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

Advisory 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 (June 2024)
(Draft Shows Proposed Changes to Current Standard)

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FOREWORD

This draft addendum is being released as an advisory public review to seek feedback on new and revised ASHRAE 90.1 Section 6 minimum HVAC for efficiency metric changes and revised minimum efficiency requirements for commercial unitary products included in Tables 6.8.1-1 and 6.8.1-2. The following products are addressed:

1. Air-cooled commercial unitary packaged cooling and Heat Pump air conditioners and splits cooling and Heat Pump systems (CUAC and CUHP) with cooling capacities of greater than or equal to 65,000 Btu/h and less than to 760,000 Btu/h, which are regulated by DOE.
2. Air-cooled commercial unitary packaged cooling and Heat Pump air conditioners and splits system cooling and Heat Pump (CUAC and CUHP) with cooling capacities greater than 760,000 Btu/h products which are regulated by ASHRAE 90.1 but not regulated by DOE.
3. All sizes of evaporatively-cooled commercial package air conditioners (ECUAC), including DOE regulated products with capacities less than 760,000 Btu/h and ASHRAE 90.1 regulated products but not DOE regulated with cooling capacities greater than or equal to 760,000 Btu/h.
4. All sizes of water-cooled commercial package air conditioners (WCUAC), including DOE regulated products with cooling capacities less than 760,000 Btu/h and ASHRAE 90.1 regulated products but not DOE regulated with cooling capacities greater than or equal to 760,000 kBtu/h.
5. Commercial double-duct cooling and Heat Pump air conditioners with cooling capacities of 65,000 Btu/h and less than or equal to 300,000 Btu/h which are regulated by DOE

Additional changes may be made with other addenda to these table for the following products:

- Air-cooled single and three phase packaged cooling and Heat Pump air conditioners and splits systems cooling and Heat Pump products with cooling capacities less than 65,000 Btu/h. A new cooling efficiency metric called SCORE and a Heat Pump heating metric call SHORE have been developed and are documented in AHRI 1600, but DOE has not completed a cross walk and proposed minimum efficiency metric. Also included in this category are the small duct high velocity products, space constrained products and double duct products with a capacity less than 65,000 Btu/h,
- Air-cooled, water cooled, and evaporatively cooled cooling split system products with a cooling capacity greater than 135,000 Btu/h which are rated tested per AHI 365 and will change to AHRI 1365 to align with the new *IVEC* cooling metric. AHRI 1365 is currently being developed by AHRI and once completed a crosswalk will be done to establish new minimum efficiency metrics. Note that products with a cooling capacity less than or equal 135,000 Btu/h must be rated with an indoor fan coil unit where AHRI 365 and AHRI 1365 are for condensing unit only ratings.
- Air-cooled Heat Pump split system products with a cooling capacity greater than 135,000 Btu/h. Currently condensing unit Heat Pump products are not covered by AHRI 365 and ASHRAE 90.1 but the new AHRI 1365 standard will include requirements for air cooled Heat Pump condensing units products and will be added to ASHRAE 90.1 table 6.8.1-2.

The changes to air-cooled commercial unitary cooling and Heat Pump air conditions and split cooling and Heat Pump systems (CUAC and CUHP) with a cooling capacity greater than or equal to 65,000 Btu/h will align with recent DOE ASRAC negotiations where applicable. DOE, industry manufacturers, and advocates recently concluded and published an Appliance Standards Regulatory Advisory Committee (ASRAC) Working Group term sheet for Air-cooled CUACs and

CUHPs (see EERE-2022-BT-STD-0015-0065 for the test procedure term sheet). This work included a new test procedure, new annualized metric for cooling and heat Pump heating, and new minimum efficiencies for air-cooled (CUAC) and air source Heat Pumps (CUHP) with capacities from 65,000 to less than 760,000 Btu/h products.

The ASRAC negotiation developed a new metric for annualized cooling efficiency called *Integrated Ventilation, Economizer, and Cooling Metric* (*IVEC*) and a new annualized efficiency metric for Heat Pump heating 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. The Heat Pump heating metric includes a US minimum performance 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, and this addendum proposes minimum efficiencies. The cooling *IVEC* metric minimums and the US Heat Pump *IVHE* heating metric minimum defined by ASRAC rule are and are included in this addendum to document the agreed to values. But this addendum expands metrics to cover the products with cooling capacities greater than or equal to 760,000 Btu/h products and other products mentioned above in items 3, 4, and 5 that DOE ASRAC negotiation did not address. The addendum also defines minimum requirements for cold climate Heat Pump $IVHE_C$.

