**Draft PDS-01 MINHERS Addendum 82, Direct Expansion HP & AC Modeling**

***Modify the ANSI/RESNET/ICC 301-2022 by adding the following:***

Direct Expansion Modeling to Appendix

# Nomenclature

## Symbols

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Description** | **Units** |
| Q | Heat (used for heating/cooling capacities and fan heat) | kBtu/h |
| P | Power | W |
| p | Specific Fan Power | W/cfm |
| SHR | Sensible Heat Ratio for cooling | - |
| V | Volumetric airflow | cfm |
| v | Volumetric airflow per rated net total capacity | cfm/ton |
| m | Mass airflow |  |
| T | Temperature | °F |

## Subscripts

|  |  |
| --- | --- |
| **Subscript** | **Description** |
| gross | Does not include fan heat/power |
| net | Includes fan heat/power |
| clg | Cooling |
| tot | Total (cooling capacity) |
| sen | Sensible (cooling capacity) |
| htg | Heating |
| ss | Steady-state (heating), does not include defrost effects |
| int | Integrated (heating), includes defrost effects |
| A | AHRI A cooling conditions (95, 80, 67) |
| rated/full | Rated full load compressor speed. Note: For some variable speed systems, the rated full load compressor speed can be lower than the maximum load compressor speed. The subscripts “rated” and “full” are used interchangeably. |
| max | Maximum load compressor speed |
| min | Minimum load compressor speed |
| i | Compressor speed/staging index |
| fan | Indoor fan |
| odb | Outdoor unit entering drybulb |
| iwb | Indoor unit entering wetbulb |
| idb | Indoor unit entering drybulb |

# Scope

Current scope includes the scope of AHRI 210/240. Not currently included are:

* Multi-splits
* Window AC/Portable AC
* PTAC/PTHP
* Ground source heat pumps

# Objective

Define the best representation of as-installed performance for unitary air-conditioning and air-source heat pump equipment at all combinations of conditions encountered in a predictive building performance model. This often requires interpretations, extrapolations, and assumptions for many aspects of operation beyond equipment ratings, design conditions, and product documentation.

# Net-to-Gross Performance Conversions

System performance shall be modeled using gross performance of the direct expansion system where the indoor fan performance is treated separately. Where net performance is provided, gross performance shall be determined by removing the impact of rated fan power/heat as follows:

Qgross,tot,clg,i = Qnet,tot,clg,I + Qfan,clg,i

Pgross,clg,i = Pnet,clg,i - Pfan,clg,i

Qgross,ss,htg,i = Qnet,ss,htg,i - Qfan,ss,htg,i

Pgross,ss,htg,i = Pnet,ss,htg,i - Pfan,ss,htg,i

The rated fan flow rate is:

Vclg,i = vclg,i\*Qnet,tot,clg,i\*(0.083 ton/(kBtu/hr))

Vhtg,ss,i = vhtg,ss,i\*Qnet,ss,htg,i\*(0.083 ton/(kBtu/hr))

Where the values of v (for all speeds) are:

|  |  |  |
| --- | --- | --- |
| **System Type** | **Mode** | **v (cfm/ton)** |
| Ducted | Cooling | 400 |
| Ducted | Heating | 400 |
| Ductless | Cooling | 400 |
| Ductless | Heating | 400 |

The rated fan power is determined using the fan efficacy listed below.

|  |  |  |
| --- | --- | --- |
| **System Type** | **Fan Motor Type** | **p (W/cfm)** |
| Ducted | PSC | 0.414 |
| Ducted | BPM | 0.281 |
| Ductless | PSC | 0.414 |
| Ductless | BPM | 0.171 |

Rated fan power is:

Pfan,rated = p\*Vclg,full

Fan power assumed in net performance at any speed or mode is then calculated as:

**BPM Motors (Ducted Systems):** Pfan,mode,i = Pfan,rated\*(Vmode,i/Vclg,full)2.75

**BPM Motors (Ductless Systems):** Pfan,mode,i = Pfan,rated\*(Vmode,i/Vclg,full)3

**PSC Motors:** Pfan,mode,i = Pfan,rated\*(Vmode,i/Vclg,full)\*(0.3\*(Vmode,i/Vclg,full) + 0.7))

# Variability with Indoor Conditions

Gross performance shall be modified to account for variations in indoor conditions relative to the indoor conditions under which the data is provided.

