Appliance Standards Awareness Project
American Council for an Energy-Efficient Economy

June 6, 2022

Ms. Catherine Rivest
U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Building Technologies Office, EE-2J
1000 Independence Avenue SW, Washington, DC 20585

RE: Docket Number EERE-2021-BT-TP-0030: Proposed Rule for Test Procedures for Central Air Conditioners and Heat Pumps

Dear Ms. Rivest:

This letter constitutes the comments of the Appliance Standards Awareness Project (ASAP) and the American Council for an Energy-Efficient Economy (ACEEE) on the notice of proposed rulemaking for test procedures for central air conditioners (CACs) and heat pumps. 87 FR 16830 (March 24, 2022). We appreciate the opportunity to provide input to the Department.

We largely support the proposed test procedure updates that provide additional clarity in advance of January 1, 2023, when manufacturers will be required to test equipment under Appendix M1. We understand that this rulemaking is limited in scope to address specific issues, several of which were raised through the test procedure waiver process, ahead of the upcoming compliance date. However, because this NOPR does not satisfy the EPCA 7-year lookback requirement, we look forward to DOE addressing broader issues related to the representativeness of the test procedures for variable-speed systems in a subsequent rulemaking.[1] Specifically, we encourage DOE to continue to explore approaches that would capture the performance of variable-speed systems under unlocked native controls.

We support the proposed approach for specifying default fan power and fan heat coefficients for ducted two-stage coil-only systems. DOE has determined that a single value for the default fan power and fan heat coefficients is not appropriate for both full- and part-load operation. In the NOPR, DOE extended its previous analysis of fan power consumption to empirically derive reduced values for the coefficients at part-load.[2] We support DOE's determination that utilizing a reduced default fan power coefficient in the calculation of average electrical power and a reduced default fan heat coefficient in the calculation of heating capacity at part-load airflow is more representative than using a single value for these coefficients at both full- and part-load operation for two-stage coil-only systems.

[1] https://www.regulations.gov/document/EERE-2021-BT-TP-0030-0002. p. 16838.
[2] https://www.regulations.gov/document/EERE-2021-BT-TP-0030-0002. p. 16835.

We support the incorporation of test provisions for variable-speed coil-only (VSCO) units, with specific provisions for variable-speed communicating and non-communicating systems. As made clear through manufacturer test procedure waiver petitions, the current test procedure includes provisions for coil-only units that may not be appropriate for variable-speed units. We support incorporating provisions for testing VSCO units and DOE's effort to ensure that the test procedures reflect differences in system control architecture between communicating (where both the outdoor unit and indoor coil communicate with each other to control both the variable-speed compressor and multi-speed indoor fan) and non-communicating systems.

DOE proposes to align the requirements for minimum air volume rate between two-capacity and VSCO units (for both communicating and non-communicating systems).[3] However, DOE proposes to limit use of varying compressor speed to communicating systems only, since the more sophisticated control systems are capable of modulating compressor speed. For non-communicating systems, DOE proposes that the control system would be provided with a control signal to indicate high- or low- stage compressor operation, with no intermediate stage operation.[4] We believe that the hybrid approach for non-communicating systems makes sense, as non-communicating systems have characteristics of both variable-speed and two-stage systems due to limitations of the less sophisticated control systems.

DOE also mentions that in a separate rulemaking the Department would consider if manufacturers should certify whether a VSCO rating is based on communicating or non-communicating controls. We would support the certification of this information to DOE (also made public through the Compliance Certification database), and we encourage DOE to finalize all pertinent certification provisions for CACs and heat pumps as soon as possible.

We encourage DOE to clarify the proposed definition of *variable-speed communicating coil-only central air conditioner or heat pump*. In the NOPR, DOE proposes the following definition:

Variable-speed Communicating Coil-only Central Air Conditioner or Heat Pump means a variable-speed compressor system having a coil-only indoor unit that is installed with a control system that:

(a) Communicates the difference in space temperature and space setpoint temperature (not a setpoint value inferred from on/off thermostat signals) to the control that sets compressor speed;
(b) Provides a signal to the indoor fan to set fan speed appropriate for compressor staging; and
(c) Has installation instructions indicating that the control system having these capabilities must be installed.