As of May 21, 2024 DOE Published a Direct Final Rule Pertaining to Standards for Air-Cooled Commercial Packaged Air Conditioners and Heat Pumps which can be found at Regulations.gov. The effective date for this rule is September 17, 2024, and requires compliance with the new minimum efficiencies and new metrics on and after January 1, 2029.

These commercial Unitary products are currently covered by the AHRI 340/360 test and rating procedure and supporting certification program. Due to the significant changes to the test procedure 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: AHRI 1340-202x (I-P) (ahrinet.org). A minor revised version to correct some test procedures and some editorial changes has been completed and is current out for public review until May 12, 2024, and will be the referenced standard.

The new test procedure makes significant changes to the cooling and heating metrics including both full load metrics and annualized metrics. The cooling *IEER* metric will be changed to *IVEC*. The full load cooling metric will be changed to *EER2*. For Heat Pump heating a new annualized metric has been developed to add an annualized metric in addition to the full load metrics for heating at 47°F and 17°F in table 6.8.1-2. There is a US average *IVHE* and a colder climate $IVHE_C$. The full load Heat Pump COP_H 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 $COP2_H$

The objective for the test procedure 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 Pressure**—As part of the ASRAC negotiation, studies were conducted to evaluate the external ratings static pressure for the indoor airflow. As shown in the table, the rating external static pressure was increased to be more representative of typical applications. The increased external rating static results in increased fan power and will negatively impact the efficiency metric values for full load an annualized efficiency. Note that static also includes an allowance for economizers which are also now part of the cooling IVEC metric.

Efficiency Capacity Rating Category	Capacity Btu/h	AHRI 340/360 External Static in H_2O	AHRI 1340 External Static (with economizer) in H_2O	AHRI 1340 External Static (without economizer) in H_2O	Increase External Static in H_2O
<65,000 Btu/h	0 to 28,600	0.10	0.50	0.60	0.50
	29,000 to 42,500	0.15	0.50	0.60	0.45
	43,000 to 64,500	0.20	0.50	0.60	0.40
≥65,000 and <135,000 Btu/hr	65,000 to 70,000	0.20	0.75	0.85	0.65
	71,000 to 105,000	0.25	0.75	0.85	0.60
	105,000 to 134,000	0.30	0.75	0.85	0.55
≥135,000 and <240,000 Btu/hr	135,000 to 210,000	0.35	1.00	1.10	0.75
	211,000 to 280,000	0.40	1.00	1.10	0.70
≥240,000 and <760,000 Btu/hr	181,000 to 350,000	0.45	1.50	1.60	1.15
	351,000 to 400,000	0.55	1.50	1.60	1.05
	401,000 to 500,000	0.65	1.50	1.60	0.95
	501,000 and greater	0.75	1.50	1.60	0.85

As part of prior work for AHRI 340/360, the test and ratings procedures included development of a new product category called double duct products which are applied with ducted condenser airflow. The revised metric for double duct required the condenser to be rated with an external rating static of 0.5-inch. But the double duct rating metric with the external condenser static is optional in AHRI 340/360 no crosswalk or adjust minimum efficiencies were developed. The new AHRI 1340 standard will make the double duct rating with the 0.5-inch condenser static mandatory. The new AHRI 1340 standard also increased the indoor external static but the same as the standard non-ducted air-cooled units. As part of this addendum proposal both the increased condenser external rating static and the increased indoor external rating static have been included. For this proposal it is assumed that the double duct would be required to comply with the ASRAC negotiated minimum efficiencies for the CUAC and CUHP but with the additional 0.5-inch condenser static.

- **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 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 for both cooling only units and for Heat Pumps.
- **Inclusion of air economizers** – Commercial unitary products often include economizers which are very efficient means for providing cooling. The benefits of an average airside economizer have been included in the new cooling metric to make the metric more representative of the applied equipment efficiency. The metric was based on 10 building and 17 US climate zone resulting in a weighted average 1,880 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 and off mode standby periods. For cooling-only units and units with gas heat, all annual crankcase heat energy is included. For Heat Pumps, only 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 Heat Pump *IVEC* and 645 hrs for *IVHE* metric.

For cooling efficiency, the current annualized *IEER* metric is 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. It does factor in a 15% oversizing of equipment which was not part of *IEER*.

These changes are and improvement were considered in the crosswalk from *IEER to IVEC*. The *IEER* was only for mechanical cooling metric (did not include economizer, ventilation, and off mode power). The *IEER* was based on three 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 was simplified and terms combined, but the following equation better explains the new metric.