Qgross,tot,clg,i = Qgross,tot,clg,Todb,i\*fQ,clg,i(T­odb,Tiwb,v)/fQ,clg,i(T­odb,67°F,vclg,i)

Pgross,clg,i = Pgross,clg,Todb,i\*fEIR,clg,i(T­odb,Tiwb,v)/fEIR,clg,i(T­odb,67°F,vclg,i)\*fQ,clg,i(T­odb,Tiwb,v)/fQ,clg,i(T­odb,67°F,vclg,i)

Qgross,ss,htg,i = Qgross,ss,htg,Todb,i\*fQ,htg,i(T­odb,Tidb,v)/fQ,htg,i(T­odb,70°F,vhtg,ss,i)

Pgross,ss,htg,i = Pgross,ss,htg,Todb,i\*fEIR,htg,i(T­odb,Tidb,v)/fEIR,htg,i(T­odb,70°F,vhtg,ss,i)\*fQ,htg,i(T­odb,Tidb,v)/fQ,htg,i(T­odb,70°F,vhtg,ss,i)

where the functions above are defined as:

f(T1,T2,v) = (c1 + c2\*T1 + c3\*T12 + c4\*T2 + c5T22 + c6T1\*T2)\*(c7 + c8\*v/[400 cfm/ton] + c9\*(v/[400 cfm/ton])2)

| **Function:** | **fQ,clg(Tiwb,Todb,v)** | **fEIR,clg(Tiwb,Todb,v)** | **fQ,htg(Tidb,Todb,v)** | **fEIR,htg(Tidb,Todb,v)** |
| --- | --- | --- | --- | --- |
| **c1** | 3.717717741 | -3.400341169 | 0.568706266 | 0.722917608 |
| **c2** | -0.09918866 | 0.135184783 | -0.000747282 | 0.003520184 |
| **c3** | 0.000964488 | -0.001037932 | -1.03432E-05 | 0.000143097 |
| **c4** | 0.005887776 | -0.007852322 | 0.00945408 | -0.005760341 |
| **c5** | -1.2808E-05 | 0.000183438 | 5.0812E-05 | 0.000141736 |
| **c6** | -0.000132822 | -0.000142548 | -6.77828E-06 | -0.000216676 |
| **c7** | 0.718664047 | 1.143487507 | 0.694045465 | 2.185418751 |
| **c8** | 0.41797409 | -0.13943972 | 0.474207981 | -1.942827919 |
| **c9** | -0.136638137 | -0.004047787 | -0.168253446 | 0.757409168 |

Cooling variations shall be held constant for Tiwb less than 57°F and greater than 72°F, and for Todb less than 75°F. These functions are also referenced in the methodology for two-stage and single-stage systems.

# Calculation of Net Performance

Net capacity and power must be determined at all combinations of outdoor drybulb temperatures and compressor speeds. The following nomenclature is adopted to combine metrics, normalizations (if applicable), outdoor temperatures, and compressor speeds into distinct terms used in the modeling approach:

Metrics:

* Q = Net Capacity
* P = Net Power
* EIR = Net Energy Input Ratio (defined as Power/Capacity)
* COP = Net Coefficient of Performance (defined as Capacity/Power)

Normalizations:

* r = ratio (quantity relative to value at maximum compressor speed)
* m = maintenance (quantity relative to next least extreme outdoor temperature)
* mslope = maintenance slope (used to define how maintenance changing below 5°F)

Heating Outdoor Temperatures:

* 47 = 47°F
* 17 = 17°F
* 5 = 5°F
* LCT = Lowest Catalogued Temperature (product-specific value from NEEP data)
* Tmin = Minimum Compressor Operating Temperature (used in the model)

Cooling Outdoor Temperatures:

* 82 = 82°F
* 95 = 95°F

Compressor Speeds:

* min = Minimum capacity compressor speed
* rated = Rated (or full) capacity compressor speed
* max = Maximum capacity compressor speed

For example, “EIRm5max” is the Energy Input Ratio maintenance at 5°F and maximum capacity compressor speed. It is the ratio of the EIR at 5°F relative to the EIR at 17°F (the next least extreme temperature) at maximum capacity compressor speed.

The following data from an AHRI Certificate shall be used as input to the model:

* *Q47rated*: Heating Capacity (H1Full) High Stage (47°F)
* *Q17rated*: Heating Capacity (H3Full) High Stage (17°F)
* *HSPF2* (Region IV)
* *Q95rated*: Cooling Capacity (AFull) High Stage (95°F)
* *EER2* (AFull) High Stage (95°F)
* *SEER2*

## Variable Capacity Systems (Systems with Three or More Stages)

Net heating performance data is defined at each combination of three compressor speeds (Minimum, Rated, and Maximum) and four outdoor temperatures (Tmin, 5°F, 17°F, and 47°F).

Net cooling performance is defined at each combination of three compressor speeds (Minimum, Rated, and Maximum) and two outdoor temperatures (82°F and 95°F).

The following mean values of normalized data from the NEEP database shall be used to determine the full set of performance data:

|  |  |  |
| --- | --- | --- |
| **Quantity** | **Definition** | **Mean Value** |
| Qr47rated | Q47rated/Q47max | 0.908 |
| Qr47min | Q47min/Q47max | 0.272 |
| Qr17rated | Q17rated/Q17max | 0.817 |
| Qr17min | Q17min/Q17min | 0.341 |
| Qm5max | Q5max/Q17max | 0.866 |
| Qr5rated | Q5rated/Q5max | 0.988 |
| Qr5min | Q5min/Q5max | 0.321 |
| QmslopeLCTmax | (1 - Q5max/QLCTmax)/(5°F - LCT) | -0.025 |
| QmslopeLCTmin | (1 - Q5min/QLCTmin)/(5°F - LCT) | -0.024 |
| Qr95rated | Q95rated/Q95max | 0.934 |
| Qm95max | Q95max/Q82max | 0.940 |
| Qm95min | Q95min/Q82min | 0.948 |
| EIRr47rated | (P47rated/Q47rated)/(P47max/Q47max) | 0.939 |
| EIRr47min | (P47min/Q47min)/(P47max/Q47max) | 0.730 |
| EIRm17rated | (P17rated/Q17rated)/(P47rated/Q47rated) | 1.351 |
| EIRr17rated | (P17rated/Q17rated)/(P17max/Q17max) | 0.902 |
| EIRr17min | (P17min/Q17min)/(P17max/Q17max) | 0.798 |
| EIRm5max | (P5max/Q5max)/(P17max/Q17max) | 1.164 |
| EIRr5rated | (P5rated/Q5rated)/(P5max/Q5max) | 1.000 |
| EIRr5min | (P5min/Q5min)/(P5max/Q5max) | 0.866 |
| EIRmslopeLCTmax | (1 - (PLCTmax/QLCTmax)/(P5max/Q5max))/(5°F - LCT) | 0.012 |
| EIRmslopeLCTmin | (1 - (PLCTmin/QLCTmin)/(P5min/Q5min))/(5°F - LCT) | 0.012 |
| EIRr95rated | (P95rated/Q95rated)/(P95max/Q95max) | 0.928 |
| EIRm95max | (P95max/Q95max)/(P82max/Q82max) | 1.326 |
| EIRm95min | (P95min/Q95min)/(P82min/Q82min) | 1.315 |

The following values are determined using bi-linear interpolation of the tables provided. The values in these tables are developed such that the model of the equipment results in consistent seasonal ratings when simulating the AHRI 210/240 2023 test procedures.

