

AHRI Standards 550/590 and 551/591

**2020 Standard for
Performance Rating of
Water-chilling and
Heat Pump Water-heating
Packages Using the Vapor
Compression Cycle**

**Changes
from 2018,
with Errata**

Major Revisions

1. Section 2: Exclude adiabatic and some heat pump chillers from the scope of the standard.
2. Section 3: Define full-load for any published rating.
3. Section 4: Reference ASHRAE Standard 30 as the method of test.
4. Table 4: Clarify standard rating conditions for water-cooled water-heating chillers.
5. Table 5: Increase the application rating condition scope.
6. Section 5.4: Update part-load rating interpolation test and calculation methods for discrete unloading chillers.
7. Section 6: Clarify published rating requirements.
8. Overall: Table, figure, and equation number comparison

1. Section 2 – Scope

Now Excluded:

- Air-to-water units designed exclusively to heat potable water
- Water-chilling Packages with an active adiabatically-cooled condenser

2.2 Exclusions.

2.2.1 Water-to-water heat pumps with a Capacity less than 135,000 Btu/h are covered by the latest edition of ASHRAE/ANSI/AHRI/ISO Standard 13256-2.

2.2.2 Air-to-water units designed exclusively to heat potable water as covered by the latest edition of ANSI/AHRI Standard 1300.

2.2.3 Water-chilling Packages are excluded when the condenser is actively adiabatically-cooled. An adiabatically-cooled condenser is an air-cooled condenser which uses evaporative cooling to pre-cool air before that air reaches the dry heat transfer surface.

2. Section 3 - Full-load Definition

Allows full-load to be known for all application ratings

3.12 *Percent Load (%Load)*. The ratio of the part-load rated net Capacity, stated in decimal format (e.g.100% = 1.0).

3.12.1 *Full load and 100% Load*. The highest Capacity at which the chiller has been rated at specific conditions. Corresponds to the 100% Load point utilized in IPLV.IP or NPLV.IP.

3. Section 4 - ASHRAE Standard 30

ASHRAE 30 References

- Test instrumentation requirements
- Air sample tree assembly requirements
- Energy and voltage balance
- Water pressure drop measurement
- Heat pump cyclic measurement

ASHRAE / AHRI Same Requirements

- Water properties
- Rounding requirements
- Test operating condition tolerances and stability criteria

Additional AHRI 550/590, 551/591 Testing Requirements

- Water connections (single entering and leaving)
- Refrigerant tubing
- Fouling factor correction
- Atmospheric pressure correction
- Air sampling array requirements
- Log-linear efficiency interpolation
- Head pressure control test requirements

4. Table 4 – Standard Rating Conditions

Water-cooled
water-heating
chillers

Table 4, Note 8. Rated water flow is determined by the water temperatures at the rated Cooling Capacity.

Operating Category	Conditions	Cooling Mode Evaporator ²		
		Entering Temperature, °F	Leaving Temperature, °F	Flow Rate, gpm/ton _R
All Cooling	Standard	54.00	44.00	Note - 8
AC Heat Pump High Heating ⁶	Low	--	105.00	Note - 1
	Medium	--	120.00	Note - 1
	High	--	140.00	Note - 1
AC Heat Pump Low Heating ⁶	Low	--	105.00	Note - 1
	Medium	--	120.00	Note - 1
	High	--	140.00	Note - 1
Water Cooled Heating	Low	--	44.00	Note - 8
	Medium	--	44.00	Note - 8
	High	--	44.00	Note - 8
	Boost	--	65.00	Note - 8
Heat Recovery	Low	--	44.00	Note - 8
	Medium	--	44.00	Note - 8
	Hot Water 1	--	44.00	Note - 8
	Hot Water 2	--	44.00	Note - 8

