BSR/ASHRAE/IES Addendum ae
to ANSI/ASHRAE/IES Standard 90.1-2022

Public Review Draft

Proposed Addendum ae to Standard 90.1-2022, Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings

First Public Review (Jan 2025)
(Draft Shows Proposed Changes to Current Standard)

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FOREWORD

This addendum was released for advisory public review from June 7, 2024, to July 22, 2024. There were 7 official comments but also 12 unofficial or late filling comments. Both the official and unofficial comments have been reviewed and addressed in this first public review addendum.

The addendum is being generated to make revisions to ASHRAE 90.1 Tables 6.8.1-1 and 6.8.1-2. In addition, table F-1 for DOE regulated products with capacity <65,0000 Btu/h will be moved into the tables 6.8.1-1 and 6.8.1-2 to allow for all information for Unitary Products to be included in one table for easier use and reference.

The following was addressed in the advisory public review;

- Air cooled commercial unitary packaged cooling and heat pump air conditioners and splits systems (CUAC and CUHP's) >65,000 Btu/h and ≤760,000 Btu/h which are regulated by DOE to add the new *IVEC* and *IVHE* efficiency metrics with improved efficiency levels. Note that these new metrics have been referenced in a final DOE rule has been released with an effective date 1/1/2029.
- Air cooled commercial unitary packaged cooling and heat pump air conditioners and splits system (CUAC and CUHP's) ≥760,000 Btu/h products also covered by ASHRAE 90.1 but not under DOE regulatory control to also add the new *IVEC* and *IVHE* efficiency metrics.
- The addendum also adds the cold climate $IVHE_C$ which was not defined by DOE ASRAC negotiations and is not a DOE regulated metric. The $IVHE_C$ minimum levels were based on a crosswalk of the *IVHE* metrics to the rating conditions for $IVHE_C$.
- All sizes of water-cooled commercial package air conditioners (WCUAC's) including DOE regulated products <760,000 Btu/h and DOE non-regulated products ≥760,000 Btu/h to add the new *IVEC* metric. Note there are no heat pump water cooled products. Water source heat pumps covered in 6.8.1-15 and the AHRI 600 standard. Note there were significant changes to the water-cooled test and rating procedure.
- All sizes of evaporatively-cooled commercial package air conditioners (ECUAC's) including DOE regulated products <760,000 Btu/h and DOE non-regulated products ≥760,000 Btu/h to add the new *IVEC*. efficiency metrics. Note there are no evaporatively cooled heat pumps.
- Commercial double-duct cooling and heat pump air conditioners >65,000 Btu/h and ≤300,000 Btu/h to add efficiency requirements to ASHRAE 90.1 and to add the new *IVEC* and *IVHE* efficiency metrics as well as requirements for cold climate $IVHE_C$. DOE did define minimum *EER* efficiencies for double duct and these are document in 10 CFR Part 431 table 5 but were never added to ASHRAE 90.1 table 6.8.1-1 or 6.8.1-2. The DOE did not change metrics to *IEER.* The ratings are based on zero external static and the new ratings with *EER2, IVEC*, *IVHE* and COP_{2H} will include the external static for the condenser and increased indoor static as defined in AHRI 1340. Note that <65,000 Btu/h double duct products are rated per AHRI 210/240 and do not include the condenser external static. The proposed addendum will include minimum efficiencies levels for *IVEC, EER2, IVHE,* $IVHE_C$ $COP2_{H17}$ and $COP2_{H5}$ for cold climates.

In addition, the changes included in the advisory public review and to address the comments received, this full public review addendum has been expanded to include the following additional changes;

- Add efficiency requirements and updates for large commercial condensing units with a capacity >135,000 Btu/h to reflect the new AHRI 1365 standard. The AHRI 1365 standard was updated to add the new *IVEC*, and heat pump

IVHE and $IVHE_C$ metrics similar to what was done for AHRI 1340. This also includes adding requirements for larger commercial HP condensing units that are currently not addressed by ASHRAE 90.1 and AHRI 365.

- Currently in ASHRAE 90.1, the <65,000 Btu/h residential Single-Phase product efficiency requirements are listed informative appendix F-1 for cooling products and heat pumps, but after review we have decided to move them into table 6.8.1-1 and 6.8.1-2 to allow all efficiency requirements for related products in one location. Other addendum will also be generated to move all the other tables F-2, F-3 thru F-6 in appendix F to move into existing or new tables in section 6.
- In Table 6.8.1-2 for Heat Pumps the cooling and heating efficiencies are separated in the table which requires scrolling up and down to get the cooling and heating efficiency requirements for heat pumps, so we have also reformatted the tables to show cooling and heating performance together in the table to make it easier to use the table.
- Some other formatting changes were also made to improve the readability of the tables.
- The new *IVHE* and $IVHE_C$ metrics include auxiliary heat in the metric when the heat pump capacity can not satisfy the building load. The DOE final rule also set minimum *IVHE* efficiencies for heat pump units with gas heat. But the current AHRI 1340 requires that the capacity not satisfied by the heat pump is then satisfied by adding in electric heat energy in kW as defined by equation 31 for operation with the compressor on or equation 29, 32 or 38 when the compressor is off and did not address gas heat.

$$P_{aux} = \frac{q_{H,BLi} - q_H}{3.412}$$ equation 31 (heat pump compression operating)

$$P_{aux} = \frac{q_{H,BLi}}{3.412} - P_{IF,H17H}$$ equation 29, 32, 38 (heat pump compression is off)

The AHRI 1340 standard and DOE final rule test procedure included the requirements for minimum efficiency for units with gas heat, but failed to provide calculation procedures for auxiliary gas heat and currently only allows for electric heat. Per the AHRI 1340 standard auxiliary heat is defined as "Electric, natural gas, propane, steam, or hot water heat used to supplement or be used at low ambient to assist the capacity delivered by a vapor compression heat pump cycle". Dual fuel heat pumps (gas heat) are growing in interest and there have been requests from users to address dual fuel heat pump efficiency. The rating calculations can easily be modified to allow for gas heat to be used in place of the electric heat. For dual fuel units that have gas heat the equations cans be modified by using the gas heat input capacity converted to kW by using the following modified equations. In the process of evaluating the metrics we found an error in AHRI 1340 heat pump *IVHE* test procedure so the standard will have to be modified with an addendum. As the metrics do not go into effect until 1/1/2029 there should be sufficient time to update the AHRI 1340 standard and for DOE to reference, but to get this into ASHRAE 90.1 we have implemented with a footnote.

$$P_{aux} = \frac{\frac{(q_{H,BLi} - q_H)}{E_t}}{3.412}$$ modified equation 31 (heat pump compression operating)

$$P_{aux} = \frac{\frac{q_{H,BLi}}{E_t}}{3.412} - P_{IF,H17H}$$ modified equation 29, 32, or 38 (heat pump compression is off)

Where:

$q_{H,BLi}$ = Building load calculated in Section 6.3.4 for the heating bin, Btu/h

q_H = Capacity calculated in Section 6.3.6 for the highest operating level in this cooling bin (that is, boost or high), Btu/h

$P_{IF,H17H}$ = Indoor fan power determined for the H17H test, W

P_{aux} = auxiliary heat kW

E_t = Combustion thermal efficiency

Analysis using the modified equation with gas heat with a minimum thermal efficiency of 81% as per table 6.8.1-5 have a neglegable impact on the *IVHE* with only -0.01for *IVHE* and -0.03 for $IVHE_C$.

There is also a new residential rating standard called AHRI 1600 which will introduce a new <65,000 Btu/h *SCORE* cooling metric to replace *SEER2* and new *SHORE* heat pump metric metric to replace *HSPF2*, but the crosswalk has not been completed and therefore for will not be ready for the ASHRAE 90.1 2025 standard and will be addressed in the 2028 standard.

For the air cooled commercial unitary cooling and heat pump air conditions and split systems (CUAC and CUHP's) >65,000 Btu/h DOE, industry manufacturers, and advocates recently concluded and published an Appliance Standards Regulatory Advisory Committee (ASRAC) Working Group negotiated standard and cross walk. DOE published the term sheet for the negotiations as well as the final rule and technical support document. AHRI has also completed a new Standard AHRI 1340 that documents the *IVEC* and *IVHE* rating procedure. Because of the significant changes to the test procedure a new standard was developed and will replace the current AHRI 340/360 when the new metrics go into effect on 1/1/2029. AHRI also recently completed a new standard AHRI 1365 for large commercial condensing units which will replace AHRI 365/366 to also adopt the new *IVEC* and *IVHE* metrics and rating procedures with some changes to allow for rating and testing of just the large condensing unit. The following documents have been published and can be used to find further information on the test procedures and new efficiency metrics.

- DOE Appliance Standards Regulatory Advisory Committee (ASRAC) Working Group term sheet EERE-2022-BT-STD-0015-0065
- DOE Final Rule http://www.regulations.gov/docket/EERE-2022-BT-STD-0015
- DOE Technical Support Document https://public-inspection.federalregister.gov/2024-22081.pdf
- AHRI 1340-2024 (I-P) Standard https://www.ahrinet.org/system/files/2024-06/AHRI%20Standard%201340-2024%20%28I-P%29.pdf
- AHRI 1365-2024 (SI/I-P) standard has also been completed and approved by the AHRI committee and is proceeding to publication. The standard was modified to align with AHRI 1340 and uses the new IVEC and IVHE metrics.

The ASRAC negotiation included the development of a new metric for annualized cooling efficiency called *Integrated Ventilation, Economizer, and Cooling Metric* (*IVEC*) and a new annualized efficiency metric for heat pumps heating operation called *Integrated Ventilation, Heating Efficiency* (*IVHE*). The new metrics and minimum efficiencies are documented in this addendum and are proposed to go into effect on 1/1/2029. Because of DOE rules for approval and implementation the addenda for <135,000 Btu/h will show an implementation date of 2027 and a compliance date of 2029 because DOE rules require that the federal requirements go into effect 2 years after the date listed in ASHRAE 90.1. For ≥135,000 Btu/h to 760,000 Btu/h products the effective date will be 2026 with a compliance date of 2029 because the DOE rules for are 3 years for these products.

The heat pump heating metric include a US average metric (*IVHE*) and a colder climate metric ($IVEC_C$). The US average is regulated by DOE and minimum efficiencies were defined by the ASRAC negotiation, but the cold climate is not regulated by DOE, and this addendum includes proposes minimum efficiencies for all the metrics. The cooling *IVEC* metric minimums and heat pump *IVHE* heating metrics minimum defined by ASRAC rule are not open for comment as the ASRAC negotiation was used for the numbers listed in the table. But this addendum expands metrics to cover the >760,000 Btu/h products and other products mentioned above that DOE ASRAC negotiation did not address.

These commercial Unitary products are currently covered by the AHRI 340/360-2024 test and rating procedure and supporting certification program. Due to the significant changes to the test and ratings procedures and the development of new cooling and heating metrics the standard has been updated and published as a new standard called AHRI 1340. The AHRI Standards Technical Committee for the new AHRI 1340 was comprised of a diverse group of stakeholders and took the requirements of the ASRAC term sheet and produced a new standard called *Performance Rating of Commercial and*

Industrial Unitary Air-conditioning and Heat Pump Equipment (AHRI 1340– 2023) (available, here: https://www.ahrinet.org/system/files/2024-06/AHRI%20Standard%201340-2024%20%28I-P%29.pdf (ahrinet.org).

The new test procedure makes significant changes to the cooling and heating metrics including both full load metrics and annualized metrics. The full load cooling metric named will be changed to *EER2* because of the increased external rating static pressure. For heat pump heating a new annualized metric has been developed where currently there are only full load metrics for heating at 47 °F and 17 °F in table 6.8.1-2. There is a U.S. average *IVHE* and a colder climate $IVHE_C$. The full load heat pump metric also have been expanded to include a 5 °F colder climate metric to support expanded use of heat pumps and electrification. Like the cooling the full load heating metric will be changed to $COP2_H$ because of the increased external rating static pressure.

The objective for the test procedure and rating standards change and new metrics was to establish metrics that are more representative of the total operational energy and included the following changes;

- **Increased External Rating Static** – As part of the ASRAC negotiation studies were conducted to evaluate the external ratings static. As shown in the table the rating external static pressure increased to be more representative and typical applications. This results in increased fan power and will have a negative impact on the efficiency metric values including the *IVEC, IVHE,* $IVHE_C$*, EER2* and $COP2_H$. Note that static also includes an allowance for economizers.

Capacity Categories	Capacity	AHRI 340	AHRI 1340	
	KBtu/h	External static in H_2O	External static (w/ econo) in H_2O	External static (w/o econo) in H_2O
<65 kBtu/h	0K to 28.8K	0.10	0.50	0.60
	29K to 42.5K	0.15	0.50	0.60
	43K TO 64.5K	0.20	0.50	0.60
65-135 kBtu/h	65K TO 70K	0.20	0.75	0.85
	71K TO 105K	0.25	0.75	0.85
	106K TO 134K	0.30	0.75	0.85
135-240 kBtu/h	135K TO 210K	0.35	1.00	1.10
	211K TO 280K	0.40	1.00	1.10
240K-760 kBtu/h >760 kBtu/h	281K TO 350K	0.45	1.50	1.60
	351K TO 400K	0.55	1.50	1.60
	401K TO 500K	0.65	1.50	1.60
	501 and greater	0.75	1.50	1.60

As part of the static pressure evaluation the test procedure development work also included creating a new product category called double duct which are often applied with ducted condenser airflow. The new AHRI 1340 standard included a requirement to rate the commercial double duct products with a 0.5 inch of water condenser external static. This increased static was also included in the current published AHRI 340/360. AHRI 210/240 also includes the double duct product category of double duct, but the standard requires ratings to be established with no external static and residential double duct products are required to comply with the packaged product rating category.

- **Inclusion of ventilation fan** – For commercial buildings, the indoor fan is often used for ventilation during the occupied operation and ventilation run hours during occupied mode can be large and are now included in the new *IVEC* and *IVHE* metrics. The new metric which was based on a 10 building and 17 US climate zone weighted average uses 338 hrs. of ventilation only fan operation.
- **Inclusion of air economizers** – Commercial unitary products often include airside economizers which are very efficient means for providing cooling. With the new *IVEC* metric the benefits of an average airside economizer have been included in the new *IVEC* cooling metric to make the metric more representative of the applied equipment efficiency. The *IVEC* metric was based on 10 building and 17 US climate zone resulting in a weighted average 1880 hrs. of economizer only fan operation power and cooling benefit and 278 hrs. of integrated economizer (economizer plus mechanical cooling).
- **Inclusion of Standby power** – Compressors lubrication systems are often protected from oil dilution by refrigerant using a crankcase heater. The new cooling (*IVEC*) and heat pump heating (*IVHE*) annualized metrics include the crankcase heat energy at part load (for multiple compressor units) and off mode standby periods. For

cooling only units and units with gas heat all annual crankcase heat energy is included in the *IVEC* metric. For heat pumps just the cooling mode hours standby power above a 49° F changeover is included in the cooling *IVEC* metric and for heating *IVHE* the below 49 °F in the heating heat pump metric. The *IVEC* metric uses 4202 hrs. of standby power (crankcase heaters and controls) for cooling only CUAC units and 1297 hrs. for HP *IVEC* and 645 hrs. for *IVHE* metric.

For cooling efficiency, the current annualized *IEER* metric will be replaced with the *Integrated Ventilation, Economizer and Cooling (IVEC).* The metric is similar to the *IEER* with a weighted average of rating points but with the inclusion of ventilation, economizers, integrated economizer, and off mode power plus the increased rating static It is an average metric based on a weighted average of 10 commercial buildings for all 17 US climate zones. The new *IVEC* as well as *IVHE* does factor in a 15% oversizing of equipment which was consider for the *IEER*.

These changes the impact on the value of the new metrics were consider the crosswalk from *IEER* and also for the adjustments from EER to EER2. *IEER* which was only for mechanical cooling (did not include economizer, ventilation, and off mode power). The *IEER* was based on 3 commercial building types where the new *IVEC* is based on 10 commercial buildings.