*COP47rated*:

|  |  |
| --- | --- |
|  | HSPF2 |
| Qm17rated | 7 | 9.25 | 11.5 | 13.75 | 16 |
| 0.500 | 2.702 | 4.050 | 5.796 | 8.202 | 11.689 |
| 0.540 | 2.620 | 3.832 | 5.341 | 7.265 | 9.800 |
| 0.620 | 2.493 | 3.507 | 4.663 | 5.990 | 7.529 |
| 0.780 | 2.364 | 3.168 | 3.995 | 4.845 | 5.720 |
| 1.100 | 2.182 | 2.875 | 3.564 | 4.248 | 4.928 |

*COP82min*:

|  |  |
| --- | --- |
|  | **SEER2** |
| **SEER2/EER2** | 14 | 24.5 | 35 |
| 1.000 | 4.047 | 7.061 | 10.058 |
| 1.747 | 6.175 | 10.289 | 14.053 |
| 2.120 | 14.240 | 23.262 | 30.962 |
| 2.307 | 19.508 | 31.842 | 42.388 |
| 2.400 | 23.029 | 37.513 | 49.863 |

Full performance is calculated using the following equations based on the mean values of normalized data from the NEEP database (in **bold**) and the AHRI certified rating data (in *italics*):

| **Value** | **Equation** |
| --- | --- |
| Q47max | *Q47rated* / **Qr47rated** |
| Q47min | Q47max \* **Qr47min** |
| Q17max | *Q17rated* / **Qr17rated** |
| Q17min | Q17max \* **Qr17min** |
| Q5max | Q17max \* **Qm5max** |
| Q5rated | Q5max \* **Qr5rated** |
| Q5min | Q5max \* **Qr5min** |
| QTminmax | Q5max / ( 1 - **QmslopeLCTmax**\*(5°F - Tmin)) |
| QTminmin | Q5min / ( 1 - **QmslopeLCTmin**\*(5°F - Tmin)) |
| QTminrated | QTminmin + (Q5rated - Q5min)/(Q5max - Q5min)\*(QTminmax - QTminmin) |
| P47rated | *Q47rated* / *COP47rated* |
| P47max | P47rated / (**Qr47rated** \* **EIRr47rated**) |
| P47min | P47max \* (**Qr47min** \* **EIRr47min**) |
| P17rated | P47rated \* ((*Q17rated*/*Q47rated*) \* **EIRm17rated**) |
| P17max | P17rated / (**Qr17rated** \* **EIRr17rated**) |
| P17min | P17max \* (**Qr17min** \* **EIRr17min**) |
| P5max | P17max \* (**Qm5max** \* **EIRm5max**) |
| P5rated | P5rated / (**Qr5rated** \* **EIRr5rated**) |
| P5min | P5max \* (**Qr5min** \* **EIRr5min**) |
| PTminmax | P5max / ((QTminmax/Q5max) \* ( 1 - **EIRmslopeLCTmax**\*(5°F - Tmin))) |
| PTminmin | P5min / ((QTminmin/Q5min) \* ( 1 - **EIRmslopeLCTmin**\*(5°F - Tmin))) |
| PTminrated | PTminmin + (P5rated - P5min)/(P5max - P5min)\*(PTminmax - PTminmin) |
| Q95max | *Q95rated* / **Qr95rated** |
| Q82max | Q95max / **Qm95max** |
| P95rated | *Q95rated* / (*EER2* / 3.412) |
| P95max | P95rated / (**Qr95rated** \* **EIRr95rated**) |
| P82max | P95max / (**Qm95max** \* **EIRm95max**) |
| Q95min | Q95max \*(0.029 + 0.369\*(Q82max/P82max)/*COP82min*) |
| Q82min | Q95min / **Qm95min** |
| Q82rated | Q82min + (*Q95rated* - Q95min)/(Q95max - Q95min)\*(Q82max - Q82min) |
| P82min | **Qr82min** / COP82min |
| P95min | P82min \* (Qm95min \* **EIRm95min**) |
| P82rated | P82min + (P95rated - P95min)/(P95max - P95min)\*(P82max - P82min) |

