Input Output Reference

The Encyclopedic Reference to EnergyPlus Input and Output

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# Input-Output Reference

### Coil:WaterHeating:AirToWaterHeatPump:VariableSpeed

Coil:WaterHeating:AirToWaterHeatPump:VariableSpeed object described here models a variable-speed, air-to-water compression system to determine its air-side and water-side performance. This water heating coil object calculates the air-side sensible and latent cooling capacity at the specific operating conditions for each simulation timestep, as well as the condenser’s water heating capacity, and water-side temperature difference at a given condenser water flow rate. It also calculates the required power consumptions, including total, compressor, and pump and crankcase power.

The Variable-Speed Water Heating Coil object is a collection of performance curves that represent the heating coil at various speed levels. The performance curves should be generated from the Heat Pump Water Heater Reference Unit catalog data. This is a curve-fit model that resembles a black box with no usage of heat transfer equations. The number of speed levels can range from 1 to 10. The heating coil has four node connections, i.e. two air sides and two water sides. The user needs to specify a nominal speed level, at which the rated heating capacity, rated volumetric air and water flow rate are sized. The rated water heating capacity, rated volumetric flow rates represent the real situation in the air and water loops, and are used to determine the flow rates at various speed levels in the parent object, e.g. WaterHeater:HeatPump. It shall be mentioned that the performance correction curves, i.e. the temperature and flow fraction correction curves, should be normalized to the capacity and flow rates at each individual speed and at the rated operating conditions, similar to the performance curves used in the DX coils. On the other hand, the performance values at individual speed levels, e.g. capacities, COPs, SHRs, pump powers, and flow rates, should be given, regarding a specific unit from the Reference Unit catalog data. In the following content, the statement started with “Reference Unit” means the actual Reference Unit catalog data. Some equations are provided below to help explain the function of the various performance curves and data fields.

The input fields for this object are described below in detail:

***Field: Name***

This alpha field defines a unique user-assigned name for an instance of a heat pump water heater coil. Any reference to this coil by another object (e.g., WaterHeater:HeatPump) will use this name.

***Field: Number of Speeds***

This numeric field contains the maximum number of speed levels that the module uses. The number of speeds, for which the user input the performance data and curves, has to be equal to or higher than the maximum number. The performance inputs at higher speeds are ignored.

***Field: Nominal Speed Level***

This numeric field defines the nominal speed level, at which the rated water heating capacity, rated air and water volumetric flow rate are correlated.

***Field: Rated Water Heating Capacity***

This numeric field defines the coil water heating capacity in Watts at the rated evaporator inlet air temperatures, rated condenser inlet water temperature, rated evaporator air flow rate, and rated condenser water flow rate specified below. Values must be greater than 0. This value represents water heating capacity, and it may or may not include the impact of condenser pump heat (see field Condenser Pump Heat Included in Rated Heating Capacity below).

The rated heating capacity is used to determine a capacity scaling factor, as compared to the Reference Unit capacity at the nominal speed level.

And then, this scaling factor is used to determine capacities at the rated condition for other speed levels, as below,

***Field: Rated Evaporator Inlet Air Dry-Bulb Temperature***

This numeric field defines the evaporator inlet air dry-bulb temperature, in degrees Celsius, that corresponds to rated coil performance (heating capacity, COP and SHR). Values must be greater than 5°C. If this field is left blank, the default value is 19.7°C.

***Field: Rated Evaporator Inlet Air Wet-Bulb Temperature***

This numeric field defines the evaporator inlet air wet-bulb temperature, in degrees Celsius, that corresponds to rated coil performance (heating capacity, COP and SHR). Values must be greater than 5°C. If this field is left blank, the default value is 13.5°C.

***Field: Rated Condenser Inlet Water Temperature***

This numeric field defines the condenser inlet water temperature, in degrees Celsius, that corresponds to rated coil performance (heating capacity, COP and SHR). Values must be greater than 25°C. If this field is left blank, the default value is 57.5°C.

***Field: Rated Evaporator Air Flow Rate***

This numeric field defines the evaporator air volume flow rate in cubic meters per second at rated conditions. Values must be greater than 0. If this field is left blank or autocalculated (field value = autocalculate), the default value is the Reference Unit Volumetric Air Flow Rate at the nominal speed level, scaled by the specified above. When autocalculating the rated evaporator air volumetric flow rate, a zone sizing object is not required.

The value is used to determine an internal scaling factor, and calculate the air flow rates in the parent object. It is recommended that the ratio of the rated volumetric air flow rate to the rated capacity is the same as the unit performance from the Reference Unit data.

And the volumetric air flow rate in the parent object are calculated as below,

***Field: Rated Condenser Water Flow Rate***

This numeric field defines the condenser water volumetric flow rate in cubic meters per second at rated conditions. Values must be greater than 0. If this field is left blank or autocalculated (field value = autocalculate), the default value is the Reference Unit Volumetric Water Flow Rate at the nominal speed level, scaled by the specified above. When autocalculating the rated condenser water volumetric flow rate, a zone sizing object is not required. The value is used to determine an internal scaling factor, and calculate the water flow rates at other speed levels. It is recommended that the ratio of the rated volumetric water flow rate to the rated capacity is the same as the unit performance from the Reference Unit data.

And the required volumetric water flow rate in the water loop are calculated as below,

***Field: Evaporator Fan Power Included in Rated COP***

This choice field specifies if evaporator fan power is included in the rated COP defined above. This input impacts the calculation of compressor electric power and total air cooling provided by the evaporator for each simulation timestep. If Yes is selected, the evaporator fan power is subtracted from the total electric heating power when calculating total evaporator cooling capacity. If No is selected, it is assumed that the total heating power does not include evaporator fan power. If this field is left blank, the default is Yes.

***Field: Condenser Pump Power Included in Rated COP***

This choice field specifies if condenser pump power is included in the rated COP defined above. This input impacts the calculation of compressor electric power which then impacts the total air cooling provided by the evaporator for each simulation timestep. If Yes is selected, the condenser pump power is subtracted from the total electric heating power when calculating total evaporator cooling capacity. If No is selected, it is assumed that the total heating power does not include the condenser pump. If this field is left blank, the default is No.

***Field: Condenser Pump Heat Included in Rated Heating Capacity and Rated COP***

This choice field specifies if condenser pump heat is included in the rated heating capacity and rated COP defined above. This input impacts the calculation of compressor electric power and total air cooling provided by the evaporator for each simulation timestep. If Yes is selected, the condenser pump heat is already included in the rated heating capacity and rated COP. If No is selected, it is assumed that the rated heating capacity and rated COP do not include the condenser pump heat, and pump heat is added to the total water heating capacity based on the Condenser Water Pump Power and Fraction of Condenser Pump Heat to Water fields below. If this field is left blank, the default is No.

***Field: Fraction of Condenser Pump Heat to Water***

This numeric field defines the fraction of condenser pump heat that is transferred to the condenser water. The pump is assumed to be downstream of the condenser water coil, and this field is used to determine the water temperature at the condenser outlet node when the field Condenser Pump Power Included in Rated Heating Capacity is set to No. Values must be greater than or equal to 0 and less than or equal to 1. If this field is left blank, the default value is 0.2.

***Field: Evaporator Air Inlet Node Name***

This alpha field defines the name of the air node from which the evaporator coil draws its inlet air.

***Field: Evaporator Air Outlet Node Name***

This alpha field defines the name of the air node to which the evaporator coil sends its outlet air.

***Field: Condenser Water Inlet Node Name***

This alpha field defines the name of the node from which the DX coil condenser draws its inlet water. This node name must also match the source side outlet node name for the water heater tank connected to this DX coil (ref: Water Heaters).

***Field: Condenser Water Outlet Node Name***

This alpha field defines the name of the node to which the heat pump condenser sends it outlet water. This node name must also match the source side inlet node name for the water heater tank connected to this DX coil (ref: Water Heaters).

***Field: Crankcase Heater Capacity***

This numeric field defines the compressor’s crankcase heater capacity in Watts. The crankcase heater only operates when the compressor is off and the air surrounding the compressor is below the Maximum Ambient Temperature for Crankcase Heater Operation specified below.

***Field: Maximum Ambient Temperature for Crankcase Heater Operation***

This numeric field defines the maximum ambient temperature for crankcase heater operation in degree Celsius. The crankcase heater only operates when the air surrounding the compressor is below this maximum temperature value and the compressor is off The ambient temperature surrounding the compressor is set by the Heat Pump:Water Heater parent object (field Compressor Location).

***Field: Evaporator Air Temperature Type for Curve Objects***

This choice field specifies the air temperature type used for the heating capacity and COP modifier curve objects below. The valid selections are Dry-bulb Temperature and Wet-bulb Temperature. If dry-bulb temperature is selected, the inlet air dry-bulb temperature entering the heat pump DX coil and fan section is used to evaluate the curve objects. If wet-bulb temperature is selected, the inlet air wet-bulb temperature entering the heat pump DX coil and fan section is used to evaluate the curve objects. If this field is left blank, the default value is wet-bulb temperature.

