



**BSR/ASHRAE Addendum a to
ANSI/ASHRAE Standard 205-2023**

Public Review Draft

Proposed Addendum a to Standard 205-2023, Representation of Performance Data for HVAC&R and Other Facility Equipment

**First Public Review (November 2023)
(Draft shows Proposed Changes to Current Standard)**

This draft has been recommended for public review by the responsible project committee. To submit a comment on this proposed standard, go to the ASHRAE website at www.ashrae.org/standards-research--technology/public-review-drafts and access the online comment database. The draft is subject to modification until it is approved for publication by the Board of Directors and ANSI. Until this time, the current edition of the standard (as modified by any published addenda on the ASHRAE website) remains in effect. The current edition of any standard may be purchased from the ASHRAE Online Store at www.ashrae.org/bookstore or by calling 404-636-8400 or 1-800-727-4723 (for orders in the U.S. or Canada).

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Proposed BSR/ASHRAE Addendum a to ANSI/ASHRAE Standard 205-2023, *Representation of Performance Data for HVAC&R and Other Facility Equipment*

(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

Foreword to Addendum a

This proposed addendum contains several “clean-up” changes to Standard 205-2023, as follows:

Deferred clarifications in response to public review comments.

- *Require parentheses in human-readable documentation of derived units*

Revisions proposed via the Continuous Maintenance Proposal (CMP) process.

- *Inclusion of standards that have been published since the initial publication of Standard 205*
- *Update of references that have been published since the initial publication of Standard 205*

Modifications proposed based on experience implementing Standard 205 supporting software.

- *Replace NULL as a data element property with OperationState data element(s)*
- *Removal of superfluous and redundant data in RS0001 (liquid-cooled chiller representation specification)*
- *Rework representation of liquid pressure differential in RS0001 (liquid-cooled chiller representation specification)*

Other corrections and clarifications.

[*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 a to Standard 205-2023

Section 3 revised as follows:

3 DEFINITIONS

[...]

~~**Null:** a conceptual representation of “no information provided” allowing omission of performance value(s). Null is transmitted in an implementation-specific manner in any given representation.~~

[...]

Table 5-2 revised as follows:

Table 5-2 Fundamental Data Type Definitions

Data Type	Description	JSON Schema Type	Examples
Integer	A positive or negative base 10 whole number (i.e., a number that can be written without a fractional part).	integer	3, 19, -4
Numeric	A base 10 number that may include a fractional part with optional leading sign and optional exponent (engineering notation). Numeric values are conveyed in CBOR files in IEEE 754 ⁴ binary64 format without rounding.	number	3.43, 0, -4, 1.03e4
Boolean	True or false.	boolean	true, false
String	A sequence of characters of any length using any (specified) character set.	string	Indirect evaporative cooler
Null	Used to represent a missing value. Shall only be used in combination with other data types, e.g., Numeric/Null.	null	null

Section 5.4.3 revised as follows:

5.4.3 Units in Representation Specification Documentation. Units of all values in all representation specifications shall be documented using symbols defined below.

If a numeric data element does not have units, the hyphen “-” character shall be used for its units. When combining base units into derived units, the following rules shall apply:

- For a symbol raised to a power use the power as a exponent (e.g., m²).

- For the product of two symbols use the interpunct “·” (e.g., N·m).
- For the quotient of two symbols use the solidus “/” (e.g., $\frac{W}{m^2 \cdot K}$ ~~$\frac{W}{m^2 \cdot K}$~~)
- Use only one solidus symbol per derived unit (e.g., m/s², not m/s/s).
- ~~Do not use~~ Use parentheses for a denominator that is more than a single unit (e.g., $\frac{W}{m^2 \cdot K}$, not $\frac{W}{(m^2 \cdot K)}$ ~~$\frac{W}{(m^2 \cdot K)}$~~ , not $\frac{W}{m^2 \cdot K}$).
- Do not use negative exponents (e.g., $\frac{W}{m^2 \cdot K}$ ~~$\frac{W}{(m^2 \cdot K)}$~~ , not $W \cdot m^{-2} \cdot K^{-1}$)

Section 5.7 revised as follows:

5.7 Common Enumerations. Common enumerations are used in more than one representation specification.

When a representation specification includes data elements of enumerations listed in this section, the specified enumerators shall be used.

[...]

Table 5–11 OperationState

<u>Enumerator</u>	<u>Description</u>	<u>Notes</u>
<u>NORMAL</u>	Indicates that the equipment is in normal operating state	
<u>STANDBY</u>	Indicates that the equipment is in standby operating state	

Section 6.3.3.6.1 revised as follows:

6.3.3.6.1 Operational Limits. Representation specifications shall define operational limits (physical or practical) that define the range of conditions under which the equipment can operate, as applicable. Such limits shall be conveyed using any of the following approaches:

- explicitly defined via individual data elements (e.g., `maximum_environmental_temperature`),
- implicitly defined by the limits of the grid variable values in performance maps (unless the representation specification explicitly defines extrapolation procedures), or
- explicitly defined ~~through the use of Null~~ using a lookup variable of type OperationState values in performance maps.