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

annual cooling capacity

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)

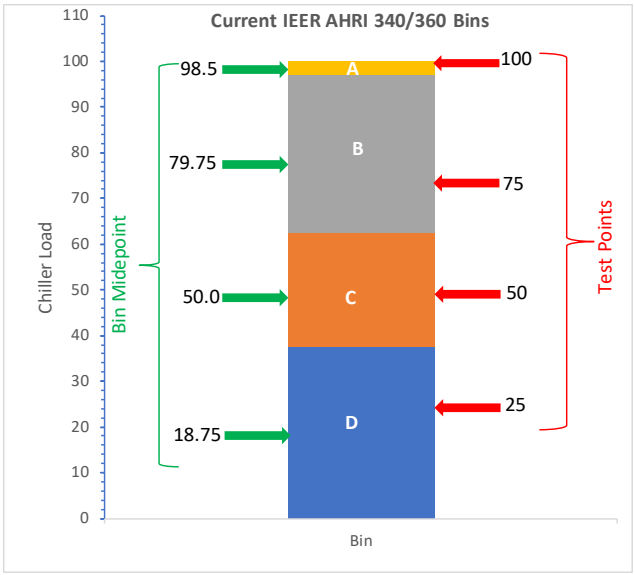
P = power (W)

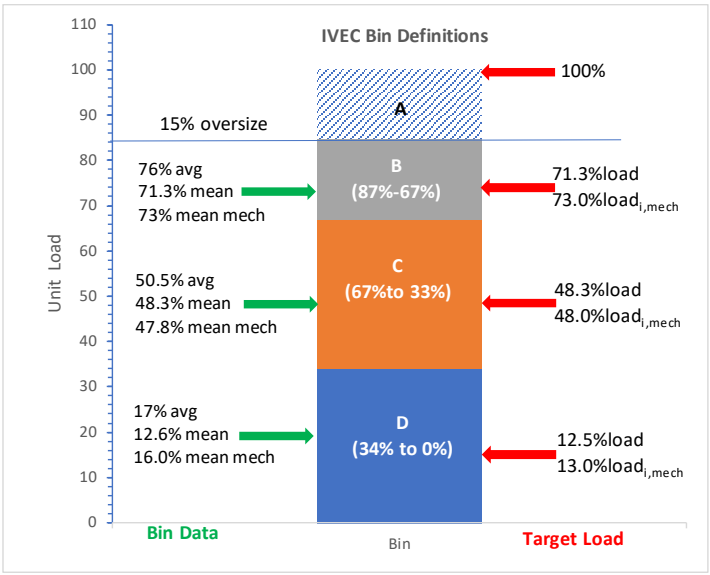
%Load = target load percentage for bin across all modes (note the % load for the capacity is different than the % load for mechanical power determination)

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 three defined mechanical cooling testing points 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. 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. 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.





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 backstop to control full load efficiency. No improvements have been proposed for full load and the *EER2* values other than to reflect the crosswalk 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 f*or 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.

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

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

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

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

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

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

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

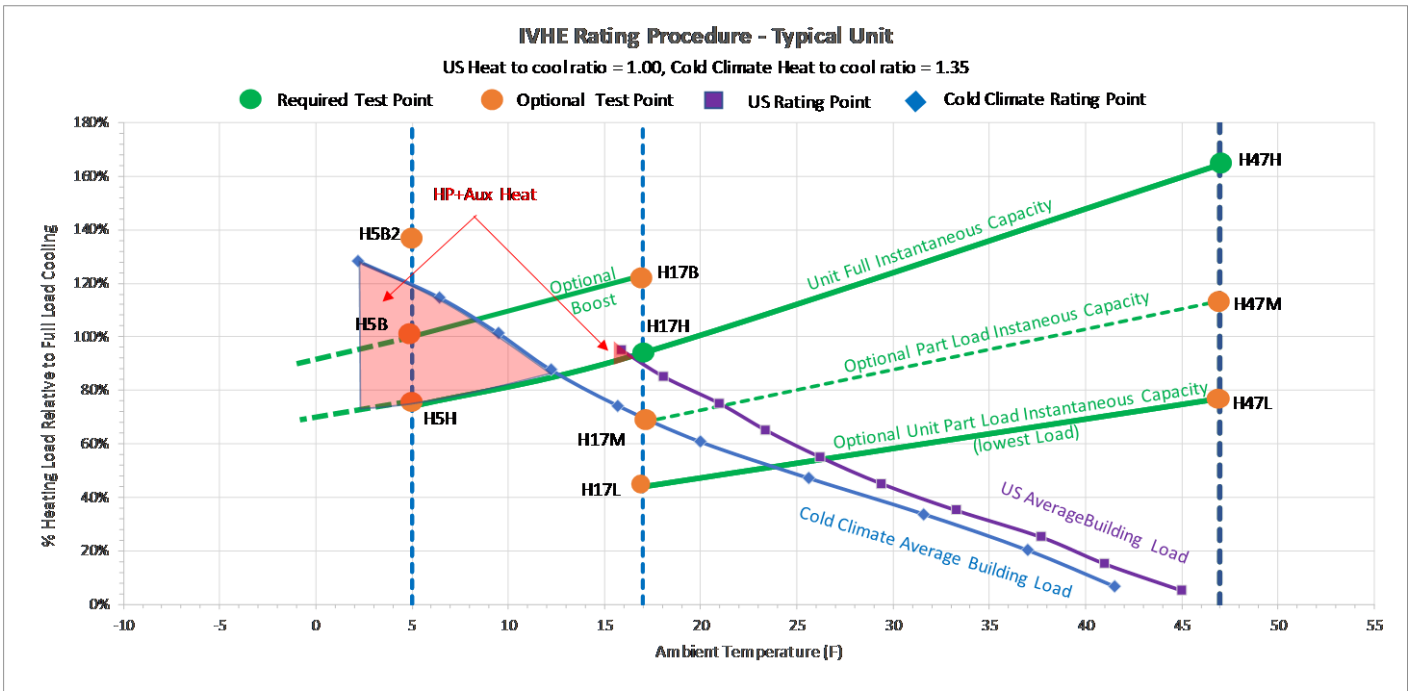
Where:

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, axillary 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 axillary gas heat but that is being worked on by a CSA committee. The new metric is called *IVHE,* which is an abbreviation for *Integrated Ventilating, Heating Efficiency*. It is a bin weighted average based on 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 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. The 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 ten 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 defrost degradation curve is used. For now, this defrost curve is based on time and temperature logic, but in the future demand defrost is being considered. This allows for better interpolation than using non-linear integrated ratings and 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 addition to the new annualized metric, the new AHRI 1340 standard and test procedure also includes the current full load metric for $COP2_H$ 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 COP 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

The ASRAC negotiations were limited just the *IVEC* and *IVHE* U.S. average for air cooled cooling units and air source Heat Pumps with a capacity greater than or equal to 65,000 Btu/h to 760,000 Btu/h, but AHRI 1340-2023 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 greater than or equal to 760,000 Btu/h
- Unitary Heat Pump products with a capacity greater than or equal to 760,000 Btu/h
- Water cooled products for all sizes
- Evaporatively cooled products for all sizes (includes less than to 65,000 Btu/h)
- Double duct products greater than or equal to 65,000 Btu/h
- Cold Climate $IVHE_C$ for all sizes.

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 proposed levels have been included in this addendum reflecting the increased external rating static. The full load efficiencies were not increased but just adjusted for the static. The annualized metrics are representative of the energy use and were the focus of increased minimum efficiencies.

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 (ACUACs and ACUHPs), the ASRAC defined the following

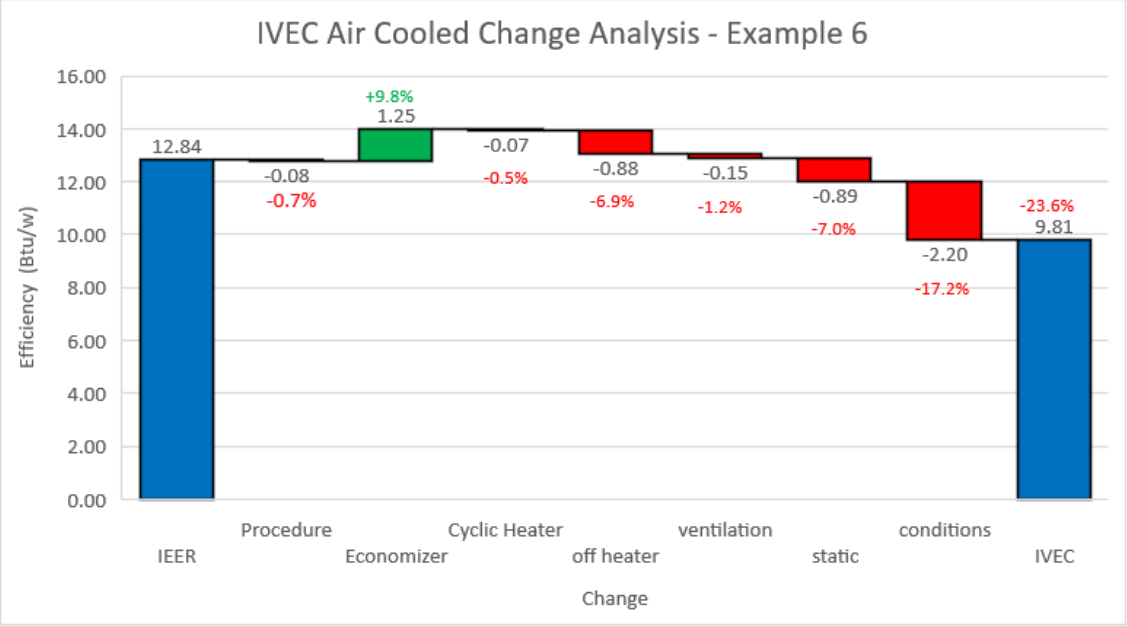
minimum efficiencies. These values have been included in the addendum to document the values agreed to in the ASRAC ruling. These efficiencies are highlighted in yellow in the addendum tables.

