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[6450-01-P]

DEPARTMENT OF ENERGY

[Case Number 2018-004; EERE-2018-BT-WAV-0007]

Energy Conservation Program: 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

AGENCY: Office of Energy Efficiency and Renewable Energy, Department of Energy.

ACTION: Notice of petition for waiver and grant of an interim waiver, and request for comments.

SUMMARY: This document announces receipt of and publishes a petition for waiver from LG Electronics USA, Inc. ("LG"), which seeks an exemption from the U.S. Department of Energy ("DOE") test procedure used for determining the efficiency of specified portable air conditioner basic models. LG seeks to use an alternate test procedure to address issues involved in testing the basic models identified in its petition. According to LG, the current DOE test procedure for single-duct portable air conditioners does not take into account the benefits of portable air conditioners that use variable-speed compressors ("variable-speed portable air conditioners"), due to their part-load performance characteristics, and misrepresents their actual energy consumption. LG requests use of an alternate test procedure, under which the test unit's final

combined energy efficiency ratio ("CEER") metric would be calculated by multiplying the unit's measured CEER value (as measured according to the existing procedure for a single-duct portable air conditioner) by a "performance adjustment factor." The performance adjustment factor would reflect the performance improvement associated with avoiding cycling losses as a result of implementing a variable-speed compressor, when tested under the two rating conditions currently used for testing dual-duct portable air conditioners. DOE grants LG an interim waiver from DOE's portable air conditioner test procedure for the basic models listed in the interim waiver, subject to use of the alternate test procedure as set forth in the Interim Waiver Order. DOE solicits comments, data, and information concerning LG's petition and its suggested alternate test procedure to inform its final decision on LG's waiver request.

DATES: Written comments and information are requested and will be accepted on or before **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**.

ADDRESSES: Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at *http://www.regulations.gov*. Alternatively, interested persons may submit comments, identified by case number "2018-004", and Docket number "EERE-2018-BT-WAV-0007," by any of the following methods:

- *Federal eRulemaking Portal*: *http://www.regulations.gov*. Follow the instructions for submitting comments.

- *E-mail*: *LG2018WAV0007@ee.doe.gov* Include the case number [Case No. 2018-004] in the subject line of the message.
- *Postal Mail*: Appliance and Equipment Standards Program. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Office, Mailstop EE-5B, Petition for Waiver Case No. 2018-004, 1000 Independence Avenue, SW., Washington, DC 20585-0121. If possible, please submit all items on a compact disc ("CD"), in which case it is not necessary to include printed copies.
- *Hand Delivery/Courier*: Appliance and Equipment Standards Program, U.S. Department of Energy, Building Technologies Office, 950 L'Enfant Plaza, SW., 6th floor, Washington, DC, 20024. If possible, please submit all items on a "CD", in which case it is not necessary to include printed copies.

No telefacsimilies (faxes) will be accepted. For detailed instructions on submitting comments and additional information on this process, see section V of this document.

Docket: The docket, which includes *Federal Register* notices, comments, and other supporting documents/materials, is available for review at *http://www.regulations.gov*. All documents in the docket are listed in the *http://www.regulations.gov* index. However, some documents listed in the index, such as those containing information that is exempt from public disclosure, may not be publicly available.

The docket web page can be found at *http://www.regulations.gov/docket?D=EERE-2018-BT-WAV-0007*. The docket web page contains simple instruction on how to access all documents, including public comments, in the docket. See section V for information on how to submit comments through *http://www.regulations.gov*.

FOR FURTHER INFORMATION CONTACT:

Ms. Lucy deButts, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Office, Mailstop EE-5B, 1000 Independence Avenue, SW., Washington, DC 20585-0121. E-mail: *AS_Waiver_Request@ee.doe.gov*.

Ms. Sarah Butler, U.S. Department of Energy, Office of the General Counsel, Mail Stop GC-33, Forrestal Building, 1000 Independence Avenue, SW., Washington, DC 20585-0103. Telephone: (202) 586-1777. E-mail: *Sarah.Butler@hq.doe.gov*.

SUPPLEMENTARY INFORMATION:

I. Background and Authority

The Energy Policy and Conservation Act of 1975, as amended ("EPCA"),[1] among other things, authorizes DOE to regulate the energy efficiency of a number of consumer products and industrial equipment. (42 U.S.C. 6291–6317) Title III, Part B[2] of EPCA established the Energy

[1] All references to EPCA in this document refer to the statute as amended through America's Water Infrastructure Act of 2018, Public Law 115-270 (October 23, 2018).
[2] For editorial reasons, upon codification in the U.S. Code, Part B was re-designated Part A.

Conservation Program for Consumer Products Other Than Automobiles. In addition to specifying a list of covered products and industrial equipment, EPCA contains provisions that enable the Secretary of Energy to classify additional types of consumer products as covered products. (42 U.S.C. 6292(a)(20)) In a final determination of coverage published in the *Federal Register* on April 18, 2016 (the "April 2016 Final Coverage Determination"), DOE classified portable air conditioners as covered products under EPCA. 81 FR 22514. The test procedure for portable air conditioners is contained in the Code of Federal Regulations ("CFR") at 10 CFR part 430, subpart B, appendix CC ("appendix CC").

Under 42 U.S.C. 6293, EPCA sets forth the criteria and procedures DOE is required to follow when prescribing or amending test procedures for covered products. EPCA requires that any test procedures prescribed or amended under this section must be reasonably designed to produce test results which reflect energy efficiency, energy use or estimated annual operating cost of a covered product during a representative average use cycle or period of use and requires that test procedures not be unduly burdensome to conduct. (42 U.S.C. 6293(b)(3))

Under 10 CFR 430.27, any interested person may submit a petition for waiver from DOE's test procedure requirements. DOE will grant a waiver from the test procedure requirements if DOE determines either that the basic model for which the waiver was requested contains a design characteristic that prevents testing of the basic model according to the prescribed test procedures, or that the prescribed test procedures evaluate the basic model in a manner so unrepresentative of its true energy consumption characteristics as to provide materially inaccurate comparative data. 10 CFR 430.27(f)(2). DOE may grant the waiver subject to conditions, including adherence to an alternate test procedure. *Id*.

As soon as practicable after the granting of any waiver, DOE will publish in the *Federal Register* a notice of proposed rulemaking to amend its regulations so as to eliminate any need for the continuation of such waiver. 10 CFR 430.27(l). As soon thereafter as practicable, DOE will publish in the *Federal Register* a final rule. *Id*.

The waiver process also provides that DOE may grant an interim waiver if it appears likely that the underlying petition for waiver will be granted and/or if DOE determines that it would be desirable for public policy reasons to grant immediate relief pending a determination on the underlying petition for waiver. 10 CFR 430.27(e)(2). Within one year of issuance of an interim waiver, DOE will either: (i) publish in the *Federal Register* a determination on the petition for waiver; or (ii) publish in the *Federal Register* a new or amended test procedure that addresses the issues presented in the waiver. 10 CFR 430.27(h)(1).

When DOE amends the test procedure to address the issues presented in a waiver, the waiver will automatically terminate on the date on which use of that test procedure is required to demonstrate compliance. 10 CFR 430.27(h)(2).

II. LG's Petition for Waiver and Petition for Interim Waiver

On May 15, 2018, LG filed a petition for waiver and a petition for interim waiver from the test procedure for portable air conditioners, set forth in appendix CC. In the petition, LG requested relief for the following portable air conditioner basic models: LP1419IVSM, LP1419HVSM, LP1219IVSM, LP1019IVSM, and LP0819IVSM.[3] LG notes that the current DOE test procedure for portable air conditioners requires testing dual-duct portable air conditioners under two operating conditions, one measuring peak-load performance (*i.e.*, at a high-temperature outdoor operating condition) and another measuring a reduced-load performance (*i.e.*, at a lower outdoor temperature operating condition). For single-duct portable air conditioners, the test procedure requires testing at only the high-temperature outdoor operating condition. LG asserts that the current DOE test procedure for single-duct portable air conditioners does not take into account the specific performance and efficiency benefits associated with single-duct variable-speed portable air conditioners under part-load conditions.

LG stated that single-duct variable-speed portable air conditioners constantly use frequency controls to adjust the compressor rotation speed to maintain the desired temperature in the home without turning the motor on and off; that the compressor responds automatically to surrounding conditions to operate in the most efficient possible manner; and that this results in both significant energy savings and faster cooling compared to a portable air conditioner without a variable-speed compressor. LG asserted that, because the DOE test procedure does not account for the general part-load performance benefits of single-duct variable-speed portable air

[3] LG provided these basic model numbers in its May 15, 2018 petition.

conditioners or properly account for the favorable difference in cycling losses for single-duct variable-speed portable air conditioners resulting from use of variable-speed technology, the results of the test procedure are not representative of the actual energy consumption of single-duct variable-speed portable air conditioners.

LG also requested an interim waiver from the existing DOE test procedure. DOE will grant an interim waiver if it appears likely that the petition for waiver will be granted, and/or if DOE determines that it would be desirable for public policy reasons to grant immediate relief pending a determination of the petition for waiver. See 10 CFR 430.27(e)(2).