The overall *IVEC* equation is shown below using the equation defined in the Term Sheet. The equation in AHRI 1340 has been simplified and terms combined, but the following Term sheet equation better explains the new metric.

annual cooling capacity

$$IVEC = \frac{q_{FL\,(test)} \times (h_{B} * \%Load_B + h_C \times \%Load_C + h_D \times \%Load_D) + \sum_{i=B}^{D} (h_{i,MO} + h_{i,IE}) \times (q_{i,test} - q_{i,mech})}{\sum_{i=B}^{D} [h_{i,EO} \times (P_{IF,EO} + P_{CT}) + h_{i,IE} \times P_{Tot,IE} + h_{i,MO} \times P_{Tot,MO}] + h_V \times (P_{IF,V} + P_{CT}) + h_{CCH} \times P_{CCH}} \text{ Btu/w}$$

economizer only power | Integrated economizer power | Mechanical only power | cooling ventilation only fan, controls and crankcase heater power | off mode crankcase heater and control power

where

i and n represent test points B, C, D

h = "bin" hours

q = capacity (Btu/h)

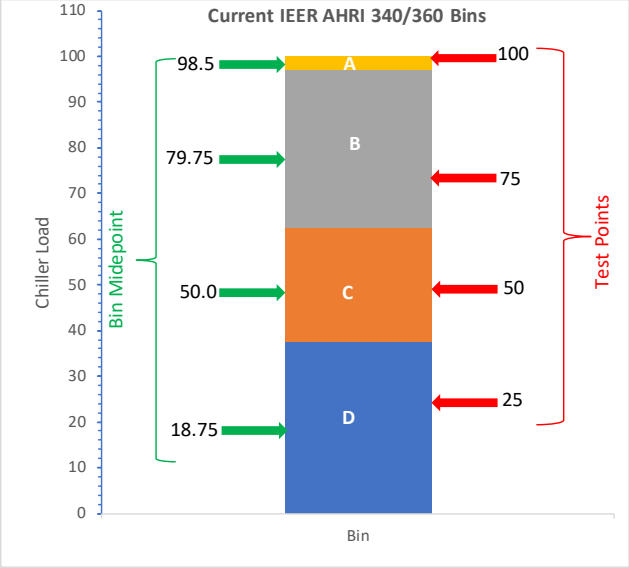
P = power (W)

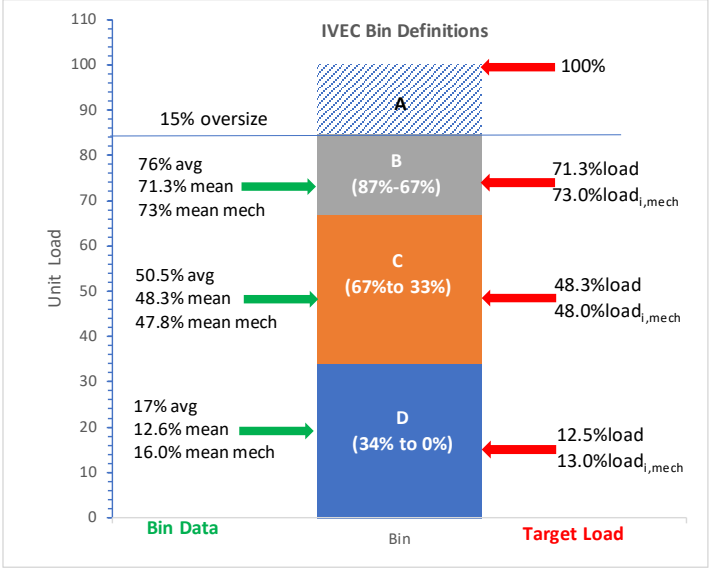
%Load = target load percentage for bin across all modes (note the % load for the capacity is different than the % load for mechanical power determination)

Subscripts:

EO = economizer-only cooling
IE = integrated economizing
MO = mechanical-only cooling (i.e., no economizer contribution)
V = fan-only ventilation (cooling fan only)
IF = indoor fan
CT = controls (includes CCH power during active cooling)
Tot = Total
FL = full-load (test)
CCH = crankcase heater
measured = test measurement value
test = test or rating
mech = mechanical

The cooling *IVEC* metric uses 3 defined mechanical cooling test points for the *IVEC* as defined by test point B, C, D. Due to the use of a 15% oversizing assumption, the *IVEC* metric will not use the full load rating test point A and will use a weighted average of the B (73% capacity) C, (48% capacity) and D (13% capacity) mechanical cooling ratings plus calculated economizer, ventilation, and off mode power as shown in the equation above. The weighting of the points was revised based on the 10 buildings and revised test procedure. Crankcase heater power is included, and crankcase heater power will be provided by manufacturers but are subject to verification crankcase. The full load rating test point A will be used for the full load capacity and *EER2* rating as well as the determination of the testing points for B, C, and D. The new *IVEC* cooling bins and test points are shown in the following chart along as well as the current *IEER* bins and test points. The revised bins are shown below.





In addition to the change to the annualized metric the full load cooling efficiency metric will change from *EER* to *EER2* which reflects the impact of the increased rating static mentioned above. As the focus is on annualized efficiency the *EER2* metric is used as a back stop to control full load efficiency. No improvements have been proposed for full load and the *EER2* values other than to reflect the cross-walk impact of the increased external static.

For heat pump heating efficiency, ASHRAE 90.1 2022 table 6.8.1-2 currently defines minimum efficiency for 47 °F full load and 17 °F full load. The new AHRI 1340 standard and ASRAC negotiations included development of a new annualized metric for heating which is similar to the *HSPF2* for residential but is based on a weighted average of 10 commercial buildings and 17 US climate zones. The new annualized heating metric is called *IVHE* (Integrated ventilation Heating Efficiency) The calculation details are shown in the following equation from the term sheet. AHRI 1340 has a simplified equation which looks somewhat different but is equivalent. The original term sheet equation better explains the details of the equation and added power included in the metric.

$$IVHE = \frac{\text{Annual Heating Capacity}: \sum_{i=1}^{10} h_i \times \dot{q}_{BLi}}{\underbrace{h_v \times (P_{IF} + P_{CT})_v}_{\text{Ventilation Energy}} + \underbrace{h_{CCH} \times P_{CCH}}_{\text{Crankcase Heating Energy}} + \underbrace{\sum_{i=1}^{10} h_i \times (P_C^a + P_{CD}^a + P_{IF} + P_{CT} + P_A)_i}_{\text{Heat Pump Operational Energy}}}$$

where;

hi = load-based bin hours
q̇ = capacity (Btu/h)
P = power (W)

Subscripts:

i		represent test points
BL	=	building load
IF	=	indoor fan
CT	=	controls
C	=	compressor
CD	=	condenser
A	=	auxiliary electric heat
V	=	ventilation
CCH	=	Crankcase heat

Superscript:

a = adjusted

where building load is less than low-stage or low-speed capacity

$$(P_C^a + P_{CD}^a)_i = \frac{X_i \times \delta_i \times (P_C + P_{CD})_i}{PLF_i}$$

$$PLF_i = 1 - C_d \times (1 - X_i);\ C_d = 0.25$$

$$X_i = \max(LF\ or\ 1)$$

$$LF = \frac{\dot{q}_{BLi}}{\dot{q}_{hLi}}$$

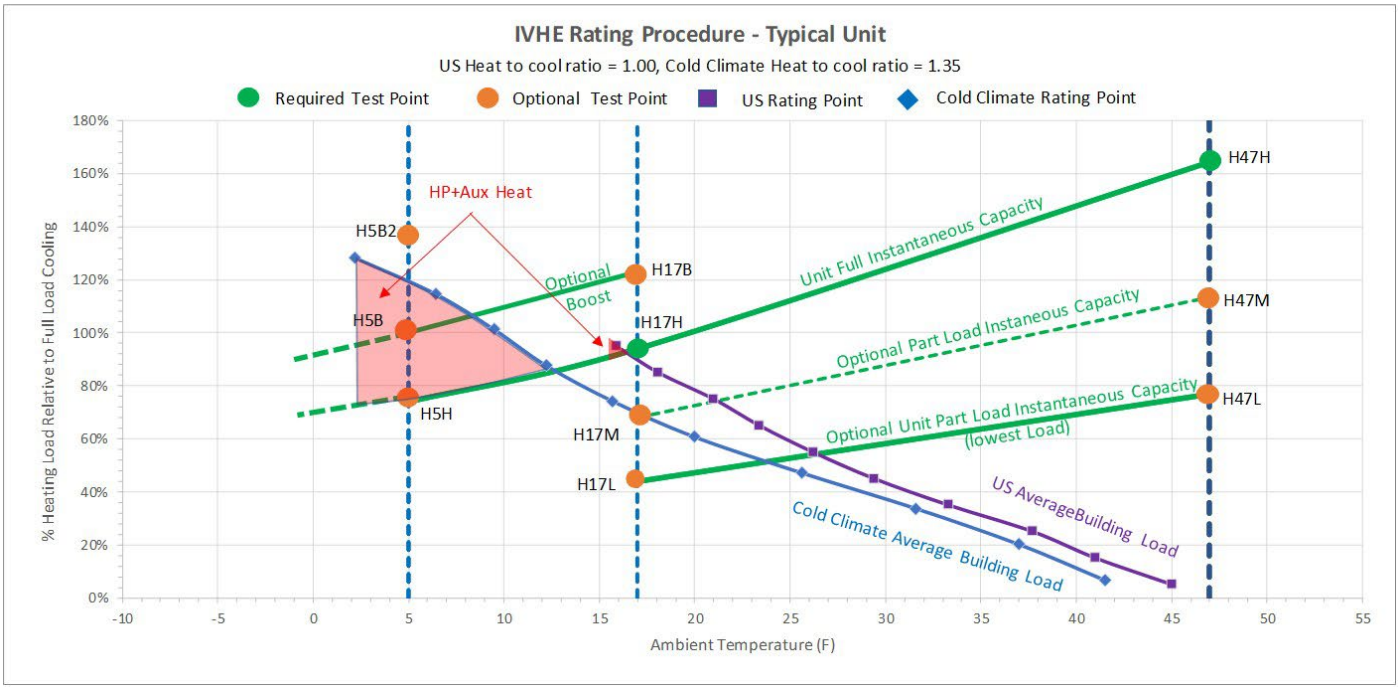
$$\delta_i = \begin{cases} 0\ if\ T_i\ is\ less\ than\ low - temp\ cut - out \\ 0.5\ if\ T_i\ is\ between\ low - temp\ cut - out\ and\ cut - in \\ 1\ if\ T_i\ is\ greater\ than\ low - temp\ cut - in \end{cases}$$

Where:

C_d = cyclic degradation
PLF = part load factor
X = duty cycle
δ = low-temperature cut-out factor

The new heating annualized metric includes the energy of the heat pump mechanical heating, auxiliary electric heat power, ventilation fan power, and off mode standby power. It also includes auxiliary electric heat when the heat pump cannot satisfy the load. It does not currently include auxiliary gas heat, but dual fuel heat pump metrics are being worked on and will likely be added in the future. The new heat pump heating metric is called *IVHE* which is an abbreviation for *Integrated Ventilating, Heating Efficiency*. It is a bin weighted average based on same 10 buildings that were used for *IVEC*. For the U.S., the weighted average is based on the 17 ASHRAE 169 US climate zones. Using the same 10 buildings a colder climate metric has also been defined based on climate zones 5 thru 8 and will be called $IVHE_C$.

The *IVHE* metric is similar to *HSPF2* but is based on commercial buildings load profiles which are different than residential due to different internal loads and occupancy schedules. . The figure below shows the overall rating approach for the *IVHE* metric . The *IVHE* rating and test procedure method is based on a building load and ambient curve as shown which is based on a weighted average of the 10 buildings. At each of the 10 bins performance is determined by interpolating the performance from a 47 °F and 17 °F point with an optional rating at 5 °F. Additional tests can be run at part load and boost mode with overspeed compression. The performance is based on instantaneous performance, but then a default defrosts curve is used. For now, this defrost curve is based on time and temperature logic, but in the future demand defrost is being consider. Using instantaneous performance allows for better interpolation than using non-linear integrated ratings and it greatly simplifies testing. The approach also includes auxiliary electric heat if the heat pump cannot satisfy the building load as shown in the following figure. In the future more advanced defrost curves may be added after testing to develop the curves.



In addition to the new annualized metric the new AHRI 1340 standard and test procedure also includes the current full load metric for COP_H which will change from COP_H to $COP2_H$ to reflect the increased static. Due to the growing interest in cold climate heat pumps the full load $COP2_H$ metrics have been expanded to include in addition to $COP2_H$ at 47 °F, $COP2_H$ at 17 °F currently included in table 6.8.1-2 to also include a $COP2_H$ at 5 °F. COP_{H47} is currently included in ASHRAE 90.1 table 6.8.1-2 as well as $COP2_{H17}$. With the growing interest in electrification and cold climate heat pumps a $COP2_{H5}$ has been added as a rating metric. For the updated of this addendum the proposal is to eliminate the minimum requirements for $COP2_{H47}$ as it is not an important metric for commercial buildings. The proposal is to require two metrics for compliance. The following compliance will be required.

- For ASHRAE 169 climate zone 0A, 0B, 1A, 1B, 2A, 2B, 3A, 3B, 3C, 4A, 4B, 4C compliance with *IVHE* and $COP2_{H17}$ will be required.

- For cold climate zones 5A, 5B, 5C, 6A, 6B, 7, and 8 compliances should be determined with $IVHE_C$ and $COP2_{H5}$ but for all US DOE applications compliance with *IVHE* for ≥65,000 Btu/h to <760,000 Btu/h products will still be required because of DOE requirements.

The $COP2_{H47}$ minimum efficiency metric compliance and minimum will no longer be required by ASHRAE 90.1 after 1/1/2029 but is still required as one of the test points by AHRI 1340.

In addition to the ASRAC negotiations for the test procedure and definition of the new metrics a cross walk was done as well as negotiations to improve efficiencies. The ASRAC negotiations were limited just the *IVEC* and *IVHE* U.S. average for air cooled cooling units and air source HPs with a capacity greater than or equal to 65,000 Btu/h to 760,000 Btu/h, but AHRI 1340-2024 also includes the following products and capacity categories that were not defined by ASRAC negotiations and will be defined as part of this addendum.

- Unitary air-cooled products with a capacity ≥760,000 Btu/h
- Unitary heat pump products with a capacity ≥760,000 Btu/h
- Water cooled products for all sizes
- Evaporatively cooled products for all sizes (includes <65,000 Btu/h)
- Double duct products ≥65,000 Btu/h
- Cold Climate $IVHE_C$ for all sizes.

The ASRAC negotiations were focused on improvements to the *IVEC and IVHE* metrics as they are representative of the annual energy efficiency. The ASRAC negotiations did not address the full load *EER2* and $COP2_H$ that are defined by current ASHRAE 90.1 table 6.8.1-1 and 6.8.1-2 and therefore proposed levels have been included in this addendum reflecting the increased external rating static and other test procedure changes.. The full load efficiencies have not increased but just adjusted for the static and test procedure change. The focus on efficiency improvements is with the annualized *IVEC* and *IVHE* metrics and the full load *EER2* is being used to provide a back stop to ensure warm climate energy efficiency and peak power use for cooling and $COP2_H$ to provide a backstop for heat pump full load energy and power.

For the water cooled the *EER2 and IVEC* metrics were also adjusted for a change to include power allowances to account for tower power. AHRI 340/360 included a tower power allowance for <135,000 Btu/h but AHRI 1340 has expanded the allowance to all sizes and also made some changes in the power allowance. Note that for water cooled the ambient rebalance at part load is also more gradual than air cooled

For air-cooled commercial package air conditioners and heat pumps with a rated cooling capacity greater than or equal to 65,000 Btu/h and less than 760,000 Btu/h (ACUAC's and ACUHP's), the ASRAC defined the following minimum efficiencies. These values have been included in the addendum but are not open for comment as they have been defined and agreed to by the ASRAC negotiations and published in the final rule.