## Two Stage Systems

Net heating performance data is defined at each combination of two compressor speeds (Minimum and Rated) and four outdoor temperatures (Tmin, 5°F, 17°F, and 47°F).

Net cooling performance is defined at each combination of two compressor speeds (Minimum and Rated) and two outdoor temperatures (82°F and 95°F).

The following values of normalized data shall be used to determine the full set of performance data:

|  |  |  |
| --- | --- | --- |
| **Quantity** | **Definition/Calculation** | **Value** |
| Qm95rated | Q95rated/Q82rated = 1.0 / fQ,clg,i(82°F,67°F,400W/cfm) | 0.936 |
| EIRm17rated | (P17rated/Q17rated)/(P47rated/Q47rated) = fEIR,htg,i(17°F,70°F,400W/cfm) | 1.356 |
| EIRm95rated | (P95rated/Q95rated)/(P82rated/Q82rated) = 1.0 / fEIR,clg,i(82°F,67°F,400W/cfm) | 1.244 |
| QrHmin | Qmin/Qrated for all heating temperatures | 0.712 |
| EIRrHmin | (Pmin/Qmin)/(Prated/Qrated) for all heating temperatures | 0.850 |
| QrCmin | Qmin/Qrated for all cooling temperatures | 0.728 |

The following values are determined using bi-linear interpolation of the tables provided. The values in these tables are developed such that the model of the equipment results in consistent seasonal ratings when simulating the AHRI 210/240 2023 test procedures.

*COP47rated*:

|  |  |
| --- | --- |
|  | **HSPF2** |
| **Qm17rated** | 5 | 6.5 | 8 | 9.5 | 11 |
| 0.500 | 1.791 | 2.587 | 3.576 | 4.843 | 6.523 |
| 0.533 | 1.775 | 2.535 | 3.457 | 4.602 | 6.061 |
| 0.600 | 1.753 | 2.451 | 3.262 | 4.218 | 5.359 |
| 0.733 | 1.716 | 2.319 | 2.973 | 3.682 | 4.456 |
| 1.000 | 1.654 | 2.169 | 2.694 | 3.229 | 3.773 |

*COP82min*:

|  | **SEER2** |
| --- | --- |
| **SEER2/EER2** | 6 | 22 |
| 1.000 | 1.777 | 6.517 |
| 2.400 | 2.105 | 7.717 |

Full performance is calculated using the following equations based on the normalized data (in **bold**) and the AHRI certified rating data (in *italics*):

| **Value** | **Equation** |
| --- | --- |
| Q47min | *Q47rated* \* **QrHmin** |
| Q17min | *Q17rated* \* **QrHmin** |
| P47rated | *Q47rated* / *COP47rated* |
| P17rated | P47rated \* ((*Q17rated*/*Q47rated*) \* **EIRm17rated**) |
| P47min | P47rated \* (**QrHmin** \* **EIRrHmin**) |
| P17min | P17rated \* (**QrHmin** \* **EIRrHmin**) |
| Q82rated | Q95rated / **Qm95rated** |
| Q95min | Q95rated \* **QrCmin** |
| Q82min | Q82rated \* **QrCmin** |
| P95rated | *Q95rated* / (*EER2* / 3.412) |
| P82rated | P95rated / (**Qm95rated** \* **EIRm95rated**) |
| P82min | Q82min / *COP82min* |
| P95min | Q82min \* (**Qm95rated** \* **EIRm95rated**) |

## Single Stage Systems

Net heating performance data is defined at the “Rated” compressor speed for four outdoor temperatures (Tmin, 5°F, 17°F, and 47°F).