Informative note: Application software utilizing the representation data should model the equipment in standby operation if any operational limit is exceeded.

Section 6.3.3.7 revised as follows:

6.3.3.7 PerformanceMap. Performance maps are required when the performance over the operational range of the equipment cannot be characterized by single data elements. One or more performance maps are included that convey equipment performance for a range of conditions and operating modes. Performance maps shall consist of data elements representing grid variables and lookup variables that relate the performance of the equipment over a range of operating conditions.

Lookup variable values shall be provided in a rectilinear, but not necessarily uniform, grid (as illustrated in Figure 6– 1 for three dimensions) defined by the grid variable values. The lookup variable values shall be provided at the vertex defined by the combination of the grid variable values. This implies that both the outer boundary and each cell are hyperrectangles (n-dimensional rectangles).

Grid variable value combinations at which the equipment is in standby operation shall be represented with corresponding lookup variable of type OperationState with a value of STANDBY~~values of Null~~. Standby operation shall be assumed for any conditions falling within a grid cell having a lookup variable of type OperationState with a value of STANDBY~~Null data~~ at any vertex.

Informative note: Application software may create temporary virtual operating points in regions of non-operation as a calculation convenience but shall not infer actual operation in non-operating regions.

Application rules shall define the conditions under which each performance map within a representation shall be used.

Lookup variable values shall be provided with sufficient grid variable spacing to capture non-linear performance characteristics (e.g., inflections).

Informative note: A minimum of two values is required to indicate the operational range of the equipment for each grid variable. A single value for a grid variable indicates that operation is limited to that value (unless otherwise noted for the specific grid variable).

Section 10 revised as follows:

10 REFERENCES

1. C. Bormann. *CBOR*. 2018. URL: <http://cbor.io/>.
2. JSON.org. *Introducing JSON*. 2018. URL: <http://www.json.org/>.
3. A. Wright and H. Andrews. *JSON Schema: A Media Type for Describing JSON Documents*. 2018. URL: <https://tools.ietf.org/html/draft-handrews-json-schema-01>.
4. IEEE. *IEEE 754-2019 - IEEE Standard for Floating-Point Arithmetic*. 2019. URL: <https://standards.ieee.org/standard/754-2019.html>.
5. ITU. *ITU-T X.667: Information technology – Procedures for the operation of object identifier registration authorities: Generation of universally unique identifiers and their use in object identifiers*. ITU, 2012.
6. ISO. *ISO 8601: Date and Time Format*. ISO, 2019.
7. SemVer. *Semantic Versioning 2.0.0*. 2013. URL: <https://semver.org/>.
8. ECMA. *Standard ECMA-262, ECMAScript® 2019 Language Specification*. 2019. URL: <https://www.ecmascriptinternational.org/publications/standards/Ecma-262.htm>.
9. ASHRAE. *SI Guide for HVAC&R*. Atlanta, Georgia: ASHRAE, 2013.

- 10. ASHRAE. *ASHRAE Handbook—Fundamentals*. Atlanta, Georgia: ASHRAE, ~~2017~~2021.
- 11. J. Schaad. *RFC 8152: CBOR Object Signing and Encryption (COSE)*. 2017. URL: <https://www.rfc-editor.org/info/rfc8152>.

Section RS0001.1 revised as follows (the schema_version and Date will depend on the order of publication of the addenda and will be completed at the time of publication):

RS0001.1 Identification and History. schema: RS0001

schema_version	Date	Initial Approved Standard	Notes
1.0.0	2023	2023	Initial publication
		<u>2023 - Addendum A</u>	

Section RS0001.3.1 revised as follows:

RS0001.3.1 Data Group Hierarchy. A representation implementation conforming to this representation specification shall consist of the following data groups:

- RS0001
 - Metadata
 - Description*
 - ProductInformation*
 - RatingAHRI550590*
 - PartLoadRatingPoint550590*
 - RatingAHRI551591*
 - PartLoadRatingPoint551591*
 - Performance
 - PerformanceMapCooling
 - GridVariablesCooling
 - LookupVariablesCooling
 - PerformanceMapStandby
 - GridVariablesStandby
 - LookupVariablesStandby
 - PerformanceMapEvaporatorLiquidPressureDifferential
 - GridVariablesEvaporatorLiquidPressureDifferential
 - LookupVariablesEvaporatorLiquidPressureDifferential

- PerformanceMapCondenserLiquidPressureDifferential
- GridVariablesCondenserLiquidPressureDifferential
- LookupVariablesCondenserLiquidPressureDifferential

where * indicates data groups that are not required to be present in a representation conforming to this representation specification.