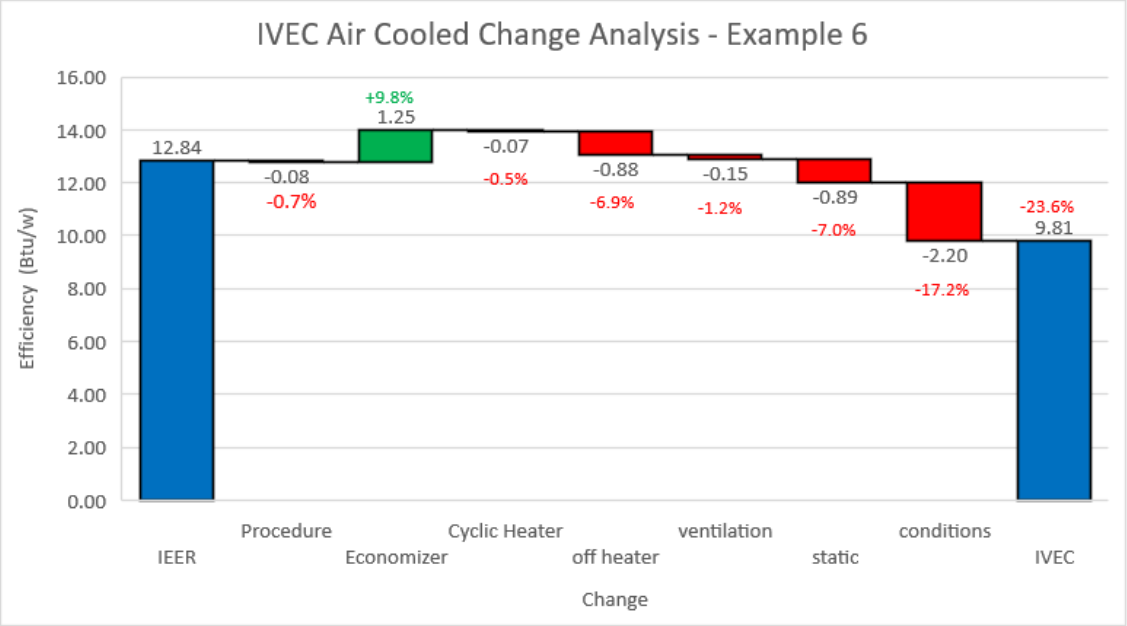
Air-Cooled Commercial Unitary Air Conditioners and Heat Pumps with a Cooling Capacity Greater Than or Equal to 65,000 Btu/h (Excluding Double-Duct Air-Conditioners and Heat Pumps)			
Cooling capacity	**Subcategory**	**Supplementary Heating type**	**Minimum Efficiency (Btu/w h)**
≥65,000 Btu/h and <135,000 Btu/h	AC	Electric Resistance Heating or No Heating	*IVEC* = 14.3
≥65,000 Btu/h and <135,000 Btu/h	AC	All Other Types of Heating	*IVEC* = 13.8
≥65,000 Btu/h and <135,000 Btu/h	HP	All Types of Heating or No Heating	*IVEC* = 13.4 *IVHE* = 6.2
≥135,000 Btu/h and <240,000 Btu/h	AC	Electric Resistance Heating or No Heating	*IVEC* = 13.8
≥135,000 Btu/h and <240,000 Btu/h	AC	All Other Types of Heating	*IVEC* = 13.3

≥135,000 Btu/h and <240,000 Btu/h	HP	All Types of Heating or No Heating	*IVEC* = 13.1 *IVHE* = 6.0
≥240,000 Btu/h and <760,000 Btu/h	AC	Electric Resistance Heating or No Heating	*IVEC* = 12.9
≥240,000 Btu/h and <760,000 Btu/h	AC	All Other Types of Heating	*IVEC* = 12.2
≥240,000 Btu/h and <760,000 Btu/h	HP	All Types of Heating or No Heating	*IVEC* = 12.1 *IVHE* = 5.8

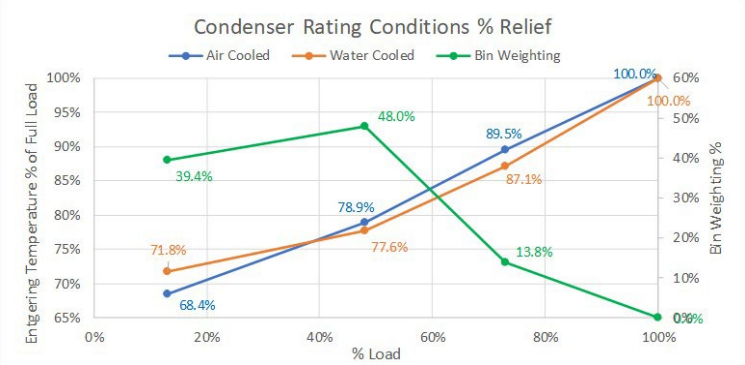
The negotiations resulted in significant increases in efficiency as shown below relative to the current *IEER* levels that were recently increased in 2023.

- 65,000 to 135,000 – 36.1% efficiency increase relative to 2023 *IEER* levels
- 135,000 to 240,000 – 17.9% efficiency increase relative to 2023 *IEER* levels
- 240,000 to 760,000 – 29.1% efficiency increase relative to 2023 *IEER* levels

Because of the metric and test procedure changes the values do decrease and the following chart shows a typical product water fall of the test procedure impact on the numeric value of the I*VEC* metric vs the *IEER* metric for an air-cooled product using example 6 from the AHRI 340/360 standard.



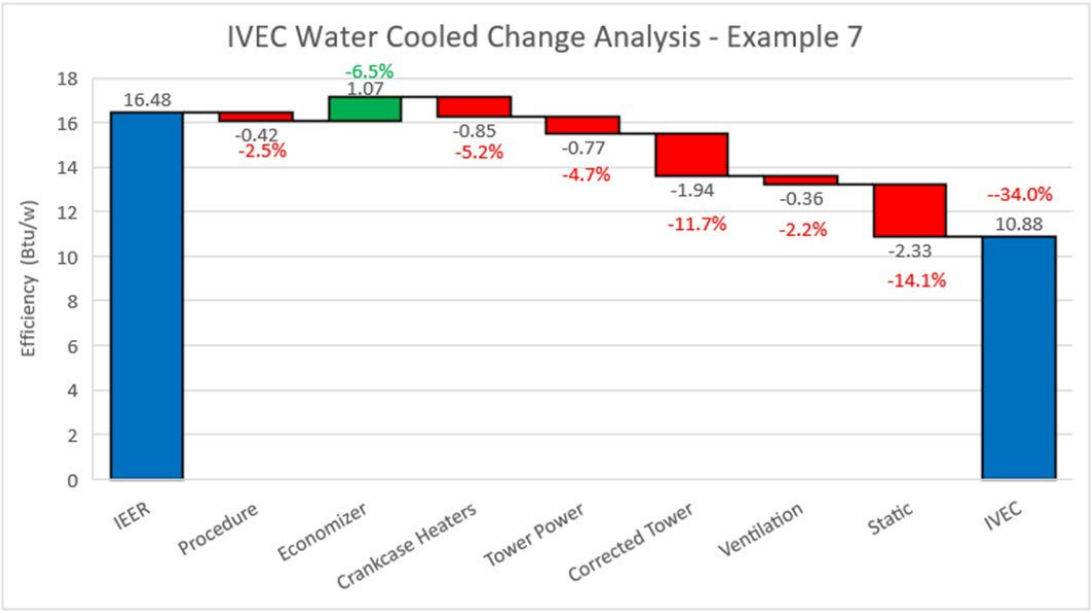
For water cooled products there were also significant changes made to the test and rating procedure for water cooled and evaporatively cooled. Like air cooled the procedure was expanded to include ventilation, airside economizers and crankcase heater power. The use of a default tower fan and pumping power was also expanded to cover all products and not just the <135,000 Btu/h products per the current AHRI 340/360 test procedure. The rating conditions were also changed include re-evaluation of the condenser conditions and they are different than the air cooled.



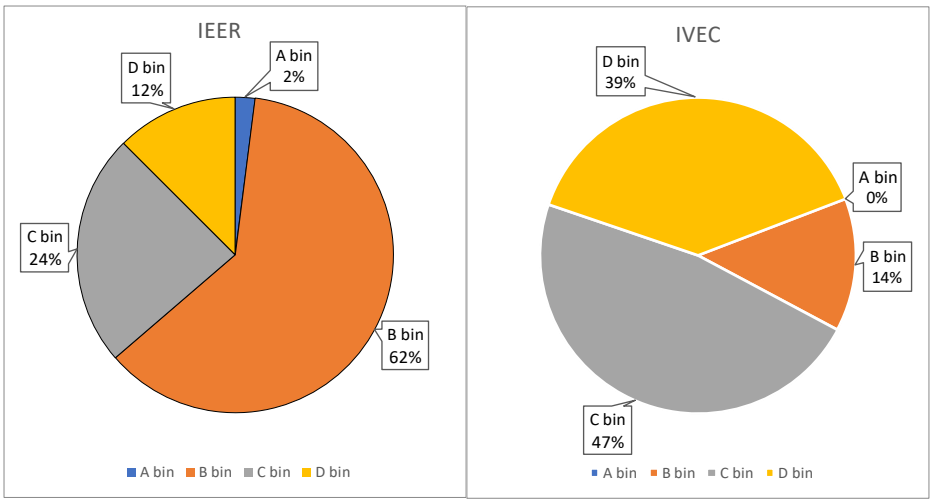
Comparing air and water cooled *IVEC* is not appropriate due to the following;

- The condenser conditions at part load are not aligned between air and water cooled which results in some differences in cross walked metrics,
- The part load bin weighting has changed between *IEER* and *IVEC* to more part load focused but with the changes in condenser rating conditions the impact is different for air and water cooled
- The water-cooled tower power allowance is fixed and is not an option for improving water cooled efficiencies like air cooled and the tower power allowance is 11.1% of the total where the air-cooled condenser fan power is 4.4%

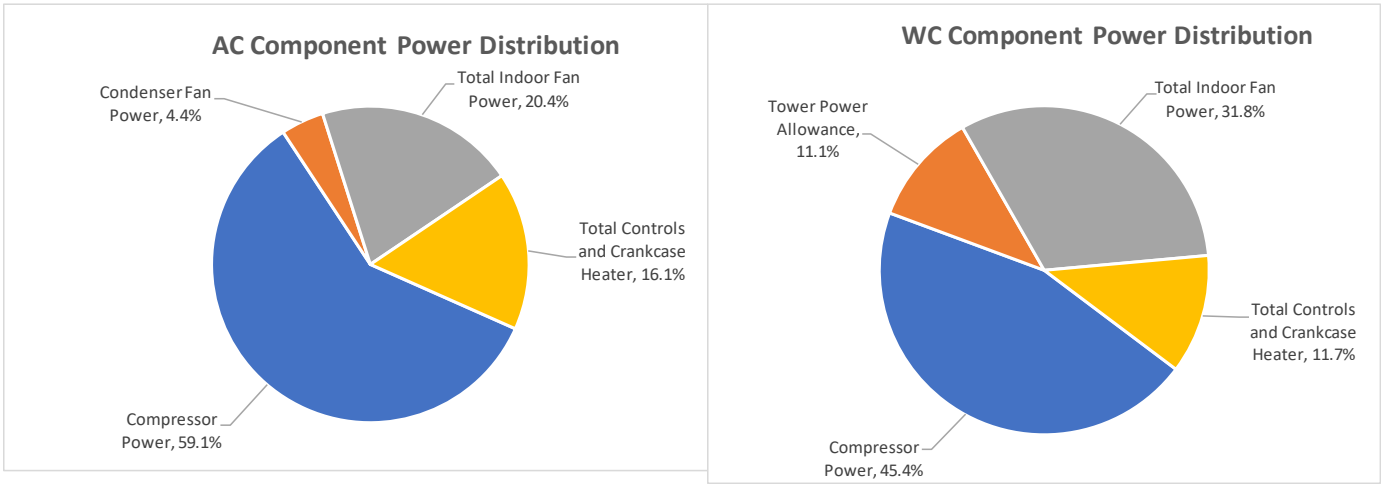
The following chart shows a typically crosswalk for water cooled using example 7 from AHRI 340/360 where the test procedure reduced the *IEER* by 34% vs 23.6% for air cooled.



Also, the significant change in bin weighting and using of 15% oversizing also impact the IVEC vs IEER has shown in the following figure.



Using the air- and water-cooled examples the following chart shows typical power use distribution and explains the differences between air and water cooled.



For evaporatively cooled there is very little industry data and products. The current *IEER* for evaporatively cooled does include the fan power and recirculation pumping power. With the changes to water cooled the water cooled to include tower fan power and condenser pumping power are no equivalent so the proposal uses the same *EER2* and *IVEC* for water cooled. There are not heat pumps for water cooled and evaporatively cooled. Water to air heat pumps fall under table 6.8.1-15 for WSHP's.

The advisory public review did not cover the large commercial condensing units greater than 135,000 Btu/h because the AHRI 1365 standard was still in development. Considerable work has been done and the AHRI 1365 standard was developed to align with the AHRI 1340 test procedure for *IVEC* cooling metrics test procedures and also expanded to included heat pump condensing units which were not covered by the current table 6.8.1-2. To make the condensing units equivalent to AHRI 1340 products the test procedure was updated to include an indoor fan power allowance so that ventilation and economizer could be part of the metric and expanded to cover the part load rating B, C, and D test points. The fan power allowance was based on VAV systems and survey data from manufactures and the same part load fan power reduction used for AHRI 1340 default fan power. The testing will be done using a defined midpoint saturated suction temperature that was developed by AHRI surveys of existing existing equipment. Based on this work and the completion of AHRI 1365 standard the minimum efficiency requirements for large condensing units has been added to the table for cooling units and heat pumps and set at the same levels as packaged units.

Cost Effective Analysis

As you can see a significant energy efficiency increase is being proposed and a detailed cost effectiveness analysis has been conducted using the 10 reference buildings used to develop the *IVEC* and *IVHE* metrics and a weighted average of the 19 climate zones. Per the requirements of ASHRAE 90.1 the analysis used the scalar cost effectiveness procedure and scalars were calculated using average electric rates of 0.1122 $/kW for energy cost and again with cost of carbon adder

cost using an electric rate of 0.1772 $/kW. The scalar limit for these products and equipment lives of 15, 18, and 20 yrs. is shown below. Industry and DOE studies over the years have used different product lives.

Equipment Life (yrs.)	Cooling Scalar Limit	Heating Scalar Limit
15	11.4	11.5
18	13.1	13.3
20	14.1	14.4

For those not familiar with the ASHRAE 90.1 scalar cost effectiveness analysis the scalar is a simple payback of the increase product cost including shipping and installation relative to the annual energy savings. The scalar limit is the maximum scalar ratio that will be justified based on a net present value of the energy cost savings or energy cost savings plus the cost of carbon.

The following chart shows the cost-effective analysis for the air-cooled products which is the dominate volume segment of the products. We have assumed the water cooled and air cooled would similar scalars. The values are weighted averages of all U.S. 17 climate zones for the 10 reference buildings.

Product Class	Energy Cost		Energy Cost + Social Cost of Carbon	
	Cooling Units	Heat Pumps	Cooling Units	Heat Pumps
65K-135K Btu/h	18.38	13.90	11.64	8.80
135K-240K Btu/h	3.21	7.12	2.03	4.51
240K-760K Btu/h	17.98	13.91	11.39	8.81
Weighted Average	13.39		8.48	

As you can see the energy cost scalar is marginally cost effective for an equipment life of 20 yrs. but does get better when including the social cost of carbon. **Manufacturers have agreed to the efficiency improvements for air cooled as part of the ASRAC negotiations.** The *IVEC* and *IVHE* metrics are new, and manufacturers likely will find ways to optimize the designs before the compliance date in 2029.

[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes. Only these changes to the current standard are open for review and comment at this time. Additional material is provided for context only and is not open for comment except as it relates to the proposed changes.]

All comments should be submitted thru the ASHRAE online comment data base.

