THERMAL CARE

Superior equipment, Exceptional service

Product Catalog

NQV Series Portable Chillers

Contents

Standard Features

Variable-Speed Compressor

Chillers usually operate with process heat loads less than 100% of available chiller capacity. With increasing emphasis on energy efficiency, we offer a variable-speed scroll compressor option for improved part-load efficiency.

Most chillers use fixed-speed compressors with a hot gas bypass valve that bypasses hot discharge refrigerant gas back into the compressor to simulate 100% load. This keeps the compressor running at full speed all the time.

Our variable-speed scroll compressor technology varies the compressor speed to match the process load. This means the compressor slows down under part load conditions for peak performance and reduced power use.

Our 5, 10, and 15 ton units use one variable-speed compressor. Our 20 ton unit uses a 10 ton variable-speed and a 10 ton fixed-speed compressor and our 30 ton unit uses a 15 ton variable-speed and 15 ton fixed-speed compressor.

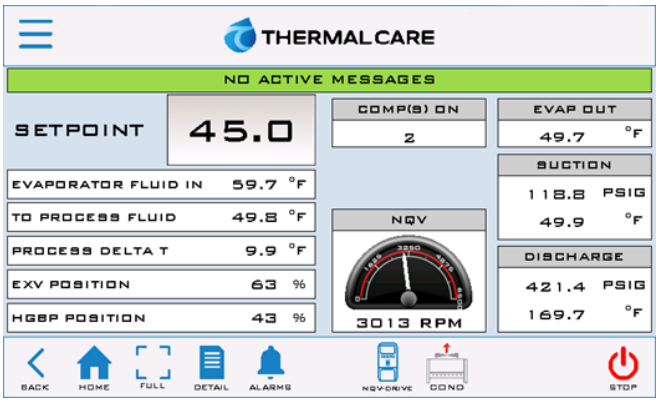
Variable-Speed Compressor Payback (Years)

Cap	Hours	Process Load (Percent of Full Capacity)							
		50%	55%	60%	65%	70%	75%	80%	85%
5 ton	4,000	3.4	3.6	3.9	4.3	4.8	5.5	6.7	8.8
	6,000	2.3	2.4	2.6	2.8	3.2	3.7	4.5	5.9
	8,400	1.6	1.7	1.9	2.0	2.3	2.6	3.2	4.2
10 ton	4,000	1.2	1.3	1.4	1.5	1.7	2.0	2.4	3.1
	6,000	0.8	0.9	0.9	1.0	1.1	1.3	1.6	2.1
	8,400	0.6	0.6	0.7	0.7	0.8	0.9	1.1	1.5
15 ton	4,000	1.1	1.2	1.3	1.4	1.6	1.9	2.4	3.5
	6,000	0.7	0.8	0.8	0.9	1.1	1.3	1.6	2.3
	8,400	0.5	0.6	0.6	0.7	0.8	0.9	1.2	1.7
20 ton	4,000	1.1	1.2	1.3	1.4	1.6	1.9	2.4	3.3
	6,000	0.7	0.8	0.9	1.0	1.1	1.3	1.6	2.2
	8,400	0.5	0.6	0.6	0.7	0.8	0.9	1.2	1.6
30 ton	4,000	0.8	0.8	0.9	1.0	1.1	1.3	1.6	2.1
	6,000	0.5	0.6	0.6	0.7	0.8	0.9	1.1	1.4
	8,400	0.4	0.4	0.4	0.5	0.5	0.6	0.8	1.0

Based on $0.10/kWHr power cost

PLC Controls

Standard PLC with 7-inch touch screen to provide an enhanced level of monitoring and control.



Sample of Home Screen

Direct Drive Scroll Compressors

Direct drive hermetically sealed scroll compressors with proven performance in industrial cooling for reliable, low maintenance, and efficient operation.

Stainless Steel Evaporators

High-efficiency stainless steel plates with copper brazing provide maximum performance, long life, and an enhanced level of protection from harsh process conditions.

Stainless Steel Pump

Stainless steel pump selected for peak performance with the utmost in corrosion protection to ensure a long useful life under severe industrial conditions.

Nonferrous Reservoir and Water Lines

The insulated reservoir, fluid lines, pumps, and other components in the process fluid circuit will remain free of rust to provide maximum corrosion protection.

Evaporator Inlet Strainer

The evaporator inlet strainer removes any debris present in the process fluid to prevent costly downtime and repair due to a clogged chiller evaporator.

Easy Access Cabinet

Heavy-gauge machine access doors with industrial grade tools-free latches provide quick access to all components for easy operation and maintenance.

Compressor Protection Technology

Our compressor protection technology uses start-to-start anti-recycle control logic to limit cycling under low-load operating conditions to extend compressor life.

Compressor and Pump Run Hour Displays
The ability to monitor compressor and pump running hours is useful and is an important tool to assist with scheduling maintenance.

Power Monitor
The main power monitoring system protects the chiller from extensive damage to the compressor and pump due to loss of phase or phase reversal in the main supply.

Reservoir Low Level Alarm
Indicates a low process fluid condition and protects the process pump and chiller from expensive damage caused by a critically low operating level in the reservoir.

Master Reset
The master reset function is a quick and easy way to reset and restore the control system to factory default settings if a control parameter is mistakenly changed.

High-Quality 24 VDC Power Supply
The 24-volt DC power supply ensures dependable control circuit power and isolates the control circuit from static interference to ensure stable and precise operation.

Warranty
18 months parts on entire unit
1 year labor

Available Options

Hand-Held Remote Control
As standard, the chillers come with a control display mounted in the control panel of the chiller. In applications where the chiller is outdoors, or in an area not frequented by the operator, a remote hand-held control display is available. This option provides a second operator interface identical in function to the primary control display on the chiller. This option includes as standard a 50-foot wire for connection between the remote hand-held controller and the chiller.

Alarm Horn and/or Alarm Relay
Provides an alarm horn that sounds when a fault condition occurs. In addition there is an alarm contact that closes whenever a fault condition occurs.

Rotary Non-Fused Disconnect Switch
Provides a rotary non-fused disconnect switch with a through the door round rotary disconnect handle.

Rotary Fused Disconnect Switch
Provides a rotary fused disconnect switch with a through the door round rotary disconnect handle.

UL508A Industrial Control Panel (cULus Listed)
Adds circuit breakers to pump and compressor starters and provides branch circuit protection and documentation.

Indoor-Duty, Condenser Air Range of 0°F to 110°F
For chillers located indoors where the ambient air temperature is between 0°F and 110°F, this option includes flooded head pressure controls, liquid receiver and liquid line solenoid valve. This option is available with or without the epoxy coated condenser coil option.

Outdoor-Duty, Condenser Air Range of 0 to 110°F
For chillers located outdoors and exposed to rain, snow, direct sunlight, and ambient air temperatures between 0°F and 110°F, this option includes flooded head pressure controls, liquid receiver, liquid line solenoid valve, sever-duty HMI, upgrades the base metal of all powder coat painted cabinet components to galvanized steel, and changes zinc coated fasteners to stainless steel. This option is available with or without the epoxy coated condenser coil option.

Outdoor-Duty, Condenser Air Range of -20 to 110°F
For chillers located outdoors and exposed to rain, snow, direct sunlight, and ambient air temperatures between -20°F and 110°F, this option includes flooded head pressure controls, control panel heater, sever-duty HMI, upgrades the base metal of all powder coat painted cabinet components to galvanized steel, and changes zinc coated fasteners to stainless steel. This option is available with or without the epoxy coated condenser coil option.

Condenser Coil Coating
For applications where a chiller with an integral air-cooled condenser or remote air-cooled condenser is in an area within 10 miles of a saltwater coast, this option provides an added level of protection for the aluminum condenser coil from possible corrosion from salt air. For chiller with integral air-cooled condenser this option also includes upgrading all galvanized internal chiller brackets to stainless steel.

Pump and Tank Deduct
For applications where the internal plastic tank and stainless steel pump are not required, this option removes the internal pump and tank. The supply and return connections are located in the same locations as

the standard chiller and the pump running hour meter, pump motor overload, and reservoir low-level alarm are not functional. In addition, if this option is selected the automatic water make-up option is not available.

Oversized Reservoirs

The standard size reservoirs are for nominal flows for a chiller operating with a 10°F temperature rise through the process. Some applications require more process fluid in the tank to act as a thermal flywheel for sudden variations in the process temperature rise. In other instances with high flows, the larger reservoir helps reduce turbulence in the reservoir. The maximum size of the reservoir is different for each size chiller and determined by the pump size and space in the chiller cabinet. Contact your local agent or one of the factory sales engineers for assistance in selecting and pricing this option for your application.

Automatic Water Make-up

This option adds a high and mid-level sensor, a solenoid valve, and a connection on the back of the chiller for a make-up fluid source. With this option, the chiller monitors the level of coolant in the reservoir and if the level drops to the make-up low-level, the solenoid valve opens to let make-up water fill the reservoir. The make-up valve remains open until the high-level sensor senses the water level is sufficient.

Water Circuit Designed for De-ionized Water

Standard chillers feature a water circuit with stainless steel pump, stainless steel evaporator, a plastic tank, and all non-ferrous water piping to provide protection from corrosion and ensure long useful life. In certain applications where the electrical properties of the coolant in the process equipment requires the unit to be filled with de-ionized water this option replaces any materials necessary to allow the unit to be filled with and operate with de-ionized water with conductivity down to 1 µSiemen/cm (NCCLS Type III).

Stainless Steel Cabinetry

Standard chillers feature powder coat painted steel cabinets; however, some applications require an enhanced appearance or durability and this option upgrades painted cabinet components to stainless steel.

High-Pressure, Variable-Speed EC Fan

Chillers with integral air-cooled condensers include fixed-speed AC fan motors designed to draw air in through the condensers and discharge the warm discharge air into an open space such as a production area. In some applications, the heat given off from the chiller is unwanted in the production area, especially if that space is air conditioned, so this option upgrades the fans to a high-power EC fan motor to provide additional discharge pressure for ducting the discharge air away from the chiller. In addition to providing added discharge pressure, this option uses high-efficiency variable-speed EC fan motors that vary speed to maintain the refrigerant head pressure. This provides better control of the chiller operation and allows for some energy savings and noise reduction when operating at a lower load and/or the condenser air temperature is cool enough to allow for a reduced airflow through the chiller.