Informative note: Required data elements of an optional data group are only required when the data group is present in a representation.

Informative note: When multiple chillers are designed to operate in concert, such as in a series counterflow arrangement, the performance of the chiller system can be represented in a single file. Other designs with multiple chillers operating independently should be represented with multiple files.

Table RS0001-2 revised as follows:

Table RS0001–2 AHRI550590TestStandardYear

Enumerator	Description	Notes
IP_2015	Ratings and design points defined using IP unit version of the standard, 2015 edition ¹	
IP_2015_ADDENDUM_1	Ratings and design points defined using IP unit version of the standard, 2015 edition with Addendum 1 ²	
IP_2018	Ratings and design points defined using IP unit version of the standard, 2018 edition ³	
IP_2020	Ratings and design points defined using IP unit version of the standard, 2020 edition ⁴	
IP_2020_ADDENDUM_1	Ratings and design points defined using IP unit version of the standard, 2020 edition with Addendum 1 ⁵	
IP_2023	Ratings and design points defined using IP unit version of the standard, 2023 edition ⁶	

Table RS0001-3 revised as follows:

Table RS0001–3 AHRI551591TestStandardYear

Enumerator	Description	Notes
SI_2015	Ratings and design points defined using SI unit version of the standard, 2015 edition ^{5,7}	
SI_2015_ADDENDUM_1	Ratings and design points defined using SI unit version of the standard, 2015 edition with Addendum 1 ^{6,8}	
SI_2018	Ratings and design points defined using SI unit version of the standard, 2018 edition ^{7,9}	
SI_2020	Ratings and design points defined using SI unit version of the standard, 2020 edition ^{8,10}	
SI_2020_ADDENDUM_1	Ratings and design points defined using SI unit version of the standard, 2020 edition with Addendum 1 ¹¹	
SI_2023	Ratings and design points defined using SI unit version of the standard, 2023 edition ¹²	

Table RS0001-6 revised as follows:

Table RS0001-6 ProductInformation

Name	Description	Data Type	Units	Constraints	Req	Notes
manufacturer	Manufacturer name	String				
model_number	Model number	Pattern				Pattern shall match all model numbers that can be represented by the representation
nominal_voltage	Unit nominal voltage	Numeric	V	≥0.0		If the unit can operate at multiple voltages, the lower of the two shall be stated
nominal_frequency	Unit nominal frequency	Numeric	Hz	≥0.0		Power supply frequency for the intended region of installation
compressor_type	Type of compressor	<CompressorType>				
liquid_data_source	Source of the liquid properties data	String				Example: 'ASHRAE Handbook Fundamentals 2013 chapter 31'
refrigerant	Refrigerant used in the chiller	String				The string shall start with 'R-' and then include the refrigerant number designation conforming to ANSI/ASHRAE Standard 34-2019 ⁹¹³
hot_gas_bypass_installed	Indicates if a hot-gas bypass valve is installed on the chiller	Boolean				

Table RS0001-11 revised as follows:

Table RS0001-11 Performance

Name	Description	Data Type	Units	Constraints	Req	Notes
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evaporator_liquid_type	Type of liquid in evaporator	{LiquidMixture}			✓	<ul style="list-style-type: none"> LiquidMixture specifies liquid constituents and their concentrations Density shall be evaluated at the evaporator inlet liquid temperature
condenser_liquid_type	Type of liquid in condenser	{LiquidMixture}			✓	<ul style="list-style-type: none"> LiquidMixture specifies liquid constituents and their concentrations Density shall be evaluated at the condenser inlet liquid temperature
evaporator_fouling_factor	Factor of heat transfer inhibition due to heat exchanger fouling layer	Numeric	m ² ·K/W	≥0.0	✓	<ul style="list-style-type: none"> Evaporator fouling factor at which the performance map was created May be different from the certification data supplied
condenser_fouling_factor	Factor of heat transfer inhibition due to heat exchanger fouling layer	Numeric	m ² ·K/W	≥0.0	✓	<ul style="list-style-type: none"> Condenser fouling factor at which the performance map was created May be different from the certification data supplied
compressor_speed_control_type	Type of compressor speed control	<SpeedControlType>			✓	
maximum_power	Maximum input power at which the chiller operates reliably and continuously	Numeric	W	≥0.0		
cycling_degradation_coefficient	Cycling degradation coefficient (C _D) as described in AHRI	Numeric	-	≥0.0, ≤1.0	✓	Used when the unit cycles to meet a setpoint

