use negligible energy during the off-mode or standby cycles. Remote condenser units may have a slightly higher consumption in the off-mode due to the pump down switch energizing the compressor to maintain a balanced minimum pressure. The exact amount of energy consumption will vary greatly based on unit installation and the ambient temperatures experienced by the remote condenser. AHRI does not have a way to quantify this energy use at this time. Incorporating the off-mode energy consumption for this subset of equipment would be both costly and difficult to test in a laboratory setting. The additional burden to the OEM and third party test facility would far outweigh the benefit of capturing the minimal energy consumption in remote condensing units.

Other Test Procedure Topics

AHRI and ASHRAE standards committees continue to address testing repeatability and reproducibility within each review cycle. AHRI urges DOE to adopt the aforementioned voluntary consensus standards in their entirety and without modification. AHRI encourages DOE to participate in upcoming revision cycles to raise any items that should be considered and identify any sections of these standards that may be improved upon. Testing burden is also addressed during this process and remains manageable when industry standards are implemented with effective dates that allow manufacturers and testing facilities to adjust and upgrade accordingly. Harmonization with the most recent relevant industry standards for automatic commercial ice makers will allow the federal test method to produce an accurate and verified representation of system performance without increasing burden which appear through variations from these standards.

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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