Chiller Model	Air Flow (cfm)	Standard Fans		High Pressure Variable Speed Fans	
		Available External Static Pressure (in W.C.)	Sound Pressure @ 1 Meter (dBA)	Available External Static Pressure (in W.C.)	Sound Pressure @ 1 Meter (dBA)
NQA04	4,000	0.22	74	0.42	75
NQA05	4,000	0.22	74	0.42	75
NQA08	8,000	0.10	74	0.32	75
NQA10	8,000	0.10	74	0.32	75
NQA13	8,000	0.00	82	0.32	75
NQA15	10,450	0.00	82	0.77	82
NQA20	18,000	0.00	85	0.79	84
NQA25	20,000	0.00	85	0.75	85
NQA30	24,000	0.23	87	1.12	82

BACnet Communications Port

For applications where there is a need to communicate with an external monitoring or control system using BACnet communications, a BACnet communications port is available to provide additional controller expansion hardware and software.

LonWorks Communications Port

For applications where there is a need to communicate with an external monitoring or control system using LonWorks communications, a LonWorks communications port is available to provide additional controller expansion hardware and software.

Coolant Supply Temperature Retransmit

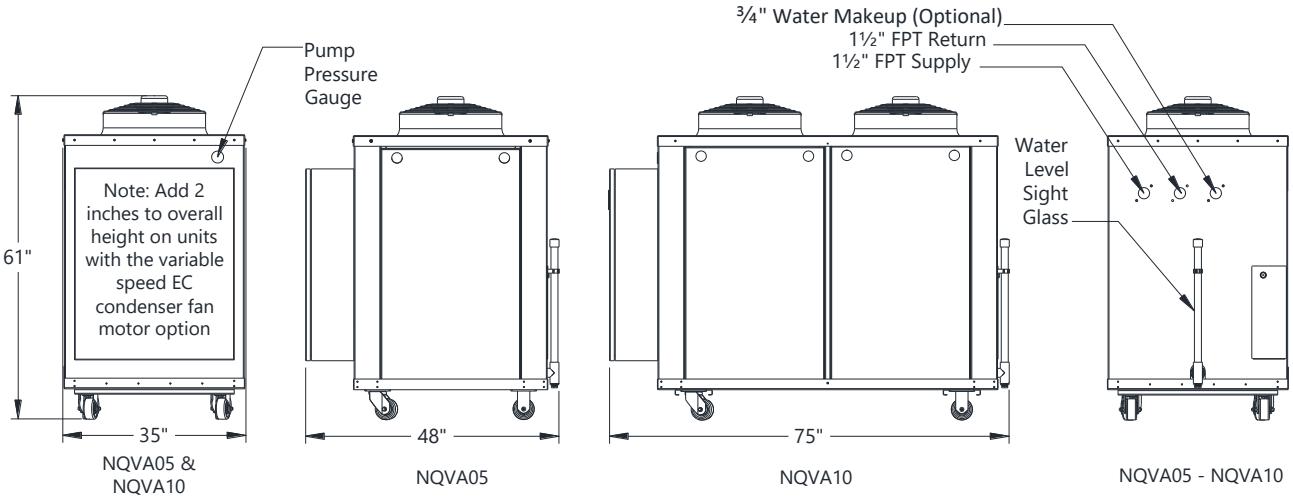
For applications where there is a need for a 4 to 20 mA output of the coolant temperature leaving the chiller, a 4 to 20 mA coolant supply temperature retransmit is available to provide a 4 to 20 mA output signal of the coolant supply temperature.

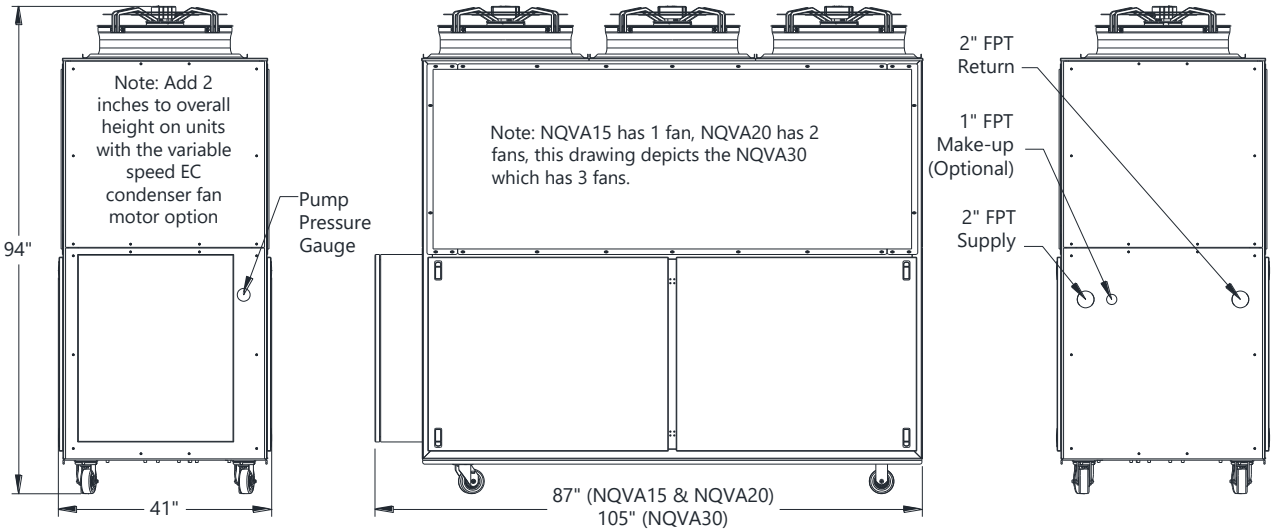
Physical Data

Air-Cooled Condenser Chillers

Model	NQVA05	NQVA10	NQVA15	NQVA20	NQVA30
Cooling Capacity (tons)[1]	5	11	15	21	31
Set Point Range (°F)	20 to 80	20 to 80	20 to 80	20 to 80	20 to 80
Compressor (qty)	1	1	1	2	2
Sound Pressure @ 1 meter (dBA)	74	76	82	84	86
Pump Motor Size (hp)	1.5	2	3	5	5
Pump Flow (gpm)	12	27	36	48	72
Net Available Pump Pressure (psi)[2]	39	38	43	50	47
Reservoir Holding Capacity (gal)	11	22	40	50	67
Shipping Weight (lbs)	770	1,245	3,250	3,350	4,200
Operating Weight (lbs)	860	1,420	3,585	3,765	4,760
MCA @ 460/3/60 (amps)[3]	22	46	86	73	125
MOP @ 460/3/60 (amps)[4]	40	80	150	110	200

[1]Cooling tons based on 12,000 BTU/Hr/ton with 50°F leaving coolant and 95°F ambient air, R410A refrigerant.
[2]Net available pressure at outlet of chiller is pump discharge pressure less the internal pressure loss through the fluid circuit.
[3]MCA is Minimum Circuit Amps with standard condenser fan(s) and pump under full load, used for minimum wire size requirement.
[4]MOP is Maximum Overcurrent Protection with standard condenser fans(s) and pump, used for sizing main power protection devices.