***Field: Part Load Fraction Correlation Curve Name***

This alpha field defines the name of a quadratic or cubic performance curve (Ref: Performance Curves) that parameterizes the variation of electrical power input to the unit as a function of the part load ratio (PLR, heating load/steady-state heating capacity for Speed 1), in the case that the unit operates under the lowest speed, i.e. on/off. The part load fraction (PLF) correlation accounts for efficiency losses due to compressor cycling. The part load fraction correlation should be normalized to a value of 1.0 when the part load ratio equals 1.0 (i.e., no efficiency losses when the compressor(s) run continuously for the simulation timestep). For PLR values between 0 and 1 (0 <= PLR < 1), the following rules apply:

PLF >= 0.7 and PLF >= PLR

If PLF < 0.7, the program resets the PLF value to 0.7, and the simulation proceeds. The runtime fraction of the coil is defined as PLR/PLF. If PLF < PLR, the runtime fraction of the coil is limited to 1.0. A typical part load fraction correlation would be:

***Field Group: rated specifications, performance curves***

The performance for each heating speed must be specified as shown below. They should be directly given from the Reference Unit data. All inputs for Speed 1 are required, followed by the optional inputs for other speeds.

***Field: Speed <x> Reference Unit Water Heating Capacity***

This numeric field defines the full load heating capacity in watts of the air-to-water heating coil unit at rated conditions for Speed <x> operation. The value entered here must be greater than 0.

***Field: Speed <x> Reference Unit COP***

This numeric field defines the coefficient of performance (COP=heating capacity output in watts divided by electrical power input in watts) of the heating coil at rated conditions for Speed <x> operation. The value entered here must be greater than 0.

***Field: Speed <x> Reference Unit SHR***

This numeric field defines sensible heat transfer ratio (SHR = sensible heat transfer rate divided by total cooling capacity) of the evaporator at rated conditions for Speed <x> operation, which should not include the fan heat. The value entered here must be greater than 0.0 and less than 1.0. This value should be obtained from the Reference Unit data. If the evaporator is located outdoor, the user can leave this field blank, and a default value of 0.85 will be used.

***Field: Speed <x> Reference Unit Volumetric Air Flow Rate***

This numeric field defines the volume air flow rate, in m3 per second, across the evaporator coil at rated conditions for Speed <x> operation. The value entered here should be directly from the Reference Unit data, corresponding to the given heating capacity and COP at the speed, as above.

***Field: Speed <x> Reference Unit Volumetric Water Flow Rate***

This numeric field defines the volume water flow rate, in m3 per second, at rated conditions for Speed <x> operation. The value entered here should be directly from the Reference Unit data, corresponding to the given heating capacity and COP at the speed, as above.

***Field: Speed <x> Reference Unit Pump Power***

This numeric field defines the pump power in Watts, to drive the water flow rate for Speed <x> operation. The value entered here should be directly from the Reference Unit data, corresponding to the given COP at the speed, as above.

***Field: Speed <x> Heating Capacity Function of Temperature Curve Name***

This alpha field defines the name of a bi-quadratic performance curve for Speed <x> (ref: Performance Curves) that parameterizes the variation of the heating capacity as a function of the indoor dry-bulb or wet bulb, and entering water temperature, from the Reference Unit. The output of this curve is multiplied by the rated heating capacity at the speed to give the heating capacity at specific temperature operating conditions (i.e., at an air dry-bulb or wet bulb temperature, and entering water temperature different from the rating point temperatures). It should be noted that the curve is normalized to the heating capacity at Speed<x> from the Reference Unit data, and have the value of 1.0 at the rating point.

***Field: Speed <x> Heating Capacity Function of Air Flow Fraction Curve Name***

This alpha field defines the name of a quadratic or cubic performance curve for Speed <x> (ref: Performance Curves) that parameterizes the variation of heating capacity as a function of the ratio of actual air flow rate across the evaporator coil to the design air flow rate (i.e., fraction of full load flow), at Speed <x> from the Reference Unit data. The curve is normalized to have the value of 1.0 when the actual air flow rate equals the design air flow rate at Speed <x>.

***Field: Speed <x> Heating Capacity Function of Water Flow Fraction Curve Name***

This alpha field defines the name of a quadratic or cubic performance curve for Speed <x> (ref: Performance Curves) that parameterizes the variation of heating capacity as a function of the ratio of actual water flow rate across the heating coil to the design water flow rate (i.e., fraction of full load flow), at Speed <x> from the Reference Unit data. The curve is normalized to have the value of 1.0 when the actual water flow rate equals the design air flow rate at Speed <x>.

The actual heating capacity at Speed <x>, considering variations in temperatures, air and water flow rate are calculated as below:

***Field: Speed <x> COP Function of Temperature Curve Name***

This alpha field defines the name of a bi-quadratic curve for Speed <x> (ref: Performance Curves) that parameterizes the variation of the COP as a function of the both the indoor air dry-bulb or wet bulb, and entering water temperatures. The output of this curve is multiplied by the rated COP at Speed <x> from the Reference Unit data to give the COP at specific temperature operating conditions (i.e., at an air dry bulb or wet bulb temperature, and entering water temperature, different from the rating point temperatures). The curve is normalized to have the value of 1.0 at the rating point.

***Field: Speed <x> COP Function of Air Flow Fraction Curve Name***

This alpha field defines the name of a quadratic or cubic performance curve for Speed <x> (ref: Performance Curves) that parameterizes the variation of the COP as a function of the ratio of actual air flow rate across the heating coil to the design air flow rate (i.e., fraction of full load flow, at Speed <x> from the Reference Unit data). This curve is normalized to a value of 1.0 when the actual air flow rate equals the rated air flow rate.

***Field: Speed <x> COP Function of Water Flow Fraction Curve Name***

This alpha field defines the name of a quadratic or cubic performance curve for Speed <x> (ref: Performance Curves) that parameterizes the variation of the COP as a function of the ratio of actual water flow rate across the heating coil to the rated water flow rate (i.e., fraction of full load flow, at Speed <x> from the Reference Unit data). This curve is normalized to a value of 1.0 when the actual water flow rate equals the design water flow rate.

The actual COP at Speed <x>, considering variations in temperatures, air and water flow rates is calculated as below:

And, the actual power consumption is calculated:

Following is an example of IDD input for a variable-speed water source heating coil.

Coil:WaterHeating:AirToWaterHeatPump:VariableSpeed,

\memo vairlable-speed Heat pump water heater (VSHPWH) heating coil, air-to-water

\memo system which includes a variable-speed water heating coil, evaporator air coil, evaporator

\memo fan, electric compressor, and water pump. Part of a WaterHeater:HeatPump system.

\min-fields 33

A1 , \field Name

\required-field

\type alpha

\reference HeatPumpWaterHeaterDXCoilsVariableSpeed

\note Unique name for this instance of a variable-speed heat pump water heater DX coil.

N1, \field Number of Speeds

\units dimensionless

\type integer

\required-field

\minimum 1

\maximum 10

\default 1

N2 , \field Nominal Speed Level

\units dimensionless

\type integer

\default 1

\required-field

\note must be lower than or equal to the highest speed number

N3 , \field Rated Water Heating Capacity

\required-field

\type real

\units W

\minimum> 0

\note Water Heating capacity at the rated inlet air temperatures, rated condenser inlet

\note water temperature, rated air flow rate, and rated water flow rate.

\note Can optionally include condenser pump heat.

N4 , \field Rated Evaporator Inlet Air Dry-Bulb Temperature

\type real

\units C

\minimum> 5

\default 19.7

\note Evaporator inlet air dry-bulb temperature corresponding to rated coil performance

\note (heating capacity, COP and SHR).

N5 , \field Rated Evaporator Inlet Air Wet-Bulb Temperature

\type real

\units C

\minimum> 5

\default 13.5

\note Evaporator inlet air wet-bulb temperature corresponding to rated coil performance

\note (heating capacity, COP and SHR).

N6 , \field Rated Condenser Inlet Water Temperature

\type real

\units C

\minimum> 25

\default 57.5

\note Condenser inlet water temperature corresponding to rated coil performance

\note (heating capacity, COP and SHR).

N7 , \field Rated Evaporator Air Flow Rate

\type real

\units m3/s

\minimum> 0

\autocalculatable

\note Evaporator air flow rate corresponding to rated coil performance

\note (heating capacity, COP and SHR).

\note Default is 5.035E-5 m3/s/W (31.25 cfm/MBH) of rated heating capacity when autocalculated.

N8 , \field Rated Condenser Water Flow Rate

\type real

\units m3/s

\minimum> 0

\autocalculatable

\note Condenser water flow rate corresponding to rated coil performance

\note (heating capacity, COP and SHR).

\note Default is 4.487E-8 m3/s/W (0.208 gpm/MBH) of rated heating capacity when autocalculated.

\note A warning message will be issued if the ratio of Rated Condenser Water Flow Rate

\note to Heating Capacity is less than 1.79405E-8 m3/s/W (0.083 gpm/MBH)

\note or greater than 8.97024E-8 m3/s/W (0.417 gpm/MBH), but the simulation will continue.

A2 , \field Evaporator Fan Power Included in Rated COP

\type choice

\key Yes

\key No

\default Yes

\note Select Yes if the evaporator fan power is included in the rated COP. This choice field

\note impacts the calculation of compressor electric power.

A3 , \field Condenser Pump Power Included in Rated COP

\type choice

\key Yes

\key No

\default No

\note Select Yes if the condenser pump power is included in the rated COP. This choice field

\note impacts the calculation of compressor electric power.