My Comments (ashrae.org)

Comments should comply with the following;

- ***Be marked as supportive or non-supportive***
- ***Be specific to the text, section or table that is the subject of the comment***
- ***Where possible proposed alternate language or requirements including justification***
- ***Provide supporting information if needed***
- ***Comments should be submitted during the comment period***
- ***Only text marked as underlined, or strikeout are open for comments.***

Do not use the following comment submittal approach;

- ***Do not submit comments by email or other systems***
- ***Comments should be on a single topic and do not submit multiple comments in one comment. If you have multiple comments submit multiple comments in the on-line system***
- ***Attachments can be used for additional backup, but comments should be entered into the system***

Addendum ae to 90.1-2022

Make the following changes to definitions to section 3.2

coefficient of performance (COP$_H$ or COP2$_H$), heat pump—heating: the ratio of the rate of heat delivered to the rate of *energy* input, in consistent units, for a complete heat-pump *system*, including the compressor and, if applicable, auxiliary heat, under designated operating conditions. (Informative Note: COP2$_H$ reflects the new higher static effective 1/1/2023 for products covered by AHRI 210/240 and effective 1/1/2029 for products covered by AHRI 1340)

energy efficiency ratio (EER or EER2): the ratio of net cooling capacity (Btu/h) to total rate of electric input in watts under designated operating conditions. (***Informative Note:*** *EER2* reflects the new higher static effective 1/1/2023 and for products covered by AHRI 210/240 and effective 1/1/2029 for products covered by AHRI 1340)

Add the following definitions to Section 3.2

Integrated Ventilation, Economizing, and Cooling Efficiency (IVEC). Total annual cooling capacity divided by total annual energy including mechanical cooling, economizer, cooling mode ventilation fan energy and off mode control energy and crankcase heat energy for an average building and average climate zone as defined in AHRI 1340 Section 6.2.

Integrated Ventilation and Heating Efficiency (IVHE and IVHE$_C$). Total annual heating capacity for a heat pump including vapor compression heating capacity and auxiliary heating capacity divided by total heating model energy including mechanical vapor compression heating, auxiliary heat energy, heating mode ventilation fan energy and heating mode control power, and crankcase heat power as defined in Section 6.3 and expressed in Btu/W h. *IVHE$_C$* is for colder climates and uses a colder climate zone weighted average load profile and is based on ASHRAE 169 Climate Zones 5 to 8.

Add the following abbreviations and acronyms to section 3.3

IVEC:	*Integrated Ventilation, Economizing, and Cooling Efficiency*
IVHE:	*Integrated Ventilation and Heating Efficiency*
IVHE$_C$:	*Integrated Ventilation and Heating Efficiency for cold climate zones*
COP$_C$/COP2$_C$	*coefficient of performance*
COP$_H$/COP2$_H$	*coefficient of performance, heat pump - heating*

Add the following reference to chapter 13:

AHRI 1340-2024 (I-P)	Performance Rating of Commercial and Industrial Unitary Air-conditioning and Heat Pump Equipment	Table 6.8.1-1, Table 6.8.1-2
AHRI 1365-2024 (SI/I-P)	Performance Rating of Commercial and Industrial Unitary Air-conditioning and Heat Pump Condensing Units	Table 6.8.1-1, Table 6.8.1-2

AHRI 1340 (2023) was the first release of the standard, but some revisions were made in a 2024 version which is now released and published. Note when the new efficiency metrics go into effect(compliance) on 1/1/2029 AHRI 340/360 will be superseded by this new standard.

AHRI 1365 (2024) has been completed and approved by the AHRI STC and is proceeding to publication.

Delete the current table 6.8.1-1, 6.8.1-2. and F-1 and replace with the new tables 6.8.1-1 and 6.8.1-2 for I-P and SI. Note that only the I-P tables are shown but both the I-P and SI tables are being totally replaced.

Table 6.8.1-1 Electrically Operated Unitary Air Conditioners and Condensing Units – Minimum Efficiency requirements (IP)

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
Air conditioners, air cooled	<65,000 Btu/h[b]	All	Split *system*, three phase and applications outside U.S. single phase [b]	13.0 *SEER* before 1/1/2023 13.4 *SEER2* after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023
			Single-package, three phase and applications outside U.S. single phase [b]	14.0 *SEER* before 1/1/2023 13.4 *SEER2* after 1/1/2023	
Space-Constrained, air cooled	≤30,000 Btu/h[b]	All	Split *system*, three phase and applications outside U.S. single phase [b]	12.0 *SEER* before 1/1/2023 11.7 *SEER2* after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023
			Single-Package, three phase and applications outside U.S. single phase [b]	12.0 *SEER* before 1/1/2023 11.7 *SEER2* after 1/1/2023	
Small-Duct, high velocity, air cooled	<65,000 Btu/h[b]	All	Split *system*, three phase and applications outside U.S. single phase [b]	12.0 *SEER* before 1/1/2023 12.0 *SEER2* after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023
Air conditioners, air cooled	≥65,000 Btu/h and <135,000 Btu/h	*Electric resistance* (or none)	Split *system* and Single-Package	11.2 *EER* 12.9 *IEER* before 1/1/2023 14.8 *IEER* after 1/1/2023	AHRI 340/360
		All other		11.0 *EER* 12.7 *IEER* before 1/1/2023 14.6 *IEER* after 1/1/2023	
	≥135,000 Btu/h and <240,000 Btu/h	*Electric resistance* (or none)		11.0 *EER* 12.4 *IEER* before 1/1/2023 14.2 *IEER* after 1/1/2023	
		All other		10.8 *EER* 12.2 *IEER* before 1/1/2023 14.0 *IEER* after 1/1/2023	
Air conditioners, air cooled (continued)	≥240,000 Btu/h and <760,000 Btu/h	*Electric resistance* (or none)	Split system and Single-Package	10.0 *EER* 11.6 *IEER* before 1/1/2023 13.2 *IEER* after 1/1/2023	AHRI 340/360
		All other		9.8 *EER* 11.4 *IEER* before 1/1/2023 13.0 *IEER* after 1/1/2023	
	≥760,000 Btu/h	*Electric resistance* (or none)		9.7 *EER* 11.2 *IEER* before 1/1/2023 12.5 *IEER* after 1/1/2023	
		All other		9.5 *EER* 11.0 *IEER* before 1/1/2023 12.3 *IEER* after 1/1/2023	
Air conditioners, water cooled	<65,000 Btu/h	All	Split *system* and Single-Package	12.1 *EER* 12.3 *IEER*	AHRI 210/240
	≥65,000 Btu/h and <135,000 Btu/h	*Electric resistance* (or none)		12.1 *EER* 13.9 *IEER*	AHRI 340/360
		All other		11.9 *EER*	

				13.7 *IEER*	
	≥135,000 Btu/h and <240,000 Btu/h	*Electric resistance* (or none)		12.5 *EER* 13.9 *IEER*	
		All other		12.3 *EER* 13.7 *IEER*	
	≥240,000 Btu/h and <760,000 Btu/h	*Electric resistance* (or none)		12.4 EER 13.6 IEER	
		All other		12.2 EER 13.4 IEER	
	>760,000 Btu/h	*Electric resistance* (or none)		12.2 EER 13.5 IEER	
		All other		12.0 EER 13.3 IEER	
Air conditioners evaporatively cooled	<65,000 Btu/h[b]	All	Split *system* and Single-Package	12.1 *EER* 12.3 *IEER*	AHRI 210/240
	≥65,000 Btu/h and <135,000 Btu/h	*Electric resistance* (or none)		12.1 *EER* 12.3 *IEER*	AHRI 340/360
		All other		11.9 *EER* 12.1 *IEER*	
	≥135,000 Btu/h and <240,000 Btu/h	*Electric resistance* (or none)		12.0 *EER* 12.2 *IEER*	
		All other		11.8 *EER* 12.0 *IEER*	
	≥240,000 Btu/h and <760,000 Btu/h	*Electric resistance* (or none)		11.9 *EER* 12.1 *IEER*	
		All other		11.7 *EER* 11.9 *IEER*	
	≥760,000 Btu/h	*Electric resistance* (or none)		11.7 *EER* 11.9 *IEER*	
		All other		11.5 *EER* 11.7 *IEER*	
Condensing units, air cooled	≥135,000 Btu/h			10.5 *EER* 11.8 *IEER*	AHRI 365
Condensing units, water cooled	≥135,000 Btu/h			13.5 *EER* 14.0 *IEER*	AHRI 365
Condensing units, evaporatively cooled	≥135,000 Btu/h			13.5 *EER* 14.0 *IEER*	AHRI 365

a. Section 13 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
b. Single-phase, U.S. air-cooled air conditioners <65,000 Btu/h are regulated as consumer products by the U.S. *Code of Federal Regulations* 10 CFR 430. *SEER* and *SEER2* values for single-phase products are set by the U.S. Department of Energy.
Informative Note: See Informative Appendix F for the U.S. Department of Energy minimum *efficiency* requirements of single-phase air conditioners for U.S. applications.

Table 6.8.1-2 Electrically Operated Air-Cooled Unitary Heat Pumps – Minimum Efficiency requirements

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
Air cooled (cooling mode)	<65,000 Btu/h	All	Split *system*, three phase and applications outside U.S. single phase [b]	14.0 *SEER* before 1/1/2023 14.3 *SEER2* after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023
			Single-Package, three phase and applications outside U.S. single phase [b]	14.0 *SEER* before 1/1/2023 13.4 *SEER2* after 1/1/2023	
Space-Constrained, air cooled (cooling mode)	≤30,000 Btu/h	All	Split *system*, three phase and applications outside U.S. single phase [b]	12.0 *SEER* before 1/1/2023 11.7 *SEER2* after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023
			Single-Package, three phase and applications outside U.S. single phase b	12.0 *SEER* before 1/1/2023 11.7 *SEER2* after 1/1/2023	
Small-Duct, high velocity, air cooled (cooling mode)	<65,000 Btu/h	All	Split *System*, three phase and applications outside U.S. single phase [b]	12.0 *SEER* before 1/1/2023 12.0 *SEER2* after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023
Air cooled (cooling mode)	≥65,000 Btu/h and <135,000 Btu/h	*Electric resistance* (or none)	Split *system* and Single-Package	11.0 *EER* 12.2 *IEER* before 1/1/2023 14.1 *IEER* after 1/1/2023	AHRI 340/360
		All other		10.8 *EER* 12.0 *IEER* before 1/1/2023 13.9 *IEER* after 1/1/2023	
	≥135,000 Btu/h and <240,000 Btu/h	*Electric resistance* (or none)		10.6 *EER* 11.6 *IEER* before 1/1/2023 13.5 *IEER* after 1/1/2023	
		All other		10.4 *EER* 11.4 *IEER* before 1/1/2023 13.3 *IEER* after 1/1/2023	
	≥240,000 Btu/h	*Electric resistance* (or none)		9.5 *EER* 10.6 *IEER* before 1/1/2023 12.5 *IEER* after 1/1/2023	
		All other		9.3 *EER* 10.4 *IEER* before 1/1/2023 12.3 *IEER* after 1/1/2023	
Air cooled (heating mode)	<65,000 Btu/h (cooling capacity)		*Split system*, three-phase and applications outside U.S. single phase [b]	8.2 HSPF before 1/1/2023 7.5 HSPF2 after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023
			Single-Package, three phase and applications outside U.S. single phase [b]	8.0 HSPF before 1/1/2023 6.7 HSPF2 after 1/1/2023	
Space-Constrained, air cooled (heating mode)	≤30,000 Btu/h (cooling capacity)		*Split system*, three-phase and applications outside U.S. single phase [b]	7.4 HSPF before 1/1/2023 6.3 HSPF2 after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023
			Single-Package, three phase and applications outside U.S. single phase [b]	7.4 HSPF before 1/1/2023 6.3 HSPF2 after 1/1/2023	
Small-Duct high velocity, air cooled (heating mode)	<65,000 Btu/h		*Split system*, three-phase and applications outside	7.2 HSPF before 1/1/2023 6.1 HSPF2	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023

			U.S. single phase [b]	after 1/1/2023	after 1/1/2023
Air cooled (heating mode)	≥65,000 Btu/h and <135,000 Btu/h (cooling capacity)		47°F db/43°F wb outdoor air	3.*30* COP_H before 1/1/2023 3.40 COP_H after 1/1/2023	AHRI 340/360
			17°F db/15°F wb outdoor air	2.25 COP_H	
	≥135,000 Btu/h and <240,000 Btu/h (cooling capacity)		47°F db/43°F wb outdoor air	3.20 COP_H before 1/1/2023 3.30 COP_H after 1/1/2023	
			17°F db/15°F wb outdoor air	2.05 COP_H	
	≥240,000 Btu/h (cooling capacity)		47°F db/43°F wb outdoor air	3.20 COP_H	
			17°F db/15°F wb outdoor air	2.05 COP_H	

Section 13 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
b. Single-phase, U.S. air-cooled heat pumps <65,000 Btu/h are regulated as consumer products by the U.S. *Code of Federal Regulations* 10 CFR 430. *SEER, SEER2*, and *HSPF* values for single-phase products are set by the U.S. Department of Energy.
Informative Note: See Informative Appendix F for the U.S. Department of Energy minimum.

Table F-1 Minimum Efficiency Requirements for Single-Phase Central Air Conditioners and Heat Pumps for Applications in the U.S.

Product Class	Capacity Range	National Standards	Southeastern Region Standards[a]	Southwestern Region Standards[b]	Test Procedure[f]
			Central Air Conditioners and Heat Pumps[e]		
Split-system air conditioners for U.S. applications	<45,000 Btu/h *single phase*	*SEER* = 13.0 $P_{W,OFF} \le 30$ W before 1/1/2023 *SEER2* = 13.4 $P_{W,OFF} \le 30$ W after 1/1/2023	*SEER* = 14.0 $P_{W,OFF} \le 30$ W before 1/1/2023 *SEER2* = 14.3 $P_{W,OFF} \le 30$ W after 1/1/2023	*SEER* = 14.0 *EER* = 12.2 $P_{W,OFF} \le 30$ W before 1/1/2023 *SEER2* = 14.3 *EER2* = 11.7/9.8 [d] $P_{W,OFF} \le 30$ W after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023
Split-system air conditioners	≥45,000 Btu/h and <65,000 Btu/h *single phase*	*SEER* = 13.0 $P_{W,OFF} \le 30$ W before 1/1/2023 *SEER2* = 13.4 $P_{W,OFF} \le 30$ W after 1/1/2023	*SEER* = 14.0 $P_{W,OFF} \le 30$ W before 1/1/2023 *SEER2* = 13.8 $P_{W,OFF} \le 30$ W after 1/1/2023	*SEER* = 14.0 *EER* = 11.7[d] $P_{W,OFF} \le 30$ W before 1/1/2023 *SEER2* = 13.8 *EER2* = 11.2/9.8[e] $P_{W,OFF} \le 30$ W after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023
Split-system heat pumps	<65,000 Btu/h *single phase*	*SEER* = 14.0 *HSPF* = 8.2 $P_{W,OFF} \le 33$ W before 1/1/2023 *SEER2* = 14.3 *HSPF2* = 7.5 $P_{W,OFF} \le 33$ W after 1/1/2023	*SEER* = 14.0 *HSPF* = 8.2 $P_{W,OFF} \le 33$ W before 1/1/2023 *SEER2* = 14.3 *HSPF2* = 7.5 $P_{W,OFF} \le 33$ W after 1/1/2023	*SEER* = 14.0 *HSPF* = 8.2 $P_{W,OFF} \le 33$ W before 1/1/2023 *SEER2* = 14.3 *HSPF2* = 7.5 $P_{W,OFF} \le 33$ W after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023
Single-package air conditioners	<65,000 Btu/h *single phase*	*SEER* = 14.0 $P_{W,OFF} \le 30$ W before 1/1/2023 *SEER2* = 13.4 $P_{W,OFF} \le 30$ W after 1/1/2023	*SEER* = 14.0 $P_{W,OFF} \le 30$ W before 1/1/2023 *SEER2* = 13.4 $P_{W,OFF} \le 30$ W after 1/1/2023	*SEER* = 14.0 *EER* = 11.0 $P_{W,OFF} \le 30$ W before 1/1/2023 *SEER2* = 13.4 *EER2* = 10.6 $P_{W,OFF} \le 30$ W after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023
Single-package heat pumps	<65,000 Btu/h *single phase*	*SEER* = 14.0 *HSPF* = 8.0 $P_{W,OFF} \le 33$ W before 1/1/2023 *SEER2* = 13.4 *HSPF2* = 6.7 $P_{W,OFF} \le 33$ W after 1/1/2023	*SEER* = 14.0 *HSPF* = 8.0 $P_{W,OFF} \le 33$ W before 1/1/2023 *SEER2* = 13.4 *HSPF2* = 6.7 $P_{W,OFF} \le 33$ W after 1/1/2023	*SEER* = 14.0 *HSPF* = 8.0 $P_{W,OFF} \le 33$ W before 1/1/2023 *SEER2* = 13.4 *HSPF2* = 6.7 $P_{W,OFF} \le 33$ W after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023
Small-duct high-velocity *systems*	<65,000 Btu/h *single phase*	*SEER* = 12.0 *HSPF* = 7.2 $P_{W,OFF} \le 30$ W before 1/1/2023 *SEER2* = 12.0 *HSPF2* = 6.1 $P_{W,OFF} \le 30$ W after 1/1/2023	*SEER* = 12.0 *HSPF* = 7.2 $P_{W,OFF} \le 30$ W before 1/1/2023 *SEER2* = 12.0 *HSPF2* = 6.1 $P_{W,OFF} \le 30$ W after 1/1/2023	*SEER* = 12.0 *HSPF* = 7.2 $P_{W,OFF} \le 30$ W before 1/1/2023 *SEER2* = 12.0 *HSPF2* = 6.1 $P_{W,OFF} \le 30$ W after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023
Space-constrained products—air conditioners [a]	<65,000 Btu/h *single phase*	*SEER* = 12.0 $P_{W,OFF} \le 30$ W before 1/1/2023 *SEER2* = 11.7 $P_{W,OFF} \le 30$ W after 1/1/2023	*SEER* = 12.0 $P_{W,OFF} \le 30$ W before 1/1/2023 *SEER2* = 11.7 $P_{W,OFF} \le 30$ W after 1/1/2023	*SEER* = 12.0 $P_{W,OFF} \le 30$ W before 1/1/2023 *SEER2* = 11.7 $P_{W,OFF} \le 30$ W after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023
Space-constrained	<65,000 Btu/h	*SEER* = 12.0	*SEER* = 12.0	*SEER* = 12.0	AHRI 210/240-2017