Net cooling performance is defined at the “Rated” compressor speed for two outdoor temperatures (82°F and 95°F).

The following values of normalized data shall be used to determine the full set of performance data:

|  |  |  |
| --- | --- | --- |
| **Quantity** | **Definition/Calculation** | **Value** |
| Qm95rated | Q95rated/Q82rated = 1.0 / fQ,clg,i(82°F,67°F,400W/cfm) | 0.936 |
| EIRm17rated | (P17rated/Q17rated)/(P47rated/Q47rated) = fEIR,htg,i(17°F,70°F,400W/cfm) | 1.356 |

The following values are determined using bi-linear interpolation of the tables provided. The values in these tables are developed such that the model of the equipment results in consistent seasonal ratings when simulating the AHRI 210/240 2023 test procedures.

*COP47rated*:

|  |  |
| --- | --- |
|  | **HSPF2** |
| **Qm17rated** | 5 | 6.5 | 8 | 9.5 | 11 |
| 0.500 | 1.971 | 2.844 | 3.933 | 5.327 | 7.178 |
| 0.533 | 1.963 | 2.801 | 3.819 | 5.085 | 6.699 |
| 0.600 | 1.946 | 2.720 | 3.622 | 4.683 | 5.951 |
| 0.733 | 1.915 | 2.589 | 3.318 | 4.111 | 4.975 |
| 1.000 | 1.904 | 2.498 | 3.102 | 3.718 | 4.345 |

Full performance is calculated using the following equations based on the normalized data (in **bold**) and the AHRI certified rating data (in *italics*):

| **Value** | **Equation** |
| --- | --- |
| P47rated | *Q47rated* / *COP47rated* |
| P17rated | P47rated \* ((*Q17rated*/*Q47rated*) \* **EIRm17rated**) |
| P95rated | *Q95rated* / (*EER2* / 3.412) |
| Q82rated | Q95rated / **Qm95rated** |
| P82rated | Q82rated / ((*SEER2*/(1.0 – 0.5\*CD)) / 3.412) where CD=0.08 |

# Extrapolation of Performance at other Outdoor Temperatures

Net capacity (total and steady state) and input power is extrapolated for all speeds according to the table below:

| **Mode** | **Temperature** | **Extrapolation** |
| --- | --- | --- |
| Cooling | 60°F | Linear from 82°F and 95°F cooling performance, but no less than 50% of the value at 82°F. |
| Cooling | Maximum compressor operating temperature | Linear from 82°F and 95°F cooling performance |
| Heating | Minimum compressor operating temperature (if different from lowest temperature where heating performance is provided) | Linear from lowest two temperatures where heating performance is provided |
| Heating | 60°F | Constant (same values as 47°F heating performance) |

The equipment is assumed to not operate beyond the temperatures listed above.

# Sensible Cooling Capacity

Calculate gross SHR at AHRI “A” conditions for each speed from Proctor correlation:

SHRgross,A,i = min(1, -0.3890114 + 0.002743\*vclg,rated,i)

Calculate “A0” coil constant from Bypass Factor at “A” conditions for each speed, using the Apparatus Dew Point methodology.

Bypass Factor for any speed at given operating conditions is:

BFi = eA0,i/mclg,i

Gross sensible cooling capacity is calculated from the gross total cooling capacity and the Bypass Factor using the corresponding Apparatus Dew Point conditions.

# Defrost

The integrated heating capacity of the heat pump shall be reduced for any outdoor drybulb temperature lower than the maximum defrost temperature (40°F) using the equations below.

fdef(Todb) = max(min(0.134-0.003\*Todb, 0.08), 0)

Qgross,int,htg,i = Qgross,ss,htg,i\*[1 - 1.8\*fdef(Todb)]

Pgross,int,htg,i = Pgross,ss,htg,i\*[1 - 0.3\*fdef(Todb)]

While defrosting, the supplemental heat is active and the indoor fan is running.