A4 , \field Condenser Pump Heat Included in Rated Heating Capacity and Rated COP

\type choice

\key Yes

\key No

\default No

\note Select Yes if the condenser pump heat is included in the rated heating capacity and

\note rated COP. This choice field impacts the calculation of water heating capacity.

N9 , \field Fraction of Condenser Pump Heat to Water

\type real

\minimum 0

\maximum 1

\default 0.2

\note Fraction of pump heat transferred to the condenser water. The pump is assumed

\note to be located downstream of the condenser.

A5 , \field Evaporator Air Inlet Node Name

\required-field

\type node

\note The node from which the DX coil draws its inlet air.

A6 , \field Evaporator Air Outlet Node Name

\required-field

\type node

\note The node to which the DX coil sends its outlet air.

A7 , \field Condenser Water Inlet Node Name

\required-field

\type node

\note The node from which the DX coil condenser draws its inlet water.

\note This name should match the source side outlet node name in the associated

\note water heater tank object.

A8 , \field Condenser Water Outlet Node Name

\required-field

\type node

\note The node to which the DX coil condenser sends its outlet water.

\note This name should match the source side inlet node name in the associated

\note water heater tank object.

N10, \field Crankcase Heater Capacity

\type real

\minimum 0

\default 0

\units W

\note The compressor crankcase heater only operates when the dry-bulb temperature of air

\note surrounding the compressor is below the Maximum Ambient Temperature for Crankcase

\note Heater Operation and the DX coil is off. The ambient temperature surrounding the

\note compressor is set by the WaterHeater:HeatPump parent object (field Compressor Location).

N11, \field Maximum Ambient Temperature for Crankcase Heater Operation

\type real

\minimum 0

\default 10

\units C

\note The compressor crankcase heater only operates when the dry-bulb temperature of air

\note surrounding the compressor is below the Maximum Outdoor Temperature for Crankcase

\note Heater Operation and the unit is off. The ambient temperature surrounding the

\note compressor is set by the WaterHeater:HeatPump parent object (field Compressor Location).

A9 , \field Evaporator Air Temperature Type for Curve Objects

\type choice

\key DryBulbTemperature

\key WetBulbTemperature

\default WetBulbTemperature

\note Determines temperature type for heating capacity curves and

\note heating COP curves. This input determines whether

\note the inlet air dry-bulb or wet-bulb temperature is used to evaluate these curves.

A10, \field Part Load Fraction Correlation Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note Part Load Fraction Correlation (function of part load ratio) should be quadratic or cubic.

\note Quadratic curve = a + b(PLR) + c(PLR)^2.

\note Cubic curve = a + b(PLR) + c(PLR)^2 + d(PLR)^3.

\note PLR = part load ratio (heating delivered/steady state heating capacity).

\note Use curve coefficients of 1,0,0 or leave this field blank when neglecting performance impacts

\note due to variations in part load ratio.

N12, \field Rated Water Heating Capacity at speed 1

\required-field

\type real

\units W

\minimum> 0

\note Heating capacity at the rated inlet air temperatures, rated condenser inlet

\note water temperature, rated air flow rate, and rated water flow rate.

\note Can optionally include condenser pump heat.

N13, \field Rated Water Heating COP at speed 1

\required-field

\type real

\units W/W

\minimum> 0

\default 3.2

\note Heating coefficient of performance at the rated inlet air and water temperatures,

\note rated condenser inlet water temperature, rated air flow rate, and rated water flow rate.

\note Can optionally include condenser pump power and evaporator fan power (see fields below).

N14, \field Rated Sensible Heat Ratio at speed 1

\required-field

\type real

\minimum 0.5

\maximum 1

\default 0.85

\note Gross air-side sensible heat ratio at the rated inlet air temperatures,

\note rated condenser inlet water temperature, rated air flow rate, and rated water flow rate.

\note Sensible heat ratio equals gross sensible cooling capacity divided by gross total cooling

\note capacity. Rated SHR (gross) should not include evaporator fan heat, only sensible cooling

\note and dehumidification by the coil alone.

N15, \field Speed 1 Reference Unit Rated Air Flow Rate

\units m3/s

\type real

\minimum 0

\required-field

N16, \field Speed 1 Reference Unit Rated Water Flow Rate

\units m3/s

\type real

\minimum 0

\required-field

N17, \field Speed 1 Reference Unit Water Pump Input Power At Rated Conditions

\units dimensionless

\type real

\minimum 0

\required-field

A11, \field Speed 1 Total WH Capacity Function of Temperature Curve Name

\required-field

\type object-list

\object-list BiquadraticCurves

\note Table:TwoIndependentVariables object can also be used

\note curve = a + b\*wb + c\*wb\*\*2 + d\*ewt + e\*ewt\*\*2 + f\*wb\*ewt

\note wb = entering wet-bulb temperature or dry bulb temperature upon selection (C)

\note ewt = water entering temperature seen by the condenser (C)

A12, \field Speed 1 Total WH Capacity Function of Air Flow Fraction Curve Name

\required-field

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffa + c\*ffa\*\*2

\note cubic curve = a + b\*ffa + c\*ffa\*\*2 + d\*ffa\*\*3

\note ffa = Fraction of the full load Air Flow

A13, \field Speed 1 Total WH Capacity Function of Water Flow Fraction Curve Name

\required-field

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffw + c\*ffw\*\*2

\note cubic curve = a + b\*ffw + c\*ffw\*\*2 + d\*ffw\*\*3

\note ffw = Fraction of the full load Water Flow

A14, \field Speed 1 COP Function of Temperature Curve Name

\required-field

\type object-list

\object-list BiquadraticCurves

\note Table:TwoIndependentVariables object can also be used

\note curve = a + b\*wb + c\*wb\*\*2 + d\*ewt + e\*ewt\*\*2 + f\*wb\*ewt

\note wb = entering wet-bulb temperature or dry bulb temperature upon selection (C)

\note ewt = water entering temperature seen by the condenser (C)

A15, \field Speed 1 COP Function of Air Flow Fraction Curve Name

\required-field

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffa + c\*ffa\*\*2

\note cubic curve = a + b\*ffa + c\*ffa\*\*2 + d\*ffa\*\*3

\note ffa = Fraction of the full load Air Flow

A16, \field Speed 1 COP Function of Water Flow Fraction Curve Name

\required-field

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffw + c\*ffw\*\*2

\note cubic curve = a + b\*ffw + c\*ffw\*\*2 + d\*ffw\*\*3

\note ffw = Fraction of the full load Water Flow

N18, \field Rated Water Heating Capacity at speed 2

\type real

\units W

\minimum> 0

\note Heating capacity at the rated inlet air temperatures, rated condenser inlet

\note water temperature, rated air flow rate, and rated water flow rate.

\note Can optionally include condenser pump heat.

N19, \field Rated Water Heating COP at speed 2

\type real

\units W/W

\minimum> 0

\default 3.2

\note Heating coefficient of performance at the rated inlet air and water temperatures,

\note rated condenser inlet water temperature, rated air flow rate, and rated water flow rate.

\note Can optionally include condenser pump power and evaporator fan power (see fields below).

N20, \field Rated Sensible Heat Ratio at speed 2

\type real

\minimum 0.5

\maximum 1

\default 0.85

\note Gross air-side sensible heat ratio at the rated inlet air temperatures,

\note rated condenser inlet water temperature, rated air flow rate, and rated water flow rate.

\note Sensible heat ratio equals gross sensible cooling capacity divided by gross total cooling

\note capacity. Rated SHR (gross) should not include evaporator fan heat, only sensible cooling

\note and dehumidification by the coil alone.

N21, \field Speed 2 Reference Unit Rated Air Flow Rate

\units m3/s

\type real

\minimum 0

N22, \field Speed 2 Reference Unit Rated Water Flow Rate

\units m3/s

\type real

\minimum 0

N23, \field Speed 2 Reference Unit Water Pump Input Power At Rated Conditions

\units dimensionless

\type real

\minimum 0

A17, \field Speed 2 Total WH Capacity Function of Temperature Curve Name

\type object-list

\object-list BiquadraticCurves

\note Table:TwoIndependentVariables object can also be used

\note curve = a + b\*wb + c\*wb\*\*2 + d\*ewt + e\*ewt\*\*2 + f\*wb\*ewt

\note wb = entering wet-bulb temperature or dry bulb temperature upon selection (C)

\note ewt = water entering temperature seen by the condenser (C)

A18, \field Speed 2 Total WH Capacity Function of Air Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffa + c\*ffa\*\*2

\note cubic curve = a + b\*ffa + c\*ffa\*\*2 + d\*ffa\*\*3

\note ffa = Fraction of the full load Air Flow

A19, \field Speed 2 Total WH Capacity Function of Water Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffw + c\*ffw\*\*2

\note cubic curve = a + b\*ffw + c\*ffw\*\*2 + d\*ffw\*\*3

\note ffw = Fraction of the full load Water Flow

A20, \field Speed 2 COP Function of Temperature Curve Name

\type object-list

\object-list BiquadraticCurves

\note Table:TwoIndependentVariables object can also be used

\note curve = a + b\*wb + c\*wb\*\*2 + d\*ewt + e\*ewt\*\*2 + f\*wb\*ewt

\note wb = entering wet-bulb temperature or dry bulb temperature upon selection (C)

\note ewt = water entering temperature seen by the condenser (C)

A21, \field Speed 2 COP Function of Air Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffa + c\*ffa\*\*2

\note cubic curve = a + b\*ffa + c\*ffa\*\*2 + d\*ffa\*\*3

\note ffa = Fraction of the full load Air Flow

A22, \field Speed 2 COP Function of Water Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffw + c\*ffw\*\*2

\note cubic curve = a + b\*ffw + c\*ffw\*\*2 + d\*ffw\*\*3

\note ffw = Fraction of the full load Water Flow

N24, \field Rated Water Heating Capacity at speed 3

\type real

\units W

\minimum> 0

\note Heating capacity at the rated inlet air temperatures, rated condenser inlet

\note water temperature, rated air flow rate, and rated water flow rate.