DOE understands that, absent an interim waiver, the test procedure does not accurately measure the energy consumption of single-duct variable-speed portable air conditioners, and without waiver relief, the test results would not reflect the part-load characteristics of the basic models listed above.

III. Requested Alternate Test Procedure

EPCA requires that manufacturers use DOE test procedures when making representations about the energy consumption and energy consumption costs of covered products. (42 U.S.C. 6293(c)) Consistent representations are important when making representations about the energy efficiency of products, including when demonstrating compliance with applicable DOE energy conservation standards. Pursuant to its regulations at 10 CFR 430.27 , and after consideration of public comments on the petition, DOE may establish in a subsequent Decision and Order an alternate test procedure for the basic models addressed by the interim waiver.

In its petition, LG requests testing the basic models listed in its petition according to the test procedure for portable air conditioners prescribed by DOE in appendix CC, except that single-duct variable-speed portable air conditioners would be tested at both the high- and low-temperature outdoor operating conditions to measure a weighted-average combined energy efficiency ratio (CEER). LG also suggests an additional set of calculations to model the CEER of a theoretical comparable single-speed portable air conditioner with and without cycling losses.[4] From these results, a "performance adjustment factor" would be calculated, representing the performance improvement associated with avoiding cycling losses. The performance adjustment factor would then be multiplied by the measured CEER value for the variable-speed portable air conditioner according to appendix CC to determine the test unit's final rated CEER value. LG states that this approach takes into account performance and efficiency improvements associated with single-duct variable-speed portable air conditioners as compared to single-duct portable air conditioners with single-speed compressors.

IV. Grant of an Interim Waiver

[4] In its suggested alternate test procedure, LG included provisions regarding dual-duct variable-speed portable air conditioners. However, the basic models specified in LG's petition for waiver and petition for interim waiver are single-duct models only. As such, the alternate test procedure specified by DOE addresses only the single-duct variable-speed portable air conditioners listed by LG.

DOE has reviewed the materials submitted in LG's petition. DOE has been unable to identify or review any marketing materials, website, or brochure for basic models LP1419IVSM, LP1419HVSM, LP1219IVSM, LP1019IVSM, and LP0819IVSM because they currently are not available in the U.S. market. The materials submitted support LG's assertion of the part-load characteristics of the single-duct variable-speed portable air conditioners and that the DOE test procedure may yield results that are unrepresentative of their true energy consumption characteristics. In particular, the DOE test procedure does not capture the relative efficiency improvements due to cycling loss avoidance that can be achieved by single-duct variable-speed portable air conditioners over a range of operating conditions compared to single-speed portable air conditioners. Without an alternate test procedure, the CEER values of single-duct variable-speed portable air conditioners would suggest that such portable air conditioners would consume at least as much energy annually as a theoretical comparable single-speed portable air conditioner, despite the anticipated benefits of improved performance under part-load conditions. DOE has reviewed the alternate procedure suggested by LG, along with additional performance modeling and analysis performed by DOE. Based on this review it appears that the suggested alternate test procedure will allow for the generally accurate measurement of efficiency of the specified basic models of single-duct variable-speed potable air conditioners, with certain additional requirements. First, the alternate test procedure provides compressor speed nomenclature and definitions that are derived from those in industry standards for testing consumer central air conditioning products with variable-speed compressors, with additional specificity for the low compressor speed definition that ensures the portable air conditioner provides adequate cooling capacity under reduced loads based on the expected load at those conditions.[5] Second, LG must maintain the compressor speed required for each test condition in accordance with the instructions LG has provided to DOE.[6,7]

Specifically, DOE has found that the suggested alternate test procedure will produce final CEER values for the single-duct variable-speed portable air conditioners that will reflect the average performance improvement associated with variable-speed compressors as compared to theoretical comparable single-speed portable air conditioners under the same test conditions. Consequently, it appears likely that LG's petition for waiver will be granted. Furthermore, DOE has determined that it is desirable for public policy reasons to grant LG immediate relief pending a determination of the petition for waiver.

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[5] The compressor speed nomenclature and definition clarifications are derived from Air-Conditioning, Heating, and Refrigeration Institute Standard (AHRI) 210/240-2017, "Performance Rating of Unitary Air-conditioning & Air-source Heat Pump Equipment", and adapted to be applicable to portable ACs. Equation 11.60 in AHRI 210/240-2017 relates the building load to an AC's full-load cooling capacity and outdoor temperature, and assumes full-load operation at 98 °F outdoor temperature. DOE adjusted (*i.e.* normalized) this equation to reflect full-load operation at 95 °F outdoor temperature, to provide consistency with the full-load test condition for portable ACs. Using the adjusted equation suggests that the representative cooling load at the 83 °F rating condition would be 60 percent of the full-load cooling capacity for portable air conditioners. DOE recognizes that variable-speed portable ACs may use compressors that vary their speed in discrete steps and may not be able to operate at a speed that provides exactly 60 percent cooling capacity; therefore, the defined cooling capacity associated with the low compressor speed is presented as a 10-percent range rather than a single value. 60 percent cooling load is the upper bound of the 10-percent range defining the cooling capacity associated with the lower compressor speed (*i.e.*, the range is defined as 50 to 60 percent). This ensures that the variable-speed portable AC is capable of matching the representative cooling load (60 percent of the maximum) at the 83 °F rating condition, while providing the performance benefits associated with variable-speed operation. In contrast, if the 10-percent range were to be defined as, for example, 55 to 65 percent (with 60 percent as the midpoint), a variable-speed portable AC could be tested at 63 percent, for example, without demonstrating the capability to maintain variable-speed performance down to 60 percent.

[6] Pursuant to 10 CFR 1004.11, if the manufacturer submits information that it believes to be confidential and exempt by law from public disclosure, the manufacturer should submit via email, postal mail, or hand delivery two well-marked copies: One copy of the document marked "confidential" including all the information believed to be confidential, and one copy of the document marked "non-confidential" with the information believed to be confidential deleted. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

[7] The instructions provided by LG were marked as confidential and, as such, the instructions will be treated as confidential. The document is located in the docket at *https://www.regulations.gov/document?D=EERE-2018-BT-WAV-0007*.

For the reasons stated, DOE has granted an interim waiver to LG for the specified portable air conditioner basic models in LG's petition. Therefore, DOE has issued an **Order** stating:

(1) LG must test the following portable air conditioner basic models with the alternate test procedure set forth in paragraph (2):

Brand	Basic Model
LG Electronics USA, Inc.	LP1419IVSM
LG Electronics USA, Inc.	LP1419HVSM
LG Electronics USA, Inc.	LP1219IVSM
LG Electronics USA, Inc.	LP1019IVSM
LG Electronics USA, Inc.	LP0819IVSM

(2) The alternate test procedure for the LG basic models referenced in paragraph (1) is the test procedure for portable air conditioners prescribed by DOE at appendix CC to subpart B of 10 CFR part 430 (Appendix CC), except: (i) determine the combined energy efficiency ratio (CEER) as detailed below, and (ii) calculate the estimated annual operating cost in 10 CFR 430.23(dd)(2) as detailed below. In addition, for each basic model listed in paragraph (1), maintain the compressor speeds at each test condition, and set the control settings used for the variable components, according to the instructions submitted to DOE by LG. Upon the compliance date of any new energy conservation standards for portable air conditioners, LG must report product specific information pursuant to 10 CFR 429.12(b)(13) and 10 CFR 429.62(b). All other requirements of Appendix CC and DOE's regulations remain applicable. In 10 CFR 430.23, in paragraph (dd) revise paragraph (2) to read as follows:

(2) Determine the estimated annual operating cost for a single-duct variable-speed portable air conditioner, expressed in dollars per year, by multiplying the following two factors:

(i) The sum of AEC_{95} multiplied by 0.2, AEC_{83} multiplied by 0.8, and AEC_T as measured in accordance with section 5.3 of appendix CC of this subpart; and

(ii) A representative average unit cost of electrical energy in dollars per kilowatt-hour as provided by the Secretary.

(iii) Round the resulting product to the nearest dollar per year.

In Appendix CC:

Add in Section 2, *Definitions*:

2.11 *Single-speed* means a type of portable air conditioner that cannot automatically adjust the compressor speed, based on detected conditions.

2.12 *Variable-speed* means a type of portable air conditioner that can automatically adjust the compressor speed, based on detected conditions.

2.13 *Full compressor speed (full)* means the compressor speed specified by the manufacturer at which the unit operates at full load testing conditions.

2.14 *Low compressor speed (low)* means the compressor speed specified by the manufacturer at which the unit operates at low load test conditions, such that the measured cooling capacity at

Condition B in Table 1 of this appendix, *i.e.*, $Capacity_{83}$, is not less than 50 percent and not greater than 60 percent of the measured cooling capacity with the full compressor speed at Condition A in Table 1 of this appendix, *i.e.,* $Capacity_{95}$.

Add to the end of Section 3.1.2, *Control settings*:

Set the compressor speed during cooling mode testing as described in section 4.1, as amended by this interim waiver.