	550/590 or AHRI 551/591					
performance_map_cooling	Data group describing cooling performance over a range of conditions	{PerformanceMapCooling}			✓	
performance_map_standby	Data group describing standby performance	{PerformanceMapStandby}			✓	
performance_map_evaporator_liquid_pressure_differential	Data group describing the liquid pressure differential through the evaporator	{PerformanceMapEvaporatorLiquidPressureDifferential}			✓	
performance_map_condenser_liquid_pressure_differential	Data group describing the liquid pressure differential through the evaporator	{PerformanceMapCondenserLiquidPressureDifferential}			✓	

Table RS0001-13 revised as follows:

Table RS0001–13 GridVariable

Name	Description	Data Type	Units	Constraints	Req	Notes
evaporator_liquid_volumetric_flow_rate	Chilled liquid (evaporator) flow	[Numeric] [1..]	m ³ /s	>0.0	✓	
evaporator_liquid_leaving_temperature	Leaving evaporator liquid temperature	[Numeric] [1..]	K	>0.0	✓	
condenser_liquid_volumetric_flow_rate	Condenser liquid flow	[Numeric] [1..]	m ³ /s	>0.0	✓	
condenser_liquid_entering_temperature	Entering condenser liquid temperature	[Numeric] [1..]	K	>0.0	✓	

compressor_sequence_number	Index indicating the relative capacity order of the compressor speed/stage expressed in order from lowest capacity (starting at 1) to highest capacity	[Integer][1..]	-	≥ 0 ≥ 1	✓	<ul style="list-style-type: none"> If compressor_speed_control_type is DISCRETE, sequence numbers shall be provided for each discrete stage of the compressor(s) If compressor_speed_control_type is CONTINUOUS, sufficient sequence numbers shall be provided to capture the continuous operation of the compressor(s)
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Table RS0001-14 revised as follows:

Table RS0001-14 LookupVariablesCooling

Name	Description	Data Type	Units	Constraints	Req	Notes
input_power	Total power input	[Numeric/Null][1..]	W	≥ 0.0	✓	All power consumed by the chiller, including controls, motors, variable speed drives, purge units, sump heaters, fans, etc.
net_evaporator_capacity	Refrigeration capacity	[Numeric/Null][1..]	W	≥ 0.0	✓	The available cooling capacity of the evaporator to the thermal load calculated using only the sensible heat transfer
net_condenser_capacity	Condenser heat rejection	[Numeric/Null][1..]	W	≥ 0.0	✓	The capacity of the condenser transferred to the condenser cooling stream using only the sensible heat transfer
evaporator_liquid_entering_temperature	Entering evaporator liquid temperature	[Numeric/Null][1..]	K	> 0.0	✓	

condenser_liquid_leaving_temperature	Leaving condenser liquid temperature	{Numeric/Null}[1..]	K	>0.0	✓	
evaporator_liquid_differential_pressure	Pressure difference across the evaporator	{Numeric/Null}[1..]	Pa	>0.0	✓	
condenser_liquid_differential_pressure	Pressure difference across the condenser	{Numeric/Null}[1..]	Pa	>0.0	✓	
oil_cooler_heat	Heat transferred to another liquid crossing the control volume boundary from the chiller oil cooler.	[Numeric/Null][1..]	W	≥0.0	✓	Set as 0 if not present or if heat rejection is met by condenser
auxiliary_heat	Heat transferred to another liquid crossing the control volume boundary from the chiller auxiliaries (motor, motor controller, inverter drive, starter, etc).	[Numeric/Null][1..]	W	≥0.0	✓	Set as 0 if not present or if heat rejection is met by condenser
operation_state	<u>The operation state at the operating conditions</u>	[<OperationState>]	=		✓	

Table RS0001-17 revised as follows:

Table RS0001–17 LookupVariablesStandby

Name	Description	Data Type	Units	Constraints	Req	Notes
input_power	Total power consumed in standby operation	[Numeric/Null][1..]	W	>0.0	✓	<ul style="list-style-type: none"> Includes devices that cycle on and off (e.g., purge units and sump units) and devices that draw continuous power

							(e.g., fans and controls) <ul style="list-style-type: none"> Expressed as a time averaged power consumption
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Tables RS0001-18 through RS0001-23 added as follows:

Table RS0001–18 PerformanceMapEvaporatorLiquidPressureDifferential

<u>Name</u>	<u>Description</u>	<u>Data Type</u>	<u>Units</u>	<u>Constraints</u>	<u>Req</u>	<u>Notes</u>
<u>grid variables</u>	Data group defining the grid variables for the evaporator liquid pressure differential	{GridVariablesEvaporatorLiquidPressureDifferential}			✓	
<u>lookup variables</u>	Data group defining the lookup variables for the evaporator liquid pressure differential	{LookupVariablesEvaporatorLiquidPressureDifferential}			✓	