5. Table 5 - Application Ratings

Increase condenser entering water temperature range

	Evaporator			Condenser		
Cooling	Water Cooled			Water Cooled		
	Leaving Temperature ¹ , °F	Temperature Difference Across Heat Exchanger ⁵ , °F	Fouling Factor Allowance, h·ft ² ·°F/Btu	Entering Temperature ² , °F	Flow Rate, gpm/ton ^{5,7}	Fouling Factor Allowance, h·ft ² ·°F/Btu
	36.00 to 70.00	5.00 to 20.00	0.000̄ to 0.00100	55.00 to 115.00	1.000̄ to 6.000̄	0.000̄ to 0.00100
				Air-Cooled		
				Entering Air Dry Bulb ³ , °F	Atmospheric Pressure ⁶ , psia	
				55.0 to 125.6	11.56 to 15.20	
				Evaporatively Cooled		
Entering Air Wet Bulb ⁴ , °F	Atmospheric Pressure ⁶ , psia					
50.0 to 80.0	11.56 to 15.20					
Heating	Water Source Evaporator			Water Cooled Condenser		
	Entering Water Temperature ¹ , °F		Fouling Factor Allowance, h·ft ² ·°F/Btu	Leaving Water Temperature ² , °F	Temperature Difference Across Heat Exchanger ⁵ , °F	Fouling Factor Allowance, h·ft ² ·°F/Btu
	40.00 to 80.00		0.000̄ to 0.00100	105.00 to 160.00	5.00 to 30.00	0.000̄ to 0.00100
	Air Source Evaporator					
Entering Air Temperature, °F	Atmospheric Pressure ⁶ , psia					
15.00 to 60.00	11.56 to 15.20					

6. Section 5.4 - Part-load Interpolation

1. Constant condenser inlet temperature
2. Log-linear interpolation

Point 1: $(\%Load_1, \eta_1)$
Point 2: $(\%Load_2, \eta_2)$
Interpolated Point: $(\%Load_{int}, \eta_{int})$

$$\text{exponent} = \log_{10}(\eta_1) + (\%Load_{int} - \%Load_1) \cdot \frac{[\log_{10}(\eta_2) - \log_{10}(\eta_1)]}{(\%Load_2 - \%Load_1)}$$