Replace Section 4.1, *Cooling mode* with the following:

Cooling mode. Measure the indoor room cooling capacity and overall power input in cooling mode in accordance with Section 7.1.b and 7.1.c of ANSI/AHAM PAC-1-2015 (incorporated by reference; see §430.3), respectively. Determine the test duration in accordance with Section 8.7 of ASHRAE Standard 37-2009 (incorporated by reference; §430.3). Apply the test conditions presented in Table 1 of this appendix instead of the test conditions in Table 3 of ANSI/AHAM PAC-1-2015. Measure the indoor room cooling capacity and overall power input in accordance with ambient conditions for Test Configuration 3, Condition A ($Capacity_{95}$, P_{95}) in Table 1 of this appendix, with the compressor speed set to full, for the duration of cooling mode testing, and then measure the indoor room cooling capacity and overall power input a second time in accordance with the ambient conditions for Test Configuration 3, Condition B ($Capacity_{83}$, P_{83}) in Table 1 of this appendix, with the compressor speed set to low, for the duration of cooling mode testing. Set the compressor speed required for each test condition in accordance with instructions provided to DOE. Note that for the purposes of this cooling mode test procedure, evaporator inlet air is considered the "indoor air" of the conditioned space and condenser inlet air is considered the "outdoor air" outside of the conditioned space.

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)

Revise Section 4.1.1, *Duct Heat Transfer* following "Calculate the total heat transferred from the surface of the condenser exhaust duct to the indoor conditioned space while operating in cooling mode for the outdoor test conditions in Table 1 of this appendix, as follows." to read as follows:

$Q_{duct\_95} = h \times A_{duct} \times (T_{duct\_95} - T_{ei})$

$Q_{duct\_83} = h \times A_{duct} \times (T_{duct\_83} - T_{ei})$

Where:

Q_{duct_95} and Q_{duct_83} = the total heat transferred from the condenser exhaust duct to the indoor conditioned space in cooling mode, in Btu/h, when tested according to the 95 °F dry-bulb and 83 °F dry-bulb outdoor test conditions in Table 1 of this appendix, respectively.

h = convection coefficient, 3 Btu/h per square foot per °F.

A_{duct} = surface area of the condenser exhaust duct, in square feet.

T_{duct_95} and T_{duct_83} = average surface temperature for the condenser exhaust duct, as measured during testing according to the two outdoor test conditions in Table 1 of this appendix, in °F.

T_{ei} = average evaporator inlet air dry-bulb temperature, in °F.

Replace Section 4.1.2, *Infiltration Air Heat Transfer* with the following:

Infiltration Air Heat Transfer. Calculate the heat contribution from infiltration air for both cooling mode outdoor test conditions, as described in this section. Calculate the dry air mass flow rate of infiltration air according to the following equations:

$$\dot{m}_{95} = \left[\frac{V_{co\_95} \times \rho_{co\_95}}{(1 + \omega_{co\_95})}\right] - \left[\frac{V_{ci\_95} \times \rho_{ci\_95}}{(1 + \omega_{ci\_95})}\right]$$

$$\dot{m}_{83} = \left[\frac{V_{co\_83} \times \rho_{co\_83}}{(1 + \omega_{co\_83})}\right] - \left[\frac{V_{ci\_83} \times \rho_{ci\_83}}{(1 + \omega_{ci\_83})}\right]$$

Where:

$\dot{m}_{95}$ and $\dot{m}_{83}$ = dry air mass flow rate of infiltration air, as calculated based on testing according to the test conditions in Table 1 of this appendix, in lb/m.

V_{co_95} and V_{co_83} = average volumetric flow rate of the condenser outlet air during cooling mode testing at the 95 °F and 83 °F dry-bulb outdoor conditions, respectively, in cubic feet per minute (cfm), as determined in section 4.1 of this appendix.

V_{ci_95}, and V_{ci_83} = average volumetric flow rate of the condenser inlet air during cooling mode testing at the 95 °F and 83 °F dry-bulb outdoor conditions, respectively, in cfm, as determined in section 4.1 of this appendix.

ρ_{co_95} and ρ_{co_83} = average density of the condenser outlet air during cooling mode testing at the 95 °F and 83 °F dry-bulb outdoor conditions, respectively, in pounds mass per cubic foot (lb_m/ft^3), as determined in section 4.1 of this appendix.

ρ_{ci_95}, and ρ_{ci_83} = average density of the condenser inlet air during cooling mode testing at the 95 °F and 83 °F dry-bulb outdoor conditions, respectively, in lb_m/ft^3, as determined in section 4.1 of this appendix.

ω_{co_95} and ω_{co_83} = average humidity ratio of condenser outlet air during cooling mode testing at the 95 °F and 83 °F dry-bulb outdoor conditions, respectively, in pounds mass of water vapor per pounds mass of dry air (lb_w/lb_{da}), as determined in section 4.1 of this appendix.

ω_{ci_95} and ω_{ci_83} = average humidity ratio of condenser inlet air during cooling mode testing at the 95 °F and 83 °F dry-bulb outdoor conditions, respectively, in lb_w/lb_{da}, as determined in section 4.1 of this appendix.

Replace Section 5.1, *Adjusted Cooling Capacity* with the following*:*

Adjusted Cooling Capacity. Calculate the adjusted cooling capacities for portable air conditioners, ACC_{95} and ACC_{83}, expressed in Btu/h, according to the following equations.

$$ACC_{95} = Capacity_{95} - Q_{duct\_95} - Q_{infiltration\_95}$$

$$ACC_{83} = Capacity_{83} - Q_{duct\_83} - Q_{infiltration\_83}$$

Where:

$Capacity_{95}$ and $Capacity_{83}$ = cooling capacity measured in section 4.1 of this appendix.

Q_{duct_95} and Q_{duct_83} = duct heat transfer while operating in cooling mode, calculated in section 4.1.1 of this appendix.

$Q_{infiltration\_95}$ and $Q_{infiltration\_83}$ = total infiltration air heat transfer in cooling mode, calculated in section 4.1.2 of this appendix

Replace Section 5.3, *Annual Energy Consumption* with the following:

Annual Energy Consumption. Calculate the annual energy consumption in each operating mode, AEC_m, expressed in kilowatt-hours per year (kWh/year). Use the following annual hours of operation for each mode:

Operating Mode	Annual Operating Hours
Cooling Mode, Dual-Duct 95 °F[1]	750
Cooling Mode, Dual-Duct 83 °F[1]	750
Off-Cycle	880
Inactive or Off	1,355

[1] These operating mode hours are for the purposes of calculating annual energy consumption under different ambient conditions and are not a division of the total cooling mode operating hours. The total cooling mode operating hours are 750 hours.

$$AEC_m = P_m \times t_m \times 0.001$$

Where:

AEC_m = annual energy consumption in each mode, in kWh/year.

P_m = average power in each mode, in watts.

m represents the operating mode ("95" and "83" cooling mode at the 95 °F and 83 °F dry-bulb outdoor conditions, respectively, "oc" off-cycle, and "ia" inactive or "om" off mode).

t_m = number of annual operating time in each mode, in hours.

0.001 kWh/Wh = conversion factor from watt-hours to kilowatt-hours.

Total annual energy consumption in all modes except cooling, is calculated according to:

$$AEC_T = \sum_m AEC_m$$

Where:

AEC_T = total annual energy consumption attributed to all modes except cooling, in kWh/year;

AEC_m = total annual energy consumption in each mode, in kWh/year.

m represents the operating modes included in AEC_T ("oc" off-cycle, and "im" inactive or "om" off mode).

Replace Section 5.4, *Combined Energy Efficiency Ratio* with the following:

Combined Energy Efficiency Ratio. Using the annual operating hours, as outlined in section 5.3 of this appendix, calculate the combined energy efficiency ratio, $CEER_{VS}$, expressed in Btu/Wh, according to the following:

$$CEER_{VS} = \left[\frac{ACC_{95}}{\left(\frac{AEC_{95} + AEC_T}{750 \times 0.001}\right)}\right] \times 0.2 + \left[\frac{ACC_{83}}{\left(\frac{AEC_{83} + AEC_T}{750 \times 0.001}\right)}\right] \times 0.8$$

Where:

$CEER_{VS}$ = combined energy efficiency ratio for the variable-speed portable air conditioner, in Btu/Wh.

ACC_{95} and ACC_{83} = adjusted cooling capacity, tested at the 95 °F and 83 °F dry-bulb outdoor conditions in Table 1 of this appendix, in Btu/h, calculated in section 5.1 of this appendix.

AEC_{95} and AEC_{83} = annual energy consumption for the two cooling mode test conditions in Table 1 of this appendix, in kWh/year, calculated in section 5.3 of this appendix.

AEC_T = total annual energy consumption attributed to all modes except cooling, in kWh/year, calculated in section 5.3 of this appendix.

750 = number of cooling mode hours per year

0.001 kWh/Wh = conversion factor for watt-hours to kilowatt-hours.

0.2 = weighting factor for the Condition A test.

0.8 = weighting factor for the Condition B test.

Add after Section 5.4, *Combined Energy Efficiency Ratio*:

5.5 *Adjustment of the Combined Energy Efficiency Ratio.* Adjust the combined energy efficiency ratio as follows.