\note Can optionally include condenser pump heat.

N25, \field Rated Water Heating COP at speed 3

\type real

\units W/W

\minimum> 0

\default 3.2

\note Heating coefficient of performance at the rated inlet air and water temperatures,

\note rated condenser inlet water temperature, rated air flow rate, and rated water flow rate.

\note Can optionally include condenser pump power and evaporator fan power (see fields below).

N26, \field Rated Sensible Heat Ratio at speed 3

\type real

\minimum 0.5

\maximum 1

\default 0.85

\note Gross air-side sensible heat ratio at the rated inlet air temperatures,

\note rated condenser inlet water temperature, rated air flow rate, and rated water flow rate.

\note Sensible heat ratio equals gross sensible cooling capacity divided by gross total cooling

\note capacity. Rated SHR (gross) should not include evaporator fan heat, only sensible cooling

\note and dehumidification by the coil alone.

N27, \field Speed 3 Reference Unit Rated Air Flow Rate

\units m3/s

\type real

\minimum 0

N28, \field Speed 3 Reference Unit Rated Water Flow Rate

\units m3/s

\type real

\minimum 0

N29, \field Speed 3 Reference Unit Water Pump Input Power At Rated Conditions

\units dimensionless

\type real

\minimum 0

A23, \field Speed 3 Total WH Capacity Function of Temperature Curve Name

\type object-list

\object-list BiquadraticCurves

\note Table:TwoIndependentVariables object can also be used

\note curve = a + b\*wb + c\*wb\*\*2 + d\*ewt + e\*ewt\*\*2 + f\*wb\*ewt

\note wb = entering wet-bulb temperature or dry bulb temperature upon selection (C)

\note ewt = water entering temperature seen by the condenser (C)

A24, \field Speed 3 Total WH Capacity Function of Air Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffa + c\*ffa\*\*2

\note cubic curve = a + b\*ffa + c\*ffa\*\*2 + d\*ffa\*\*3

\note ffa = Fraction of the full load Air Flow

A25, \field Speed 3 Total WH Capacity Function of Water Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffw + c\*ffw\*\*2

\note cubic curve = a + b\*ffw + c\*ffw\*\*2 + d\*ffw\*\*3

\note ffw = Fraction of the full load Water Flow

A26, \field Speed 3 COP Function of Temperature Curve Name

\type object-list

\object-list BiquadraticCurves

\note Table:TwoIndependentVariables object can also be used

\note curve = a + b\*wb + c\*wb\*\*2 + d\*ewt + e\*ewt\*\*2 + f\*wb\*ewt

\note wb = entering wet-bulb temperature or dry bulb temperature upon selection (C)

\note ewt = water entering temperature seen by the condenser (C)

A27, \field Speed 3 COP Function of Air Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffa + c\*ffa\*\*2

\note cubic curve = a + b\*ffa + c\*ffa\*\*2 + d\*ffa\*\*3

\note ffa = Fraction of the full load Air Flow

A28, \field Speed 3 COP Function of Water Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffw + c\*ffw\*\*2

\note cubic curve = a + b\*ffw + c\*ffw\*\*2 + d\*ffw\*\*3

\note ffw = Fraction of the full load Water Flow

N30, \field Rated Water Heating Capacity at speed 4

\type real

\units W

\minimum> 0

\note Heating capacity at the rated inlet air temperatures, rated condenser inlet

\note water temperature, rated air flow rate, and rated water flow rate.

\note Can optionally include condenser pump heat.

N31, \field Rated Water Heating COP at speed 4

\type real

\units W/W

\minimum> 0

\default 3.2

\note Heating coefficient of performance at the rated inlet air and water temperatures,

\note rated condenser inlet water temperature, rated air flow rate, and rated water flow rate.

\note Can optionally include condenser pump power and evaporator fan power (see fields below).

N32, \field Rated Sensible Heat Ratio at speed 4

\type real

\minimum 0.5

\maximum 1

\default 0.85

\note Gross air-side sensible heat ratio at the rated inlet air temperatures,

\note rated condenser inlet water temperature, rated air flow rate, and rated water flow rate.

\note Sensible heat ratio equals gross sensible cooling capacity divided by gross total cooling

\note capacity. Rated SHR (gross) should not include evaporator fan heat, only sensible cooling

\note and dehumidification by the coil alone.

N33, \field Speed 4 Reference Unit Rated Air Flow Rate

\units m3/s

\type real

\minimum 0

N34, \field Speed 4 Reference Unit Rated Water Flow Rate

\units m3/s

\type real

\minimum 0

N35, \field Speed 4 Reference Unit Water Pump Input Power At Rated Conditions

\units dimensionless

\type real

\minimum 0

A29, \field Speed 4 Total WH Capacity Function of Temperature Curve Name

\type object-list

\object-list BiquadraticCurves

\note Table:TwoIndependentVariables object can also be used

\note curve = a + b\*wb + c\*wb\*\*2 + d\*ewt + e\*ewt\*\*2 + f\*wb\*ewt

\note wb = entering wet-bulb temperature or dry bulb temperature upon selection (C)

\note ewt = water entering temperature seen by the condenser (C)

A30, \field Speed 4 Total WH Capacity Function of Air Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffa + c\*ffa\*\*2

\note cubic curve = a + b\*ffa + c\*ffa\*\*2 + d\*ffa\*\*3

\note ffa = Fraction of the full load Air Flow

A31, \field Speed 4 Total WH Capacity Function of Water Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffw + c\*ffw\*\*2

\note cubic curve = a + b\*ffw + c\*ffw\*\*2 + d\*ffw\*\*3

\note ffw = Fraction of the full load Water Flow

A32, \field Speed 4 COP Function of Temperature Curve Name

\type object-list

\object-list BiquadraticCurves

\note Table:TwoIndependentVariables object can also be used

\note curve = a + b\*wb + c\*wb\*\*2 + d\*ewt + e\*ewt\*\*2 + f\*wb\*ewt

\note wb = entering wet-bulb temperature or dry bulb temperature upon selection (C)

\note ewt = water entering temperature seen by the condenser (C)

A33, \field Speed 4 COP Function of Air Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffa + c\*ffa\*\*2

\note cubic curve = a + b\*ffa + c\*ffa\*\*2 + d\*ffa\*\*3

\note ffa = Fraction of the full load Air Flow

A34, \field Speed 4 COP Function of Water Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffw + c\*ffw\*\*2

\note cubic curve = a + b\*ffw + c\*ffw\*\*2 + d\*ffw\*\*3

\note ffw = Fraction of the full load Water Flow

N36, \field Rated Water Heating Capacity at speed 5

\type real

\units W

\minimum> 0

\note Heating capacity at the rated inlet air temperatures, rated condenser inlet

\note water temperature, rated air flow rate, and rated water flow rate.

\note Can optionally include condenser pump heat.

N37, \field Rated Water Heating COP at speed 5

\type real

\units W/W

\minimum> 0

\default 3.2

\note Heating coefficient of performance at the rated inlet air and water temperatures,

\note rated condenser inlet water temperature, rated air flow rate, and rated water flow rate.

\note Can optionally include condenser pump power and evaporator fan power (see fields below).

N38, \field Rated Sensible Heat Ratio at speed 5

\type real

\minimum 0.5

\maximum 1

\default 0.85

\note Gross air-side sensible heat ratio at the rated inlet air temperatures,

\note rated condenser inlet water temperature, rated air flow rate, and rated water flow rate.

\note Sensible heat ratio equals gross sensible cooling capacity divided by gross total cooling

\note capacity. Rated SHR (gross) should not include evaporator fan heat, only sensible cooling

\note and dehumidification by the coil alone.