Table RS0001–19 GridVariablesEvaporatorLiquidPressureDifferential

<u>Name</u>	<u>Description</u>	<u>Data Type</u>	<u>Units</u>	<u>Constraints</u>	<u>Req</u>	<u>Notes</u>
<u>evaporator liquid volumetric flow rate</u>	Chilled liquid (evaporator) flow	[Numeric][1..]	m ³ /s	>0.0	✓	
<u>evaporator liquid leaving temperature</u>	Leaving evaporator liquid temperature	[Numeric][1..]	K	>0.0	✓	

Table RS0001–20 LookupVariablesEvaporatorLiquidPressureDifferential

<u>Name</u>	<u>Description</u>	<u>Data Type</u>	<u>Units</u>	<u>Constraints</u>	<u>Req</u>	<u>Notes</u>
<u>evaporator liquid differential pressure</u>	Pressure difference across the evaporator	[Numeric][1..]	Pa	>0.0	✓	

Table RS0001–21 PerformanceMapCondenserLiquidPressureDifferential

<u>Name</u>	<u>Description</u>	<u>Data Type</u>	<u>Units</u>	<u>Constraints</u>	<u>Req</u>	<u>Notes</u>
<u>grid_variables</u>	Data group defining the grid variables for the condenser liquid pressure differential	{GridVariablesCondenserLiquidPressureDifferential}			✓	
<u>lookup_variables</u>	Data group defining the lookup variables for the condenser liquid pressure differential	{LookupVariablesCondenserLiquidPressureDifferential}			✓	

Table RS0001–22 GridVariablesCondenserLiquidPressureDifferential

<u>Name</u>	<u>Description</u>	<u>Data Type</u>	<u>Units</u>	<u>Constraints</u>	<u>Req</u>	<u>Notes</u>
<u>condenser_liquid_volumetric_flow_rate</u>	Condenser liquid flow	[Numeric][1..]	m ³ /s	>0.0	✓	
<u>condenser_liquid_entering_temperature</u>	Entering condenser liquid temperature	[Numeric][1..]	K	>0.0	✓	

Table RS0001–23 LookupVariablesCondenserLiquidPressureDifferential

<u>Name</u>	<u>Description</u>	<u>Data Type</u>	<u>Units</u>	<u>Constraints</u>	<u>Req</u>	<u>Notes</u>
<u>condenser_liquid_differential_pressure</u>	Pressure difference across the condenser	[Numeric][1..]	Pa	>0.0	✓	

Section RS0001.6 revised as follows:

RS0001.6 Application Rules

RS0001.6.1 Cooling Performance. `performance_map_cooling` shall be used to simulate performance when system controls call for cooling.

RS0001.6.2 Standby Performance. `performance_map_standby` shall be used to simulate performance under any of the following conditions:

- a. system controls are not calling for cooling, or
- b. system controls are calling for cooling, but either:

1. the current simulated conditions are outside the range of grid variables in `performance_map_cooling`, or
2. the corresponding lookup variable `operation_state` values in `performance_map_cooling` have has a value of `Null` STANDBY at the current simulated conditions.

RS0001.6.3 Fluid Types. The fluid type used in the simulation shall be the same as defined in the representation. A warning shall be provided to the software user if the fluid types do not match.

Section RS0001.7 revised as follows:

RS0001.7 References

1. AHRI. ~~ANSI/AHRI 550/590 (I-P) 2015: Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle.~~ Arlington, Virginia: AHRI, 2015.
2. AHRI. ~~ANSI/AHRI 550/590 (I-P) 2015 with Addendum 1: Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle.~~ Arlington, Virginia: AHRI, 2017.
3. AHRI. ~~ANSI/AHRI 550/590 (I-P) 2018 with Errata: Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle.~~ Arlington, Virginia: AHRI, 2018.
4. AHRI. ~~ANSI/AHRI 550/590 (I-P/2020): Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle.~~ Arlington, Virginia: AHRI, 2020.
5. AHRI. AHRI 550/590 (I-P) 2020 with Addendum 1: Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle. Arlington, Virginia: AHRI, 2022.
6. AHRI. ANSI/AHRI 550/590 (I-P) 2023: Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle. Arlington, Virginia: AHRI, 2023.
57. AHRI. ~~ANSI/AHRI 551/591 (SI) 2015: Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle.~~ Arlington, Virginia: AHRI, 2015.
68. AHRI. ~~ANSI/AHRI 551/591 (SI) 2015 with Addendum 1: Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle.~~ Arlington, Virginia: AHRI, 2017.
79. AHRI. ~~ANSI/AHRI 551/591 (SI) 2018 with Errata: Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle.~~ Arlington, Virginia: AHRI, 2018.
810. AHRI. ~~ANSI/AHRI 551/591 (SI/2020): Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle.~~ Arlington, Virginia: AHRI, 2020.
11. AHRI. AHRI 551/591 (SI) 2020 with Addendum 1: Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle. Arlington, Virginia: AHRI, 2022.