[3]DOE proposes that all VSCOs, regardless of communicative capability, would be tested using the cooling minimum air volume rate for the cooling minimum, heating minimum, cooling intermediate, and heating intermediate tests.
[4]DOE explains that it could not determine from the waivers for non-communicating systems how compressor speeds are set to match the internal building load, only that "compressor speed varies based only on controls located on the outdoor unit." It seems that, here, DOE has written the test procedure broadly, to allow the outdoor unit and/or the indoor unit to be provided with a control signal.

As written, part (c) of the proposed definition seems to suggest that the referenced installation instructions are those of the control system. This ambiguity was acknowledged by DOE during the April 18, 2022 public webinar.[5] We therefore encourage DOE to revise the proposed definition to clarify that the installation instructions refer to those of the indoor unit (not of the control system).

We support DOE's proposal to require coil-only representations for space-constrained units. DOE received multiple test procedure waiver petitions from manufacturers of space-constrained CAC outdoor units that requested relief from the coil-only certification required for split systems. In these cases, the petitioners stated that their outdoor units are intended to be sold exclusively with high-efficiency blower-coil indoor units.

However, DOE discovered cases where outdoor units designed for space-constrained applications were being sold without a blower-coil indoor unit, and therefore will be paired with an indoor unit of unknown efficiency, which may include a fan that is less efficient than the ECM fan included as part of the blower-coil rating for space-constrained systems. DOE concluded that waiving the coil-only rating requirement for these systems would be inappropriate because the blower-coil rating may be based on a high-efficiency indoor unit that is not what would be paired with the outdoor unit in the field. We therefore support DOE's proposal to not waive the coil-only rating requirement for space-constrained units.

We support DOE's proposed clarifications regarding the regional standard requirements. The proposed amendments to 10 CFR 429 codify guidance that DOE issued in December 2021. The regulatory text would now explicitly reflect that a model of outdoor unit may only be certified as compliant with a regional standard if all individual combinations meet the regional standard; this must include at least one coil-only combination that represents the least-efficient combination distributed in commerce with that outdoor unit. We believe this updated text reflects the intent of the standards and the work of the ASRAC working groups on regional standards enforcement and central air conditioners and heat pumps.[6]

We encourage DOE to investigate more representative test procedures for variable-speed CACs and heat pumps for a future rulemaking. In the NOPR, DOE acknowledged that the current test procedures may give manufacturers "too much flexibility in specifying fixed settings of the compressor and indoor fan for testing without requiring the selected settings to be demonstrated using native control testing."[7] The current test procedure fails to capture the impact of controls on the performance of variable-speed equipment; it instead only reflects performance under fixed compressor (and fan) speeds, which we do not believe is representative of an average use cycle. A March 2020 International Energy Agency (IEA) report summarizes the problematic nature of testing variable-speed systems under test settings rather

[5] https://www.regulations.gov/document/EERE-2021-BT-TP-0030-0007. p. 33.
[6] https://www.regulations.gov/document/EERE-2011-BT-CE-0077-0070 ; https://www.regulations.gov/document/EERE-2014-BT-STD-0048-0076
[7] https://www.regulations.gov/document/EERE-2021-BT-TP-0030-0002. p. 16838.

than native controls.[8] The importance of controls is also highlighted in a recent Northwest Energy Efficiency Alliance (NEEA) report, which illustrated the stark contrast in power consumption of a unit before and after a controls software update, due to differences in cycling behavior.[9] This data strongly suggests that controls matter enormously to the performance of a variable-speed unit, and that it is critical that these variations be captured in the test procedure. Therefore, we encourage DOE to continue to explore approaches that would capture the performance of variable-speed systems under unlocked native controls.

Thank you for considering these comments.

Sincerely,

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[8] https://www.iea-4e.org/wp-content/uploads/publications/2020/03/AC_Test_Methods_Report_Final_V2_incl_JP_KO.pdf p. 15-16.

[9] https://neea.org/resources/heat-pump-and-air-conditioner-efficiency-ratings-why-metrics-matter.