N39, \field Speed 5 Reference Unit Rated Air Flow Rate

\units m3/s

\type real

\minimum 0

N40, \field Speed 5 Reference Unit Rated Water Flow Rate

\units m3/s

\type real

\minimum 0

N41, \field Speed 5 Reference Unit Water Pump Input Power At Rated Conditions

\units dimensionless

\type real

\minimum 0

A35, \field Speed 5 Total WH Capacity Function of Temperature Curve Name

\type object-list

\object-list BiquadraticCurves

\note Table:TwoIndependentVariables object can also be used

\note curve = a + b\*wb + c\*wb\*\*2 + d\*ewt + e\*ewt\*\*2 + f\*wb\*ewt

\note wb = entering wet-bulb temperature or dry bulb temperature upon selection (C)

\note ewt = water entering temperature seen by the condenser (C)

A36, \field Speed 5 Total WH Capacity Function of Air Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffa + c\*ffa\*\*2

\note cubic curve = a + b\*ffa + c\*ffa\*\*2 + d\*ffa\*\*3

\note ffa = Fraction of the full load Air Flow

A37, \field Speed 5 Total WH Capacity Function of Water Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffw + c\*ffw\*\*2

\note cubic curve = a + b\*ffw + c\*ffw\*\*2 + d\*ffw\*\*3

\note ffw = Fraction of the full load Water Flow

A38, \field Speed 5 COP Function of Temperature Curve Name

\type object-list

\object-list BiquadraticCurves

\note Table:TwoIndependentVariables object can also be used

\note curve = a + b\*wb + c\*wb\*\*2 + d\*ewt + e\*ewt\*\*2 + f\*wb\*ewt

\note wb = entering wet-bulb temperature or dry bulb temperature upon selection (C)

\note ewt = water entering temperature seen by the condenser (C)

A39, \field Speed 5 COP Function of Air Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffa + c\*ffa\*\*2

\note cubic curve = a + b\*ffa + c\*ffa\*\*2 + d\*ffa\*\*3

\note ffa = Fraction of the full load Air Flow

A40, \field Speed 5 COP Function of Water Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffw + c\*ffw\*\*2

\note cubic curve = a + b\*ffw + c\*ffw\*\*2 + d\*ffw\*\*3

\note ffw = Fraction of the full load Water Flow

N42, \field Rated Water Heating Capacity at speed 6

\type real

\units W

\minimum> 0

\note Heating capacity at the rated inlet air temperatures, rated condenser inlet

\note water temperature, rated air flow rate, and rated water flow rate.

\note Can optionally include condenser pump heat.

N43, \field Rated Water Heating COP at speed 6

\type real

\units W/W

\minimum> 0

\default 3.2

\note Heating coefficient of performance at the rated inlet air and water temperatures,

\note rated condenser inlet water temperature, rated air flow rate, and rated water flow rate.

\note Can optionally include condenser pump power and evaporator fan power (see fields below).

N44, \field Rated Sensible Heat Ratio at speed 6

\type real

\minimum 0.5

\maximum 1

\default 0.85

\note Gross air-side sensible heat ratio at the rated inlet air temperatures,

\note rated condenser inlet water temperature, rated air flow rate, and rated water flow rate.

\note Sensible heat ratio equals gross sensible cooling capacity divided by gross total cooling

\note capacity. Rated SHR (gross) should not include evaporator fan heat, only sensible cooling

\note and dehumidification by the coil alone.

N45, \field Speed 6 Reference Unit Rated Air Flow Rate

\units m3/s

\type real

\minimum 0

N46, \field Speed 6 Reference Unit Rated Water Flow Rate

\units m3/s

\type real

\minimum 0

N47, \field Speed 6 Reference Unit Water Pump Input Power At Rated Conditions

\units dimensionless

\type real

\minimum 0

A41, \field Speed 6 Total WH Capacity Function of Temperature Curve Name

\type object-list

\object-list BiquadraticCurves

\note Table:TwoIndependentVariables object can also be used

\note curve = a + b\*wb + c\*wb\*\*2 + d\*ewt + e\*ewt\*\*2 + f\*wb\*ewt

\note wb = entering wet-bulb temperature or dry bulb temperature upon selection (C)

\note ewt = water entering temperature seen by the condenser (C)

A42, \field Speed 6 Total WH Capacity Function of Air Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffa + c\*ffa\*\*2

\note cubic curve = a + b\*ffa + c\*ffa\*\*2 + d\*ffa\*\*3

\note ffa = Fraction of the full load Air Flow

A43, \field Speed 6 Total WH Capacity Function of Water Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffw + c\*ffw\*\*2

\note cubic curve = a + b\*ffw + c\*ffw\*\*2 + d\*ffw\*\*3

\note ffw = Fraction of the full load Water Flow

A44, \field Speed 6 COP Function of Temperature Curve Name

\type object-list

\object-list BiquadraticCurves

\note Table:TwoIndependentVariables object can also be used

\note curve = a + b\*wb + c\*wb\*\*2 + d\*ewt + e\*ewt\*\*2 + f\*wb\*ewt

\note wb = entering wet-bulb temperature or dry bulb temperature upon selection (C)

\note ewt = water entering temperature seen by the condenser (C)

A45, \field Speed 6 COP Function of Air Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffa + c\*ffa\*\*2

\note cubic curve = a + b\*ffa + c\*ffa\*\*2 + d\*ffa\*\*3

\note ffa = Fraction of the full load Air Flow

A46, \field Speed 6 COP Function of Water Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffw + c\*ffw\*\*2

\note cubic curve = a + b\*ffw + c\*ffw\*\*2 + d\*ffw\*\*3

\note ffw = Fraction of the full load Water Flow

N48, \field Rated Water Heating Capacity at speed 7

\type real

\units W

\minimum> 0

\note Heating capacity at the rated inlet air temperatures, rated condenser inlet

\note water temperature, rated air flow rate, and rated water flow rate.

\note Can optionally include condenser pump heat.

N49, \field Rated Water Heating COP at speed 7

\type real

\units W/W

\minimum> 0

\default 3.2

\note Heating coefficient of performance at the rated inlet air and water temperatures,

\note rated condenser inlet water temperature, rated air flow rate, and rated water flow rate.

\note Can optionally include condenser pump power and evaporator fan power (see fields below).

N50, \field Rated Sensible Heat Ratio at speed 7

\type real

\minimum 0.5

\maximum 1

\default 0.85

\note Gross air-side sensible heat ratio at the rated inlet air temperatures,

\note rated condenser inlet water temperature, rated air flow rate, and rated water flow rate.

\note Sensible heat ratio equals gross sensible cooling capacity divided by gross total cooling

\note capacity. Rated SHR (gross) should not include evaporator fan heat, only sensible cooling

\note and dehumidification by the coil alone.

N51, \field Speed 7 Reference Unit Rated Air Flow Rate

\units m3/s

\type real

\minimum 0

N52, \field Speed 7 Reference Unit Rated Water Flow Rate

\units m3/s

\type real

\minimum 0

N53, \field Speed 7 Reference Unit Water Pump Input Power At Rated Conditions

\units dimensionless

\type real

\minimum 0

A47, \field Speed 7 Total WH Capacity Function of Temperature Curve Name

\type object-list

\object-list BiquadraticCurves

\note Table:TwoIndependentVariables object can also be used

\note curve = a + b\*wb + c\*wb\*\*2 + d\*ewt + e\*ewt\*\*2 + f\*wb\*ewt

\note wb = entering wet-bulb temperature or dry bulb temperature upon selection (C)

\note ewt = water entering temperature seen by the condenser (C)

A48, \field Speed 7 Total WH Capacity Function of Air Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffa + c\*ffa\*\*2

\note cubic curve = a + b\*ffa + c\*ffa\*\*2 + d\*ffa\*\*3

\note ffa = Fraction of the full load Air Flow

A49, \field Speed 7 Total WH Capacity Function of Water Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffw + c\*ffw\*\*2

\note cubic curve = a + b\*ffw + c\*ffw\*\*2 + d\*ffw\*\*3

\note ffw = Fraction of the full load Water Flow

A50, \field Speed 7 COP Function of Temperature Curve Name

\type object-list

\object-list BiquadraticCurves

\note Table:TwoIndependentVariables object can also be used

\note curve = a + b\*wb + c\*wb\*\*2 + d\*ewt + e\*ewt\*\*2 + f\*wb\*ewt

\note wb = entering wet-bulb temperature or dry bulb temperature upon selection (C)

\note ewt = water entering temperature seen by the condenser (C)

A51, \field Speed 7 COP Function of Air Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffa + c\*ffa\*\*2

\note cubic curve = a + b\*ffa + c\*ffa\*\*2 + d\*ffa\*\*3

\note ffa = Fraction of the full load Air Flow

A52, \field Speed 7 COP Function of Water Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffw + c\*ffw\*\*2

\note cubic curve = a + b\*ffw + c\*ffw\*\*2 + d\*ffw\*\*3

\note ffw = Fraction of the full load Water Flow

N54, \field Rated Water Heating Capacity at speed 8

\type real

\units W

\minimum> 0

\note Heating capacity at the rated inlet air temperatures, rated condenser inlet

\note water temperature, rated air flow rate, and rated water flow rate.

\note Can optionally include condenser pump heat.

N55, \field Rated Water Heating COP at speed 8

\type real

\units W/W

\minimum> 0

\default 3.2

\note Heating coefficient of performance at the rated inlet air and water temperatures,

\note rated condenser inlet water temperature, rated air flow rate, and rated water flow rate.

\note Can optionally include condenser pump power and evaporator fan power (see fields below).

N56, \field Rated Sensible Heat Ratio at speed 8

\type real

\minimum 0.5

\maximum 1

\default 0.85

\note Gross air-side sensible heat ratio at the rated inlet air temperatures,

\note rated condenser inlet water temperature, rated air flow rate, and rated water flow rate.

\note Sensible heat ratio equals gross sensible cooling capacity divided by gross total cooling

\note capacity. Rated SHR (gross) should not include evaporator fan heat, only sensible cooling

\note and dehumidification by the coil alone.