5.5.1 *Theoretical Comparable Single-Speed Portable Air Conditioner Cooling Capacity and Power at the Lower Outdoor Test Condition.* Calculate the cooling capacity and cooling capacity with cycling losses, expressed in British thermal units per hour (Btu/h), and electrical power input, expressed in watts, for a theoretical comparable single-speed portable air conditioner at the 83 °F dry-bulb outdoor conditions (Condition B in Table 1 of this appendix). A theoretical comparable single-speed portable air conditioner has the same cooling capacity and electrical power input, with no cycling losses, as the single-duct variable-speed portable air conditioner under test at Condition A in Table 1 of this appendix.

$Capacity_{83\_SS} = Capacity_{95}$

$Capacity_{83\_SS\_CLF} = Capacity_{95} \times CLF$

$P_{83\_SS} = P_{95}$

Where:

$Capacity_{83\_SS}$ = theoretical comparable single-speed portable air conditioner cooling capacity, in Btu/h, calculated for Condition B in Table 1 of this appendix.

$Capacity_{83\_SS\_CLF}$ = theoretical comparable single-speed portable air conditioner cooling capacity with cycling losses, in Btu/h, calculated for Condition B in Table 1 of this appendix.

$Capacity_{95}$ = cooling capacity, in Btu/h, determined in section 4.1 of this appendix for Condition A in Table 1 of this appendix.

P_{83_SS} = theoretical comparable single-speed portable air conditioner electrical power input, in watts, calculated for Condition B in Table 1 of this appendix.

P_{95} = electrical power input, in watts, determined in section 4.1 of this appendix for Condition A in Table 1 of this appendix.

CLF = cycling loss factor for Condition B in Table 1 of this appendix, 0.875.

5.5.2 *Duct Heat Transfer for a Theoretical Comparable Single-Speed Portable Air Conditioner at the Lower Outdoor Test Condition.* Calculate the condenser exhaust duct heat transfer to the conditioned space for a theoretical comparable single-speed portable air conditioner at the 83 °F dry-bulb outdoor conditions (Condition B in Table 1 of this appendix), as follows:

$$Q_{duct\_83\_SS} = h \times A_{duct} \times (T_{duct\_95} - T_{ei})$$

Where:

$Q_{duct\_83\_SS}$ = total heat transferred from the ducts to the indoor conditioned space in cooling mode, in Btu/h, for a theoretical comparable single-speed portable air conditioner at Condition B in Table 1 of this appendix.

h = convection coefficient, 3 Btu/h per square foot per °F.

A_{duct} = surface area of the condenser exhaust duct, in square feet, as calculated in section 4.1.1 of this appendix.

T_{duct_95} = average surface temperature for the condenser exhaust duct, as measured during testing at Condition A in Table 1 of this appendix, in °F.

T_{ei} = average evaporator inlet air dry-bulb temperature, in °F.

5.5.3 *Infiltration Air Heat Transfer for a Theoretical Comparable Single-Speed Portable Air Conditioner at the Lower Outdoor Test Condition.* Calculate the heat contribution from infiltration air for a theoretical comparable single-speed portable air conditioner at Condition B in Table 1 of this appendix, as described in this section. Calculate the dry air mass flow rate of infiltration air according to the following equations:

$$\dot{m}_{83\_SS} = \frac{V_{co\_95} \times \rho_{co\_95}}{(1 + \omega_{co\_95})}$$

Where:

$\dot{m}_{83\_SS}$ = dry air mass flow rate of infiltration air for a theoretical comparable single-speed portable air conditioner at Condition B in Table 1 of this appendix, in lb/m.

V_{co_95} = actual average volumetric flow rate of the condenser outlet air during cooling mode testing at Condition A in Table 1 of this appendix, in cubic feet per minute (cfm), as determined in section 4.1 of this appendix.

ρ_{co_95} = actual average density of the condenser outlet air during cooling mode testing at Condition A in Table 1 of this appendix, in lb_m/ft^3, as determined in section 4.1 of this appendix.

ω_{co_95}= average humidity ratio of condenser outlet air during cooling mode testing at Condition A in Table 1 of this appendix, in pounds mass of water vapor per pounds mass of dry air (lb_w/lb_{da}), as determined in section 4.1 of this appendix.

Calculate the sensible component of infiltration air heat contribution for a theoretical comparable single-speed portable air conditioner at Condition B in Table 1 of this appendix as follows:

$$Q_{s\_83\_SS} = \dot{m}_{83\_SS} \times 60 \times [(0.24 \times (T_{ia\_83} - T_{indoor})) + (0.444 \times (\omega_{ia\_83} \times T_{ia\_83} - \omega_{indoor} \times T_{indoor}))]$$

Where:

$Q_{s\_83\_SS}$ = sensible heat added to the room by infiltration air for a theoretical comparable single-speed portable air conditioner, at Condition B in Table 1 of this appendix, in Btu/h.

0.24 $Btu/lb_m - °F$ = specific heat of dry air.

0.444 $Btu/lb_m - °F$ = specific heat of water vapor.

T_{indoor} = indoor chamber dry-bulb temperature, 80 °F.

T_{ia_95} and T_{ia_83} = infiltration air dry-bulb temperatures for Condition A and Condition B in Table 1 of this appendix, 95 °F and 83 °F, respectively.

ω_{ia_95} and ω_{ia_83} = humidity ratios of the infiltration air at Condition A and Condition B in Table 1 of this appendix, 0.0141 and 0.01086 lb_w/lb_{da}, respectively.

ω_{indoor} = humidity ratio of the indoor chamber air, 0.0112 lb_w/lb_{da}.

60 = conversion factor from minutes to hours.

$\dot{m}_{83\_SS}$ as previously defined in this section.

Calculate the latent component of infiltration air heat contribution for a theoretical comparable single-speed portable air conditioner at Condition B in Table 1 of this appendix as follows:

$Q_{l\_83\_SS} = \dot{m}_{83\_SS} \times 60 \times 1061 \times (\omega_{ia\_83} - 0.0112)$

Where:

$Q_{l\_83\_SS}$ = latent heat added to the room by infiltration air for a theoretical comparable single-speed portable air conditioner, at Condition B in Table 1 of this appendix, in Btu/h.

1061 Btu/lb_m = latent heat of vaporization for water vapor.

0.0112 lb_w/lb_{da} = humidity ratio of the indoor chamber air.

60 = conversion factor from minutes to hours.

$\dot{m}_{83\_SS}$, ω_{ia_95}, and ω_{ia_83} as previously defined in this section.

The total heat contribution of the infiltration air for a theoretical comparable single-speed portable air conditioner at Condition B in Table 1 of this appendix is the sum of the sensible and latent heat calculated above in this section:

$Q_{infiltration\_83\_SS} = Q_{s\_83\_SS} + Q_{l\_83\_SS}$

Where:

$Q_{infiltration\_83\_SS}$ = total infiltration air heat in cooling mode for a theoretical comparable single-speed portable air conditioner at Condition B in Table 1 of this appendix, in Btu/h.

$Q_{s\_83\_SS}$, $Q_{l\_83\_SS}$ as previously defined.

5.5.4 *Adjusted Cooling Capacity for a Theoretical Comparable Single-Speed Portable Air Conditioner at the Lower Outdoor Test Condition.* Calculate the adjusted cooling capacity for a theoretical comparable single-speed portable air conditioner at Condition B in Table 1 of this appendix with and without cycling losses, ACC_{83_SS} and $ACC_{83\_SS\_CLF}$, respectively, expressed in Btu/h, according to the following equations:

$$ACC_{83\_SS} = Capacity_{83\_SS} - Q_{duct\_83\_SS} - Q_{infiltration\_83\_SS}$$

$$ACC_{83\_SS\_CLF} = Capacity_{83\_SS\_CLF} - Q_{duct\_83\_SS} - Q_{infiltration\_83\_SS}$$

Where:

ACC_{83_SS} and $ACC_{83\_SS\_CLF}$ = adjusted cooling capacity for a theoretical comparable single-speed portable air conditioner at Condition B in Table 1 of this appendix without and with cycling losses, respectively, in Btu/h.

$Capacity_{83\_SS}$ and $Capacity_{83\_SS\_CLF}$ = theoretical comparable single-speed portable air conditioner cooling capacity without and with cycling losses, respectively, in Btu/h, at Condition B in Table 1 of this appendix, calculated in section 5.5.1 of this appendix.

$Q_{duct\_83\_SS}$ = total heat transferred from the ducts to the indoor conditioned space in cooling mode for a theoretical comparable single-speed portable air conditioner at Condition B in Table 1 of this appendix, in Btu/h, calculated in section 5.5.2 of this appendix.

$Q_{infiltration\_83\_SS}$ = total infiltration air heat in cooling mode for a theoretical comparable single-speed portable air conditioner at Condition B in Table 1 of this appendix, in Btu/h, calculated in section 5.5.3 of this appendix.

5.5.5 *Annual Energy Consumption in Cooling Mode for a Theoretical Comparable Single-Speed Portable Air Conditioner at the Lower Outdoor Test Condition.* Calculate the annual energy consumption in cooling mode for a theoretical comparable single-speed portable air conditioner at Condition B in Table 1 of this appendix, expressed in kWh/year, according to the following equations:

$$AEC_{83\_SS} = P_{83\_SS} \times 750 \times 0.001$$

Where:

AEC_{83_SS} = annual energy consumption for a theoretical comparable single-speed portable air conditioner in cooling mode at Condition B in Table 1 of this appendix, in kWh/year.