~~products—heat pumps~~ [a]	~~*single phase*~~	~~*HSPF* = 7.4~~ ~~$P_{W,OFF}$ ≤ 33 W~~ ~~before 1/1/2023~~ ~~*SEER2* = 11.9~~ ~~*HSPF2* = 6.3~~ ~~$P_{W,OFF}$ ≤ 33 W~~ ~~after 1/1/2023~~	~~*HSPF* = 7.4~~ ~~$P_{W,OFF}$ ≤ 33 W~~ ~~before 1/1/2023~~ ~~*SEER2* = 11.9~~ ~~*HSPF2* = 6.3~~ ~~$P_{W,OFF}$ ≤ 33 W~~ ~~after 1/1/2023~~	~~*HSPF* = 7.4~~ ~~$P_{W,OFF}$ ≤ 33 W~~ ~~before 1/1/2023~~ ~~*SEER2* = 11.9~~ ~~*HSPF2* = 6.3~~ ~~$P_{W,OFF}$ ≤ 33 W~~ ~~after 1/1/2023~~	~~before 1/1/2023~~ ~~AHRI 210/240-2023~~ ~~after 1/1/2023~~

a. ~~The Southeastern region for central air conditioners and heat pumps contains the following States: Alabama, Arkansas, Delaware, Florida, Georgia, Hawaii, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia, and the District of Columbia.~~

b. ~~The Southwestern region for central air conditioners contains the States of Arizona, California, Nevada, and New Mexico.~~

c. ~~*SEER* is *seasonal energy efficiency ratio*; *EER* is *energy efficiency ratio*; *HSPF* is *heating seasonal performance factor*; and Btu/h is British thermal units per hour. *SEER2* is *seasonal energy efficiency ratio* reflecting the new higher static that is effective 1/1/2023; *EER2* is *energy efficiency ratio* also reflecting the higher static; and *HSPF2* is new *heating seasonal performance factor* reflecting the new higher static and load line. Test and rating procedure defined in AHRI 210/240-2017 for *EER*, *SEER*, and *HSPF* and AHRI 210/ 240-2023 for *EER2*, *SEER2*, and *HSPF2*. The added "2" in the metric names reflects the new higher static (all metrics) and load line (*HSPF2* only) for the new metrics effective 1/1/2023.~~

d. ~~The 11.7 *EER2* standard applies to products with a certified *SEER2* less than 15.2. The 9.8 *EER2* standard applies to products with a certified *SEER2* greater than or equal to 15.2.~~

e. ~~The 11.2 *EER2* standard applies to products with a certified *SEER2* less than 15.2. The 9.8 *EER2* standard applies to products with a certified *SEER2* greater than or equal to 15.2.~~

~~Section 13 contains a complete specification of the referenced test procedures, including the referenced year version of the test procedure.~~

Replace the deleted table I-P 6.8.1-1 6.8.1-2 and table F-1 with the following new revised I-P tables. Table F-1 is being eliminated and other addenda will move the other Appendix F tables to Sections 6 and 7.

Table 6.8.1-1 Electrically Operated Unitary Air Conditioners and Condensing Units – Minimum Efficiency requirements (I-P)

Equipment Type	Size Category	Heating Section Type	Subcategory	Minimum Efficiency[g]	Test Procedure[a]
Air-Cooled *Single-Phase* Split-*System* Products <65,000 Btu/h[b]					
Split-*system* air-cooled air conditioners	<45,000 Btu/h	All	For U.S applications National Standard	13.4 *SEER2* $P_{W,Off} \leq$ 30 W	AHRI 210/240-2024
			For U.S applications Southeastern Region[c]	14.3 *SEER2* $P_{W,Off} \leq$ 30 W	
			For U.S applications Southwestern Region[d]	11.7 *EER2*[e], 14.3 *SEER2*[e] $P_{W,Off} \leq$ 30 W *or* 9.8 *EER2*, 15.2 *SEER2*[e] $P_{W,Off} \leq$ 30 W	
			Outside U.S. Applications	13.4 *SEER2*	
	≥45,000 Btu/h and <65,000 Btu/h	All	For U.S applications National Standard	13.4 *SEER2* $P_{W,Off} \leq$ 30 W	
			For U.S applications Southeastern Region[c]	13.8 *SEER2* $P_{W,Off} \leq$ 30 W	
			For U.S applications Southwestern Region[d]	11.2 *EER2*[f], 13.8 *SEER2*[f] $P_{W,Off} \leq$ 30 W *or* 9.8 *EER2*[f], *15.2 SEER2*[f] $P_{W,Off} \leq$ 30 W	
			Outside U.S. applications	13.4 *SEER2*	
Air-Cooled *Single-Phase* Single-Package Air Conditioners <65,000 Btu/h[b]					
Single-package air-cooled air conditioners[h]	<65,000 Btu/h[b]	All	For U.S applications National Standard	13.4 *SEER2*, $P_{W,Off} \leq$ 30 W	AHRI 210/240-2024
			For U.S applications Southeastern Region[c]		
			For U.S applications Southwestern Region[d]	10.6 *EER2*, 13.4 *SEER2*, $P_{W,Off} \leq$ 30 W	
			Outside U.S. applications	13.4 *SEER2*	
Air-Cooled *Single-Phase* Small-Duct High Velocity Systems[b]					
Small-Duct high velocity split-*system* air-cooled air conditioners	<65,000 Btu/h[b]	All	All U.S. applications	12.0 *SEER2*, $P_{W,Off} \leq$ 30 W	AHRI 210/240-2024
			Outside U.S. applications	12.0 *SEER2*	
Air-Cooled *Single-Phase* Space-Constrained Air Conditioners[b]					
Space-Constrained air-cooled air conditioners	<30,000 Btu/h[b]	All	All U.S. applications	11.7 *SEER2*, $P_{W,Off} \leq$ 30 W	AHRI 210/240-2024
			Outside U.S. applications	11.7 *SEER2*	
Air-Cooled Three-Phase Small-Duct High Velocity Systems					
Small-Duct high velocity air-cooled air conditioners	<65,000 Btu/h[b]	All	All U.S. and outside U.S. applications	13.0 *SEER2*	AHRI 210/240-2024
Air-Cooled Three-Phase Space Constrained Air Conditioners					
Split-*System* Space-Constrained air-cooled air conditioners	<30,000 Btu/h[b]	All	All U.S. and outside U.S. applications	12.7 *SEER2*	AHRI 210/240-2024
Single-Package Space-Constrained air- cooled air conditioners	<30,000 Btu/h[b]	All	All U.S. and outside U.S. applications	13.9 *SEER2*	AHRI 210/240-2024
Air-Cooled Three-Phase Double Duct Air Conditioners					

Double Duct air-cooled Air conditioners [h]	<65,000 Btu/h	All	All U.S. and outside U.S. applications	13.4 *SEER2* [h]	AHRI 210/240-2024
	≥65,000 Btu/h and <135,000 Btu/h	*Electric resistance* (or none)	All U.S. and outside U.S. applications	11.2 *EER* before 1/1/2029 10.0 *EER2* [h], 13.6 *IVEC* [h], on or after 1/1/2029	AHRI 340/360 before 1/1/2029 AHRI 1340 on or after 1/1/2029
		All other		11.0 *EER* before 1/1/2029 9.8 *EER2* [h], 13.1 *IVEC* [h] on or after 1/1/2029	
	≥135,000 Btu/h and <240,000 Btu/h	*Electric resistance* (or none)	All U.S. and outside U.S. applications	11.0 *EER* [h] before 1/1/2029 9.7 *EER2* [h], 13.0 *IVEC* [h] on or after 1/1/2029	
		All other		10.8 *EER* before 1/1/2029 9.5 *EER2* [h], 12.5 *IVEC* [h] on or after 1/1/2029	
	≥240,000 Btu/h and < 300,000 Btu/h	*Electric resistance* (or none)	All U.S. and outside U.S. applications	10.0 *EER* before 1/1/2029 8.5 *EER2* [h], 12.3 *IVEC* [h] on or after 1/1/2029	
		All other		9.8 *EER* before 1/1/2029 8.3 *EER2* [h] 11.8 *IVEC* [h] on or after 1/1/2029	
Air-Cooled Unitary Three-Phase Air Conditioners					
Split-*system* air-cooled air conditioners	<65,000 Btu/h[b]	All	All U.S. and outside U.S. applications	13.4 *SEER2*	AHRI 210/240-2024
Single-package Air-cooled conditioners	<65,000 Btu/h[b]	All	All U.S. and outside U.S. applications	13.4 *SEER2*	
Split-*Systems* and Single-Package air-cooled Air conditioners	≥65,000 Btu/h and <135,000 Btu/h	*Electric resistance* (or none)	All U.S. and outside U.S. applications	11.2 *EER*, 14.8, *IEER* before 1/1/2029 10.6 *EER2*, 14.3 *IVEC* on or after 1/1/2029	AHRI 340/360 before 1/1/2029 AHRI 1340 on or after 1/1/2029
		All other		11.0 *EER*, 14.6 *IEER* before 1/1/2029 10.4 *EER2*, 13.8 *IVEC* on or after 1/1/2029	
	≥135,000 Btu/h and <240,000 Btu/h	*Electric resistance* (or none)	All U.S. and outside U.S. applications	11.0 *EER*, 14.2 *IEER* before 1/1/2029 10.2 *EER2*, 13.8 *IVEC* on or after 1/1/2029	
		All other		10.8 *EER*, 14.0 *IEER* before 1/1/2029 10.0 *EER2*, 13.3 *IVEC* on or after 1/1/2029	
	≥240,000 Btu/h and <760,000 Btu/h	*Electric resistance* (or none)	All U.S. and outside U.S. applications	10.0 *EER*, 13.2 *IEER* before 1/1/2029 9.2 *EER2*, 12.9 *IVEC* on or after 1/1/2029	
		All other		9.8 *EER*, 13.0 *IEER* before 1/1/2029 9.0 *EER2*, 12.2 *IVEC* on or after 1/1/2029	
	≥760,000 Btu/h	*Electric resistance* (or none)	All U.S. and outside U.S. applications	9.7 *EER*, 12.5 *IEER* before 1/1/2029 8.9 *EER2*, 11.7 *IVEC* on or after 1/1/2029	

		All other		9.5 *EER*, 12.3 *IEER* before 1/1/2029 8.7 *EER2*, 11.0 *IVEC* on or after 1/1/2029	
Air-Cooled *Condensing Unit* ≥135,000 Btu/h					
Condensing units air-Cooled	≥135,000 Btu/h and <240,000 Btu/h	All	All U.S. and outside U.S. applications	10.5 *EER*, 11.8 *IEER* before 1/1/2029 10.2 *EER2*, 13.8 *IVEC* on or after 1/1/2029	AHRI 365 before 1/1/2029 AHRI 1365 on or after 1/1/2029
	≥240,000 Btu/h and <760,000 Btu/h	All	All U.S. and outside U.S. applications	10.5 *EER*, 11.8 *IEER* before 1/1/2029 10.0 *EER2*, 13.3 *IVEC* on or after 1/1/2029	
	≥760,000 Btu/h	All	All U.S. and outside U.S. applications	10.5 *EER*, 11.8 *IEER* before 1/1/2029 8.7 *EER2*, 11.0 *IVEC* on or after 1/1/2029	
Water-Cooled *Single-Phase* and Three-Phase Air Conditioners					
Split-*System* and Single-Package Air conditioners water-cooled	<65,000 Btu/h	*Electric resistance* (or none)	All U.S. and outside U.S. applications	12.1 *EER*, 12.3 *IEER* before 1/1/2029 11.5 *EER2*, 13.7 *IVEC* on or after 1/1/2029	AHRI 340/360 before 1/1/2029 AHRI 1340 on or after 1/1/2029
		All other		12.1 *EER*, 12.3 *IEER* before 1/1/2029 11.3 *EER2*, 13.2 *IVEC* on or after 1/1/2029	
	≥65,000 Btu/h and <135,000 Btu/h	*Electric resistance* (or none)	All U.S. and outside U.S. applications	12.1 *EER*, 13.9 *IEER* before 1/1/2029 11.3 *EER2*, 13.0 *IVEC* on or after 1/1/2029	
		All other		11.9 *EER*, 13.7 *IEER* before 1/1/2029 11.1 *EER2*, 12.5 *IVEC* on or after 1/1/2029	
	≥135,000 Btu/h and <240,000 Btu/h	*Electric resistance* (or none)	All U.S. and outside U.S. applications	12.5 *EER*, 13.9 *IEER* before 1/1/2029 10.3 *EER2*, 12.4 *IVEC* on or after 1/1/2029	
		All other		12.3 *EER*, 13.7 *IEER* before 1/1/2029 10.1 *EER2*, 11.9 *IVEC* on or after 1/1/2029	
	≥240,000 Btu/h and <760,000 Btu/h	*Electric resistance* (or none)	All U.S. and outside U.S. applications	12.4 *EER*, 13.6 *IEER* before 1/1/2029 10.1 *EER2*, 11.3 *IVEC* on or after 1/1/2029	
		All other		12.2 *EER*, 13.4 *IEER* before 1/1/2029 9.9 *EER2*, 10.6 *IVEC* on or after 1/1/2029	
	>760,000 Btu/h	*Electric resistance* (or none)	All U.S. and outside U.S. applications	12.2 *EER*, 13.5 *IEER* before 1/1/2029 9.9 *EER2*, 11.3 *IVEC* on or after 1/1/2029	
		All other		12.0 *EER*, 13.3 *IEER* before 1/1/2029 9.7 *EER2*, 10.5 *IVEC* on or after 1/1/2029	
Water-Cooled *Condensing Unit* ≥135,000 Btu/h					