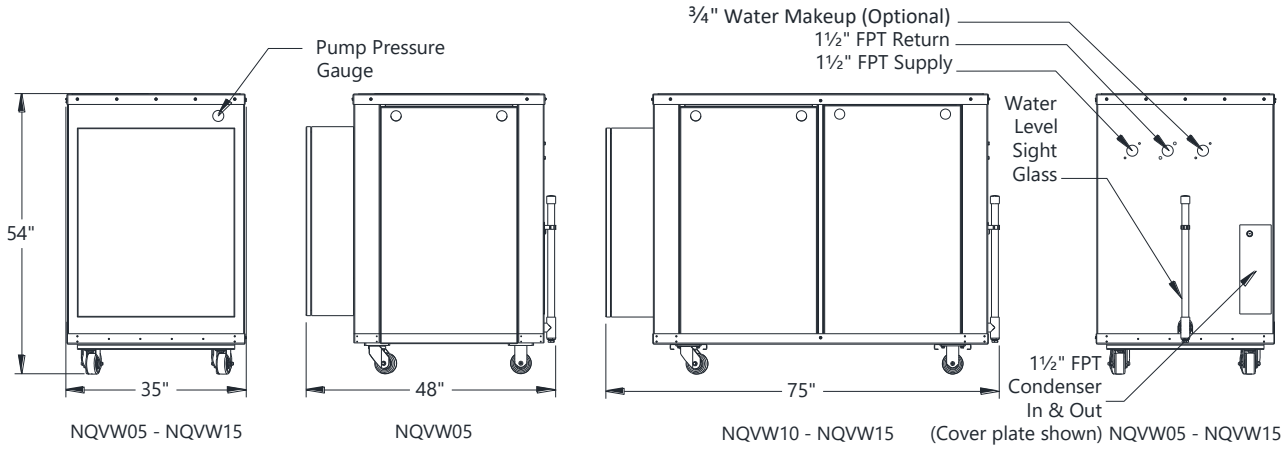


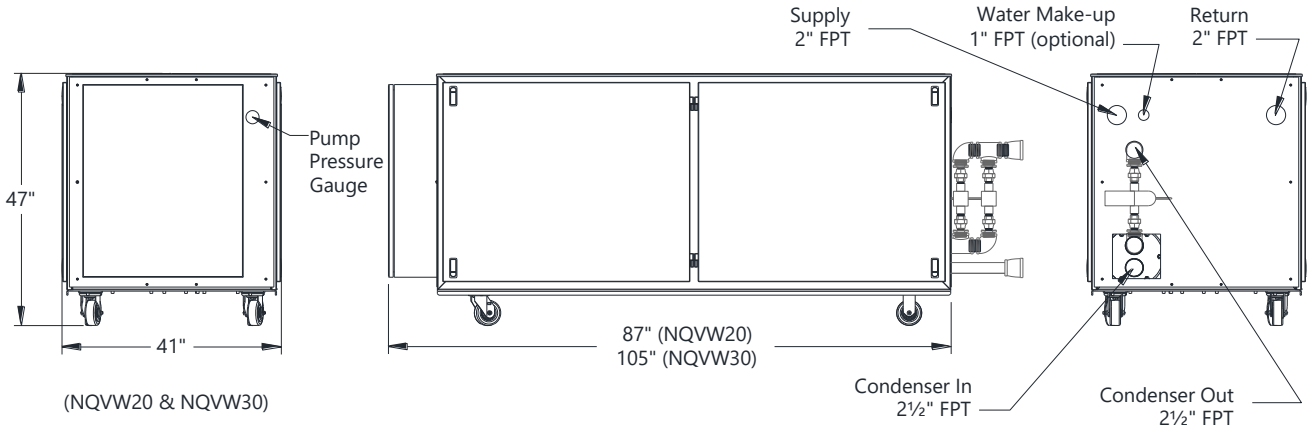


Water-Cooled Condenser Chillers

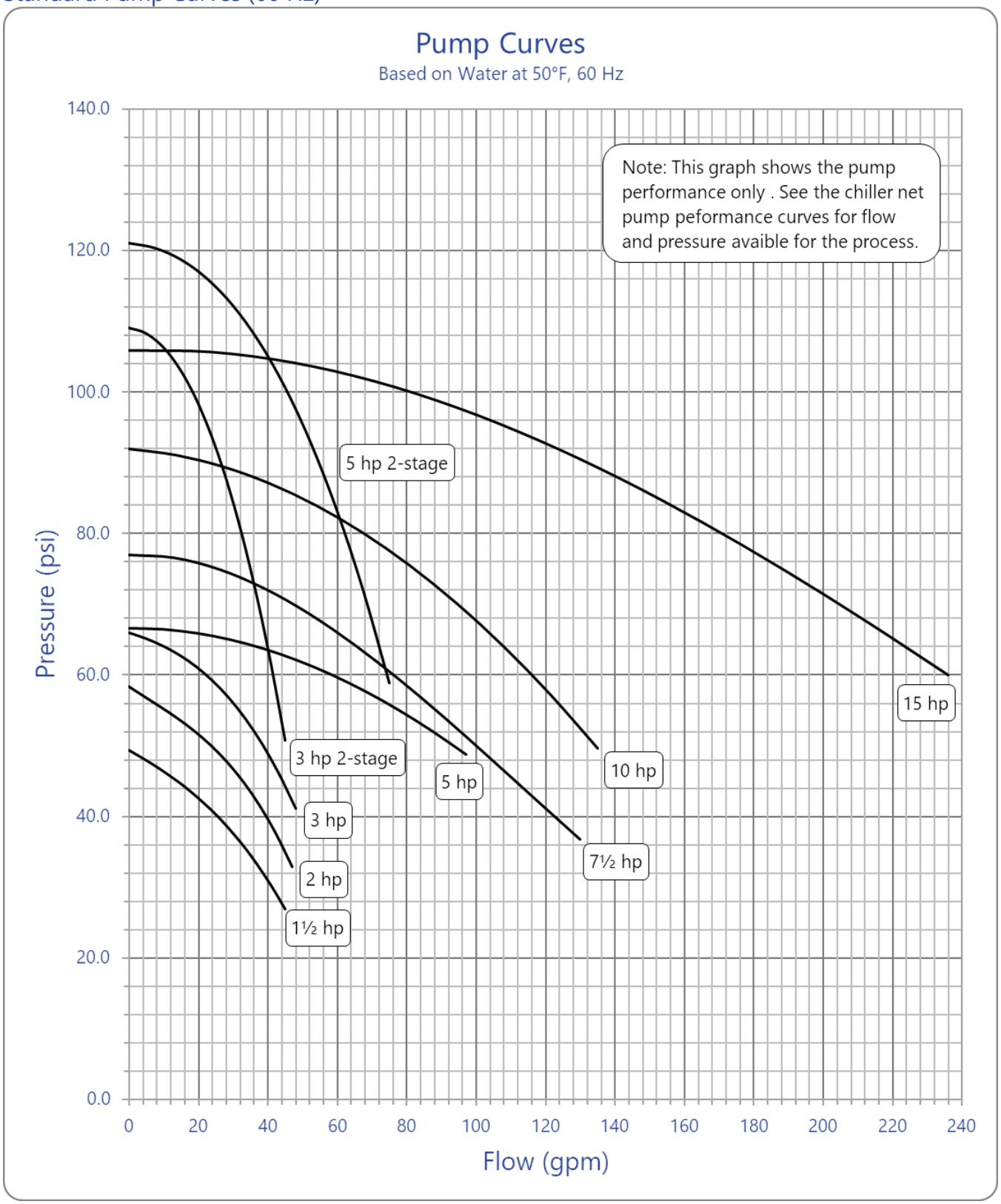
Model	NQW05	NQW10	NQW15	NQW20	NQW30
Cooling Capacity (tons)[1]	6	12	17	23	33
Set Point Range (°F)	20 to 80	20 to 80	20 to 80	20 to 80	20 to 80
Compressor (qty)	1	1	1	2	2
Sound Pressure @ 1 meter (dBA)	70	71	73	74	75
Pump Motor Size (hp)	1.5	2	3	5	5
Pump Flow (gpm)	13	29	39	54	79
Net Available Pump Pressure (psi)[2]	37	36	39	45	44
Reservoir Holding Capacity (gal)	11	22	22	50	67
Shipping Weight (lbs)	770	1,245	1,365	1,950	2,300
Operating Weight (lbs)	860	1,420	1,550	2,365	2,860
MCA @ 460/3/60 (amps)[3]	20	42	81	64	111
MOP @ 460/3/60 (amps)[4]	35	80	150	100	175

[1]Cooling tons based on 12,000 BTU/Hr/ton with 50°F leaving coolant and 85°F condenser water, R410A refrigerant.
[2]Net available pressure at outlet of chiller is pump discharge pressure less the internal pressure loss through the fluid circuit.
[3]MCA is Minimum Circuit Amps with standard pump under full load, used for minimum wire size requirement.
[4]MOP is Maximum Overcurrent Protection with standard pump, used for sizing main power protection device.