N57, \field Speed 8 Reference Unit Rated Air Flow Rate

\units m3/s

\type real

\minimum 0

N58, \field Speed 8 Reference Unit Rated Water Flow Rate

\units m3/s

\type real

\minimum 0

N59, \field Speed 8 Reference Unit Water Pump Input Power At Rated Conditions

\units dimensionless

\type real

\minimum 0

A53, \field Speed 8 Total WH Capacity Function of Temperature Curve Name

\type object-list

\object-list BiquadraticCurves

\note Table:TwoIndependentVariables object can also be used

\note curve = a + b\*wb + c\*wb\*\*2 + d\*ewt + e\*ewt\*\*2 + f\*wb\*ewt

\note wb = entering wet-bulb temperature or dry bulb temperature upon selection (C)

\note ewt = water entering temperature seen by the condenser (C)

A54, \field Speed 8 Total WH Capacity Function of Air Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffa + c\*ffa\*\*2

\note cubic curve = a + b\*ffa + c\*ffa\*\*2 + d\*ffa\*\*3

\note ffa = Fraction of the full load Air Flow

A55, \field Speed 8 Total WH Capacity Function of Water Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffw + c\*ffw\*\*2

\note cubic curve = a + b\*ffw + c\*ffw\*\*2 + d\*ffw\*\*3

\note ffw = Fraction of the full load Water Flow

A56, \field Speed 8 COP Function of Temperature Curve Name

\type object-list

\object-list BiquadraticCurves

\note Table:TwoIndependentVariables object can also be used

\note curve = a + b\*wb + c\*wb\*\*2 + d\*ewt + e\*ewt\*\*2 + f\*wb\*ewt

\note wb = entering wet-bulb temperature or dry bulb temperature upon selection (C)

\note ewt = water entering temperature seen by the condenser (C)

A57, \field Speed 8 COP Function of Air Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffa + c\*ffa\*\*2

\note cubic curve = a + b\*ffa + c\*ffa\*\*2 + d\*ffa\*\*3

\note ffa = Fraction of the full load Air Flow

A58, \field Speed 8 COP Function of Water Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffw + c\*ffw\*\*2

\note cubic curve = a + b\*ffw + c\*ffw\*\*2 + d\*ffw\*\*3

\note ffw = Fraction of the full load Water Flow

N60, \field Rated Water Heating Capacity at speed 9

\type real

\units W

\minimum> 0

\note Heating capacity at the rated inlet air temperatures, rated condenser inlet

\note water temperature, rated air flow rate, and rated water flow rate.

\note Can optionally include condenser pump heat.

N61, \field Rated Water Heating COP at speed 9

\type real

\units W/W

\minimum> 0

\default 3.2

\note Heating coefficient of performance at the rated inlet air and water temperatures,

\note rated condenser inlet water temperature, rated air flow rate, and rated water flow rate.

\note Can optionally include condenser pump power and evaporator fan power (see fields below).

N62, \field Rated Sensible Heat Ratio at speed 9

\type real

\minimum 0.5

\maximum 1

\default 0.85

\note Gross air-side sensible heat ratio at the rated inlet air temperatures,

\note rated condenser inlet water temperature, rated air flow rate, and rated water flow rate.

\note Sensible heat ratio equals gross sensible cooling capacity divided by gross total cooling

\note capacity. Rated SHR (gross) should not include evaporator fan heat, only sensible cooling

\note and dehumidification by the coil alone.

N63, \field Speed 9 Reference Unit Rated Air Flow Rate

\units m3/s

\type real

\minimum 0

N64, \field Speed 9 Reference Unit Rated Water Flow Rate

\units m3/s

\type real

\minimum 0

N65, \field Speed 9 Reference Unit Water Pump Input Power At Rated Conditions

\units dimensionless

\type real

\minimum 0

A59, \field Speed 9 Total WH Capacity Function of Temperature Curve Name

\type object-list

\object-list BiquadraticCurves

\note Table:TwoIndependentVariables object can also be used

\note curve = a + b\*wb + c\*wb\*\*2 + d\*ewt + e\*ewt\*\*2 + f\*wb\*ewt

\note wb = entering wet-bulb temperature or dry bulb temperature upon selection (C)

\note ewt = water entering temperature seen by the condenser (C)

A60, \field Speed 9 Total WH Capacity Function of Air Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffa + c\*ffa\*\*2

\note cubic curve = a + b\*ffa + c\*ffa\*\*2 + d\*ffa\*\*3

\note ffa = Fraction of the full load Air Flow

A61, \field Speed 9 Total WH Capacity Function of Water Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffw + c\*ffw\*\*2

\note cubic curve = a + b\*ffw + c\*ffw\*\*2 + d\*ffw\*\*3

\note ffw = Fraction of the full load Water Flow

A62, \field Speed 9 COP Function of Temperature Curve Name

\type object-list

\object-list BiquadraticCurves

\note Table:TwoIndependentVariables object can also be used

\note curve = a + b\*wb + c\*wb\*\*2 + d\*ewt + e\*ewt\*\*2 + f\*wb\*ewt

\note wb = entering wet-bulb temperature or dry bulb temperature upon selection (C)

\note ewt = water entering temperature seen by the condenser (C)

A63, \field Speed 9 COP Function of Air Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffa + c\*ffa\*\*2

\note cubic curve = a + b\*ffa + c\*ffa\*\*2 + d\*ffa\*\*3

\note ffa = Fraction of the full load Air Flow

A64, \field Speed 9 COP Function of Water Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffw + c\*ffw\*\*2

\note cubic curve = a + b\*ffw + c\*ffw\*\*2 + d\*ffw\*\*3

\note ffw = Fraction of the full load Water Flow

N66, \field Rated Water Heating Capacity at speed 10

\type real

\units W

\minimum> 0

\note Heating capacity at the rated inlet air temperatures, rated condenser inlet

\note water temperature, rated air flow rate, and rated water flow rate.

\note Can optionally include condenser pump heat.

N67, \field Rated Water Heating COP at speed 10

\type real

\units W/W

\minimum> 0

\default 3.2

\note Heating coefficient of performance at the rated inlet air and water temperatures,

\note rated condenser inlet water temperature, rated air flow rate, and rated water flow rate.

\note Can optionally include condenser pump power and evaporator fan power (see fields below).

N68, \field Rated Sensible Heat Ratio at speed 10

\type real

\minimum 0.5

\maximum 1

\default 0.85

\note Gross air-side sensible heat ratio at the rated inlet air temperatures,

\note rated condenser inlet water temperature, rated air flow rate, and rated water flow rate.

\note Sensible heat ratio equals gross sensible cooling capacity divided by gross total cooling

\note capacity. Rated SHR (gross) should not include evaporator fan heat, only sensible cooling

\note and dehumidification by the coil alone.

N69, \field Speed 10 Reference Unit Rated Air Flow Rate

\units m3/s

\type real

\minimum 0

N70, \field Speed 10 Reference Unit Rated Water Flow Rate

\units m3/s

\type real

\minimum 0

N71, \field Speed 10 Reference Unit Water Pump Input Power At Rated Conditions

\units dimensionless

\type real

\minimum 0

A65, \field Speed 10 Total WH Capacity Function of Temperature Curve Name

\type object-list

\object-list BiquadraticCurves

\note Table:TwoIndependentVariables object can also be used

\note curve = a + b\*wb + c\*wb\*\*2 + d\*ewt + e\*ewt\*\*2 + f\*wb\*ewt

\note wb = entering wet-bulb temperature or dry bulb temperature upon selection (C)

\note ewt = water entering temperature seen by the condenser (C)

A66, \field Speed 10 Total WH Capacity Function of Air Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffa + c\*ffa\*\*2

\note cubic curve = a + b\*ffa + c\*ffa\*\*2 + d\*ffa\*\*3

\note ffa = Fraction of the full load Air Flow

A67, \field Speed 10 Total WH Capacity Function of Water Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffw + c\*ffw\*\*2

\note cubic curve = a + b\*ffw + c\*ffw\*\*2 + d\*ffw\*\*3

\note ffw = Fraction of the full load Water Flow

A68, \field Speed 10 COP Function of Temperature Curve Name

\type object-list

\object-list BiquadraticCurves

\note Table:TwoIndependentVariables object can also be used

\note curve = a + b\*wb + c\*wb\*\*2 + d\*ewt + e\*ewt\*\*2 + f\*wb\*ewt

\note wb = entering wet-bulb temperature or dry bulb temperature upon selection (C)

\note ewt = water entering temperature seen by the condenser (C)

A69, \field Speed 10 COP Function of Air Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffa + c\*ffa\*\*2

\note cubic curve = a + b\*ffa + c\*ffa\*\*2 + d\*ffa\*\*3

\note ffa = Fraction of the full load Air Flow

A70; \field Speed 10 COP Function of Water Flow Fraction Curve Name

\type object-list

\object-list QuadraticCubicCurves

\note Table:OneIndependentVariable object can also be used

\note quadratic curve = a + b\*ffw + c\*ffw\*\*2

\note cubic curve = a + b\*ffw + c\*ffw\*\*2 + d\*ffw\*\*3

\note ffw = Fraction of the full load Water Flow

An example of this statement in an IDF is:

Coil:WaterHeating:AirToWaterHeatPump:VariableSpeed,

HPWHDXCoilVS, !- Name

10, !- Number of Speeds

10, !- Nominal speed level

4000.0, !- Rated Heating Capacity {W} at the nominal speed level

29.44, !- Rated Evaporator Inlet Air Dry-Bulb Temperature {C}

22.22, !- Rated Evaporator Inlet Air Wet-Bulb Temperature {C}

55.72, !- Rated Condenser Inlet Water Temperature {C}

autocalculate, !- Rated Evaporator Air Flow Rate {m3/s}

autocalculate, !- Rated Condenser Water Flow Rate {m3/s}

No, !- Evaporator Fan Power Included in Rated COP

No, !- Condenser Pump Power Included in Rated COP

No, !- Condenser Pump Heat Included in Rated Heating Capacity and Rated COP

0.1, !- Fraction of Condenser Pump Heat to Water

HPWHInletAirMixerNode, !- Evaporator Air Inlet Node Name

HPWHDXCoilAirOutletNode, !- Evaporator Air Outlet Node Name

HPWHWaterInletNode, !- Condenser Water Inlet Node Name

HPWHWaterOutletNode, !- Condenser Water Outlet Node Name

100.0, !- Crankcase Heater Capacity {W}

5.0, !- Maximum Ambient Temperature for Crankcase Heater Operation {C}

WetBulbTemperature, !- Evaporator Air Temperature Type for Curve Objects

HPWHPLFFPLR, !- Part Load Fraction Correlation Curve Name

400.00, !- Speed 1 Water Heating capacity {W} of Reference Unit

5.0, !- Speed 1 Water Heating COP {W/W} of Reference Unit

0.80, !- Speed 1 Sensible Heat Transfer Ratio of Reference Unit

0.020140, !- Speed 1 Air Flow Rate of Reference Unit

0.000018, !- Speed 1 water Air Flow Rate of Reference Unit

10.0, !- Speed 1 Water Pump Power of Reference Unit

HPWHHeatingCapFTemp, !- Heating Capacity Function of Temperature Curve Name

ConstantCubic, !- Heating Capacity Function of Air Flow Fraction Curve Name

ConstantCubic, !- Heating Capacity Function of Water Flow Fraction Curve Name

HPWHHeatingCOPFTemp, !- Heating COP Function of Temperature Curve Name

ConstantCubic, !- Heating COP Function of Air Flow Fraction Curve Name

ConstantCubic, !- Heating COP Function of Water Flow Fraction Curve Name

800.00, !- Speed 2 Water Heating capacity {W} of Reference Unit

4.8, !- Speed 2 Water Heating COP {W/W} of Reference Unit

0.79, !- Speed 2 Sensible Heat Transfer Ratio of Reference Unit

0.040280, !- Speed 2 Air Flow Rate of Reference Unit

0.000036, !- Speed 2 water Air Flow Rate of Reference Unit

20.0, !- Speed 2 Water Pump Power of Reference Unit

HPWHHeatingCapFTemp, !- Heating Capacity Function of Temperature Curve Name

ConstantCubic, !- Heating Capacity Function of Air Flow Fraction Curve Name

ConstantCubic, !- Heating Capacity Function of Water Flow Fraction Curve Name

HPWHHeatingCOPFTemp, !- Heating COP Function of Temperature Curve Name

ConstantCubic, !- Heating COP Function of Air Flow Fraction Curve Name

ConstantCubic, !- Heating COP Function of Water Flow Fraction Curve Name

1200.00, !- Speed 3 Water Heating capacity {W} of Reference Unit

4.4, !- Speed 3 Water Heating COP {W/W} of Reference Unit

0.78, !- Speed 3 Sensible Heat Transfer Ratio of Reference Unit

0.060420, !- Speed 3 Air Flow Rate of Reference Unit

0.000054, !- Speed 3 water Air Flow Rate of Reference Unit

30.0, !- Speed 3 Water Pump Power of Reference Unit

HPWHHeatingCapFTemp, !- Heating Capacity Function of Temperature Curve Name

ConstantCubic, !- Heating Capacity Function of Air Flow Fraction Curve Name

ConstantCubic, !- Heating Capacity Function of Water Flow Fraction Curve Name

HPWHHeatingCOPFTemp, !- Heating COP Function of Temperature Curve Name

ConstantCubic, !- Heating COP Function of Air Flow Fraction Curve Name

ConstantCubic, !- Heating COP Function of Water Flow Fraction Curve Name

1600.00, !- Speed 4 Water Heating capacity {W} of Reference Unit

4.0, !- Speed 4 Water Heating COP {W/W} of Reference Unit

0.77, !- Speed 4 Sensible Heat Transfer Ratio of Reference Unit

0.080560, !- Speed 4 Air Flow Rate of Reference Unit

0.000072, !- Speed 4 water Air Flow Rate of Reference Unit

40.0, !- Speed 4 Water Pump Power of Reference Unit

HPWHHeatingCapFTemp, !- Heating Capacity Function of Temperature Curve Name

ConstantCubic, !- Heating Capacity Function of Air Flow Fraction Curve Name

ConstantCubic, !- Heating Capacity Function of Water Flow Fraction Curve Name

HPWHHeatingCOPFTemp, !- Heating COP Function of Temperature Curve Name

ConstantCubic, !- Heating COP Function of Air Flow Fraction Curve Name

ConstantCubic, !- Heating COP Function of Water Flow Fraction Curve Name

2000.00, !- Speed 5 Water Heating capacity {W} of Reference Unit

3.8, !- Speed 5 Water Heating COP {W/W} of Reference Unit

0.76, !- Speed 5 Sensible Heat Transfer Ratio of Reference Unit

0.100700, !- Speed 5 Air Flow Rate of Reference Unit

0.000090, !- Speed 5 water Air Flow Rate of Reference Unit

50.0, !- Speed 5 Water Pump Power of Reference Unit

HPWHHeatingCapFTemp, !- Heating Capacity Function of Temperature Curve Name

ConstantCubic, !- Heating Capacity Function of Air Flow Fraction Curve Name

ConstantCubic, !- Heating Capacity Function of Water Flow Fraction Curve Name

HPWHHeatingCOPFTemp, !- Heating COP Function of Temperature Curve Name

ConstantCubic, !- Heating COP Function of Air Flow Fraction Curve Name

ConstantCubic, !- Heating COP Function of Water Flow Fraction Curve Name

2400.00, !- Speed 6 Water Heating capacity {W} of Reference Unit

3.4, !- Speed 6 Water Heating COP {W/W} of Reference Unit

0.75, !- Speed 6 Sensible Heat Transfer Ratio of Reference Unit

0.120840, !- Speed 6 Air Flow Rate of Reference Unit

0.000108, !- Speed 6 water Air Flow Rate of Reference Unit

60.0, !- Speed 6 Water Pump Power of Reference Unit

HPWHHeatingCapFTemp, !- Heating Capacity Function of Temperature Curve Name

ConstantCubic, !- Heating Capacity Function of Air Flow Fraction Curve Name

ConstantCubic, !- Heating Capacity Function of Water Flow Fraction Curve Name

HPWHHeatingCOPFTemp, !- Heating COP Function of Temperature Curve Name

ConstantCubic, !- Heating COP Function of Air Flow Fraction Curve Name

ConstantCubic, !- Heating COP Function of Water Flow Fraction Curve Name

2800.00, !- Speed 7 Water Heating capacity {W} of Reference Unit

3.0, !- Speed 7 Water Heating COP {W/W} of Reference Unit

0.74, !- Speed 7 Sensible Heat Transfer Ratio of Reference Unit

0.140980, !- Speed 7 Air Flow Rate of Reference Unit

0.000126, !- Speed 7 water Air Flow Rate of Reference Unit

70.0, !- Speed 7 Water Pump Power of Reference Unit

HPWHHeatingCapFTemp, !- Heating Capacity Function of Temperature Curve Name

ConstantCubic, !- Heating Capacity Function of Air Flow Fraction Curve Name

ConstantCubic, !- Heating Capacity Function of Water Flow Fraction Curve Name

HPWHHeatingCOPFTemp, !- Heating COP Function of Temperature Curve Name

ConstantCubic, !- Heating COP Function of Air Flow Fraction Curve Name

ConstantCubic, !- Heating COP Function of Water Flow Fraction Curve Name

3200.00, !- Speed 8 Water Heating capacity {W} of Reference Unit

2.6, !- Speed 8 Water Heating COP {W/W} of Reference Unit

0.73, !- Speed 8 Sensible Heat Transfer Ratio of Reference Unit

0.161120, !- Speed 8 Air Flow Rate of Reference Unit

0.000144, !- Speed 8 water Air Flow Rate of Reference Unit

80.0, !- Speed 8 Water Pump Power of Reference Unit

HPWHHeatingCapFTemp, !- Heating Capacity Function of Temperature Curve Name

ConstantCubic, !- Heating Capacity Function of Air Flow Fraction Curve Name

ConstantCubic, !- Heating Capacity Function of Water Flow Fraction Curve Name

HPWHHeatingCOPFTemp, !- Heating COP Function of Temperature Curve Name

ConstantCubic, !- Heating COP Function of Air Flow Fraction Curve Name

ConstantCubic, !- Heating COP Function of Water Flow Fraction Curve Name

3600.00, !- Speed 9 Water Heating capacity {W} of Reference Unit

2.3, !- Speed 9 Water Heating COP {W/W} of Reference Unit

0.72, !- Speed 9 Sensible Heat Transfer Ratio of Reference Unit

0.181260, !- Speed 9 Air Flow Rate of Reference Unit

0.000162, !- Speed 9 water Air Flow Rate of Reference Unit

90.0, !- Speed 9 Water Pump Power of Reference Unit

HPWHHeatingCapFTemp, !- Heating Capacity Function of Temperature Curve Name

ConstantCubic, !- Heating Capacity Function of Air Flow Fraction Curve Name

ConstantCubic, !- Heating Capacity Function of Water Flow Fraction Curve Name