$$\eta_{int} = 10^{(\text{exponent})}$$

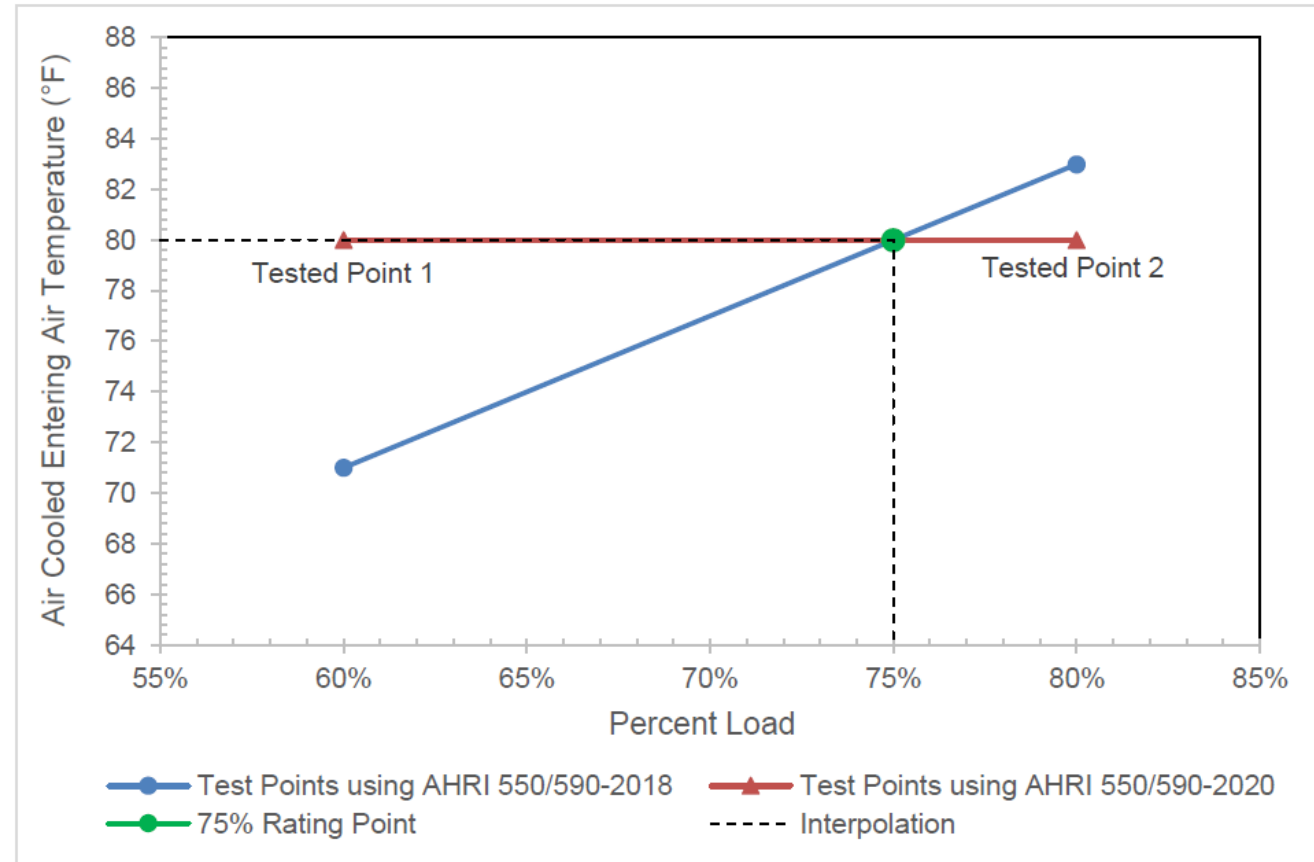


Figure 2. Interpolated IPLV.IP Condition

7. Section 6 – Published Ratings

- Moved all requirements to Table 8
- Optional integral pump power
- Required refrigerant tubing length for remote condensers and evaporators

Integral Pumps	
Pump Power	W, kW, MW
Water Pressure Drop	ft H ₂ O ¹⁴ , psid
Remote Condenser or Evaporator	
Length of each line of interconnecting refrigerant tubing	ft

Table 8, Note 1. Table key: ■ = required, □ = optional

8. Overall – Table, Figure, Equations

AHRI 550/590 - 2018 to 2020 Version

Equation #s				Table #s						Figure #s		Appendix #s	
2018	2020	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020
C9	1	10	17	25	32	12	1	4A	F1	E3	1	A	A
C10	2	11	18a	27	33	E1	2	4B	F2	-	2	B	B
C11	3	12	18b	28	34	E2	3	5A	F3	3	3	F	C
C12	4	13	19	29	35	1	4	5B	F4	4	4	D	D
C13	5	14	20	F1	C1	2	5	6A	F5	D1	D1	I	E
C14	6	15	21	F2	C2	3	6	6B	F6	D2	D2	-	F
C15	7	16	22	F3	C3	11	7	7A	F7	D3	D3		
C16	8	17a	23	F4	C4	14	8	7B	F8	D4	D4		
C17	9	17b	24	F5	C5	15	9	8A	F9	I1	E1		
1	10a	18	25a	F6	C6	16	10	8B	F10	I2	E2		
2	10b	19	25b	F7	C7	F1	C1	9A	F11	2	F1		
3	10c	20	25c	F8	C8	D1	D1	9B	F12				
4	11	21	26	D1	D1	D2	D2	10A	F13				
5	12	22	27	D2	D2	D3	D3	10B	F14				
6	13	-	28	D3	D3	I1.1	E1.1						
7	14	-	29	D4	D4	I1.2	E1.2						
8	15	23	30	D5	D5	I2.1	E2.1						
9	16	24	31			I2.2	E2.2						