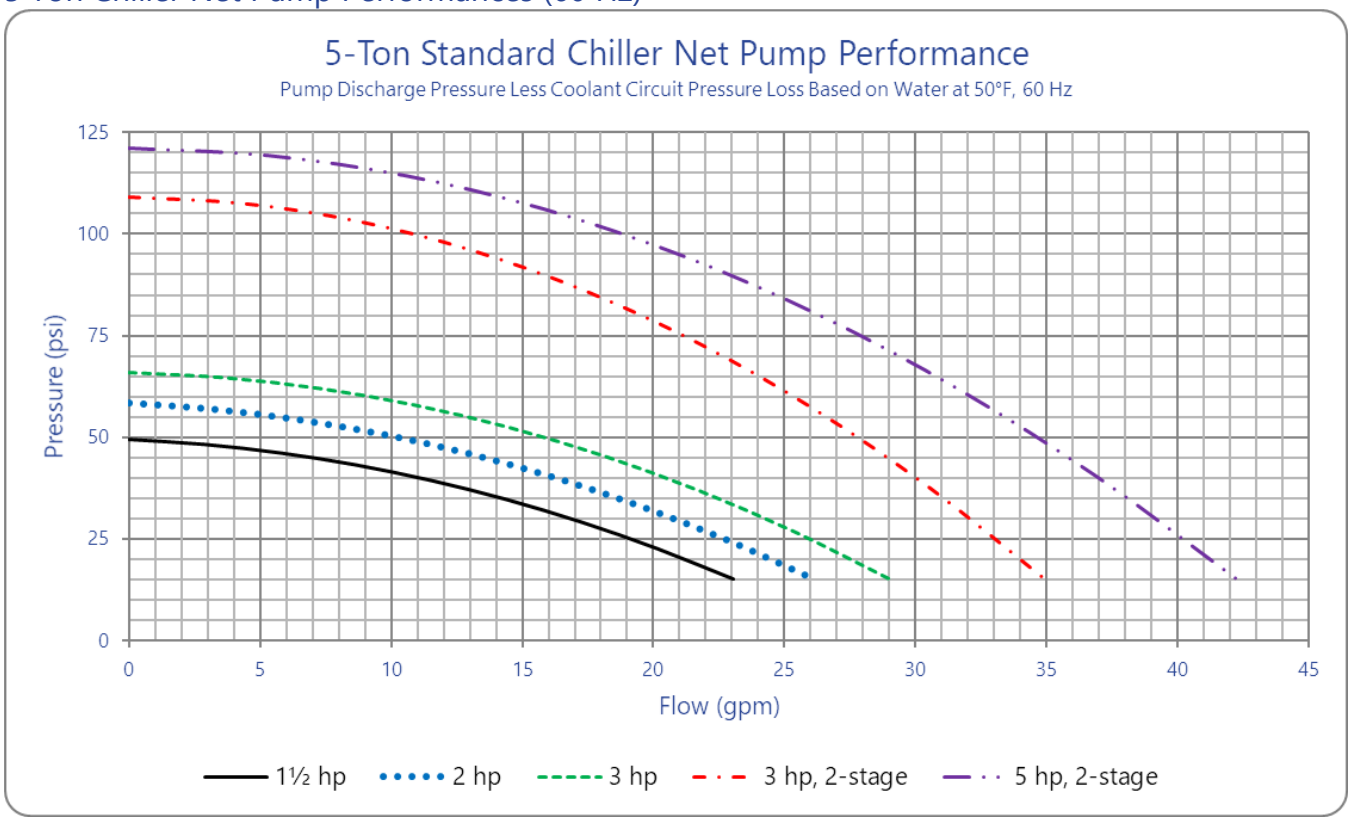




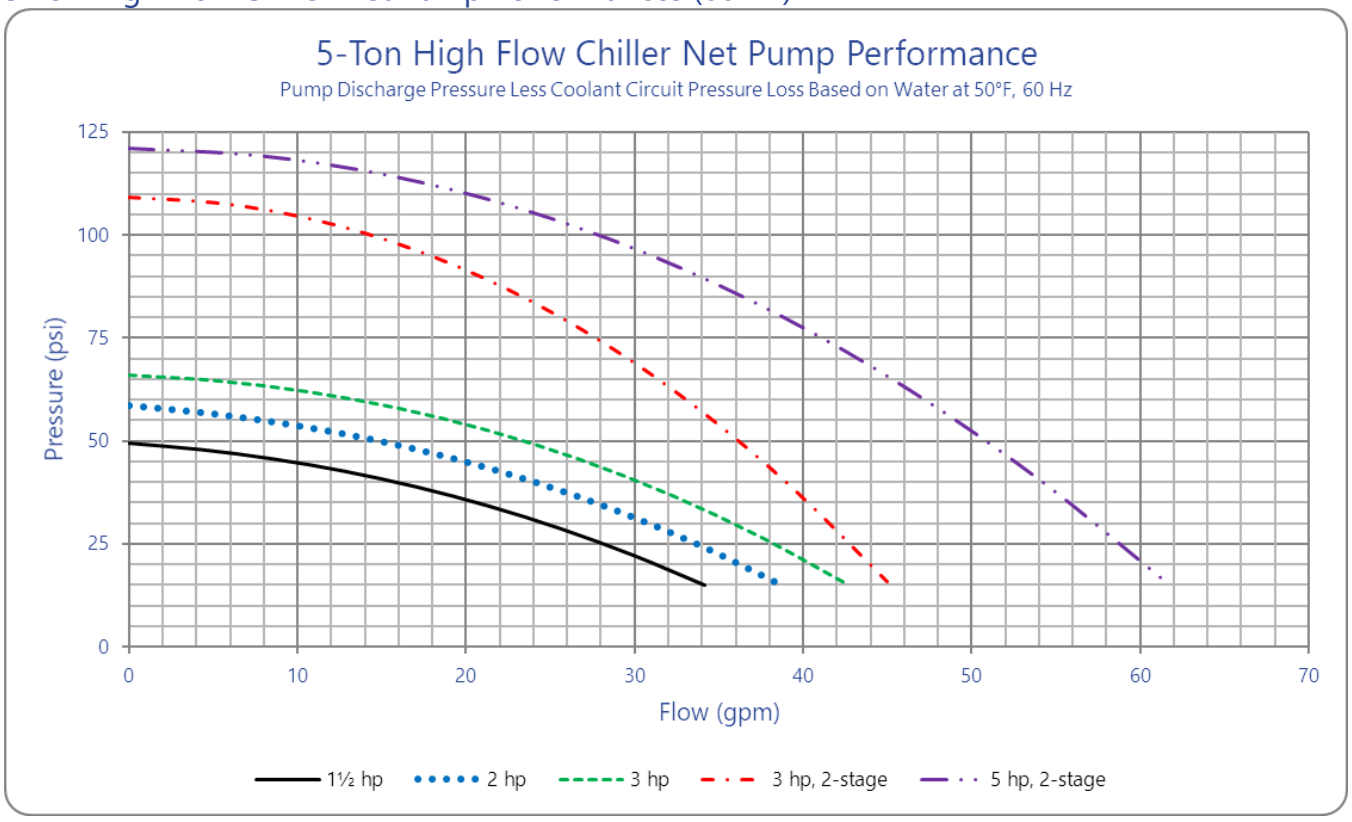
Standard Pump Curves (60 Hz)



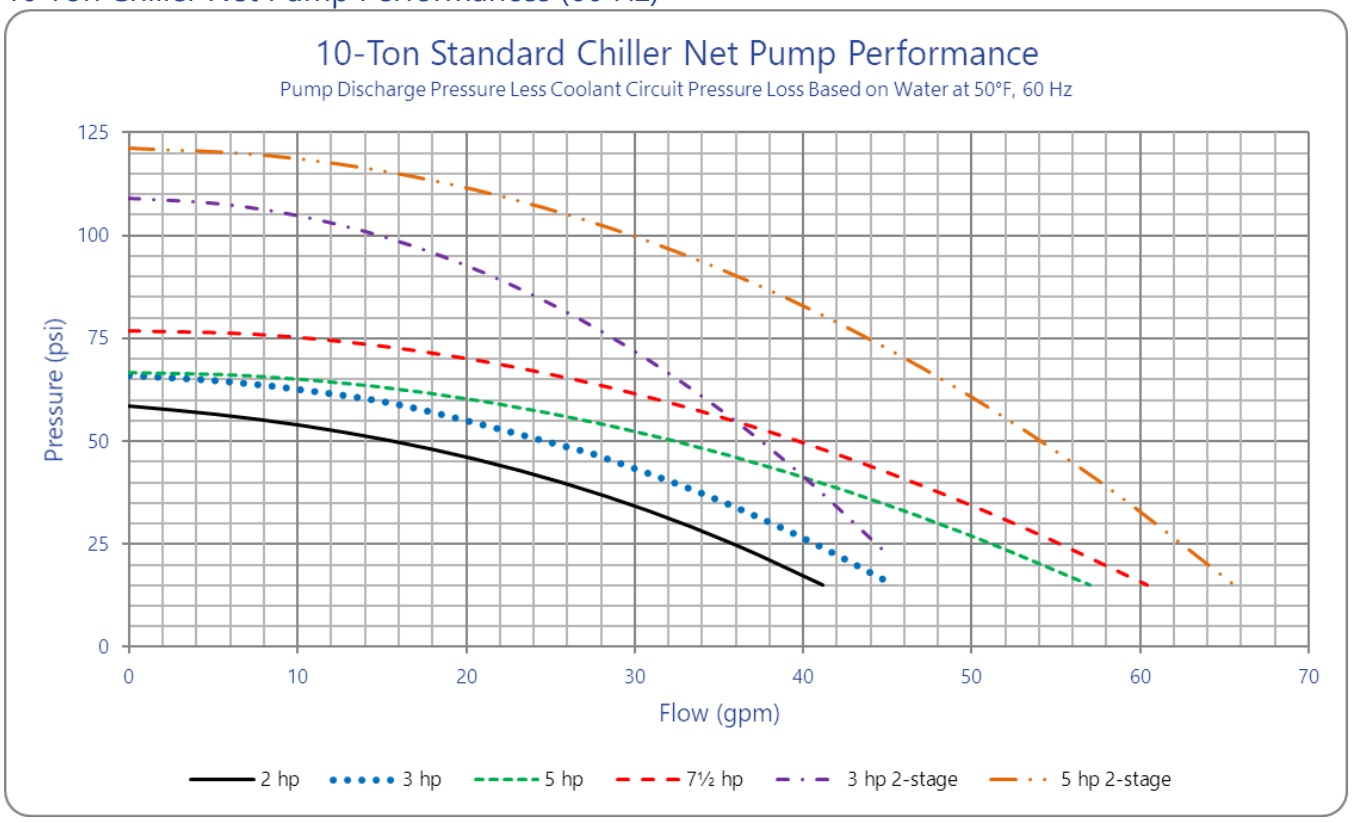
5 Ton Chiller Net Pump Performances (60 Hz)



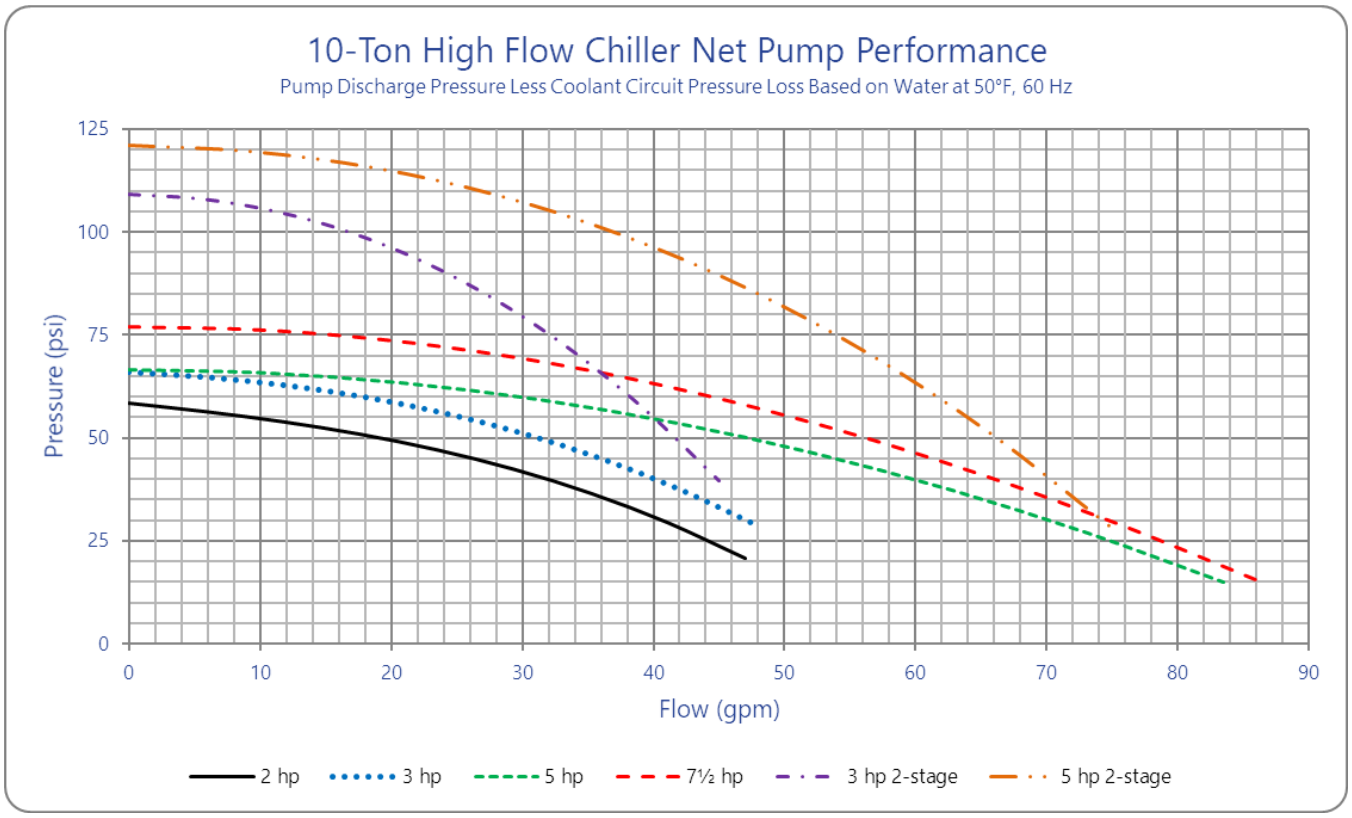
5 Ton High Flow Chiller Net Pump Performances (60 Hz)