Condensing units water Cooled	≥135,000 Btu/h and <240,000 Btu/h	All	All U.S. and outside U.S. applications	13.5 *EER*, 14.0 *IEER* before 1/1/2029 10.3 *EER2*, 12.4 *IVEC* on or after 1/1/2029	AHRI 365 before 1/1/2029 AHRI 1365 on or after 1/1/2029
	≥240,000 Btu/h and <760,000 Btu/h	All	All U.S. and outside U.S. applications	13.5 *EER*, 14.0 *IEER* before 1/1/2029 10.1 *EER2*, 11.3 *IVEC* on or after 1/1/2029	
	≥760,000 Btu/h	All	All U.S. and outside U.S. applications	13.5 *EER*, 14.0 *IEER* before 1/1/2029 9.9 *EER2*, 11.3 *IVEC* on or after 1/1/2029	
Evaporatively-Cooled Unitary *Single-Phase* and Three-Phase Air Conditioners					
Split-*System* and Single-Package Air conditioners Evaporatively-cooled	<65,000 Btu/h[b]	*Electric resistance* (or none)	All U.S. and outside U.S. applications	12.1 *EER*, 12.3 *IEER* before 1/1/2029 11.5 *EER2*, 13.7 *IVEC* on or after 1/1/2029	AHRI 340/360 before 1/1/2029 AHRI 1340 on or after 1/1/2029
		All other		12.1 *EER*, 12.3 *IEER* before 1/1/2029 11.3 *EER2*, 13.2 *IVEC* on or after 1/1/2029	
	≥65,000 Btu/h and <135,000 Btu/h	*Electric resistance* (or none)	All U.S. and outside U.S. applications	12.1 *EER*, 12.3 *IEER* before 1/1/2029 11.3 *EER2*, 13.0 *IVEC* on or after 1/1/2029	
		All other		11.9 *EER*, 12.1 *IEER* before 1/1/2029 11.1 *EER2*, 12.5 *IVEC* on or after 1/1/2029	
	≥135,000 Btu/h and <240,000 Btu/h	*Electric resistance* (or none)	All U.S. and outside U.S. applications	12.0 *EER*, 12.2 *IEER* before 1/1/2029 10.3 *EER2*, 12.4 *IVEC* on or after 1/1/2029	
		All other		11.8 *EER*, 12.0 *IEER* before 1/1/2029 10.1 *EER2*, 11.9 *IVEC* on or after 1/1/2029	
	≥240,000 Btu/h and <760,000 Btu/h	*Electric resistance* (or none)	All U.S. and outside U.S. applications	11.9 *EER*, 12.1 *IEER* before 1/1/2029 10.1 *EER2*, 11.3 *IVEC* on or after 1/1/2029	
		All other		11.7 *EER*, 11.9 *IEER* before 1/1/2029 9.9 *EER2*, 10.6 *IVEC* on or after 1/1/2029	
	>760,000 Btu/h	*Electric resistance* (or none)	All U.S. and outside U.S. applications	11.7 *EER*, *11.9 IEER* before 1/1/2029 9.9 *EER2*, 11.3 *IVEC* on or after 1/1/2029	
		All other		11.5 *EER*, 11.7 *IEER* before 1/1/2029 9.7 *EER2*, 10.5 *IVEC* on or after 1/1/2029	
Evaporatively-Cooled *Condensing Unit*≥135,000 Btu/h					
Condensing units Evaporatively-Cooled	≥135,000 Btu/h and <240,000 Btu/h	All	All U.S. and outside U.S. applications	13.5 *EER*, 14.0 *IEER* before 1/1/2029 10.3 *EER2*, 12.4 *IVEC* on or after 1/1/2029	AHRI 365 before 1/1/2029 AHRI 1365 on or after 1/1/2029

≥240,000 Btu/h and <760,000 Btu/h	All	All U.S. and outside U.S. applications	13.5 *EER,* 14.0 *IEER* before 1/1/2029 10.1 *EER2,* 11.3 *IVEC* on or after 1/1/2029
≥760,000 Btu/h	All	All U.S. and outside U.S. applications	13.5 *EER,* 14.0 *IEER* before 1/1/2029 9.9 *EER2,* 11.3 *IVEC* on or after 1/1/2029

a. Section 13 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
b. *Single-phase*, U.S. air-cooled air conditioners <65,000 Btu/h are regulated as consumer products by the U.S. Code of Federal Regulations 10 CFR 430. *SEER2* values for *single-phase* products are set by the U.S. Department of Energy.
c. The Southeastern region for central air conditioners contains the following States: Alabama, Arkansas, Delaware, Florida, Georgia, Hawaii, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia, and the District of Columbia.
d. The Southwestern region for central air conditioners contains the States of Arizona, California, Nevada, and New Mexico.
e. The 11.7 *EER2* standard applies to products with a certified SEER2 less than 15.2. The 9.8 *EER2* standard applies to products with a certified SEER2 greater than or equal to 15.2.
f. The 11.2 *EER2* standard applies to products with a certified *SEER2* less than 15.2. The 9.8 *EER2* standard applies to products with a certified SEER2 greater than or equal to 15.2.
g. For definition of efficiency metrics see the reference standards. The metrics have the following units: Btu/W·h – *EER, EER2, SEER2, IEER, IVEC, IVHE, IVHE$_C$, HSPF2.*
h. All double duct units with capacities ≥65,000 Btu/h should be rated per AHRI 1340 which requires an additional 0.5 in of water external static pressure for the condenser, and double duct units with capacities <65,000 Btu/h should be rated per AHRI 210/240 with 0.0 in of water external static pressure for the condenser and shall comply with packaged air conditioner requirements.

Table 6.8.1-2 Electrically Operated Air Source Unitary Heat Pumps – Minimum Efficiency requirements (I-P)

Equipment Type	Size Category	Heating Section Type	Subcategory	Minimum Efficiency [d]	Test Procedure[a]
HP Air-Source *Single-Phase* Split-*System* Products <65,000 Btu/h[b]					
Split-*system* air-source HP air conditioners	<65,000 Btu/h	All	For U.S applications National Standard	14.3 *SEER2*, 7.5 *HSPF2* $P_{W.Off} \leq$ 33 W	AHRI 210/240-2024
			Outside U.S. applications	14.3 *SEER2*, 7.5 *HSPF2*	
HP Air-Source *Single-Phase* Single-Package Air Conditioners <65,000 Btu/h[b]					
Single-package air-source HP air conditioners [f]	<65,000 Btu/h [b]	All	For U.S applications National Standard	13.4 *SEER2*, 6.7 *HSPF2* $P_{W.Off} \leq$ 33 W	AHRI 210/240-2024
			Outside U.S. applications	13.4 *SEER2*, 6.7 *HSPF2*	
HP Air Source *Single-Phase* Small-Duct High Velocity Systems[b]					
Small-Duct high velocity air-source HP air conditioners	<65,000 Btu/h [b]	All	All U.S. applications	12.0 *SEER2*, 6.1 *HSPF2* $P_{W.Off} \leq$ 30 W	AHRI 210/240-2024
			Outside U.S. applications	12.0 *SEER2*, 6.1 *HSPF2*	
HP Air-Source *Single-Phase* Space Constrained Air Conditioners[b]					
Space-Constrained air-source HP air conditioners	<30,000 Btu/h [b]	All	All U.S. applications	11.9 *SEER2*, 6.3 *HSPF2* $P_{W.Off} \leq$ 33 W	AHRI 210/240-2024
			Outside U.S. applications	11.9 *SEER2*, 6.3 *HSPF2*	
HP Air-Source Three-Phase Small-Duct High Velocity Systems[b]					
Small-Duct high velocity air-source HP air conditioners	<65,000 Btu/h [b]	All	All U.S. and outside U.S. applications	14.0 *SEER2*, 6.9 *HSPF2*	AHRI 210/240-2024
HP Air-Source Three-Phase Space Constrained Air Conditioners					
Split-*System* Space Constrained air-source HP air conditioners	<30,000 Btu/h [b]	All	All U.S. and outside U.S. applications	13.9 *SEER2*, 7.0 *HSPF2*	AHRI 210/240-2024
Single-Package Space Constrained air-source HP air conditioners	<30,000 Btu/h [b]	All	All U.S. and outside U.S. applications	13.9 *SEER2*, 7.0 *HSPF2*	AHRI 210/240-2024
HP Air-Source Three-Phase Air Cooled Double Duct Air Conditioners					
Double Duct air-source HP air conditioners [e]	<65,000 Btu/h	All	All U.S. and outside U.S. applications	14.3 *SEER2*, 7.5 *HSPF2*	AHRI 210/240-2024
	≥65,000 Btu/h and <135,000 Btu/h	*Electric resistance* (or none)	All U.S. and outside U.S. applications	11.0 *EER*, 3.3 COP_{H47}, before 1/1/2029 9.9 *EER2*, 14.0 *IVEC* 2.06 $COP2_{H17}$, 1.65 $COP2_{H5}$ [c] 5.98 *IVHE*, 5.70 $IVHE_C$ [c] on or after 1/1/2029	AHRI 340/360 before 1/1/2029 AHRI 1340 on or after 1/1/2029
		All other including dual fuel heat pumps [f]	All U.S. and outside U.S. applications	10.8 *EER*, 3.30 COP_{H47} before 1/1/2029 9.7 *EER2*, 14.0 *IVEC* 2.06 $COP2_{H17}$, 1.65 $COP2_{H5}$ [c] 5.98 *IVHE*, 5.70 $IVHE_C$ [c] on or after 1/1/2029	
	≥135,000 Btu/h and <240,000 Btu/h	*Electric resistance* (or none)	All U.S. and outside U.S. applications	10.6 *EER* 3.30 COP_{H47}, before 1/1/2029 9.3 *EER2*, 13.5 *IVEC* 1.89 $COP2_{H17}$, 1.45 $COP2_{H5}$ [c] 5.72 *IVHE*, 5.44 $IVHE_C$ [c] on or after 1/1/2029	

		All other including dual fuel heat pumps [f]		10.4 *EER* 3.30 COP_{H47} before 1/1/2029 9.1 *EER2*, 13.5 *IVEC* 1.89 $COP2_{H17}$, 1.45 $COP2_{H5}$ [e] 5.72 *IVHE*, 5.44 $IVHE_C$ [e] on or after 1/1/2029	
	≥240,000 Btu/h and < 300,000 Btu/h	*Electric resistance* (or none)	All U.S. and outside U.S. applications	9.5 *EER* 3.20 COP_{H47} before 1/1/2029 8.0 *EER2*, 12.8 *IVEC* 1.88 $COP2_{H17}$, 1.47 $COP2_{H5}$ [e] 5.47 *IVHE*, 5.19 $IVHE_C$ [e] on or after 1/1/2029	
		All other including dual fuel heat pumps [f]		9.3 *EER* 3.20 COP_{H47} before 1/1/2029 7.8 *EER2*, 12.8 *IVEC* 1.88 $COP2_{H17}$, 1.47 $COP2_{H5}$ [e] 5.47 *IVHE*, 5.19 $IVHE_C$ [e] on or after 1/1/2029	
HP Air-Source Unitary Three-Phase Air Cooled Air Conditioners					
Split-*system* air-source HP air conditioners	<65,000 Btu/h [b]	All	All U.S. and outside U.S. applications	14.3 *SEER2*, 7.50 *HSPF2*	AHRI 210/240-2024
Single-package air-source HP air conditioners	<65,000 Btu/h [b]	All	All U.S. and outside U.S. applications	13.4 *SEER2*, 6.70 *HSPF2*	
Split-*Systems* and Single-Package air-source HP air conditioners	≥65,000 Btu/h and <135,000 Btu/h	*Electric resistance* (or none)	All U.S. and outside U.S. applications	11.0 *EER*, 14.1, *IEER*, 3.40 COP_{H47}, 2.25 COP_{H17} before 1/1/2029 10.4 *EER2* 13.4 *IVEC*, 2.20 $COP2_{H17}$, 1.76 $COP2_{H5}$ [e] 6.20 *IVHE*, 5.92 $IVHE_C$ [e] on or after 1/1/2029	AHRI 340/360 before 1/1/2029 AHRI 1340 on or after 1/1/2029
		All other including dual fuel heat pumps [f]		10.8 *EER*, 13.9 *IEER* 3.40 COP_{H47}, 2.25 COP_{H17} before 1/1/2029 10.2 *EER2* 13.4 *IVEC*, 2.20 $COP2_{H17}$, 1.76 $COP2_{H5}$ [e] 6.20 *IVHE*, 5.92 $IVHE_C$ [e] on or after 1/1/2029	
	≥135,000 Btu/h and <240,000 Btu/h	*Electric resistance* (or none)	All U.S. and outside U.S. applications	10.6 *EER*, 13.5 *IEER* 3.30 COP_{H47}, 2.05 COP_{H17} before 1/1/2029 9.9 *EER2*, 13.1 *IVEC*, 1.99 $COP2_{H17}$, 1.52 $COP2_{H5}$ [e] 6.00 *IVHE*, 5.71 $IVHE_C$ [e] on or after 1/1/2029	
		All other including dual fuel heat pumps [f]		9.7 *EER*, 13.3 *IEER* 3.30 COP_{H47}, 2.05 COP_{H17} before 1/1/2029 10.0 *EER2*, 13.1 *IVEC*, 1.99 $COP2_{H17}$, 1.52 $COP2_{H5}$ [e] 6.00 *IVHE*, 5.71 $IVHE_C$ [e] on or after 1/1/2029	
	≥240,000 Btu/h and <760,000 Btu/h	*Electric resistance* (or none)	All U.S. and outside U.S. applications	9.5 *EER*, 12.5 *IEER* 3.20 COP_{H47}, 2.05 COP_{H17} before 1/1/2029 8.8 *EER2* 12.1 *IVEC* 1.98 $COP2_{H17}$, 1.55 $COP2_{H5}$ [e] 5.80 *IVHE*, 5.71 $IVHE_C$ [e] on or after 1/1/2029	

		All other including dual fuel heat pumps [f]		9.3 *EER*, 12.3 *IEER* 3.20 $COP_{H47,}$ 2.05 COP_{H17} before 1/1/2029 8.6 *EER2* 12.1 *IVEC* 1.98 $COP_{H17,}$ 1.55 $COP2_{H5}$ [e] 5.80 *IVHE*, 5.71 $IVHE_C$ [e] on or after 1/1/2029	
	≥760,000 Btu/h	*Electric resistance* (or none)	All U.S. and outside U.S. applications	9.5 *EER*, 10.6 *IEER* 3.20 $COP_{H47,}$ 2.05 COP_{H17} before 1/1/2029 8.8 *EER2* 11.7 *IVEC* 1.98 $COP_{H17,}$ 1.55 $COP2_{H5}$ [e] 5.80 *IVHE*, 5.52 $IVHE_C$ [e] on or after 1/1/2029	
		All other including dual fuel heat pumps [f]		9.3 *EER*, 10.4 *IEER* 3.20 $COP_{H47,}$ 2.05 COP_{H17} before 1/1/2029 8.6 *EER2* 11.7 *IVEC* 1.98 $COP_{H17,}$ 1.55 $COP2_{H5}$ [e] 5.80 *IVHE*, 5.52 $IVHE_C$ [e] on or after 1/1/2029	
HP Air-Source Air-Cooled *Condensing Unit* ≥135,000 Btu/h					
HP *Condensing units* air-source	≥135,000 Btu/h and <240,000 Btu/h	All	All U.S. and outside U.S. applications	No requirements before 1/1/2029 9.9 *EER2*, 13.8 *IVEC* 1.99 $COP2_{H17,}$ 1.52 $COP2_{H5}$ [e] 6.00 *IVHE*, 5.71 $IVHE_C$ [e] on or after 1/1/2029	AHRI 365 before 1/1/2029 AHRI 1365 on or after 1/1/2029
	≥240,000 Btu/h and <760,000 Btu/h	All	All U.S. and outside U.S. applications	No requirements before 1/1/2029 8.8 *EER2* 12.9 *IVEC* 1.98 $COP2_{H17,}$ 1.55 $COP2_{H5}$ [e] 5.80 *IVHE*, 5.71 $IVHE_C$ [e] on or after 1/1/2029	
	≥760,000 Btu/h	All	All U.S. and outside U.S. applications	No requirements before 1/1/2029 8.8 *EER2* 11.7 *IVEC* 1.98 $COP_{H17,}$ 1.55 $COP2_{H5}$ [e] 5.80 *IVHE*, 5.52 $IVHE_C$ [e] on or after 1/1/2029	

a. Section 13 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

b. *Single-phase*, U.S. air-cooled air conditioners <65,000 Btu/h are regulated as consumer products by the U.S. Code of Federal Regulations 10 CFR 430. *SEER2* values for *single-phase* products are set by the U.S. Department of Energy.

c For heating efficiency requirement compliance with $COP2_{H17}$ and *IVHE* is required for ASHRAE 169 climate zone 0A, 0B, 1A, 1B, 2A, 2B, 3A, 3B, 3C, 4A, 4B, 4C and compliance with $COP2_{H17}$ and $IVHE_C$ is required for climate zones 5A, 5B, 5C, 6A, 6B, 7, and 8, but for all US DOE requires compliance with IVHE for ≥65,000 Btu/h to <760,000 Btu/h products which includes climate zones 1A, 1B, 2A, 2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, and 8.

d For definition of efficiency metrics see the reference standards. The metrics have the following units:
Btu/W·h – *EER, EER2, SEER2, IEER, IVEC, IVHE,* $IVHE_C$, *HSPF2*
W/W – $COP2_{H17}$, $COP2_{H5}$. Note the number in $COP2_H$ is the I-P rating ambient.

e All double duct units with capacities ≥65,000 Btu/h should be rated per AHRI 1340 which requires an additional 0.5 in of water external static pressure for the condenser, and double duct units with capacities <65,000 Btu/h should be rated per AHRI 210/240 with 0.0 in of water external static pressure for the condenser and shall comply with packaged air conditioner requirements.

f Dual fuel heat pumps with gas heat shall comply with the *IVHE* but instead of using electric auxiliary heat as defined in equation 29, 31, 32, and 38 of AHRI 1340 for the *IVHE* and $IVHE_C$ calculations shall replace the calculated electric auxiliary heat required with the output gas heat (input divided by thermal efficiency) converted to *kW*.

