Appliance Standards Awareness Project
Natural Resources Defense Council

September 9, 2019

Lucy deButts
U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Building Technologies Office, EE-5B
1000 Independence Avenue, SW
Washington, DC 20585

RE: Case Number 2018–004 / EERE-2018-BT-WAV-0007: Petition for Waiver of LG Electronics USA, Inc. from the Department of Energy Portable Air Conditioner Test Procedure and Notice of Grant of Interim Waiver

Dear Ms. deButts:

This letter constitutes the comments of the Appliance Standards Awareness Project (ASAP) and Natural Resources Defense Council (NRDC) on the notice of petition for waiver and grant of an interim waiver of LG Electronics USA, Inc. (LG) from the Department of Energy (DOE) portable air conditioner (PAC) test procedure. 84 Fed. Reg. 39274 (August 9, 2019). We appreciate the opportunity to provide input to the Department.

DOE has granted LG an interim test procedure waiver for certain basic models of single-duct PACs with variable-speed compressors. LG argues that the current test procedure does not accurately measure the energy use of these units. While we share LG's concern that the current test procedure for PACs does not capture the potential benefits of variable-speed technology, we do not believe that a test procedure waiver is the appropriate way to address this concern. Instead, we encourage DOE to investigate a load-based test procedure for PACs to better capture the field performance of all units. We are also puzzled by LG's assertions about the cooling mode test for single-duct PACs and the modifications to the cooling mode test provided in the interim waiver.

We encourage DOE to investigate a load-based test procedure for PACs to capture part-load operation for all units. During part-load operation, variable-speed units can lower the speed of the compressor to meet the load, while single-speed units will cycle on and off. However, neither of these part-load performance impacts are captured in the current test procedure. The current test procedure is therefore not representative of how either single-speed or variable-speed units perform in the field. A load-based test would better reflect how all PAC units actually operate and would thus provide better information to consumers.

We are also concerned that the alternate test procedure in LG's interim waiver does not reflect how variable-speed PACs actually operate in the field. The alternate test procedure contains some of the same weaknesses present in current test procedures for other types of variable-speed equipment, namely that the compressor speeds are fixed.[1] Control strategies can have a significant impact on

[1] Specifically, under the alternate test procedure in LG's interim waiver, tests would be conducted at the "full" and "low" compressor speeds.

efficiency performance. But by fixing the compressor speeds, the alternate test procedure will not capture the impact of a unit's control strategy for adjusting the compressor (and potentially fan) speeds in response to varying conditions. Furthermore, LG's petition states that their variable-speed units provide "both dramatic energy savings and faster cooling compared to products without [variable-speed compressors]" and that their variable-speed units "have a higher/lower operating range (10 Hz to 120 Hz) than those without [variable-speed compressors]."[2] If these units provide faster cooling by running the compressor at a higher speed than single-speed compressors are capable of operating at, we would expect that this faster cooling would come at the expense of higher energy consumption.

A load-based test would capture not only the benefits of variable-speed compressors, but also other important factors that affect efficiency performance including cycling losses and control strategies. Capturing these performance impacts is critical to ensuring that the test procedure is representative.

We are puzzled by LG's assertions about the cooling mode test for single-duct PACs and the modifications to the cooling mode test in LG's interim waiver. LG states in their petition that "Unfortunately, while the current DOE test procedure for dual-duct PACs provides that they be tested in two conditions, the test procedure provides for testing only with full-load performance for single-duct PACs. Thus, the PAC test procedure as applied to single-duct PACs does not take into account the benefits of [variable-speed compressors], with its part-load performance characteristics."[3] LG seems to be suggesting that part-load performance is accounted for in the test procedure for dual-duct units, but not for single-duct units, and that the test procedure does not treat dual-duct and single-duct units equally. However, based on our understanding of the test procedure, we believe that this is a mischaracterization.

Table 1 in the DOE test procedure for PACs (Appendix CC) shown below specifies the evaporator and condenser inlet test conditions.[4]

TABLE 1—EVAPORATOR (INDOOR) AND CONDENSER (OUTDOOR) INLET TEST CONDITIONS

	Evaporator inlet air, °F (°C)		Condenser inlet air, °F (°C)	
Test configuration	Dry bulb	Wet bulb	Dry bulb	Wet bulb
3 (Dual-Duct, Condition A)	80 (26.7)	67 (19.4)	95 (35.0)	75 (23.9)
3 (Dual-Duct, Condition B)	80 (26.7)	67 (19.4)	83 (28.3)	67.5 (19.7)
5 (Single-Duct)	80 (26.7)	67 (19.4)	80 (26.7)	67 (19.4)

We first note that our understanding is that while there are two condenser inlet air test conditions for dual-duct units, both tests are "full-load" tests (i.e. there is no compressor cycling during the tests). The test procedure for dual-duct units thus does not capture part-load performance, but rather full-load performance at two different outdoor temperatures. Second, the seasonally adjusted cooling capacity (SACC) and combined energy efficiency ratio (CEER) are calculated for single-duct and dual-duct units in a way that provides an apples-to-apples comparison of the two types of PACs. For both single-duct and

[2] 84 Fed. Reg. 39282.
[3] 84 Fed. Reg. 39282.
[4] 10 CFR 430, Subpart B, Appendix CC.

dual-duct units, weighting factors of 0.2 and 0.8 for the 95°F and 83°F outdoor conditions, respectively, are applied in calculating SACC and CEER.

The reason that there is a single test condition specified for single-duct units in Table 1 of Appendix CC is that single-duct units draw all of the condenser inlet air from the conditioned space. In contrast, dual-duct units draw some or all of the condenser inlet air from the outside. Therefore, for single-duct units, the condenser inlet air temperature will always be equal to the temperature of the indoor air, regardless of the outdoor temperature, which is why the specified condenser inlet air temperature for single-duct units (80°F) is equal to the evaporator inlet air temperature. The impact of the two different outdoor temperatures (95°F and 83°F) is captured for single-duct units in the calculation of infiltration air heat transfer (where the impact of infiltration air is significantly greater at the 95°F outdoor condition than at the 83°F outdoor condition).

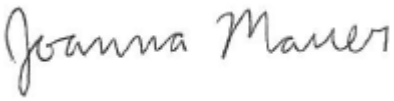
Given that single-duct PACs draw all of the condenser inlet air from the conditioned space, we are puzzled by the test conditions in Table 1 of the alternate test procedure provided in LG's interim waiver and shown below.[5] The alternate test conditions would specify the two condenser inlet air conditions that are provided for dual-duct units in the current DOE test procedure (95°F and 83°F). We do not understand what it would mean for the condenser inlet air conditions to be different than the evaporator inlet air conditions for a single-duct unit.

TABLE 1—EVAPORATOR (INDOOR) AND CONDENSER (OUTDOOR) INLET TEST CONDITIONS

Test configuration	Evaporator inlet air, °F (°C)		Condenser inlet air, °F (°C)	
	Dry bulb	Wet bulb	Dry bulb	Wet bulb
3 (Condition A)	80 (26.7)	67 (19.4)	95 (35.0)	75 (23.9)
3 (Condition B)	80 (26.7)	67 (19.4)	83 (28.3)	67.5 (19.7)

Thank you for considering these comments.

Sincerely,



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[5] 84 Fed. Reg. 39278.