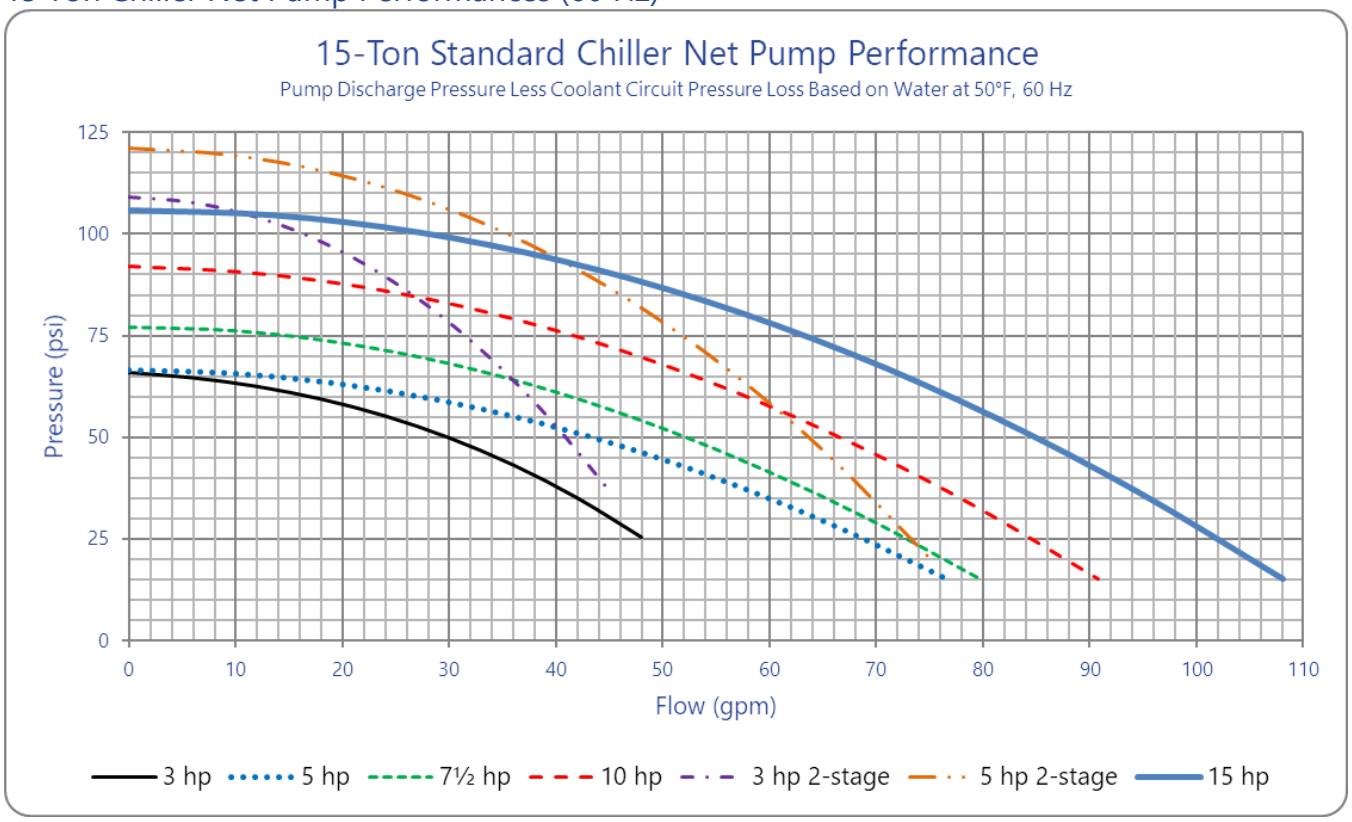
10 Ton Chiller Net Pump Performances (60 Hz)



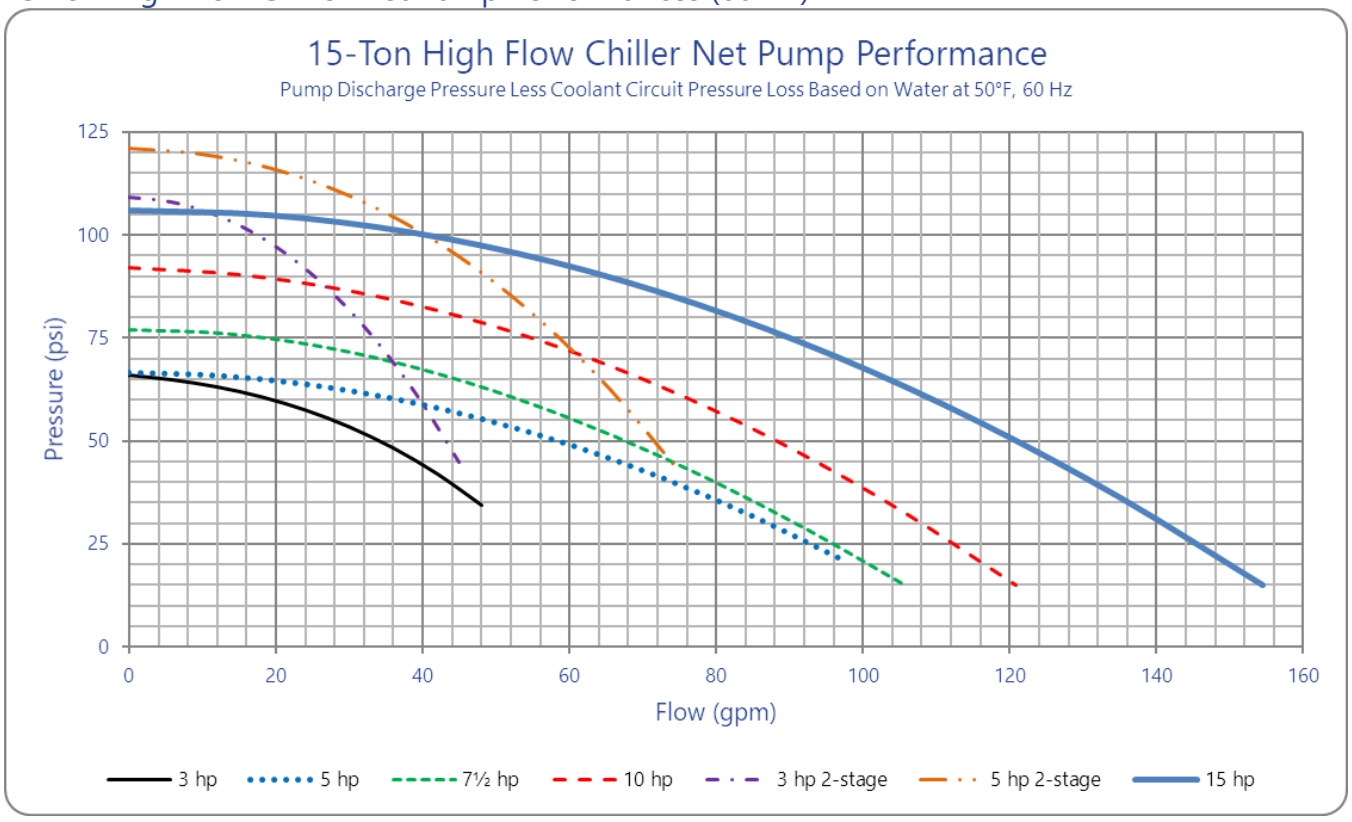
10 Ton High Flow Chiller Net Pump Performances (60 Hz)



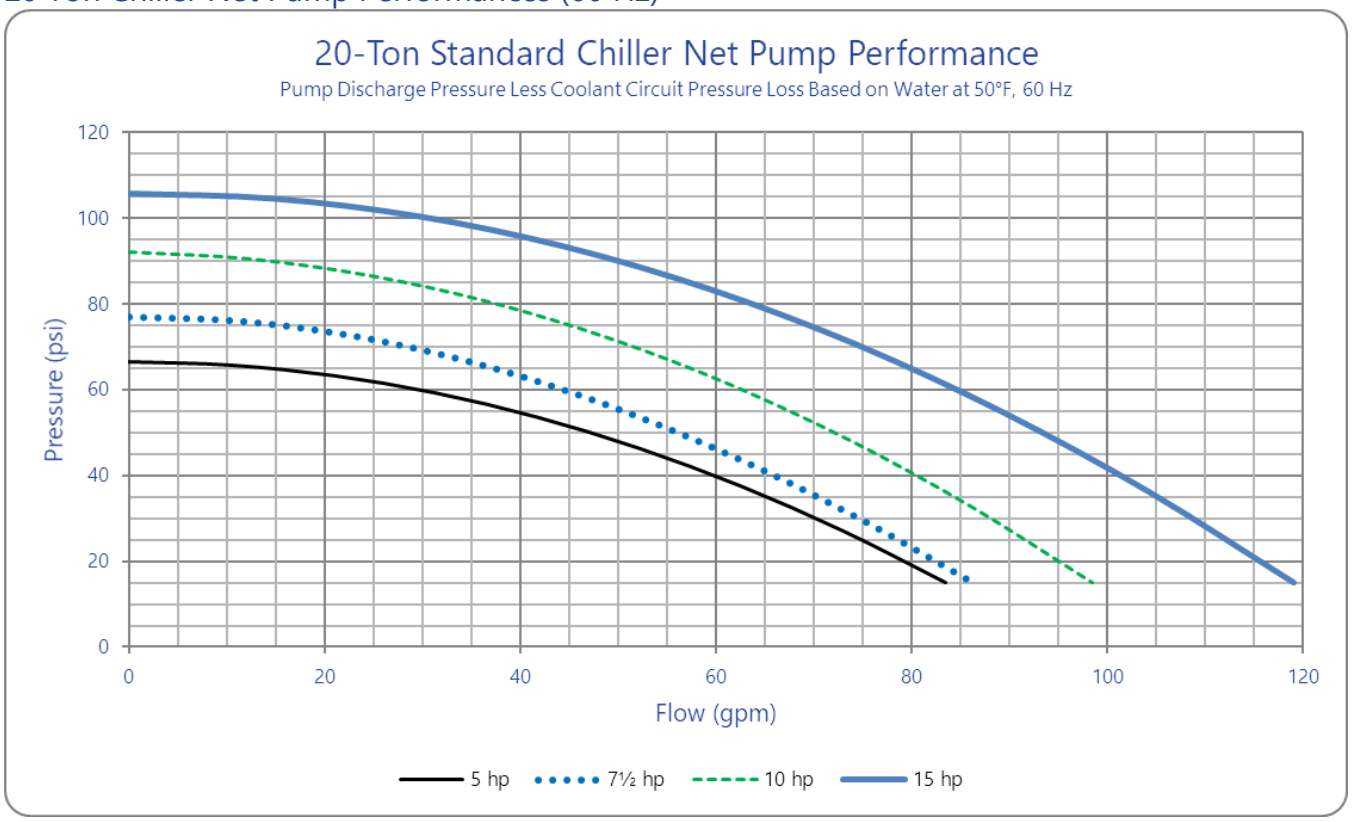
15 Ton Chiller Net Pump Performances (60 Hz)