12. AHRI. ANSI/AHRI 551/591 (SI) 2023: Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle. Arlington, Virginia: AHRI, 2023.

913. ASHRAE. *Standard 34-2019: Designation and Safety Classification of Refrigerants*. Atlanta, Georgia: ASHRAE, ~~2019~~2022.

Section RS0002.1 revised as follows (the schema_version and Date will depend on the order of publication of the addenda and will be completed at the time of publication):

RS0002.1 Identification and History. schema: RS0002

schema_version	Date	Initial Approved Standard	Notes
1.0.0	2023	2023	Initial publication
		<u>2023 - Addendum A</u>	

Table RS0002-4 revised as follows:

Table RS0002-4 AHRI210240TestStandardYear

Enumerator	Description	Notes
IP_2008	Ratings defined using IP unit version of the standard, 2008 edition. Rating is based on 2008 AHRI standard ¹	
IP_2017	Ratings defined using IP unit version of the standard, 2017 edition. Rating is based on 2017 AHRI standard ²	
IP_2023	Ratings defined using IP unit version of the standard, 2023 edition. Rating is based on 2023 AHRI standard ³	

Table RS0002-6 revised as follows:

Table RS0002-6 AHRI340360TestStandardYear

Enumerator	Description	Notes
IP_2007	Ratings defined using IP unit version of the standard, 2007 edition. Rating is based on 2007 AHRI standard ⁴	
IP_2015	Ratings defined using IP unit version of the standard, 2015 edition. Rating is based on 2015 AHRI standard ⁵	

IP_2019	Ratings defined using IP unit version of the standard, 2019 edition. Rating is based on 2019 AHRI standard ⁶	
IP_2022	Ratings defined using IP unit version of the standard, 2022 edition. ⁷	

Table RS0002–14 Performance revised as follows:

Name	Description	Data Type	Units	Constraints	Req	Notes
standby_power	Continuous unit power draw regardless of fan or DX system operation	Numeric	W	≥0.0	✓	Includes on-board controls and other power not included in the fan or dx system representations
indoor_fan_representation	The corresponding Standard 205 fan assembly representation	{RS0003}				Required if the indoor fan is packaged with the unitary equipment
fan_position	Position of the fan relative to the cooling coil	<FanPosition>			if indoor_fan_representation	
dx_system_representation	The corresponding Standard 205 direct expansion system representation	{RS0004}			✓	

Section RS0002.7 revised as follows:

RS0002.7 References

1. AHRI. ~~ANSI~~AHRI 210/240 (2008) with Addenda 1 and 2: Performance Rating of Unitary Air-conditioning & Air-source Heat Pump Equipment. Arlington, Virginia: AHRI, 2008.
2. AHRI. ~~ANSI~~AHRI 210/240 (2017) with Addendum 1: Performance Rating of Unitary Air-conditioning & Air-source Heat Pump Equipment. Arlington, Virginia: AHRI, 2017.
3. AHRI. ~~ANSI~~AHRI 210/240-2023 (2020): Performance Rating of Unitary Air-conditioning & Air-source Heat Pump Equipment. Arlington, Virginia: AHRI, 2020.

4. AHRI. ~~ANSI~~AHRI 340/360 (2007) with Addenda 1 and 2: Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment. Arlington, Virginia: AHRI, 2007.
5. AHRI. ~~ANSI~~AHRI 340/360 (2015): Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment. Arlington, Virginia: AHRI, 2015.
6. AHRI. ~~ANSI~~AHRI 340/360 (I-P/2019): Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment. Arlington, Virginia: AHRI, 2019.
7. AHRI. AHRI 340/360 (I-P/2022): Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment. Arlington, Virginia: AHRI, 2022.

Section RS0003.1 revised as follows (the schema_version and Date will depend on the order of publication of the addenda and will be completed at the time of publication):

RS0003.1 Identification and History. schema: RS0003

schema_version	Date	Initial Approved Standard	Notes
1.0.0	2023	2023	Initial publication
		<u>2023 - Addendum A</u>	

Table RS0003-14 revised as follows:

Table RS0003–14 LookupVariablesContinuous

Name	Description	Data Type	Units	Constraints	Req	Notes
impeller_rotational_speed	Rotational speed of fan impeller	[Numeric/Null][1..]	rev/s	≥0.0	✓	
shaft_power	Mechanical shaft power input to fan assembly	[Numeric/Null][1..]	W	≥0.0	✓	Does not include the mechanical efficiency of any mechanical drive used to modify rotational speed between the motor and impeller