P_{83_SS} = theoretical comparable single-speed portable air conditioner electrical power input at Condition B in Table 1 of this appendix, in watts, calculated in section 5.5.1 of this appendix.

750 = number of cooling mode hours per year.

0.001 kWh/Wh = conversion factor from watt-hours to kilowatt-hours.

5.5.6 *Combined Energy Efficiency Ratio for a Theoretical Comparable Single-Speed Portable Air Conditioner.* Calculate the combined energy efficiency ratio for a theoretical comparable single-speed portable air conditioner without and with cycling losses considered, $CEER_{SS}$ and $CEER_{SS\_CLF}$, respectively, expressed in Btu/Wh, according to the following equations:

$$CEER_{SS} = \left[\frac{ACC_{95}}{\left(\frac{AEC_{95} + AEC_{T}}{750 \times 0.001}\right)}\right] \times 0.2 + \left[\frac{ACC_{83\_SS}}{\left(\frac{AEC_{83\_SS} + AEC_{T}}{750 \times 0.001}\right)}\right] \times 0.8$$

$$CEER_{SS\_CLF} = \left[\frac{ACC_{95}}{\left(\frac{AEC_{95} + AEC_{T}}{750 \times 0.001}\right)}\right] \times 0.2 + \left[\frac{ACC_{83\_SS\_CLF}}{\left(\frac{AEC_{83\_SS} + AEC_{T}}{750 \times 0.001}\right)}\right] \times 0.8$$

Where:

$CEER_{SS}$ and $CEER_{SS\_CLF}$ = combined energy efficiency ratio for a theoretical comparable single-speed portable air conditioner without and with cycling losses considered, respectively, in Btu/Wh.

ACC_{95} = adjusted cooling capacity, tested for the single-duct variable-speed portable air conditioner at Condition A in Table 1 of this appendix, in Btu/h, calculated in section 5.1 of this appendix.

ACC_{83_SS} and $ACC_{83\_SS\_CLF}$ = adjusted cooling capacity for a theoretical comparable single-speed portable air conditioner at Condition B in Table 1 of this appendix without and with cycling losses, respectively, in Btu/h, calculated in section 5.5.4 of this appendix.

AEC_{95} = annual energy consumption for the sample unit at Condition A in Table 1 of this appendix, in kWh/year, calculated in section 5.3 of this appendix.

AEC_{83_SS} = annual energy consumption for a theoretical comparable single-speed portable air conditioner in cooling mode at Condition B in Table 1 of this appendix, in kWh/year, calculated in section 5.5.5 of this appendix.

AEC_T = total annual energy consumption attributed to all modes except cooling for the sample unit , in kWh/year, calculated in section 5.3 of this appendix.

750 and 0.001 as defined previously in this section.

0.2 = weighting factor for the Condition A test.

0.8 = weighting factor for the Condition B test.

5.5.7 *Single-Duct Variable-Speed Portable Air Conditioner Performance Adjustment Factor.* Calculate the single-duct variable-speed portable air conditioner performance adjustment factor, F_p, according to the following equation:

$$F_p = \frac{(CEER_{SS} - CEER_{SS\_CLF})}{CEER_{SS\_CLF}}$$

Where:

$CEER_{SS}$ and $CEER_{SS\_CLF}$ = combined energy efficiency ratio for a theoretical comparable single-speed portable air conditioner without and with cycling losses considered, respectively, in Btu/Wh, calculated in section 5.5.6 of this appendix.

5.5.8 *Single-Duct Variable-Speed Portable Air Conditioner Combined Energy Efficiency Ratio.* Calculate the final combined energy efficiency ratio, CEER, expressed in Btu/Wh, according to the following equation:

$$CEER = CEER_{VS} \times (1 + F_p)$$

Where:

CEER = combined energy efficiency ratio for the sample unit , in Btu/Wh.

$CEER_{VS}$ = combined energy efficiency ratio initially determined for the sample unit , in Btu/Wh, calculated in section 5.4 of this appendix.

F_p = single-duct variable-speed portable air conditioner performance adjustment factor, determined in section 5.5.7 of this appendix."

(3) *Representations*. LG may not make representations about the energy efficiency of the basic models listed in paragraph (1) for compliance, marketing, or other purposes unless the basic model has been tested in accordance with the provisions in this alternate test procedure and such representations fairly disclose the results of such testing.

(4) This interim waiver shall remain in effect according to the provisions of 10 CFR 430.27.

(5) This interim waiver is issued to LG on the condition that the statements, representations, and information provided by LG are valid. DOE may revoke or modify this waiver at any time if it determines the factual basis underlying the petition for waiver is incorrect, or the results from the

alternate test procedure are unrepresentative of a basic model's true energy consumption characteristics. 10 CFR 430.27(k)(1). Likewise, LG may request that DOE rescind or modify the interim waiver if LG discovers an error in the information provided to DOE as part of its petition, determines that the interim waiver is no longer needed, or for other appropriate reasons. 10 CFR 430.27(k)(2).

(6) LG remains obligated to fulfill any certification requirements set forth at 10 CFR part 429.

DOE makes decisions on waivers and interim waivers for only those basic models specifically set out in the petition, not future models that may be manufactured by the petitioner. LG may submit a new or amended petition for waiver and request for grant of interim waiver, as appropriate, for additional basic models of portable air conditioners. Alternatively, if appropriate, LG may request that DOE extend the scope of a waiver or an interim waiver to include additional basic models employing the same technology as the basic models set forth in the original petition consistent with 10 CFR 430.27(g).

V. Request for Comments

DOE is publishing LG's petition for waiver in its entirety, pursuant to 10 CFR 430.27(b)(1)(iv).[8] The petition includes a suggested alternate test procedure, as specified in the petition and summarized in section IV of this document, to determine the efficiency of LG's specified portable air conditioners. DOE may consider including the alternate procedure

[8] The petition did not identify any of the information contained therein as confidential business information.

specified in the Interim Waiver Order, and restated in section IV of this document, in a subsequent Decision and Order.

DOE invites all interested parties to submit in writing by [**INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER***], comments and information on all aspects of the petition, including the alternate test procedure. Pursuant to 10 CFR 430.27(d), any person submitting written comments to DOE must also send a copy of such comments to the petitioner. The contact information for the petitioner is Scott Blake Harris, Harris, Wiltshire & Grannis LLP, 1919 M Street, NW, Eighth Floor, Washington, DC 20036.

Submitting comments via *http://www.regulations.gov*. The *http://www.regulations.gov* web page will require you to provide your name and contact information. Your contact information will be viewable to DOE Building Technologies staff only. Your contact information will not be publicly viewable except for your first and last names, organization name (if any), and submitter representative name (if any). If your comment is not processed properly because of technical difficulties, DOE will use this information to contact you. If DOE cannot read your comment due to technical difficulties and cannot contact you for clarification, DOE may not be able to consider your comment.

However, your contact information will be publicly viewable if you include it in the comment or in any documents attached to your comment. Any information that you do not want to be publicly viewable should not be included in your comment, nor in any document attached to your comment. Persons viewing comments will see only first and last names, organization names, correspondence containing comments, and any documents submitted with the comments.

Do not submit to *http://www.regulations.gov* information for which disclosure is restricted by statute, such as trade secrets and commercial or financial information (hereinafter referred to as Confidential Business Information ("CBI")). Comments submitted through *http://www.regulations.gov* cannot be claimed as CBI. Comments received through the website will waive any CBI claims for the information submitted. For information on submitting CBI, see the Confidential Business Information section.

DOE processes submissions made through *http://www.regulations.gov* before posting. Normally, comments will be posted within a few days of being submitted. However, if large volumes of comments are being processed simultaneously, your comment may not be viewable for up to several weeks. Please keep the comment tracking number that *http://www.regulations.gov* provides after you have successfully uploaded your comment.

Submitting comments via email, hand delivery, or mail. Comments and documents submitted via email, hand delivery, or mail also will be posted to *http://www.regulations.gov*. If you do not want your personal contact information to be publicly viewable, do not include it in your comment or any accompanying documents. Instead, provide your contact information on a cover letter. Include your first and last names, email address, telephone number, and optional mailing address. The cover letter will not be publicly viewable as long as it does not include any comments.

Include contact information each time you submit comments, data, documents, and other information to DOE. If you submit via mail or hand delivery, please provide all items on a CD, if feasible. It is not necessary to submit printed copies. No facsimiles (faxes) will be accepted.

Comments, data, and other information submitted to DOE electronically should be provided in PDF (preferred), Microsoft Word or Excel, WordPerfect, or text (ASCII) file format. Provide documents that are written in English, free of any defects or viruses, and are not secured. Documents should not contain special characters or any form of encryption and, if possible, they should carry the electronic signature of the author.

Campaign form letters. Please submit campaign form letters by the originating organization in batches of between 50 to 500 form letters per PDF or as one form letter with a list of supporters' names compiled into one or more PDFs. This reduces comment processing and posting time.