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* = *IVHE* =	13.4 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* = *IVHE* =	13.1 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* = *IVHE* =	12.1 5.8

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

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

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 *IVEC* metric vs the *IEER* metric using example 6 from the AHRI 340/360 standard.



This addendum proposal is being released for advisory public review because we are seeking input on the revised and new metrics values that were not covered by the ASRAC negotiations.

The SSPC 90.1 seeks input on the following items:

1. *IVEC, IVHE* and $IVHE_C$ levels for greater than or equal to 760,000 Btu/h products
2. *IVEC* and levels for all sizes of water and evaporatively cooled product.
3. *IVEC* and *IVHE* levels for all sizes of double duct (new category)
4. Need for double duct product category greater than 240,000 Btu/h
5. Feedback on the proposed double duct IVEC and *IVHE* levels and the *EER2* and $COP2_H$ levels.
6. Need to include full load *EER2* levels and the reason why or why not as well as feedback on the proposed levels.
7. Need for $COP2_H$ levels for 47°F, 17°F, and 5°F and feedback on the proposed levels and where they should be required.
8. Would you prefer all Unitary products to be in tables 6.8.1-1 and 6.8.1-2 including the less than 65,000 Btu/h products covered in table F-1

Please provided feedback on these questions as well as comments on efficiency levels that are not highlighted in yellow (defined by ASRAC). Comments should be specific and include details on the proposed changes. Justification should be provided for any proposed changes.

To provide further background a technical support document has been prepared and is available here: ASHRAE Table 6.8.1-1 and 6.8.1-2 Updates rev 14.pdf

Once we have comments from the advisory public review a full public review will be released. This likely will include other changes and updates to the table for products with a cooling capacity of less than 65,000 Btu/h large commercial condensing units. We are also considering combining table F-1 products into the table to allow for easier use of the ASHRAE 90.1 efficiency tables.

[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.]

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 the net cooling capacity (Btu/h) to the total rate of electric input in watts under designated operating conditions.-(***Informative Note:*** *EER2* 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)

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, 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/COP2	*coefficient of performance*
COP_H/$COP2_H$	*coefficient of performance, heat pump, heating*

Add the following reference to Section 13:

AHRI 1340 (2024)	Performance Rating of Commercial and Industrial Unitary Air-conditioning and Heat Pump Equipment	Table 6.8.1-1, Table 6.8.1-2

AHRI 1340 (2023) is published, but a few minor changes were discovered, and a revised version will be published shortly as the 2024 version. It is currently public review and will close on May 12.

In the final table update to table 6.8.1-1 and 6.8.1-2 additional reference updates will be added for AHRI 1600 that will replace AHRI 210/240 for residential and light commercial Unitary equipment <65,000 Btu/h capacity and AHRI 1365 that will replace AHRI 365 for commercial condensing units.

Delete the current table 6.8.1-1, 6.8.1-2 sections as shown below and replace with the new requirements. Only the IP version of the table has been shown, but the final changes will include SI tables.

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

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
~~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*~~	

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 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 and <135,000 Btu/h		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		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		47°F db/43°F wb outdoor air	3.20 COP_H	
			17°F db/15°F wb outdoor air	2.05 COP_H	

Replace the deleted section of table 6.8.1-1 with the following new revised requirements.

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

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
Double Duct Air conditioners (air-cooled)[h]	≥65,000 Btu/h and <135,000 Btu/h	*Electric resistance* (or none)	Single-package	11.2 *EER*, 14.8 *IEER* before 1/1/2029 10.4 *EER2* 14.0 *IVEC* after 1/1/2029	AHRI 340/360 before 1/1/2029 AHRI 1340 after 1/1/2029
		All other		11.0 *EER* 14.6 *IEER* before 1/1/2029 10.2 *EER2* 13.5 *IVEC* after 1/1/2029	
	≥135,000 Btu/h and <240,000 Btu/h	*Electric resistance* (or none)		11.0 *EER* 14.2 *IEER* before 1/1/2029 10.1 *EER2* 13.5 *IVEC* after 1/1/2029	
		All other		10.8 *EER* 14.0 *IEER* before 1/1/2029 9.9 *EER2*, 13.0 *IVEC* after 1/1/2029	
	≥240,000 Btu/h and < 300,000 Btu/h	*Electric resistance* (or none)		10.5 *EER* 13.2 *IEER* before 1/1/2029 9.5 *EER2* 12.8 *IVEC* after 1/1/2029	
		All other		10.3 *EER* 13.0 *IEER*, before 1/1/2029 9.3 *EER2* 12.1 *IVEC* after 1/1/2029	
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* 14.8 *IEER* before 1/1/2029 10.8 *EER2* 14.3 *IVEC* after 1/1/2029	AHRI 340/360 before 1/1/2029 AHRI 1340 after 1/1/2029
		All other		11.0 *EER* 14.6 *IEER* before 1/1/2029 10.6 *EER2* 13.8 *IVEC* after 1/1/2029	
	≥135,000 Btu/h and <240,000 Btu/h	*Electric resistance* (or none)		11.0 *EER* , 14.2 *IEER* before 1/1/2029 10.5 *EER2* 13.8 *IVEC* after 1/1/2029	
		All other		10.8 *EER* 14.0 *IEER* before 1/1/2029	