Replace the deleted SI table 6.8.1-1 6.8.1-2 and table F-1 with the following new revised SI tables. Table F-1 is being eliminated and other addenda will move the other Appendix F tables to Sections 6 and 7.

Table 6.8.1-1 Electrically Operated Unitary Air Conditioners and Condensing Units – Minimum Efficiency requirements (SI)

Equipment Type	Size Category	Heating Section Type	Subcategory	Minimum Efficiency [g]	Test Procedure[a]
Air-Cooled *Single-Phase* Split-*System* Products <65,000 Btu/h[b]					
Split-*system* air-cooled air conditioners	<13 *kW*	All	For U.S applications National Standard	3.93 $SCOP2_C$ $P_{W,Off} \leq 30$ W	AHRI 210/240-2024
			For U.S applications Southeastern Region [c]	4.19 $SCOP2_C$ $P_{W,Off} \leq 30$ W	
			For U.S applications Southwestern Region [d]	3.43 $COP2_C$ [e], 4.19 $SCOP2_C$ [e] $P_{W,Off} \leq 30$ W *or* 2.87 $COP2_C$, 4.45 $SCOP2_C$ [e] $P_{W,Off} \leq 30$ W	
			Outside U.S. Applications	3.93 $SCOP2_C$	
	≥13 *kW* and <19 *kW*	All	For U.S applications National Standard [c]	3.93 $SCOP2_C$ $P_{W,Off} \leq 30$ W	
			For U.S applications Southeastern Region [d]	4.04 $SCOP2_C$ $P_{W,Off} \leq 30$ W	
			For U.S applications Southwestern Region	3.28 $COP2_C$ [f], 4.04 $SCOP2_C$ [f] $P_{W,Off} \leq 30$ W *or* 2.87 $COP2_C$ [f], 4.45 $SCOP2_C$ [f] $P_{W,Off} \leq 30$ W	
			Outside U.S. applications	3.93 $SCOP2_C$	
Air-Cooled *Single-Phase* Single-Package Air Conditioners <65,000 Btu/h[b]					
Single-package air-cooled air conditioners [h]	<19 *kW* [b]	All	For U.S applications National Standard	3.93 $SCOP2_C$ $P_{W,Off} \leq 30$ W	AHRI 210/240-2024
			For U.S applications Southeastern Region[c]		
			For U.S applications Southwestern Region	3.11 $COP2_C$, 3.93 $SCOP2_C$ $P_{W,Off} \leq 30$ W	
			Outside U.S. applications	3.93 $SCOP2_C$	
Air-Cooled *Single-Phase* Small-Duct High Velocity Systems[b]					
Small-Duct high velocity split system air-cooled air conditioners	<19 *kW* [b]	All	All U.S. applications	3.52 $SCOP2_C$, $P_{W,Off} \leq 30$ W	AHRI 210/240-2024
			Outside U.S. applications	3.52 $SCOP2_C$	
Air-Cooled *Single-Phase* Space-Constrained Air Conditioners[b]					
Space-Constrained air-cooled air conditioners	<9 *kW* [b]	All	All U.S. applications	3.43 $SCOP2_C$ $P_{W,Off} \leq 30$ W	AHRI 210/240-2024
			Outside U.S. applications	3.43 $SCOP2_C$	
Air-Cooled Three-Phase Small-Duct High Velocity Systems					
Small-Duct high velocity air-cooled air conditioners	<19 kW [b]	All	All U.S. and outside U.S. applications	3.81 $SCOP2_C$	AHRI 210/240-2024
Air-Cooled Three-Phase Space-Constrained Air Conditioners					
Split-*System* Space-Constrained air-cooled air conditioners	<9 *kW* [b]	All	All U.S. and outside U.S. applications	3.72 $SCOP2_C$	AHRI 210/240-2024
Single-Package Space-Constrained air- cooled air conditioners	<9 *kW* [b]	All	All U.S. and outside U.S. applications	4.07 $SCOP2_C$	AHRI 210/240-2024
Air-Cooled Three-Phase Double Duct Air Conditioners					

Double Duct air-cooled Air conditioners [h]	<19 *kW*	All	All U.S. and outside U.S. applications	3.93 $SCOP2_C$ [h]	AHRI 210/240-2024
	≥19 *kW* and <40 *kW*	*Electric resistance* (or none)	All U.S. and outside U.S. applications	3.28 COP_C before 1/1/2029 2.93 $COP2_C$ [h], 3.99 *IVEC* [h], on or after 1/1/2029	AHRI 340/360 before 1/1/2029 AHRI 1340 on or after 1/1/2029
		All other		3.22 COP_C before 1/1/2029 2.87 $COP2_C$ [h], 3.84 *IVEC* [h] on or after 1/1/2029	
	≥40 *kW* and <70 *kW*	*Electric resistance* (or none)	All U.S. and outside U.S. applications	3.22 COP_C [h] before 1/1/2029 2.84 $COP2_C$ [h], 3.81 *IVEC* [h] on or after 1/1/2029	
		All other		3.17 COP_C before 1/1/2029 2.78 $COP2_C$ [h], 3.66 *IVEC* [h] on or after 1/1/2029	
	≥70 *kW* and < 88 *kW*	*Electric resistance* (or none)	All U.S. and outside U.S. applications	2.93 COP_C before 1/1/2029 2.49 $COP2_C$ [h], 3.60 *IVEC* [h] on or after 1/1/2029	
		All other		2.87 COP_C before 1/1/2029 2.43 $COP2_C$ [h] 3.46 *IVEC* [h] on or after 1/1/2029	
Air-Cooled Unitary Three-Phase Air Conditioners					
Split-*system* air-cooled air conditioners	<19 *kW* [b]	All	All U.S. and outside U.S. applications	3.93 $SCOP2_C$	AHRI 210/240-2024
Single-package Air-cooled conditioners	<19 *KW* [b]	All	All U.S. and outside U.S. applications	3.93 $SCOP2_C$	
Split-*Systems* and Single-Package air-cooled Air conditioners	≥19 *kW* and <40 *kW*	*Electric resistance* (or none)	All U.S. and outside U.S. applications	3.28 COP_C, 4.34, $ICOP_C$ before 1/1/2029 3.11 $COP2_C$, 4.19 *IVEC* on or after 1/1/2029	AHRI 340/360 before 1/1/2029 AHRI 1340 on or after 1/1/2029
		All other		3.22 COP_C, 4.28 $ICOP_C$ before 1/1/2029 3.05 $COP2_C$, 4.04 *IVEC* on or after 1/1/2029	
	≥40 *KW* and <70 *KW*	*Electric resistance* (or none)	All U.S. and outside U.S. applications	3.22 COP_C, 4.16 $ICOP_C$ before 1/1/2029 2.99 $COP2_C$, 4.04 *IVEC* on or after 1/1/2029	
		All other		3.17 COP_C, 4.10 $ICOP_C$ before 1/1/2029 2.93 $COP2_C$, 3.90 *IVEC* on or after 1/1/2029	
	≥70 *kW* and <223 *kW*	*Electric resistance* (or none)	All U.S. and outside U.S. applications	2.93 COP_C, 3.87 $ICOP_C$ before 1/1/2029 2.70 $COP2_C$, 3.78 *IVEC* on or after 1/1/2029	
		All other		2.87 COP_C, 3.81 $ICOP_C$ before 1/1/2029 2.64 $COP2_C$, 3.58 *IVEC* on or after 1/1/2029	
	≥223 *kW*	*Electric resistance* (or none)	All U.S. and outside U.S. applications	2.84 COP_C, 3.66 $ICOP_C$ before 1/1/2029 2.61 $COP2_C$, 3.43 *IVEC* on or after 1/1/2029	

		All other		2.78 COP_C, 3.60 $ICOP_C$ before 1/1/2029 2.55 $COP2_C$, 3.22 *IVEC* on or after 1/1/2029	
Air-Cooled *Condensing Unit* ≥135,000 Btu/h					
Condensing units air-Cooled	≥40 *kW* and <70 *kW*	All	All U.S. and outside U.S. applications	3.08 COP_C, 3.46 $ICOP_C$ before 1/1/2029 2.99 $COP2_C$, 4.04 *IVEC* on or after 1/1/2029	AHRI 365 before 1/1/2029 AHRI 1365 on or after 1/1/2029
	≥70 *kW* and <223 *kW*	All	All U.S. and outside U.S. applications	3.08 COP_C, 3.46 $ICOP_C$ before 1/1/2029 2.93 $COP2_C$, 3.90 *IVEC* on or after 1/1/2029	
	≥223 *kW*	All	All U.S. and outside U.S. applications	3.08 COP_C, 3.46 $ICOP_C$ before 1/1/2029 2.55 $COP2_C$, 3.22 *IVEC* on or after 1/1/2029	
Water-Cooled *Single-Phase* and Three-Phase Air Conditioners					
Split-*System* and Single-Package Air conditioners water-cooled	<19 *kW*	*Electric resistance* (or none)	All U.S. and outside U.S. applications	3.55 COP_C, 3.60 $ICOP_C$ before 1/1/2029 3.37 $COP2_C$, 4.02 *IVEC* on or after 1/1/2029	AHRI 340/360 before 1/1/2029 AHRI 1340 on or after 1/1/2029
		All other		3.55 COP_C, 3.60 $ICOP_C$ before 1/1/2029 3.31 $COP2_C$, 3.87 *IVEC* on or after 1/1/2029	
	≥19 *kW* and <40 *kW*	*Electric resistance* (or none)	All U.S. and outside U.S. applications	3.55 COP_C, 4.07 $ICOP_C$ before 1/1/2029 3.31 $COP2_C$, 3.81 *IVEC* on or after 1/1/2029	
		All other		3.49 COP_C, 4.02 $ICOP_C$ before 1/1/2029 3.25 $COP2_C$, 3.66 *IVEC* on or after 1/1/2029	
	≥40 k*W* and <70 *kW*	*Electric resistance* (or none)	All U.S. and outside U.S. applications	3.66 COP_C, 4.07 $ICOP_C$ before 1/1/2029 3.02 $COP2_C$, 3.63 *IVEC* on or after 1/1/2029	
		All other		3.60 COP_C, 4.02 $ICOP_C$ before 1/1/2029 2.96 $COP2_C$, 3.49 *IVEC* on or after 1/1/2029	
	≥70 *kW* and <223 *kW*	*Electric resistance* (or none)	All U.S. and outside U.S. applications	3.63 COP_C, 3.99 $ICOP_C$ before 1/1/2029 2.96 $COP2_C$, 3.31 *IVEC* on or after 1/1/2029	
		All other		3.58 COP_C, 3.93 $ICOP_C$ before 1/1/2029 2.90 $COP2_C$, 3.11 *IVEC* on or after 1/1/2029	
	>223 *kW*	*Electric resistance* (or none)	All U.S. and outside U.S. applications	3.58 COP_C, 3.96 $ICOP_C$ before 1/1/2029 2.90 $COP2_C$, 3.31 *IVEC* on or after 1/1/2029	
		All other		3.52 COP_C, 3.90 $ICOP_C$ before 1/1/2029 2.84 $COP2_C$, 3.08 *IVEC* on or after 1/1/2029	
Water-Cooled *Condensing Unit*≥135,000 Btu/h					

	≥40 *kW* and <70 *kW*	All	All U.S. and outside U.S. applications	3.96 COP_C, 4.10 $ICOP_C$ before 1/1/2029 3.02 $COP2_C$, 3.63 *IVEC* on or after 1/1/2029	
Condensing units water Cooled	≥70 *kW* and <223 *kW*	All	All U.S. and outside U.S. applications	3.96 COP_C, 4.10 $ICOP_C$ before 1/1/2029 2.96 $COP2_C$, 3.31 *IVEC* on or after 1/1/2029	AHRI 365 before 1/1/2029 AHRI 1365 on or after 1/1/2029
	≥223 *kW*	All	All U.S. and outside U.S. applications	3.96 COP_C, 4.10 $ICOP_C$ before 1/1/2029 2.90 $COP2_C$, 3.31 *IVEC* on or after 1/1/2029	
Evaporatively-Cooled Unitary Three Phase Air Conditioners					
Split-*System* and Single-Package Air conditioners Evaporatively-cooled	<19 *kW*[b]	*Electric resistance* (or none)	All U.S. and outside U.S. applications	3.55 COP_C, 3.60 $ICOP_C$ before 1/1/2029 3.37 $COP2_C$, 4.02 *IVEC* on or after 1/1/2029	AHRI 340/360 before 1/1/2029 AHRI 1340 on or after 1/1/2029
		All other		3.55 COP_C, 3.60 $ICOP_C$ before 1/1/2029 3.31 $COP2_C$, 3.87 *IVEC* on or after 1/1/2029	
	≥19 *kW* and <40 *kW*	*Electric resistance* (or none)	All U.S. and outside U.S. applications	3.55 COP_C, 3.60 $ICOP_C$ before 1/1/2029 3.31 $COP2_C$, 3.81 *IVEC* on or after 1/1/2029	
		All other		3.49 COP_C, 3.55 $ICOP_C$ before 1/1/2029 3.25 $COP2_C$, 3.66 *IVEC* on or after 1/1/2029	
	≥40 *kW* and <70 *kW*	*Electric resistance* (or none)	All U.S. and outside U.S. applications	3.52 COP_C, 3.58 $ICOP_C$ before 1/1/2029 3.02 *COP2C*, 3.63 *IVEC* on or after 1/1/2029	
		All other		3.46 *COPC*, 3.52 $ICOP_C$ before 1/1/2029 2.96 $COP2_C$, 3.49 *IVEC* on or after 1/1/2029	
	≥70 *kW* and <223 *kW*	*Electric resistance* (or none)	All U.S. and outside U.S. applications	3.49 COP_C, 3.55 $ICOP_C$ before 1/1/2029 2.96 $COP2_C$, 3.31 *IVEC* on or after 1/1/2029	
		All other		3.43 COP_C, 3.49 $ICOP_C$ before 1/1/2029 2.90 $COP2_C$, 3.11 *IVEC* on or after 1/1/2029	
	>223 *kW*	*Electric resistance* (or none)	All U.S. and outside U.S. applications	3.43 COP_C, 3.49 $ICOP_C$ before 1/1/2029 2.90 $COP2_C$, 3.31 *IVEC* on or after 1/1/2029	
		All other		3.37 COP_C, 3.43 $ICOP_C$ before 1/1/2029 2.84 $COP2_C$, 3.08 *IVEC* on or after 1/1/2029	
Evaporatively-Cooled *Condensing Uni t* ≥135,000 Btu/h					
Condensing units Evaporatively-Cooled	≥40 *kW* and <70 *kW*	All	All U.S. and outside U.S. applications	3.96 COP_C, 4.10 $ICOP_C$ before 1/1/2029 3.02 $COP2_C$, 3.63 *IVEC* on or after 1/1/2029	AHRI 365 before 1/1/2029 AHRI 1365 on or after 1/1/2029