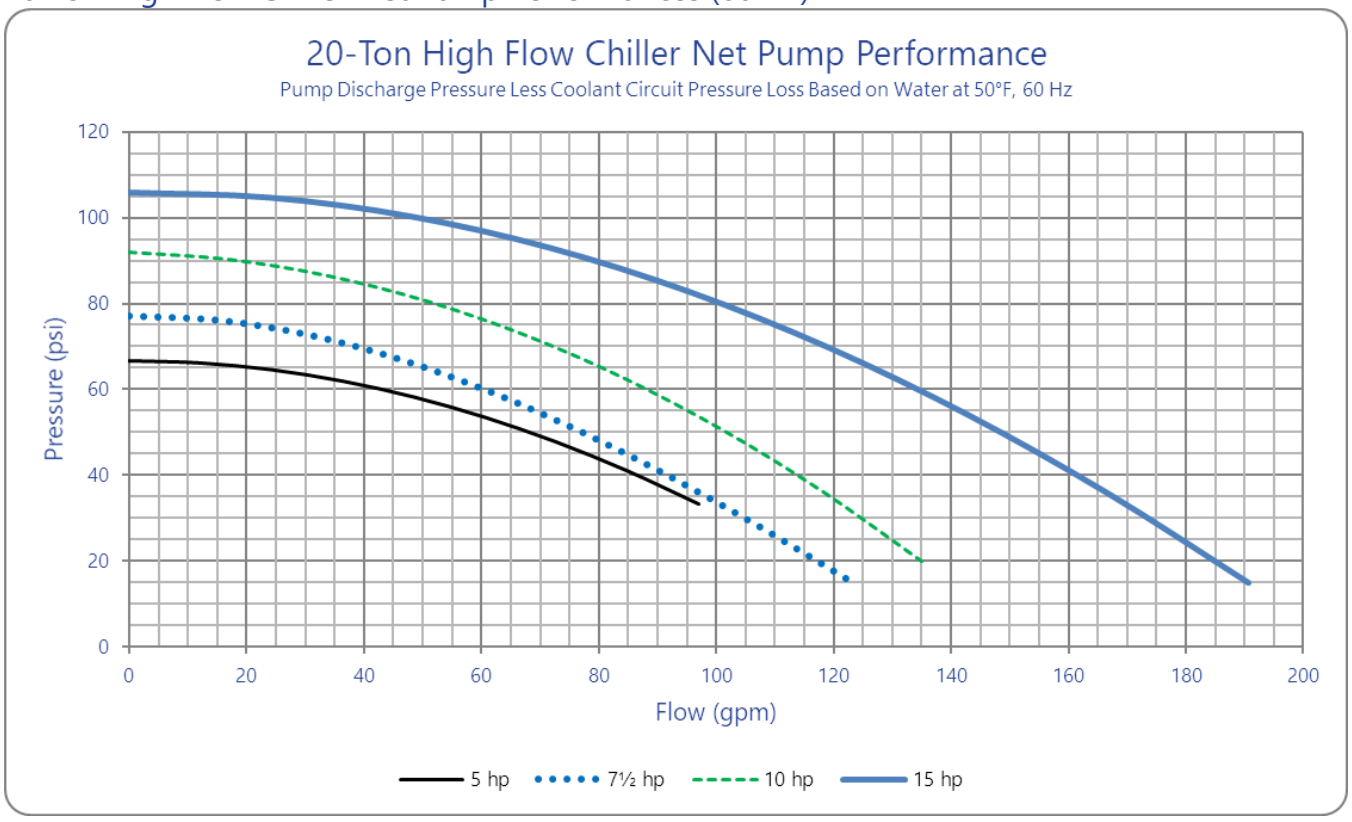
15 Ton High Flow Chiller Net Pump Performances (60 Hz)



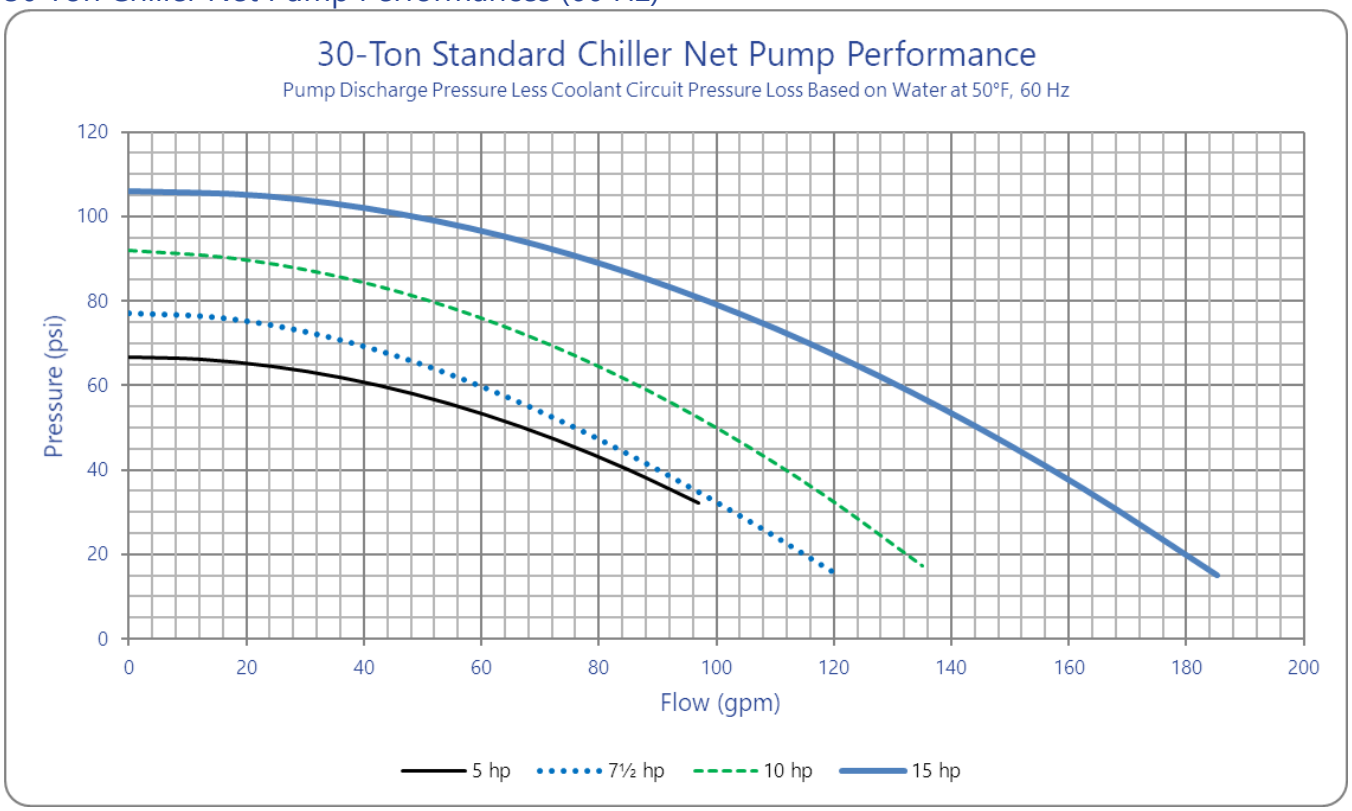
20 Ton Chiller Net Pump Performances (60 Hz)



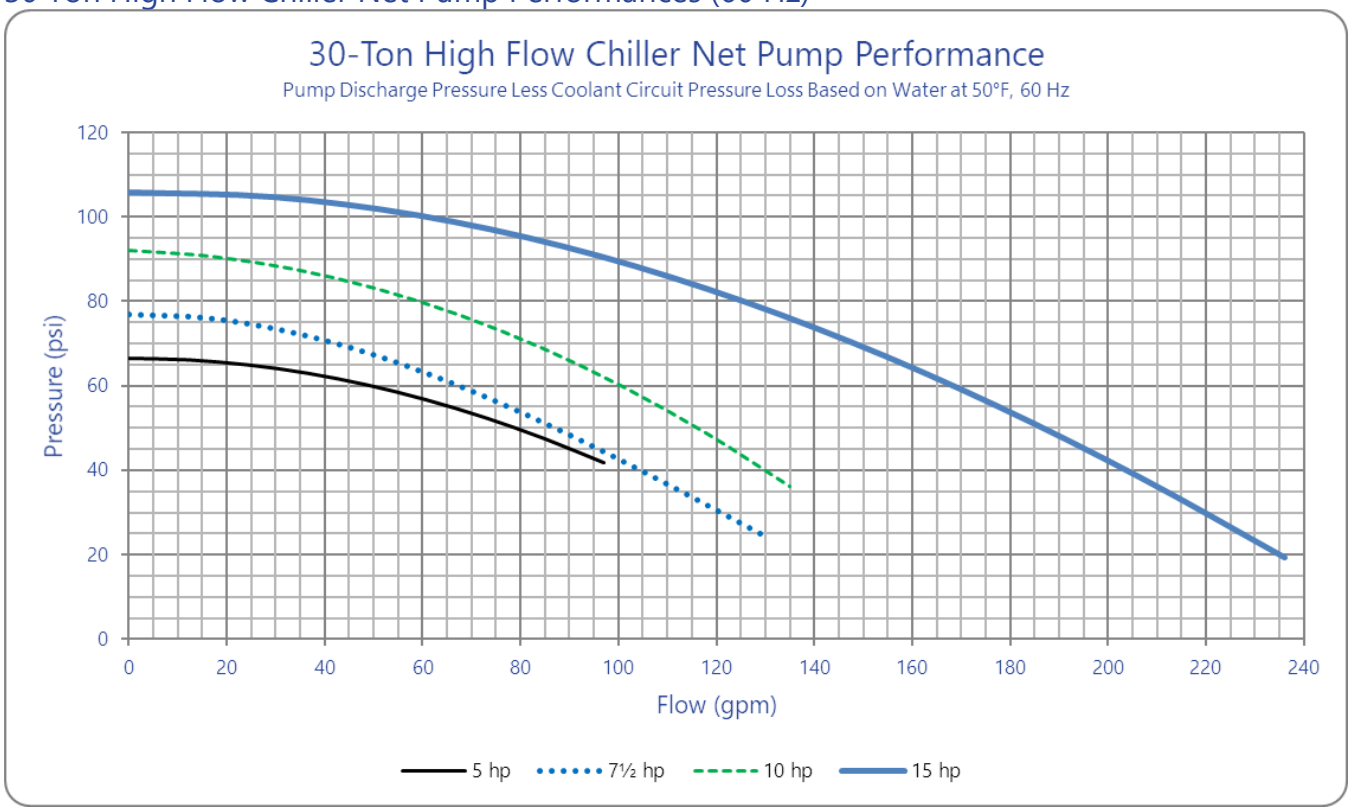
20 Ton High Flow Chiller Net Pump Performances (60 Hz)