Pan heaters are assumed to operate at 150W whenever the outdoor temperature is below 32°F.

# Operating Performance

Operating performance is determined based on the gross performance of the system (interpolated based on outdoor temperature), and the sensible load on the system:

* If the sensible load is less than the minimum capacity of the system at the current operating conditions, the system will cycle between performance at minimum capacity and off. While cycling, a degradation coefficient of 0.08 shall be applied to single stage and two stage systems, and a degradation coefficient of 0.40 shall be applied to variable speed systems.
* If the sensible load is greater than the maximum capacity of the system at the current operating conditions, the system will operate at maximum capacity.
* If the sensible load is between the capacity of two speeds, the gross performance is interpolated using the ratio of the load to the gross sensible capacities at the speeds above and below the load.

When cycling, the cycling ratio is ratio of the sensible load to the minimum sensible capacity at the current operating conditions:

fcyc = Loadsen/Qsen,min

The additional energy related to cycling degradation is accounted for by adjusting the power:

Pgross,cyc = Pgross,min/[1+CD\*(fcyc - 1)]

# Indoor Fan Energy

Operational fan energy

* Airflow from grading / default
* Airflow at other conditions proportional to gross capacity at other conditions
* Fan power from grading / default
* Fan power at other conditions uses the same fan power relationships as used earlier based on distribution type and blower motor type.

# Supplemental Heating

Supplemental heating shall only operate when there is not adequate capacity (in the compressor and/or gas backup) to meet the full load, including when the outdoor temperature falls below the minimum compressor operating temperature. Supplemental heating shall only provide the additional amount of heat to meet the load. The supplemental heating capacity in both the Rated Home and the Reference Home shall be sized to meet the building heating load.

If the system does not have supplemental heating, the system in the Rated Home shall include electric resistance supplemental heat.

# Standby Power

Crankcase power = 10 W per ton of rated net cooling capacity when the system is not on and the temperature is below 50°F.

# Minimum Rated Features

|  |  |  |  |
| --- | --- | --- | --- |
| **Feature** | **Description** | **Source** | **Default** |
| Qnet,tot,clg,A,full | Rated full load net total cooling capacity at AHRI “A” (95°F) conditions | AHRI Certificate/Directory | Required |
| SEER2 | Seasonal Energy Efficiency Ratio as defined by AHRI 210/240-2023 | AHRI Certificate | Required |
| EER2 | Energy Efficiency Ratio at AHRI “A” (95°F) conditions as defined by AHRI 210/240-2023 | AHRI Certificate | Required |
| Qnet,ss,htg,H1,full | Rated full load net steady-state heating capacity at AHRI “H1” (47°F) conditions | AHRI Certificate | Required |
| Qnet,ss,htg,H3,full | Rated full load net steady-state heating capacity at AHRI “H3” (17°F) conditions | AHRI Certificate | Required |
| HSPF2 | Heating Seasonal Performance Factor as defined by AHRI 210/240-2023 | AHRI Certificate | Required |
| Number of Speeds/stages | Number of speeds/stages used in compressor control:Single StageTwo StageVariable Capacity | Product Literature | Required |
| Fan Motor Type | Type of motor used by the indoor fan | Product Literature | Permanent Split Capacitor (PSC) for single speed equipment, otherwise Brushless Permanent Magnet (BPM) |
| Type of Supplemental Heating | Electric ResistanceFossil Fuel FurnaceNone | Product literature, visual inspection | Electric Resistance |
| Minimum Compressor Operating Temperature | Minimum temperature for compressor heating operation | Product Literature, NEEP Database Lowest Catalogued Temperature (LCT) | Number of Speeds <= 2: 0°FNumber of Speeds > 2: -20°F |
| Maximum Compressor Operating Temperature | Maximum temperature for compressor cooling operation | Product Literature | 125°F |