≥70 *kW* and <223 *kW*	All	All U.S. and outside U.S. applications	3.96 COP_C, 4.10 $ICOP_C$ before 1/1/2029 2.96 $COP2_C$, 3.31 *IVEC* on or after 1/1/2029
≥223 *kW*	All	All U.S. and outside U.S. applications	3.96 COP_C, 4.10 $ICOP_C$ before 1/1/2029 2.90 $COP2_C$, 3.31 *IVEC* on or after 1/1/2029

a. Section 13 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
b. *Single-phase*, U.S. air-cooled air conditioners <19 *kW* are regulated as consumer products by the U.S. Code of Federal Regulations 10 CFR 430 $SCOP2_C$ values for *single-phase* products are set by the U.S. Department of Energy.
c. The Southeastern region for central air conditioners contains the following States: Alabama, Arkansas, Delaware, Florida, Georgia, Hawaii, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia, and the District of Columbia.
d. The Southwestern region for central air conditioners contains the States of Arizona, California, Nevada, and New Mexico.
e. The 3.43 $COP2_C$ standard applies to products with a certified S$COP2_C$ less than 4.45. The 2.87 $COP2_C$ standard applies to products with a certified $SCOP2_C$ greater than or equal to 4.45.
f. The 3.28 $COP2_C$ standard applies to products with a certified S$COP2_C$ less than 4.45. The 2.87 $COP2_C$ standard applies to products with a certified $SCOP2_C$ greater than or equal to 4.45.
g. For definition of efficiency metrics see the reference standards. The cooling metrics have the following units: W/W – COP_C, $COP2_C$, $SCOP2_C$, $ICOP_C$, *IVEC, IVHE,* $IVHE_C$.
h. All double duct units with capacities ≥19 *kW* should be rated per AHRI 1340 which requires an additional 0.12 kPa of water external static pressure for the condenser, and double duct units with capacities <19 *kW* should be rated per AHRI 210/240 with 0.0 kPa of water external static pressure for the condenser and shall comply with packaged air conditioner requirements.

Table 6.8.1-2 Electrically Operated Air Source Unitary Heat Pumps – Minimum Efficiency requirements (SI)

Equipment Type	Size Category	Heating Section Type	Subcategory	Minimum Efficiency [d]	Test Procedure[a]
HP Air-Source *Single-Phase Split System* Products <65,000 Btu/h[b]					
Split-*system* air-source HP air conditioners	<19 *kW*	All	For U.S applications National Standard	4.19 $SCOP2_C$, 2.20 $SCOP2_H$ $P_{W.Off} \leq$ 33 W	AHRI 210/240-2024
			Outside U.S. applications	4.19 $SCOP2_C$, 2.20 $SCOP2_H$	
HP Air-Source *Single-Phase* Single-Package Air Conditioners <65,000 Btu/h[b]					
Single-package air-source HP air conditioners	<19 *kW* [b]	All	For U.S applications National Standard	3.93 $SCOP2_C$, 1.96 $SCOP2_H$ $P_{W.Off} \leq$ 33 W	AHRI 210/240-2024
			Outside U.S. applications	3.93 $SCOP2_C$, 1.96 $SCOP2_H$	
HP Air Source *Single-Phase* Small-Duct High Velocity Systems [b]					
Small-Duct high velocity air-source HP air conditioners	<19 *kW* [b]	All	All U.S. applications	3.52 $SCOP2_C$, 1.79 $SCOP2_H$ $P_{W.Off} \leq$ 30 W	AHRI 210/240-2024
			Outside U.S. applications	3.52 $SCOP2_C$, 1.79 $SCOP2_H$	
HP Air-Source *Single-Phase* Space-Constrained Air Conditioners [b]					
Space-Constrained air-source HP air conditioners	<9 *kW* [b]	All	All U.S. applications	3.49 $SCOP2_C$, 1.85 $SCOP2_H$ $P_{W.Off} \leq$ 33 W	AHRI 210/240-2024
			Outside U.S. applications	11.9 $SCOP2_C$, 1.85 $SCOP2_H$	
HP Air-Source Three-Phase Small-Duct High Velocity Systems [b]					
Small-Duct high velocity air-source HP air conditioners	<19 *kW* [b]	All	All U.S. and outside U.S. applications	4.10 $SCOP2_C$, 2.02 $SCOP2_H$	AHRI 210/240-2024
HP Air-Source Three-Phase Space-Constrained Air Conditioners					
Split-*System* Space Constrained air-source HP air conditioners	<9 *kW* [b]	All	All U.S. and outside U.S. applications	4.07 $SCOP2_C$, 2.05 $SCOP2_H$	AHRI 210/240-2024
Single-Package Space Constrained air-source HP air conditioners	<9 *KW* [b]	All	All U.S. and outside U.S. applications	4.07 $SCOP2_C$, 2.05 $SCOP2_H$	AHRI 210/240-2024
HP Air-Source Three-Phase Air Cooled Double Duct Air Conditioners					
Double Duct air-source HP air conditioners [f]	<19 *kW*	All	All U.S. and outside U.S. applications	4.19 $SCOP2_C$, 2.20 $SCOP2_H$	AHRI 210/240-2024
	≥19 *kW* and <40 *kW*	*Electric resistance* (or none)	All U.S. and outside U.S. applications	3.22 COP_C, 3.3 COP_{H47}, before 1/1/2029 2.90 $COP2_C$, 4.10 *IVEC* 2.06 $COP2_{H17}$, 1.65 $COP2_{H5}$ [e] 5.98 *IVHE*, 5.70 $IVHE_C$ [e] on or after 1/1/2029	AHRI 340/360 before 1/1/2029 AHRI 1340 on or after 1/1/2029
		All other including dual fuel heat pumps [f]	All U.S. and outside U.S. applications	10.8 COP_C, 3.30 COP_{H47} before 1/1/2029 9.7 $COP2_C$, 14.0 *IVEC* 2.06 $COP2_{H17}$, 1.65 $COP2_{H5}$ [e] 1.75 *IVHE*, 1.67 *I* $IVHE_C$ [e] on or after 1/1/2029	
	≥40 *kW* and <70 *kW*	*Electric resistance* (or none)	All U.S. and outside U.S. applications	3.11 COP_C 3.30 COP_{H47}, before 1/1/2029 2.73 $COP2_C$, 3.96 *IVEC* 1.89 $COP2_{H17}$, 1.45 $COP2_{H5}$ [e] 1.68 *IVHE*, 1.59 $IVHE_C$ [e] on or after 1/1/2029	

		All other including dual fuel heat pumps [f]		10.4 COP_C 3.30 COP_{H47} before 1/1/2029 2.67 $COP2_C$, 13.5 *IVEC* 1.89 $COP2_{H17}$, 1.45 $COP2_{H5}$ [e] 1.68 *IVHE*, 5.44 $IVHE_C$ [e] on or after 1/1/2029	
	≥70 *kW* and < 88 *kW*	*Electric resistance* (or none)	All U.S. and outside U.S. applications	9.5 COP_C 3.20 COP_{H47} before 1/1/2029 8.0 $COP2_C$, 12.8 *IVEC* 1.88 $COP2_{H17}$, 1.47 $COP2_{H5}$ [e] 5.47 *IVHE*, 1.59 $IVHE_C$ [e] on or after 1/1/2029	
		All other including dual fuel heat pumps [f]		2.73 COP_C 3.20 COP_{H47} before 1/1/2029 2.29 $COP2_C$, 3.75 *IVEC* 1.88 $COP2_{H17}$, 1.47 $COP2_{H5}$ [e] 1.60 *IVHE*, 1.52 $IVHE_C$ [e] on or after 1/1/2029	
HP Air-Source Unitary Three-Phase Air Cooled Air Conditioners					
Split-*system* air-source HP air conditioners	<19 *kW* [b]	All	All U.S. and outside U.S. applications	4.19 $SCOP2_C$, 2.20 $SCOP2_H$	AHRI 210/240-2024
Single-package air air-source HP air conditioners	<19 *kW* [b]	All	All U.S. and outside U.S. applications	3.93 $SCOP2_C$, 1.96 $SCOP2_H$	
Split-*Systems* and Single-Package air-source HP air conditioners	≥19 *kW* and <40 *kW*	*Electric resistance* (or none)	All U.S. and outside U.S. applications	11.0 COP_C, 14.1, $ICOP_C$, 3.40 COP_{H47}, 2.25 COP_{H17} before 1/1/2029 3.05 $COP2_C$ 3.93 *IVEC*, 2.20 $COP2_{H17}$, 1.76 $COP2_{H5}$ [e] 1.82 *IVHE*, 1.74 $IVHE_C$ [e] on or after 1/1/2029	AHRI 340/360 before 1/1/2029 AHRI 1340 on or after 1/1/2029
		All other including dual fuel heat pumps [f]		3.17 COP_C, 4.07 $ICOP_C$ 3.40 COP_{H47}, 2.25 COP_{H17} before 1/1/2029 2.99 $COP2_C$, 3.93 *IVEC*, 2.20 $COP2_{H17}$, 1.76 $COP2_{H5}$ [e] 1.82 *IVHE*, 1.74 $IVHE_C$ [e] on or after 1/1/2029	
	≥40 *kW* and <70 *kW*	*Electric resistance* (or none)	All U.S. and outside U.S. applications	3.11 COP_C, 3.96 $ICOP_C$ 3.30 COP_{H47}, 2.05 COP_{H17} before 1/1/2029 2.90 $COP2_C$, 3.84 *IVEC*, 1.99 $COP2_{H17}$, 1.52 $COP2_{H5}$ [e] 1.76 *IVHE*, 1.67 $IVHE_C$ [e] on or after 1/1/2029	
		All other including dual fuel heat pumps [f]		2.84 COP_C, 3.90 $ICOP_C$ 3.30 COP_{H47} 2.05 COP_{H17} before 1/1/2029 2.93 $COP2_C$, 3.84 *IVEC*, 1.99 $COP2_{H17}$, 1.52 *C* $COP2_{H5}$ [e] 1.76 *IVHE*, 1.67 $IVHE_C$ [e] on or after 1/1/2029	
	≥70 *kW* and <223 *kW*	*Electric resistance* (or none)	All U.S. and outside U.S. applications	2.78 COP_C, 3.66 $ICOP_C$ 3.20 COP_{H47}, 2.05 COP_{H17} before 1/1/2029 2.58 $COP2_C$ 3.55 *IVEC* 1.98 $COP2_{H17}$, 1.55 $COP2_{H5}$ [e] 1.70 *IVHE*, 1.67 $IVHE_C$ [e] on or after 1/1/2029	

		All other including dual fuel heat pumps [f]		2.73 COP_C, 3.60 $ICOP_C$ 3.20 COP_{H47}, 2.05 COP_{H17} before 1/1/2029 2.52 $COP2_C$, 3.55 *IVEC* 1.98 COP_{H17}, 1.55 $COP2_{H5}$ [e] 1.70 *IVHE*, 1.67 $IVHE_C$ [e] on or after 1/1/2029	
	≥223 *kW*	*Electric resistance* (or none)	All U.S. and outside U.S. applications	2.78 COP_C, 3.11 $ICOP_C$ 3.20 COP_{H47}, 2.05 COP_{H17} before 1/1/2029 8.8 $COP2_C$, 11.7 *IVEC* 1.98 COP_{H17}, 1.55 $COP2_{H5}$ [e] 1.70 *IVHE*, 1.62 $IVHE_C$ [e] on or after 1/1/2029	
		All other including dual fuel heat pumps [f]		2.73 COP_C, 3.05 $ICOP_C$ 3.20 COP_{H47}, 2.05 COP_{H17} before 1/1/2029 2.52 $COP2_C$, 3.43 *IVEC* 1.98 COP_{H17}, 1.55 $COP2_{H5}$ [d] 1.70 *IVHE*, 1.62 $IVHE_C$ [d] on or after 1/1/2029	
HP Air-Source Air-Cooled *Condensing Unit*≥135,000 Btu/h					
HP *Condensing units* air-source	≥40 *kW* and <70 *kW*	All	All U.S. and outside U.S. applications	No requirements before 1/1/2029 2.90 $COP2_C$, 4.04 *IVEC* 1.99 $COP2_{H17}$, 1.52 $COP2_{H5}$ [e] 1.76 *IVHE*, 1.67 $IVHE_C$ [e] on or after 1/1/2029	AHRI 365 before 1/1/2029 AHRI 1365 on or after 1/1/2029
	≥70 *kW* and <223 *kW*	All	All U.S. and outside U.S. applications	No requirements before 1/1/2029 2.58 $COP2_C$, 12.9 *IVEC* 1.98 $COP2_{H17}$, 1.55 $COP2_{H5}$ [e] 1.70 *IVHE*, 1.67 $IVHE_C$ [e] on or after 1/1/2029	
	≥223 *kW*	All	All U.S. and outside U.S. applications	No requirements before 1/1/2029 2.58 $COP2_C$, 3.43 *IVEC* 1.98 COP_{H17}, 1.55 $COP2_{H5}$ [d] 1.70 *IVHE*, 1.62 $IVHE_C$ [e] on or after 1/1/2029	

a. Section 13 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

b. *Single-phase*, U.S. air-cooled air conditioners <19 *kW* are regulated as consumer products by the U.S. Code of Federal Regulations 10 CFR 430. $SCOP2_C$ values for *single-phase* products are set by the U.S. Department of Energy.

c. For heating efficiency requirement compliance with $COP2_{H17}$ and *IVHE* is required for ASHRAE 169 climate zone 0A, 0B, 1A, 1B, 2A, 2B, 3A, 3B, 3C, 4A, 4B, 4C and compliance with $COP2_{H17}$ and $IVHE_C$ is required for climate zones 5A, 5B, 5C, 6A, 6B, 7, and 8, but for all US DOE requires compliance with IVHE for ≥19 *kW* to <*223 kW* products which includes climate zones 1A, 1B, 2A, 2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, and 8.

d. For definition of efficiency metrics see the reference standards. The metrics have the following units:
Cooling Metrics W/W – COP_C, $COP2_C$, $SCOP2_C$, *ICOP*, *IVEC*
Heating Metrics W/W – *IVHE*, $IVHE_C$, $SCOP2_H$, $COP2_{H17}$, $COP2_{H5}$. Note the number in $COP2_H$ is the I-P rating ambient.

e All double duct units with capacities ≥19 *kW* should be rated per AHRI 1340 which requires an additional 0.12 kPa of water external static pressure for the condenser, and double duct units with capacities <19 *kW* should be rated per AHRI 210/240 with 0.0 kPa of water external static pressure for the condenser and shall comply with packaged air conditioner requirements.

f Dual fuel heat pumps with gas heat shall comply with the *IVHE* but instead of using electric auxiliary heat as defined in equation 29, 31, 32, and 38 of AHRI 1340 for the *IVHE* and $IVHE_C$ calculations shall replace the calculated electric axillary heat required with the output gas heat (input divided by thermal efficiency) converted to *kW*.