Confidential Business Information. According to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email, postal mail, or hand delivery two well-marked copies: one copy of the document marked confidential including all the information believed to be confidential, and one copy of the document marked "non-confidential" with the information believed to be confidential deleted. Submit these documents via email or on a CD, if feasible. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

Factors of interest to DOE when evaluating requests to treat submitted information as confidential include (1) a description of the items, (2) whether and why such items are customarily treated as confidential within the industry, (3) whether the information is generally known by or available from other sources, (4) whether the information has previously been made available to others without obligation concerning its confidentiality, (5) an explanation of the competitive injury to the submitting person which would result from public disclosure, (6) when such information might lose its confidential character due to the passage of time, and (7) why disclosure of the information would be contrary to the public interest.

It is DOE's policy that all comments may be included in the public docket, without change and as received, including any personal information provided in the comments (except information deemed to be exempt from public disclosure).

Signed in Washington, DC, on July 30, 2019.

Alexander N. Fitzsimmons
Acting Deputy Assistant Secretary for Energy Efficiency
Energy Efficiency and Renewable Energy

BEFORE THE
UNITED STATES DEPARTMENT OF ENERGY
WASHINGTON, D.C. 20585

In the Matter of: Energy Efficiency Program: Test Procedure for Portable Air Conditioners

PETITION OF LG ELECTRONICS, INC. FOR WAIVER AND APPLICATION FOR INTERIM WAIVER OF TEST PROCEDURE FOR PORTABLE AIR CONDITIONERS

LG Electronics, Inc. (LG) respectfully submits this Petition for Waiver and Application for Interim Waiver[1] from DOE's test procedure for portable air conditioners (PACs). LG seeks a waiver because the current test procedure for PACs does not accurately measure the energy consumption of single-duct PACs with variable speed compressors (VSCs). LG requests expedited treatment of the Petition and Application.

LG is a manufacturer of PACs and other products sold worldwide, including in the United States. LG's United States affiliate is LG Electronics USA, Inc., with headquarters at 1000 Sylvan Avenue, Englewood Cliffs, NJ 07632 (tel. 201-816-2000).

I. Basic Models for Which a Waiver is Requested

The basic models for which a waiver is requested are set forth in the Appendix. They are single-duct PACs distributed in commerce under the LG brand name.

1 *See* 10 C.F.R. § 430.27 (petitions for waiver and interim waiver).

II. Need for the Requested Waiver

The LG PACs with VSC technology are advanced, energy efficient products. A VSC (inverter compressor) uses frequency controls constantly to adjust the compressor's rotation speed to maintain the desired temperature in the home without turning the motor on and off. The compressor responds automatically to surrounding conditions to operate in the most efficient possible manner. This results in both dramatic energy savings and faster cooling compared to products without VSCs. PACs with VSCs also have a higher/lower operating range (10Hz to 120Hz) than those without VSC.[2]

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.[3] Thus, the PAC test procedure as applied to single-duct PACs does not take into account the benefits of VSC, with its part-load performance characteristics. This is also unlike the DOE test procedure for central air conditioners, which provides for testing with part-load performance for VSCs. Additionally, the PAC test procedure as applied to single-duct PACs does not properly account for the favorable difference in cycling losses resulting from use of VSC technology. This technology limits the inefficiencies associated performance degradation from

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2 To the best of LG's knowledge, LG is the only manufacturer of PAC basic models distributed in commerce in the United States to incorporate design characteristic(s) similar to those found in the basic models that are the subject of this petition, namely, PAC VSC technology.

3 10 C.F.R. Pt. 430, Subpart B, App. CC, § 4.1, Tbl.1.

cycling losses. Cycling losses are avoided when the unit modulates its speed to meet a partial load rather than cycles on and off.

DOE has recognized this serious shortcoming in the context of its test procedure for room air conditioners (RACs).[4] It has stated that the RAC test procedure "does not measure the benefits of technologies that improve part-load performance."[5]

> The current room AC test procedure measures only the full-load performance at outdoor ambient conditions of 95 °F dry-bulb and 75 °F wet-bulb. Therefore, technologies that improve part-load performance, such as multiple-speed compressors and variable-opening expansion devices, will not improve the rated performance of a room AC under the current test procedure.[6]

Indeed, DOE has correctly stressed that, "[i]n contrast, central ACs and heat pumps are rated" using "multiple rating points at different conditions."[7] DOE has said it intends to investigate potential revision of the test procedure "to account for any benefits of technologies that improve part-load performance."[8] DOE is currently considering a waiver request by LG for RACs with VSCs.

These considerations apply to single-duct PACs as well as dual-duct PACs and RACs. At the moment, however, the DOE test procedure for PACs as applied to single-duct PACs does not include any provision to account for the benefits of the part-load performance of VSCs or properly

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4 *Id.* App. F.

5 80 Fed. Reg. 34843, 34848 (June 18, 2015).

6 *Id.*

7 *Id.*

8 *Id.*

account for the favorable difference in cycling losses resulting from use of VSC technology. Therefore, the test procedure evaluates the LG models with VSCs in a manner that misrepresents their actual energy consumption. LG urges that a waiver be granted, for the basic models in the Appendix, that will allow use of the alternate test procedure discussed below. The alternate test procedure is designed to take into account the energy savings characteristics of VSCs, properly account for the favorable difference in cycling losses, and yield results more representative of the actual energy consumption of these products than the current DOE test procedure. And the rules provide that DOE "will grant a waiver from the test procedure requirements" in these circumstances.[9] The waiver should continue until DOE adopts an applicable amended test procedure.

III. PROPOSED ALTERNATE TEST PROCEDURE

LG proposes the following alternate test procedure to evaluate the performance of the basic models listed in the Appendix. The alternate test procedure is the same as the existing test procedure for PACs except that it takes into account VSC part-load characteristics for single-duct PACs. It does so by providing for tests at multiple load conditions. Specifically:

LG shall be required to test the performance of the basic models listed in the Appendix hereto according to the test procedure for portable air conditioners in 10 C.F.R. Part 430, Subpart B, Appendix CC, except as follows:

Add new Section 2.10 to Appendix CC as follows:

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9 10 C.F.R. § 430.27(f)(2).

"2.10 *Single-speed* means a type of portable air conditioner that does not automatically adjust either the compressor or fan speed, or both, based on the detected outdoor conditions."

Add new Section 2.12 to Appendix CC as follows:

"2.12 *Variable-speed* means a type of portable air conditioner that can automatically adjust compressor and fan speed, only compressor speed, or only fan speed, based on the detected outdoor conditions."

Add the following at the end of Section 3.1.2 of Appendix CC:

"For a variable-speed portable air conditioner, the compressor speed shall be set during cooling mode testing as described in section 4.1 of this appendix."

Add the following at the end of Section 4.1 of Appendix CC:

"For a single-duct or dual-duct variable-speed portable air conditioner, measure the indoor room cooling capacity and overall power input in accordance with ambient conditions for Test Configuration 3, Condition A ($Capacity_{95}$, P_{95}) with the compressor speed set to maximum, and then measure the indoor room cooling capacity and overall power input a second time in accordance with the ambient conditions for Test Configuration 3, Condition B ($Capacity_{83}$, P_{83}) with the compressor speed set to minimum, for the duration of cooling mode testing."

Add in Section 4.1.1, Duct Heat Transfer following "Calculate the total heat transferred from the surface of the duct(s) to the indoor conditioned space while operating in cooling mode for the outdoor test conditions in Table 1 of this appendix, as follows.":

"Variable-speed portable air conditioners shall use the dual-duct portable air conditioner calculations."

Add in Section 4.1.2, Infiltration Air Heat Transfer after "Calculate the heat contribution from infiltration air for single-duct and dual-duct portable air conditioners for both cooling mode outdoor test conditions, as described in this section.:

"Variable-speed portable air conditioners shall use the dual-duct portable air conditioner calculations, except that the condenser inlet terms shall not be included for single-duct variable-speed portable air conditioners."

Add in Section 4.1.2, Infiltration Air Heat Transfer after "Calculate the dry air mass flow rate of infiltration air according to the following equations.":

"For single-duct portable air conditioners:"

Add in Section 5.1, Adjusted Cooling Capacity after "Calculate the adjusted cooling capacities for portable air conditioners, ACC_{95} and ACC_{83}, expressed in Btu/h, according to the following equations.":

"Variable-speed portable air conditioners shall use the dual-duct portable air conditioner calculations."

Add in Section 5.3, Annual Energy Consumption after "Calculate the annual energy consumption in each operating mode, AEC_m, expressed in kilowatt-hours per year (kWh/year).":

"Variable-speed portable air conditioners shall use the dual-duct portable air conditioner annual operating hours and calculations."

Add in Section 5.4, Combined Energy Efficiency Ratio after "expressed in Btu/Wh,":

"which shall be the combined energy efficiency ratio reported in §429.62(b)(2) for single-speed portable air conditioners,"

Add the following after "according to the following:" in Section 5.4 of Appendix CC:

"Variable-speed portable air conditioners shall use the dual-duct portable air conditioner calculation."