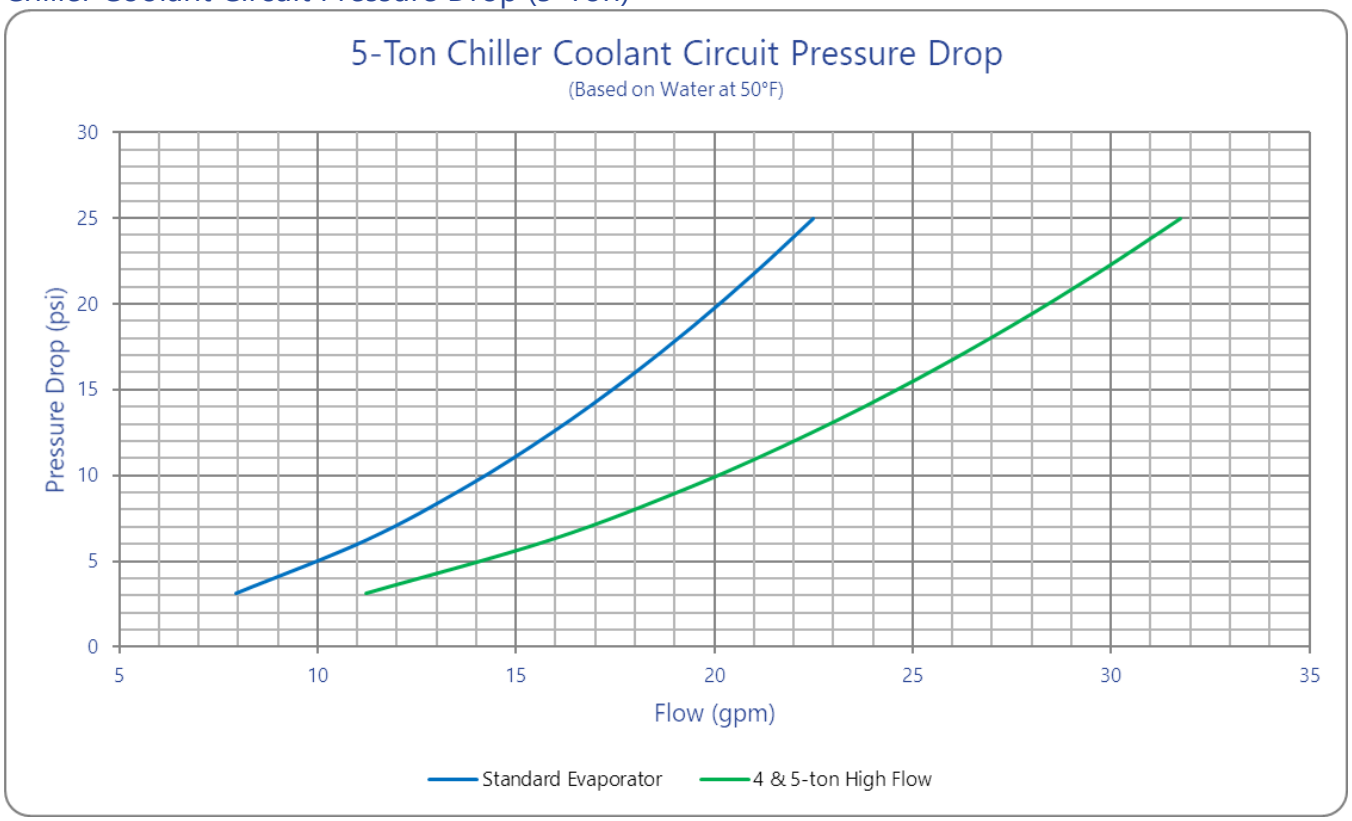
30 Ton Chiller Net Pump Performances (60 Hz)



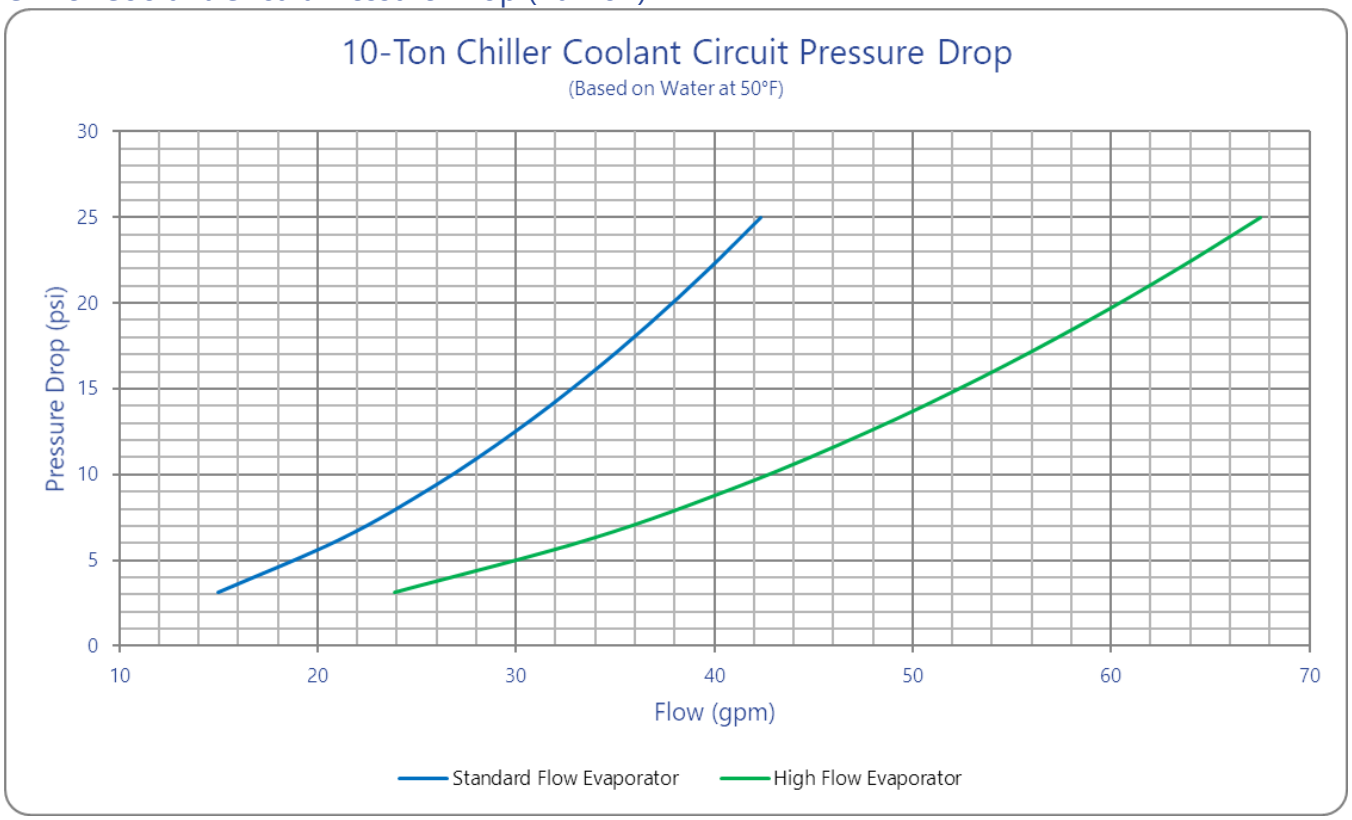
30 Ton High Flow Chiller Net Pump Performances (60 Hz)