				10.3 *EER2* 13.3 *IVEC* after 1/1/2029	
	≥240,000 Btu/h and <760,000 Btu/h	*Electric resistance* (or none)		10.0 *EER*, 13.2 *IEER* before 1/1/2029 9.3 *EER2* 12.9 *IVEC* after 1/1/2029	
		All other		9.8 *EER* 13.0 *IEER* before 1/1/2029 9.1 *EER2* 12.2 *IVEC* after 1/1/2029	
	≥760,000 Btu/h	*Electric resistance* (or none)		9.7 *EER* 12.5 *IEER* before 1/1/2029 9.0 *EER2* 11.7 *IVEC* after 1/1/2029	
		All other		9.5 *EER* 12.3 *IEER* before 1/1/2029 8.8 *EER2* 11.0 *IVEC* after 1/1/2029	
Air conditioners, water-cooled	<65,000 Btu/h	*Electric resistance* (or none)	Split-*system* and single package	12.1 *EER* 12.3 *IEER* before 1/1/2029 11.8 *EER2* 13.7 *IVEC* after 1/1/2029	AHRI 340/360 before 1/1/2029 AHRI 1340 after 1/1/2029
		All other		12.1 *EER* 12.3 *IEER* before 1/1/2029 11.6 *EER2* 13.5 *IVEC* after 1/1/2029	
	≥65,000 Btu/h and <135,000 Btu/h	*Electric resistance* (or none)		12.1 *EER* 13.9 *IEER*, before 1/1/2029 11.7 *EER2* 13.0 *IVEC* after 1/1/2029	
		All other		11.9 EER 13.7 IEER before 1/1/2029 11.5 *EER2* 12.5 *IVEC* after 1/1/2029	
	≥135,000 Btu/h and <240,000 Btu/h	*Electric resistance* (or none)		12.5 *EER* 13.9 *IEER* before 1/1/2029 11.4 *EER2* 12.4 *IVEC* after 1/1/2029	
		All other		12.3 *EER* 13.7 *IEER* before 1/1/2029 11.2 *EER2* 11.9 *IVEC* after 1/1/2029	

	≥240,000 Btu/h and <760,000 Btu/h	*Electric resistance* (or none)		12.4 *EER* 13.6 *IEER* before 1/1/2029 11.1 *EER2* 11.3 *IVEC* after 1/1/2029	
		All other		12.2 *EER* 13.4 *IEER* before 1/1/2029 10.9 *EER2* 10.6 *IVEC* after 1/1/2029	
	≥760,000 Btu/h	*Electric resistance* (or none)		12.2 *EER* 13.5 *IEER* before 1/1/2029 10.9 *EER2* 11.3 *IVEC* after 1/1/2029	
		All other		12.0 *EER* 13.3 *IEER* before 1/1/2029 10.7 *EER2* 10.6 *IVEC* after 1/1/2029	
Air conditioners, Evaporatively-cooled	<65,000 Btu/h[b]	*Electric resistance* (or none)	Split-*system* and single-package	12.1 *EER* 12.3 *IEER* before 1/1/2029 11.8 *EER2* 13.7 *IVEC* after 1/1/2029	AHRI 340/360 before 1/1/2029 AHRI 1340 after 1/1/2029
		All other		12.1 *EER* 12.3 *IEER* before 1/1/2029 11.6 *EER2* 13.5 *IVEC* after 1/1/2029	
	≥65,000 Btu/h and <135,000 Btu/h	*Electric resistance* (or none)		12.1 *EER* 13.9 *IEER.* before 1/1/2029 11.7 *EER2* 13.0 *IVEC* after 1/1/2029	
		All other		11.9 EER 13.7 IEER before 1/1/2029 11.5 *EER2* 12.5 *IVEC* after 1/1/2029	
	≥135,000 Btu/h and <240,000 Btu/h	*Electric resistance* (or none)		12.5 *EER* 13.9 *IEER* before 1/1/2029 11.4 *EER2* 12.4 *IVEC* after 1/1/2029	
		All other		12.3 *EER* 13.7 *IEER* before 1/1/2029 11.2 *EER2* 11.9 *IVEC* after 1/1/2029	
	≥240,000 Btu/h and <760,000 Btu/h	*Electric resistance* (or none)		12.4 *EER* 13.6 *IEER* before 1/1/2029	