HPWHHeatingCOPFTemp, !- Heating COP Function of Temperature Curve Name

ConstantCubic, !- Heating COP Function of Air Flow Fraction Curve Name

ConstantCubic, !- Heating COP Function of Water Flow Fraction Curve Name

4000.00, !- Speed 10 Water Heating capacity {W} of Reference Unit

2.0, !- Speed 10 Water Heating COP {W/W} of Reference Unit

0.70, !- Speed 10 Sensible Heat Transfer Ratio of Reference Unit

0.201400, !- Speed 10 Air Flow Rate of Reference Unit

0.000179, !- Speed 10 water Air Flow Rate of Reference Unit

100.0, !- Speed 10 Water Pump Power of Reference Unit

HPWHHeatingCapFTemp, !- Heating Capacity Function of Temperature Curve Name

ConstantCubic, !- Heating Capacity Function of Air Flow Fraction Curve Name

ConstantCubic, !- Heating Capacity Function of Water Flow Fraction Curve Name

HPWHHeatingCOPFTemp, !- Heating COP Function of Temperature Curve Name

ConstantCubic, !- Heating COP Function of Air Flow Fraction Curve Name

ConstantCubic; !- Heating COP Function of Water Flow Fraction Curve Name

### Variable-Speed Heat Pump Water Heating Coil Outputs

HVAC, Average, VSAirtoWaterHPWH Cooling Coil Water Heating Electric Power [W]

HVAC, Average, VSAirtoWaterHPWH Cooling Coil Total Cooling Rate [W]

HVAC, Average, VSAirtoWaterHPWH Cooling Coil Sensible Cooling Rate [W]

HVAC, Average, VSAirtoWaterHPWH Cooling Coil Latent Cooling Rate [W]

HVAC, Average, VSAirtoWaterHPWH Cooling Coil Total Water Heating Rate [W]

HVAC, Average, VSAirtoWaterHPWH Cooling Coil Part Load Ratio

HVAC, Average, VSAirtoWaterHPWH Cooling Coil Run Time Fraction

HVAC, Average, VSAirtoWaterHPWH Cooling Coil Air Mass Flow Rate[kg/s]

HVAC, Average, VSAirtoWaterHPWH Cooling Coil Air Inlet Temperature [C]

HVAC, Average, VSAirtoWaterHPWH Cooling Coil Air Inlet Humidity Ratio [kg/kg]

HVAC, Average, VSAirtoWaterHPWH Cooling Coil Air Outlet Temperature [C]

HVAC, Average, VSAirtoWaterHPWH Cooling Coil Air Outlet Humidity Ratio [kg/kg]

HVAC, Average, VSAirtoWaterHPWH Cooling Coil Water Mass Flow Rate[kg/s]

HVAC, Average, VSAirtoWaterHPWH Cooling Coil Water Inlet Temperature [C]

HVAC, Average, VSAirtoWaterHPWH Cooling Coil Water Outlet Temperature [C]

HVAC, Average, VSAirtoWaterHPWH Cooling Coil Crankcase Heater Power[W]

HVAC, Sum, VSAirtoWaterHPWH Cooling Coil Crankcase Heater Consumption[J]

HVAC, Average, VSAirtoWaterHPWH Cooling Coil Upper Speed Level [Dimensionless]

HVAC, Average, VSAirtoWaterHPWH Cooling Speed Ratio between Two Neighboring Speeds [dimensionless]

HVAC, Sum, VSAirtoWaterHPWH Cooling Coil Electric Energy [J]

HVAC, Sum, VSAirtoWaterHPWH Cooling Coil Cooling Energy [J]

HVAC, Sum, VSAirtoWaterHPWH Cooling Coil Sensible Cooling Energy [J]

HVAC, Sum, VSAirtoWaterHPWH Cooling Coil Latent Cooling Energy [J]

HVAC, Sum, VSAirtoWaterHPWH Cooling Coil Water Side Heat Transfer Energy [J]

HVAC, Average, VSAirtoWaterHPWH Cooling Coil Water Heating Pump Electric Power [W]

HVAC, Sum, VSAirtoWaterHPWH Cooling Coil Water Heating Pump Electric Energy[J]

***VSAirtoWaterHPWH Cooling Coil Water Heating Electric Power [W]***

This output variable is the average electric consumption rate of the heat pump water heater in Watts over the timestep being reported.

***VSAirtoWaterHPWH Cooling Coil Total Cooling Rate [W]***

The output variable is the average total cooling load provide by the heat pump water heater which includes the sensible and latent load in Watts over the timestep being reported.

***VSAirtoWaterHPWH Cooling Coil Sensible Heat Transfer Rate [W]***

The output variable is the average sensible cooling load provide by the heat pump water heater in Watts over the timestep being reported.

***VSAirtoWaterHPWH Cooling Coil Latent Heat Transfer Rate [W]***

The output variable is the average latent cooling load provide by the heat pump water heater in Watts over the timestep being reported.

***VSAirtoWaterHPWH Cooling Coil Total Water Heating Rate [W]***

The output variable is the average heat rejected to the water at the heat pump condenser in Watts over the timestep being reported.

***VSAirtoWaterHPWH Cooling Coil Part-Load Ratio***

This output variable is the ratio of the part-load capacity to the steady state capacity of the VSAirtoWaterHPWH coil. For the cycling fan mode, the runtime fraction for the heat pump compressor may be different from the compressor part-load ratio reported here due to the part-load performance of the VSAirtoWaterHPWH coil (delay at start-up to reach steady-state output). In general, runtime fractions are reported by individual components where appropriate.

***VSAirtoWaterHPWH Cooling Coil Run Time Fraction***

This output variable is the rum time fraction of the compressor when the VSAirtoWaterHPWH coil running below the lowest speed in cyclic operation.

***VSAirtoWaterHPWH Cooing Coil Air Mass Flow Rate [kg/s]***

The output variable is the average air mass flow rate going through the heat pump evaporator over the timestep being reported.

***VSAirtoWaterHPWH Cooling Coil Air Inlet Dry Bulb Temperature [C]***

The output variable is the average entering air dry-bulb temperature over the timestep being reported.

***VSAirtoWaterHPWH Cooling Coil Air Inlet Humidity Ratio [kg/kg]***

The output variable is the average entering air dry humidity ratio over the timestep being reported.

***VSAirtoWaterHPWH Cooling Coil Air Outlet Dry Bulb Temperature [C]***

The output variable is the average leaving air dry-bulb temperature over the timestep being reported.

***VSAirtoWaterHPWH Cooling Coil Air Outlet Humidity Ratio [kg/kg]***

The output variable is the average leaving air dry humidity ratio over the timestep being reported.

***VSAirtoWaterHPWH Cooling Coil Water Mass Flow Rate [kg/s]***

The output variable is the average water mass flow rate going through the heat pump over the timestep being reported.

***VSAirtoWaterHPWH Cooling Coil Water Inlet Temperature [C]***

The output variable is the average entering water temperature over the timestep being reported.

***VSAirtoWaterHPWH Cooling Coil Water Outlet Temperature [C]***

The output variable is the average leaving water temperature over the timestep being reported.

***VSAirtoWaterHPWH Cooling Coil Crankcase Heater Power [W]***

The output variable is the average power used for crankcase heater, in Watts over the timestep being reported.

***VSAirtoWaterHPWH Cooling Coil Crankcase Heater Consumption [J]***

The output variable is the total electric energy usage of the coil for crankcase heater, in Joules over the timestep being reported.

***VSAirtoWaterHPWH Upper Speed Level [Dimensionless]***

The output variable is the average upper speed level, for interpolating performances between two neighboring speed levels.

***VSAirtoWaterHPWH Speed Ratio between Two Neighboring Speeds [Dimensionless]***

The output variable is the average speed ratio, for interpolating performances between two neighboring speed levels.

***VSAirtoWaterHPWH Cooling Coil Electric Energy [J]***

The output variable is the electric consumption of the heat pump in Joules over the timestep being reported.

***VSAirtoWaterHPWH Cooling Coil Cooling Energy [J]***

The output variable is the total cooling output of the coil in Joules over the timestep being reported.

***VSAirtoWaterHPWH Cooling Coil Sensible Cooling Energy [J]***

The output variable is the total sensible cooling output of the coil in Joules over the timestep being reported

***VSAirtoWaterHPWH Cooling Coil Latent Cooling Energy [J]***

The output variable is the total latent cooling output of the coil in Joules over the timestep being reported.

***VSAirtoWaterHPWH Cooling Coil Water Heating Energy [J]***

The output variable is the total water heating energy of the coil in Joules over the timestep being reported.

***VSAirtoWaterHPWH Cooling Coil Water Heating Pump Electric Power [W]***

The output variable is the average power used for condenser water pump, in Watts over the timestep being reported.

***VSAirtoWaterHPWH Cooling Coil Water Heating Pump Electric Energy [J]***

The output variable is the total electric energy usage of the condenser water heating pump, in Joules over the timestep being reported.