<u>operation state</u>	<u>The operation state at the operating conditions</u>	[<OperationState>]	=		✓	
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Table RS0003-17 revised as follows:

Table RS0003–17 LookupVariablesDiscrete

Name	Description	Data Type	Units	Constraints	Req	Notes
standard_air_volumetric_flow_rate	Volumetric air flow rate through fan assembly at standard air conditions	[Numeric/Null] [1..]	m ³ /s	≥0.0	✓	
shaft_power	Mechanical shaft power input to fan assembly	[Numeric/Null] [1..]	W	≥0.0	✓	Does not include the mechanical efficiency of any mechanical drive used to modify rotational speed between the motor and impeller
impeller_rotational_speed	Rotational speed of fan impeller	[Numeric/Null] [1..]	rev/s	≥0.0	✓	
<u>operation state</u>	<u>The operation state at the operating conditions</u>	[<OperationState>]	=		✓	

Section RS0003.6 revised as follows:

RS0003.6 Application Rules. Corrections to different operating conditions shall use fan laws from the ASHRAE SI Handbook of HVAC Systems and Equipment-2020¹, Chapter 21, based on the assumption that the fan assembly is a constant volume device. For instance, the fan power and static pressure values at standard air conditions would be modified according to the fan laws at different temperatures and atmospheric pressures by using density correction factors.

Section RS0004.1 revised as follows (the schema_version and Date will depend on the order of publication of the addenda and will be completed at the time of publication):

RS0004.1 Identification and History. schema: RS0004

schema_version	Date	Initial Approved Standard	Notes
1.0.0	2023	2023	Initial publication
		<u>2023 - Addendum A</u>	

Table RS0004-4 revised as follows:

Table RS0004-4 Product Information

Name	Description	Data Type	Units	Constraints	Req	Notes
outdoor_unit_manufacturer	Outdoor unit manufacturer name	String				
outdoor_unit_model_number	Outdoor unit model number	Pattern				Pattern shall match all model numbers that can be represented by the representation
indoor_unit_manufacturer	Indoor unit manufacturer name	String				May be omitted for packaged systems with a single manufacturer
indoor_unit_model_number	Indoor unit model number	Pattern				Pattern shall match all model numbers that can be represented by the representation

refrigerant	Refrigerant used	String				The string shall start with 'R-' and then include the refrigerant number designation conforming to ANSI/ASHRAE Standard 34-2019 ¹
compressor_type	Type of compressor	<CompressorType>				

Table RS0004-7 revised as follows:

Table RS0004-7 GridVariablesCooling

Name	Description	Data Type	Units	Constraints	Req	Notes
indoor_coil_entering_relative_humidity	Relative humidity of the air entering the indoor coil	[Numeric][1..]	-	≥0.0, ≤1.0	✓	As measured immediately before entering the coil (i.e., after the fan in a blow-through configuration)
indoor_coil_entering_dry_bulb_temperature	Dry bulb temperature of the air entering the indoor coil	[Numeric][1..]	K	≥0.0	✓	As measured immediately before entering the coil (i.e., after the fan in a blow-through configuration)
indoor_coil_air_mass_flow_rate	Mass flow rate of air entering the indoor coil	[Numeric][1..]	kg/s	>0.0	✓	
compressor_sequence_number	Index indicating the relative capacity order of the compressor speed/stage expressed in order from lowest capacity (starting at 1) to highest capacity	[Integer][1..]	-	≥ <u>1</u>	✓	<ul style="list-style-type: none"> If compressor_speed_control_type is DISCRETE, sequence numbers shall be provided for each discrete stage of the compressor(s) If compressor_speed_control_type is CONTINUOUS, sufficient sequence numbers shall be provided to capture the continuous operation of the compressor(s)
ambient_absolute_air_pressure	Ambient absolute air pressure	[Numeric][1..]	Pa	≥0.0	✓	

Table RS0004-8 revised as follows:

Table RS0004-8 LookupVariablesCooling

Name	Description	Data Type	Units	Constraints	Req	Notes
gross_total_capacity	Total heat removed by the indoor coil	[Numeric/Null] [1..]	W	≥0.0	✓	Shall not include fan heat
gross_sensible_capacity	Sensible heat removed by the indoor coil	[Numeric/Null] [1..]	W	≥0.0	✓	Shall not include fan heat
gross_power	Gross power draw (of the outdoor unit)	[Numeric/Null] [1..]	W	>0.0	✓	<ul style="list-style-type: none"> Includes compressor, outdoor fan, and any auxiliary power used by the unit's controls and any sump heater Shall not include power drawn by the indoor fan
operation_state	<u>The operation state at the operating conditions</u>	[<OperationState>]	=		✓	

Table RS0004-11 revised as follows:

Table RS0004-11 LookupVariablesStandby

Name	Description	Data Type	Units	Constraints	Req	Notes
gross_power	Gross power draw (of the outdoor unit)	[Numeric/Null] [1..]	W	>0.0	✓	Includes any auxiliary power used by the unit's controls and any sump heater

Section RS0004.4 revised as follows:

RS0004.4 Verification Rules. Performance data supplied must satisfy the following verification tests. The psychrometric functions used below shall follow the definitions provided by the ASHRAE Handbook of Fundamentals-2021, Chapter 1².