				11.1 *EER2* 11.3 *IVEC* after 1/1/2029	
		All other		12.2 *EER* 13.4 *IEER* before 1/1/2029 10.9 *EER2* 10.6 *IVEC* after 1/1/2029	
	≥760,000 Btu/h	*Electric resistance* (or none)		12.2 *EER* 13.5 *IEER* before 1/1/2029 10.9 *EER2* 11.3 *IVEC* after 1/1/2029	
		All other		12.0 *EER* 13.3 *IEER* before 1/1/2029 10.7 *EER2* 10.6 *IVEC* 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 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.
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.
h All double duct units should be rated per AHRI 1340 which includes an additional 0.5 in of water external static pressure for the condenser

Table 6.8.1-2 Electrically Operated Air Source Unitary Heat Pumps – Minimum Efficiency Requirements

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
Double Duct Air conditioner (cooling mode)	≥65,000 Btu/h and <135,000 Btu/h	*Electric resistance* (or none)	Single-package HP	11.0 *EER* 14.1 *IEER* before 1/1/2029 10.2 *EER2* 13.5 *IVEC* after 1/1/2029	AHRI 340/360 before 1/1/2029 AHRI 1340 after 1/1/2029
		All other		10.8 *EER* 14.1 *IEER* before 1/1/2029 10.0 *EER2* 13.5 *IVEC* after 1/1/2029	
	≥135,000 Btu/h and <240,000 Btu/h	*Electric resistance* (or none)		10.6 *EER* 13.5 *IEER* before 1/1/2029 9.7 *EER2* 13.0 *IVEC* after 1/1/2029	
		All other		10.4 *EER* 13.5 *IEER* before 1/1/2029 9.5 *EER2* 13.0 *IVEC* after 1/1/2029	
	≥300,000 Btu/h	*Electric resistance* (or none)		9.1 *EER* 12.5 *IEER* before 1/1/2029 7.8 *EER2* 11.8 I*VEC* after 1/1/2029	
		All other		18.9 *EER* 12.5 *IEER* before 1/1/2029 7.6 *EER2* 11.8 I*VEC* after 1/1/2029	
Air cooled (cooling mode)	≥65,000 Btu/h and <135,000 Btu/h	*Electric resistance* (or none)	Split *system* HP and single package HP	11.0 *EER* 14.1 *IEER* before 1/1/2029 10.6 *EER2* 13.4 *IVEC* after 1/1/2029	AHRI 340/360 before 1/1/2029 AHRI 1340 after 1/1/2029
		All other		10.8 *EER* 13.9 *IEER* before 1/1/2029 10.4 *EER2* 13.4 *IVEC* after 1/1/2029	
	≥135,000 Btu/h and <240,000 Btu/h	*Electric resistance* (or none)		10.6 *EER* 13.5 *IEER* before 1/1/2029 10.1 *EER2* 13.1 *IVEC* after 1/1/2029	
		All other		10.4 *EER* 13.3 *IEER* before 1/1/2029 9.9 *EER2* 13.1 *IVEC* after 1/1/2029	