Add the following after Section 5.4 of Appendix CC:

"5.5 *Adjustment of the Combined Energy Efficiency Ratio for Variable-Speed Portable Air Conditioners.* Adjust the combined energy efficiency ratio for variable-speed portable air conditioners as follows, which shall be the combined energy efficiency ratio reported in §429.62(b)(2) for variable-speed portable air conditioners.

5.5.1 *Comparable Single-Speed Portable Air Conditioner Cooling Capacity and Power at the Lower Outdoor Test Condition.* Calculate the cooling capacity and cooling capacity with cycling losses, expressed in British thermal units per hour (Btu/h), and electrical power input, expressed in watts, for a comparable single-speed portable air conditioner at the 83 °F dry-bulb outdoor conditions (Condition B in Table 1 of this appendix).

For a single-duct variable-speed portable air conditioner:

$Capacity_{83\_SS} = Capacity_{95}$

$Capacity_{83\_SS\_CLF} = Capacity_{95} \times CLF$

$P_{83\_SS} = P_{95}$

For a dual-duct variable-speed portable air conditioner:

$Capacity_{83\_SS} = Capacity_{95} \times (1 + (M_c \times (T_{95} – T_{83})))$

$Capacity_{83\_SS\_CLF} = [Capacity_{95} \times (1 + (M_c \times (T_{95} – T_{83})))] \times CLF$

$P_{83\_SS} = P_{95} \times (1 - (M_p \times (T_{95} – T_{83})))$

Where:

$Capacity_{83\_SS}$ = comparable single-speed portable air conditioner cooling capacity, in Btu/h, calculated for Condition B in Table 1.

$Capacity_{83\_SS\_CLF}$ = comparable single-speed portable air conditioner cooling capacity with cycling losses, in Btu/h, calculated for Condition B in Table 1.

$Capacity_{95}$ = variable-speed portable air conditioner cooling capacity, in Btu/h, determined in section 4.1 of this appendix for Condition A in Table 1.

P_{83_SS} = comparable single-speed portable air conditioner electrical power input, in watts, calculated for Condition B in Table 1.

P_{95} = variable-speed portable air conditioner electrical power input, in watts, determined in section 4.1 of this appendix for Condition A in Table 1.

M_c = adjustment factor to determine the increased cooling capacity at lower outdoor test conditions, 0.0099.

M_p = adjustment factor to determine the reduced electrical power input at lower outdoor test conditions, 0.0076.

T_{95} = outdoor dry-bulb temperature for Condition A in Table 1, 95 °F.

T_{83} = outdoor dry-bulb temperature for Condition B in Table 1, 83 °F.

CLF = cycling loss factor for Condition B, 0.875.

5.5.2 *Duct Heat Transfer for a Comparable Single-Speed Portable Air Conditioner at the Lower Outdoor Test Condition.* Calculate the condenser exhaust duct and condenser inlet duct heat transfer to the conditioned space for a comparable single-speed portable air conditioner at the 83 °F dry-bulb outdoor conditions (Condition B in Table 1 of this appendix).

For a single-duct variable-speed portable air conditioner:

$Q_{duct\_83\_SS} = h \times A_{duct\_exhaust} \times (T_{duct\_95\_exhaust} - T_{ei})$

For a dual-duct variable-speed portable air conditioner:

$Q_{duct\_95\_inlet} = h \times A_{duct\_inlet} \times (T_{duct\_95\_inlet} - T_{ei})$

$Q_{duct\_95\_exhaust} = h \times A_{duct\_exhaust} \times (T_{duct\_95\_exhaust} - T_{ei})$

$Q_{duct\_83\_SS} = M_D \times Q_{duct\_95\_inlet} + Q_{duct\_95\_exhaust}$

Where:

$Q_{duct\_95\_inlet}$ and $Q_{duct\_95\_exhaust}$ = the heat transferred from the variable-speed portable air conditioner condenser inlet duct and condenser exhaust duct to the indoor conditioned space in cooling mode, in Btu/h, at the 95 °F dry-bulb outdoor test conditions in Table 1 of this appendix, respectively.

$Q_{duct\_83\_SS}$ = total heat transferred from the ducts to the indoor conditioned space in cooling mode, in Btu/h, for a comparable single-speed portable air conditioner at the 83 °F dry-bulb outdoor test conditions in Table 1 of this appendix.

h = convection coefficient, 3 Btu/h per square foot per °F.

A_{duct_inlet} and $A_{duct\_exhaust}$ = surface area of the variable-speed portable air conditioner condenser inlet and condenser exhaust ducts, respectively, in square feet, as calculated in section 4.1.1 of this appendix.

$T_{duct\_95\_inlet}$ and $T_{duct\_95\_exhaust}$ = average surface temperature for the variable-speed portable air conditioner condenser inlet and exhaust ducts, respectively, as measured during testing according to the 95 °F outdoor test condition (Condition A in Table 1 of this appendix), in °F.

T_{ei} = variable-speed portable air conditioner average evaporator inlet air dry-bulb temperature, in °F.

M_D = adjustment factor to determine the comparable single-speed portable air conditioner inlet condenser duct heat transfer at the lower outdoor test condition, 0.241.

5.5.3 *Infiltration Air Heat Transfer for a Comparable Single-Speed Portable Air Conditioner at the Lower Outdoor Test Condition.* Calculate the heat contribution from infiltration air for a comparable single-speed portable air conditioner at Condition B in Table 1 of this appendix, as described in this section. Calculate the dry air mass flow rate of infiltration air according to the following equations:

For a single-duct variable-speed portable air conditioner:

$$\dot{m}_{83\_SS} = \frac{V_{co\_95} \times \rho_{co\_95}}{(1 + \omega_{co\_95})}$$

For a dual-duct variable-speed portable air conditioner:

$$\dot{m}_{83\_SS} = \left[\frac{V_{co\_95} \times \rho_{co\_95}}{(1 + \omega_{co\_95})}\right] - \left[\frac{V_{ci\_95} \times \rho_{ci\_83}}{(1 + \omega_{ci\_83})}\right]$$

Where:

$\dot{m}_{83\_SS}$ = dry air mass flow rate of infiltration air for a comparable single-speed portable air conditioner at the 83 °F dry-bulb outdoor conditions (Condition B in Table 1 of this appendix), in lb/m.

V_{co_95} = average volumetric flow rate of the condenser outlet air during cooling mode testing for the variable-speed portable conditioner at the 95 °F dry-bulb outdoor conditions, in cubic feet per minute (cfm).

ρ_{ci_95} and ρ_{ci_83} = average density of the condenser inlet air during cooling mode testing for the variable-speed portable air conditioner at the 95 °F and 83 °F dry-bulb outdoor conditions, respectively, in lb_m/ft^3.

ω_{co_95}, and ω_{co_83} = average humidity ratio of condenser outlet air during cooling mode testing for the variable-speed portable air conditioner at the 95 °F and 83 °F dry-bulb outdoor conditions, respectively, in pounds mass of water vapor per pounds mass of dry air (lb_w/lb_{da}).

Calculate the sensible component of infiltration air heat contribution for a comparable single-speed portable air conditioner at Condition B in Table 1 of this appendix as follows:

$$Q_{s\_83\_SS} = \dot{m}_{83\_SS} \times 60 \times [(c_{p\_da} \times (T_{ia\_83} - T_{indoor})) + (c_{p\_wv} \times (\omega_{ia\_83} \times T_{ia\_83} - \omega_{indoor} \times T_{indoor}))]$$

Where:

$Q_{s\_83\_SS}$ = sensible heat added to the room by infiltration air for a comparable single-speed portable air conditioner, at the 83 °F dry-bulb outdoor condition in Table 1 of this appendix, in Btu/h.

$\dot{m}_{83\_SS}$ = dry air mass flow rate of infiltration air for a comparable single-speed portable air conditioner, at the 83 °F dry-bulb outdoor condition in Table 1 of this appendix, in lb/m.

c_{p_da} = specific heat of dry air, 0.24 $Btu/lb_m - °F$.

c_{p_wv} = specific heat of water vapor, 0.444 $Btu/lb_m - °F$.

T_{indoor} = indoor chamber dry-bulb temperature, 80 °F.

T_{ia_95} and T_{ia_83} = infiltration air dry-bulb temperatures for the two test conditions in Table 1 of this appendix, 95 °F and 83 °F, respectively.

ω_{ia_95} and ω_{ia_83} = humidity ratios of the 95 °F and 83 °F dry-bulb infiltration air, 0.0141 and 0.01086 lb_w/lb_{da}, respectively.

ω_{indoor} = humidity ratio of the indoor chamber air, 0.0112 lb_w/lb_{da}.

60 = conversion factor from minutes to hours.

Calculate the latent component of infiltration air heat contribution for a comparable single-speed portable air conditioner at Condition B in Table 1 of this appendix as follows:

$Q_{l\_83\_SS} = \dot{m}_{83\_SS} \times 60 \times H_{fg} \times (\omega_{ia\_83} - \omega_{indoor})$

Where:

$Q_{l\_83\_SS}$ = latent heat added to the room by infiltration air for a comparable single-speed portable air conditioner, at the 83 °F dry-bulb outdoor condition in Table 1 of this appendix, in Btu/h.

$\dot{m}_{83\_SS}$ = dry air mass flow rate of infiltration air for a comparable single-speed portable air conditioner, at the 83 °F dry-bulb outdoor condition in Table 1 of this appendix, in lb/m.