Section RS0004.6.2 revised as follows:

RS0004.6.2 Standby Performance. `performance_map_standby` shall be used to simulate performance under any of the following conditions:

- a. system controls are not calling for cooling, or
- b. system controls are calling for cooling, but either:
 - 1. the current simulated conditions are outside the range of grid variables in `performance_map_cooling`, or
 - 2. the corresponding lookup variable `operation_state` values in `performance_map_cooling` have has a value of `Null` STANDBY at the current simulated conditions.

Section RS0004.7 revised as follows:

RS0004.7 References

- 1. ASHRAE. *Standard 34-2019: Designation and Safety Classification of Refrigerants*. Atlanta, Georgia: ASHRAE, ~~2019~~ 2022.
- 2. ASHRAE. *ASHRAE Handbook—Fundamentals*. Atlanta, Georgia: ASHRAE, ~~2017~~2021.

Section RS0005.1 revised as follows (the `schema_version` and Date will depend on the order of publication of the addenda and will be completed at the time of publication):

RS0005.1 Identification and History. `schema`: RS0005

<code>schema_version</code>	Date	Initial Approved Standard	Notes
1.0.0	2023	2023	Initial publication
		<u>2023 - Addendum A</u>	

Table RS0005-9 revised as follows:

Table RS0005-9 LookupVariables

Name	Description	Data Type	Units	Constraints	Req	Notes
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efficiency	Efficiency of motor	[Numeric/Null] [1..]	-	≥0.0, ≤1.0	✓	Defined as the ratio of mechanical shaft power to electrical input power of the motor
power_factor	Power factor of the motor	[Numeric/Null] [1..]	-	≥0.0, ≤1.0	✓	
operation_state	<u>The operation state at the operating conditions</u>	[<OperationState>]	=		✓	

Section RS0005.6 revised as follows:

RS0005.6 Application Rules

RS0005.6.1 Standby Performance. `standby_power` shall be used to simulate performance under the following conditions:

- a. when system controls are not calling for shaft rotation, or
- b. system controls are calling for shaft rotation, but the corresponding lookup variable `operation_state` values in `performance_map_cooling` ~~have~~ has a value of ~~Null~~ STANDBY at the current simulated conditions.

Section RS0006.1 revised as follows (the `schema_version` and Date will depend on the order of publication of the addenda and will be completed at the time of publication):

RS0006.1 Identification and History. `schema`: RS0006

<code>schema_version</code>	Date	Initial Approved Standard	Notes
1.0.0	2023	2023	Initial publication
		<u>2023 - Addendum A</u>	

Table RS0006-9 revised as follows:

Table RS0006-9 LookupVariables

Name	Description	Data Type	Units	Constraints	Req	Notes
efficiency	Efficiency of drive	[Numeric/Null] [1..]	-	≥0.0, ≤1.0	✓	<ul style="list-style-type: none"> Defined as the ratio of electrical output power (to the motor) to electrical input power (to the drive) Input power shall include any power required to provide active air cooling for the device
operation_state	The operation state at the operating conditions	[<OperationState>]	=		✓	

Section RS0006.6 revised as follows:

RS0006.6 Application Rules. standby_power shall be used to simulate performance under the following conditions:

- a. when system controls are not calling for drive output, or
- b. system controls are calling for drive output, but the corresponding lookup variable operation_state values in performance_map_cooling have has a value of Null STANDBY at the current simulated conditions.

Section RS0007.1 revised as follows (the schema_version and Date will depend on the order of publication of the addenda and will be completed at the time of publication):

RS0007.1 Identification and History. schema: RS0007

schema_version	Date	Initial Approved Standard	Notes
1.0.0	2023	2023	Initial publication
		<u>2023 - Addendum A</u>	

Table RS0007-9 revised as follows:

Table RS0007-9 LookupVariables

Name	Description	Data Type	Units	Constraints	Req	Notes
efficiency	Efficiency of drive	[Numeric/Null][1..]	-	$\geq 0.0, \leq 1.0$	✓	Defined as the ratio of output shaft power to input shaft power
<u>operation state</u>	<u>The operation state at the operating conditions</u>	[<OperationState>]	=		✓	