	≥240,000 Btu/h and < 760,000 Btu/h	*Electric resistance* (or none)		9.5 *EER* 12.5 *IEER* before 1/1/2029 8.8 *EER2* 12.1 *IVEC* after 1/1/2029	
		All other		9.3 *EER* 12.3 *IEER* before 1/1/2029 8.6 *EER2* 12.1 *IVEC* after 1/1/2029	
	≥760,000 Btu/h	*Electric resistance* (or none)		9.1 *EER* 12.5 *IEER* before 1/1/2029 8.4 *EER2* 10.9 *IVEC* after 1/1/2029	
		All other		8.9 *EER* 12.3 *IEER* before 1/1/2029 8.2 *EER2* 10.9 *IVEC* after 1/1/2029	
Double Duct (heating mode)	≥65,000 Btu/h and <135,000 Btu/h (cooling capacity)	*All*	47° F db/43° F wb outdoor air	3.40 COP_H before 1/1/2029 3.13 $COP2_H$ after 1/1/2029	AHRI 340/360 before 1/1/2029 AHRI 1340 after 1/1/2029
			17°F db/15°F wb outdoor air	2.25 COP_H before 1/1/2029 2.03 $COP2_H$ after 1/1/2029	
			5°F db/3°F wb outdoor air[d]	1.65 $COP2_H$ after 1/1/2029	
			U.S. Annualized Metric	5.99 *IVHE* after 1/1/2029	
			Annualized Cold Regions[d]	5.71 $IVHE_C$ after 1/1/2029	
	≥135,000 Btu/h and <240,000 Btu/h (cooling capacity)	All	47° F db/43° F wb outdoor air	3.30 COP_H before 1/1/2029 3.01 $COP2_H$ after 1/1/2029	
			17°F db/15°F wb outdoor air	2.05 COP_H before 1/1/2029 1.83 $COP2_H$ after 1/1/2029	
			5°F db/3°F wb outdoor air[d]	1.61 $COP2_H$ after 1/1/2029	
			U.S. Annualized Metric	5.79 *IVHE* after 1/1/2029	
			Annualized Cold Regions[d]	5.59 $IVHE_C$ after 1/1/2029	
	>240,000 Btu/h (cooling capacity)	All	47° F db/43° F wb outdoor air	3.20 COP_H before 1/1/2029 2.88 $COP2_H$ after 1/1/2029	
			17°F db/15°F wb outdoor air	2.05 COP_H before 1/1/2029 1.81 $COP2_H$ after 1/1/2029	
			5°F db/3°F wb outdoor air[d]	1.46 $COP2_H$ after 1/1/2029	
			U.S. Annualized Metric	5.59 *IVHE* after 1/1/2029	
			Annualized Cold Regions[d]	5.31 $IVHE_C$ after 1/1/2029	
Air-cooled (heating mode)	≥65,000 Btu/h and <135,000 Btu/h (cooling capacity)	All	47°F db/43°F wb outdoor air	3.40 COP_H before 1/1/2029 3.28 $COP2_H$ after 1/1/2029	AHRI 340/360 before 1/1/2029 AHRI 1340 after 1/1/2029
			17°F db/15°F wb outdoor air	2.25 COP_H before 1/1/2029 2.18 $COP2_H$ after 1/1/2029	
			5°F db/3°F wb outdoor air[d]	1.73 $COP2_H$ after 1/1/2029	
			U.S. Annualized Metric	6.20 *IVHE* after 1/1/2029	

			Annualized Cold Regions[d]	5.92 $IVHE_C$ after 1/1/2029
≥135,000 Btu/h and <240,000 Btu/h (cooling capacity)	All		47°F db/43°F wb outdoor air	3.30 COP_H before 1/1/2029 3.16 $COP2_H$ after 1/1/2029
			17°F db/15°F wb outdoor air	2.05 COP_H before 1/1/2029 1.98 $COP2_H$ after 1/1/2029
			5°F db/3°F wb outdoor air[d]	1.69 $COP2_H$ after 1/1/2029
			U.S. Annualized Metric	6.00 *IVHE* after 1/1/2029
			Annualized Cold Regions[d]	5.72 $IVHE_C$ after 1/1/2029
240,000 Btu/h and <760,000 Btu/h (cooling capacity)	All		47°F db/43°F wb outdoor air	3.20 COP_H before 1/1/2029 3.03 $COP2_H$ after 1/1/2029
			17°F db/15°F wb outdoor air	2.05 COP_H before 1/1/2029 1.96 $COP2_H$ after 1/1/2029
			5°F db/3°F wb outdoor air[d]	1.59 $COP2_H$ after 1/1/2029
			U.S. Annualized Metric	5.80 *IVHE* after 1/1/2029
			Annualized Cold Regions[d]	5.52 $IVHE_C$ after 1/1/2029
≥760,000 Btu/h (cooling capacity)	All		47°F db/43°F wb outdoor air	3.20 COP_H before 1/1/2029 3.00 $COP2_H$ after 1/1/2029
			17°F db/15°F wb outdoor air	2.05 COP_H before 1/1/2029 1.90 $COP2_H$ after 1/1/2029
			5°F db/3°F wb outdoor air[d]	1.54 $COP2_H$ after 1/1/2029
			U.S. Annualized Metric	5.60 *IVHE* after 1/1/2029
			Annualized Cold Regions[d]	5.42 $IVHE_C$ 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 heat pumps <65,000 Btu/h are regulated as consumer products by the U.S. Code of Federal Regulations 10 CFR 430. *SEER2*, and *HSPF2* 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.
c All double duct units should be rated per AHRI 1340 which includes an additional 0.5 in of water external static pressure for the condenser
d. Colder climate region $IVHE_C$ and COP5 are only required for ASHRAE 169 climate zone 5, 6, 7, and 8