H_{fg} = latent heat of vaporization for water vapor, 1061 Btu/lb_m.

ω_{ia_95} and ω_{ia_83} = humidity ratios of the 95 °F and 83 °F dry-bulb infiltration air, 0.0141 and 0.01086 lb_w/lb_{da}, respectively.

ω_{indoor} = humidity ratio of the indoor chamber air, 0.0112 lb_w/lb_{da}.60 = conversion factor from minutes to hours.

The total heat contribution of the infiltration air for a comparable single-speed portable air conditioner at Condition B in Table 1 of this appendix is the sum of the sensible and latent heat calculated above in this section:

$Q_{infiltration\_83\_SS} = Q_{s\_83\_SS} + Q_{l\_83\_SS}$

Where:

$Q_{infiltration\_83\_SS}$ = total infiltration air heat in cooling mode for a comparable single-speed portable air conditioner at the 83 °F dry-bulb outdoor condition in Table 1 of this appendix, in Btu/h.

$Q_{s\_83\_SS}$ = sensible heat added to the room by infiltration air for a comparable single-speed portable air conditioner, at the 83 °F dry-bulb outdoor condition in Table 1 of this appendix, in Btu/h.

$Q_{l\_83\_SS}$ = latent heat added to the room by infiltration air for a comparable single-speed portable air conditioner, at the 83 °F dry-bulb outdoor condition in Table 1 of this appendix, in Btu/h.

5.5.4 *Adjusted Cooling Capacity for a Comparable Single-Speed Portable Air Conditioner at the Lower Outdoor Test Condition.* Calculate the adjusted cooling capacity for a comparable single-speed portable air conditioner at Condition B in Table 1 of this appendix with and without cycling losses, ACC_{83_SS} and $ACC_{83\_SS\_CLF}$, respectively, expressed in Btu/h, according to the following equations.

$$ACC_{83\_SS} = Capacity_{83\_SS} - Q_{duct\_83\_SS} - Q_{infiltration\_83\_SS}$$

$$ACC_{83\_SS\_CLF} = Capacity_{83\_SS\_CLF} - Q_{duct\_83\_SS} - Q_{infiltration\_83\_SS}$$

Where:

ACC_{83_SS} and $ACC_{83\_SS\_CLF}$ = adjusted cooling capacity for a comparable single-speed portable air conditioner at Condition B in Table 1 of this appendix without and with cycling losses, respectively, in Btu/h.

$Capacity_{83\_SS}$ and $Capacity_{83\_SS\_CLF}$ = comparable single-speed portable air conditioner cooling capacity without and with cycling losses, respectively, in Btu/h, at Condition B in Table 1, calculated in section 5.5.1 of this appendix.

$Q_{duct\_83\_SS}$ = total heat transferred from the ducts to the indoor conditioned space in cooling mode for a comparable single-speed portable air conditioner at the 83 °F dry-bulb outdoor test condition, in Btu/h, calculated in section 5.5.2 of this appendix.

$Q_{infiltration\_83\_SS}$ = total infiltration air heat in cooling mode for a comparable single-speed portable air conditioner at the 83 °F dry-bulb outdoor condition, in Btu/h, calculated in section 5.5.3 of this appendix.

5.5.5 *Annual Energy Consumption in Cooling Mode for a Comparable Single-Speed Portable Air Conditioner at the Lower Outdoor Test Condition.* Calculate the annual energy consumption in cooling mode for a comparable single-speed portable air conditioner at Condition B in Table 1 of this appendix, expressed in kWh/year, according to the following equations.

$$AEC_{83\_SS} = P_{83\_SS} \times t \times k$$

Where:

AEC_{83_SS} = annual energy consumption for a comparable single-speed portable air conditioner in cooling mode at the 83 °F dry-bulb outdoor condition, in kWh/year.

P_{83_SS} = comparable single-speed portable air conditioner electrical power input, in watts, calculated for the 83 °F dry-bulb outdoor condition in section 5.5.1.

t = number of cooling mode hours per year, 750.

k = 0.001 kWh/Wh conversion factor from watt-hours to kilowatt-hours.

5.5.6 *Combined Energy Efficiency Ratio for a Comparable Single-Speed Portable Air Conditioner.* Calculate the combined energy efficiency ratio for a comparable single-speed portable air conditioner without and with cycling losses considered, $CEER_{SS}$ and $CEER_{SS\_CLF}$, respectively, expressed in Btu/Wh, according to the following:

$$CEER_{SS} = \left[\frac{ACC_{95}}{\left(\frac{AEC_{95} + AEC_T}{k \times t}\right)}\right] \times 0.2 + \left[\frac{ACC_{83\_SS}}{\left(\frac{AEC_{83\_SS} + AEC_T}{k \times t}\right)}\right] \times 0.8$$

$$CEER_{SS\_CLF} = \left[\frac{ACC_{95}}{\left(\frac{AEC_{95} + AEC_T}{k \times t}\right)}\right] \times 0.2 + \left[\frac{ACC_{83\_SS\_CLF}}{\left(\frac{AEC_{83\_SS} + AEC_T}{k \times t}\right)}\right] \times 0.8$$

Where:

$CEER_{SS}$ and $CEER_{SS\_CLF}$ = combined energy efficiency ratio for a comparable single-speed portable air conditioner without and with cycling losses considered, respectively, in Btu/Wh.

ACC_{95} = adjusted cooling capacity, tested for the variable-speed portable air conditioner at the 95 °F outdoor condition in Table 1 of this appendix, in Btu/h, calculated in section 5.1 of this appendix.

ACC_{83_SS} and $ACC_{83\_SS\_CLF}$ = adjusted cooling capacity for a comparable single-speed portable air conditioner at the 83 °F outdoor condition in Table 1 of this appendix without and with cycling losses, respectively, in Btu/h, calculated in section 5.5.4 of this appendix.

AEC_{95} = annual energy consumption for the variable-speed portable air conditioner at the 95 °F outdoor conditions in Table 1 of this appendix, in kWh/year, calculated in section 5.3 of this appendix.

AEC_{83_SS} = annual energy consumption for a comparable single-speed portable air conditioner in cooling mode at the 83 °F dry-bulb outdoor condition, in kWh/year, calculated in section 5.5.5 of this appendix.

AEC_T = total annual energy consumption for the variable-speed portable air conditioner attributed to all modes except cooling, in kWh/year, calculated in section 5.3 of this appendix.

t = number of cooling mode hours per year, 750.

k = 0.001 kWh/Wh conversion factor for watt-hours to kilowatt-hours.

0.2 = weighting factor for the 95 °F dry-bulb outdoor condition test.

0.8 = weighting factor for the 83 °F dry-bulb outdoor condition test.

5.5.7 *Variable-Speed Portable Air Conditioner Performance Adjustment Factor.* Calculate the variable-speed portable air conditioner performance adjustment factor, F_p.

$$F_p = \frac{\left(CEER_{SS} - CEER_{SS\_CLF}\right)}{CEER_{SS\_CLF}}$$

Where:

F_p = variable-speed portable air conditioner performance adjustment factor.

$CEER_{SS}$ and $CEER_{SS\_CLF}$ = combined energy efficiency ratio for a comparable single-speed portable air conditioner without and with cycling losses considered, respectively, in Btu/Wh.

5.5.8 *Variable-Speed Portable Air Conditioner Combined Energy Efficiency Ratio.* For single-duct and dual-duct variable-speed portable air conditioners, multiply the combined energy efficiency ratio, $CEER_{DD}$, expressed in Btu/Wh, determined in section 5.4 by $(1 + F_p)$ to obtain the final CEER for variable-speed portable air conditioners.

Where:

F_p = variable-speed portable air conditioner performance adjustment factor, determined in section 5.5.7 of this appendix."

IV. APPLICATION FOR INTERIM WAIVER

LG also hereby applies for an interim waiver of the applicable test procedure requirements for the LG basic models set forth in the Appendix. LG meets the criteria for an interim waiver.

LG's Petition for Waiver is likely to be granted because the test method contained in 10 C.F.R. Part 430, Subpart B, Appendix CC clearly does not address the VSC characteristics of these LG basic models and does not properly account for the favorable difference in cycling losses resulting from use of VSC technology. Thus, the test procedure does not accurately measure these models' energy consumption. Without waiver relief, LG would be subject to requirements that are inapplicable to these products. Additionally, LG will suffer economic hardship and be at a competitive disadvantage if it must wait to rate these basic models pending a determination on the petition for waiver.

DOE approval of LG's interim waiver application is also supported by sound public policy. These LG products employ advanced technology that increases efficiency and reduces energy consumption, while offering a new level of affordable comfort to consumers.

V. CONCLUSION

LG respectfully requests that DOE grant its Petition for Waiver of the applicable test procedure for specified basic models, and also grant its Application for Interim Waiver.

LG requests expedited treatment of the Petition and Application.

Respectfully submitted,
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APPENDIX

The waiver and interim waiver requested herein should apply to testing and rating of the following basic models that are manufactured by LG:

LP1419IVSM

LP1419HVSM

LP1219IVSM

LP1019IVSM

LP0819IVSM