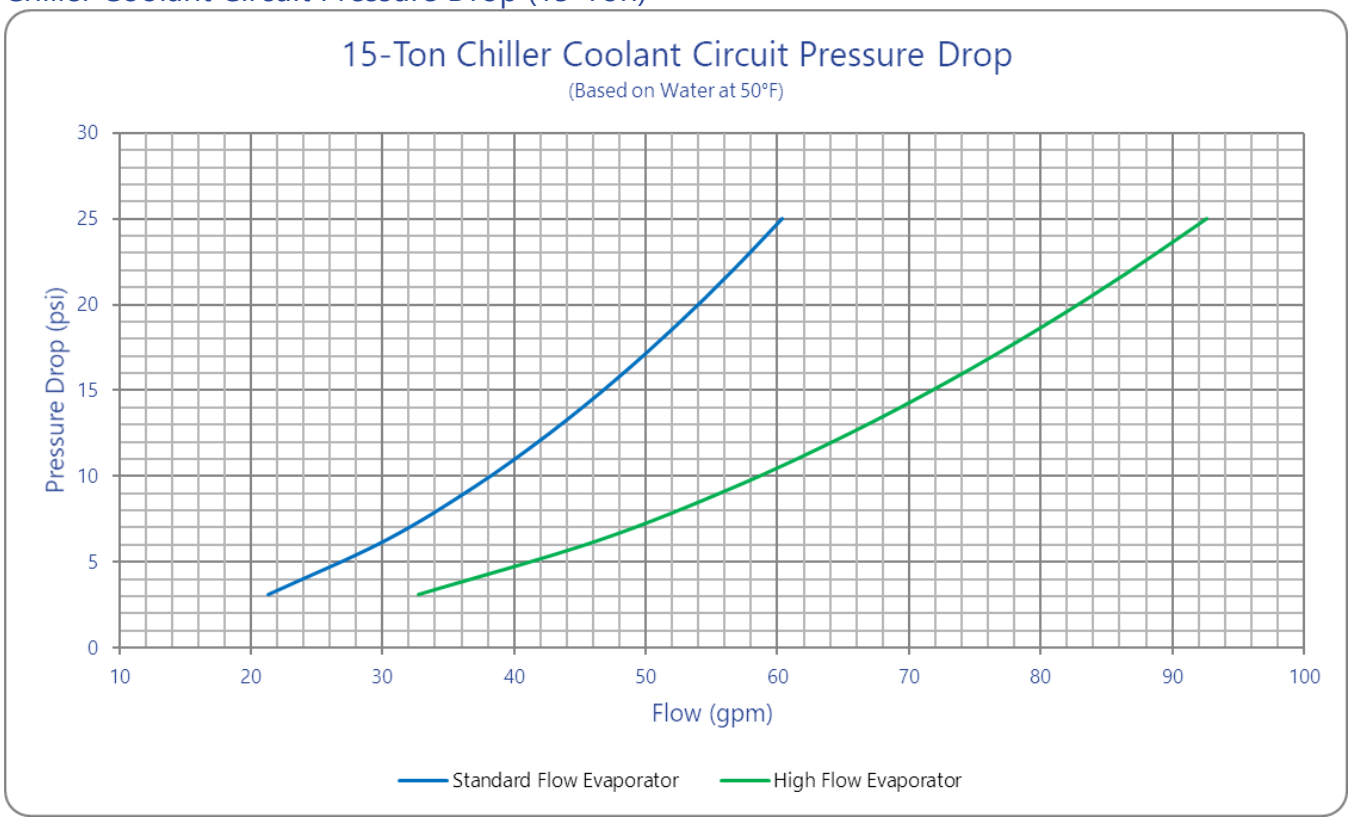
Chiller Coolant Circuit Pressure Drop (5-Ton)



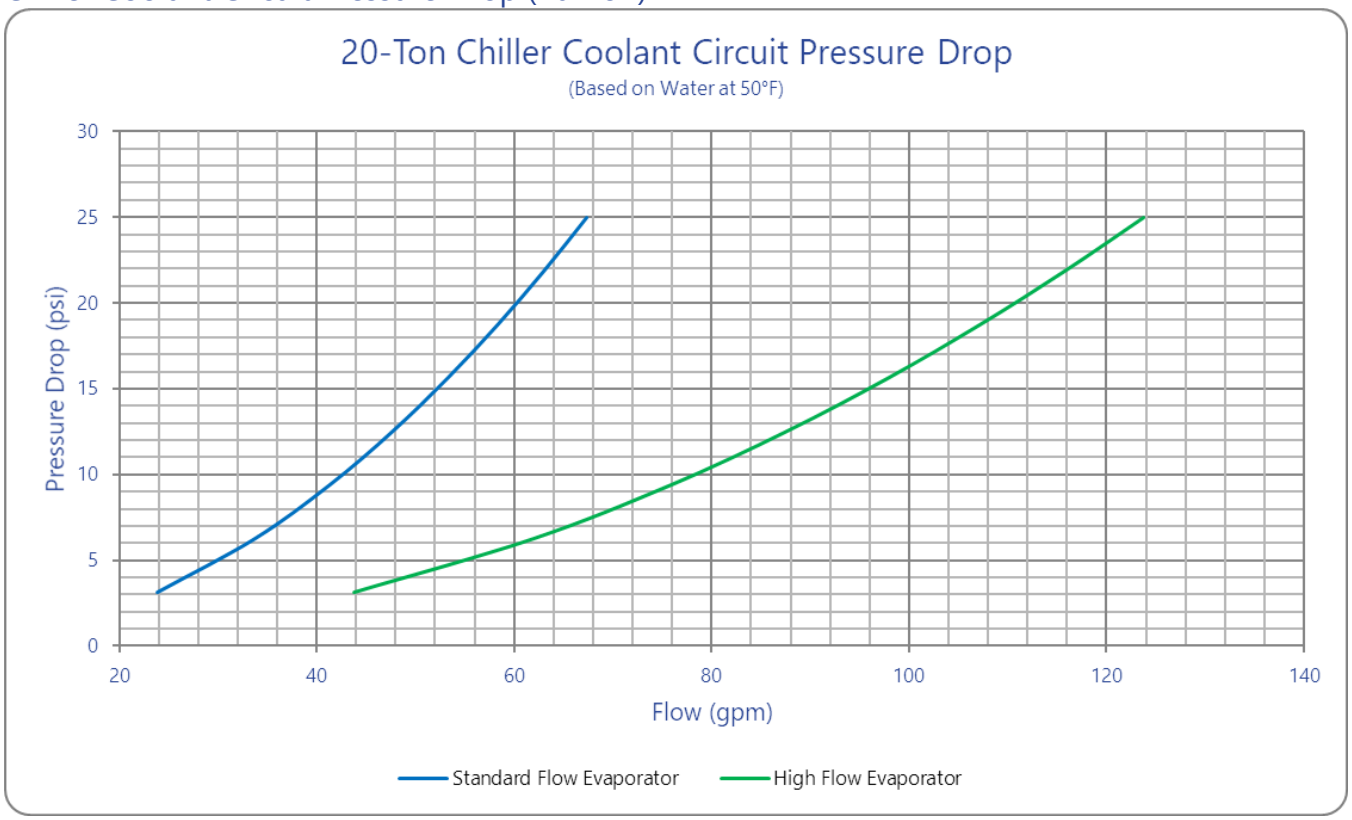
Chiller Coolant Circuit Pressure Drop (10-Ton)



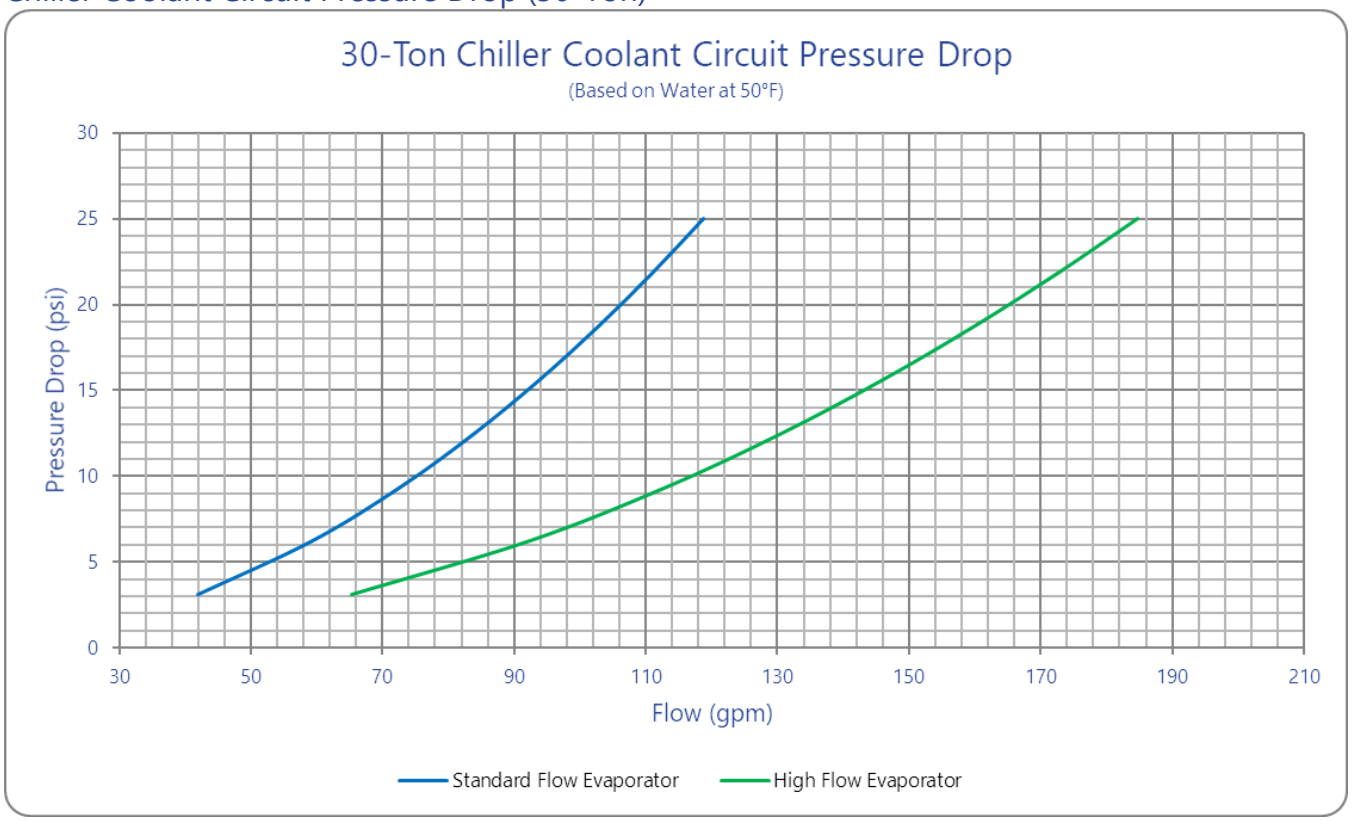
Chiller Coolant Circuit Pressure Drop (15-Ton)



Chiller Coolant Circuit Pressure Drop (20-Ton)



Chiller Coolant Circuit Pressure Drop (30-Ton)



Electrical Data

Air-Cooled Chiller Electrical Data

Model	Process Pump (hp)	Rated Voltage	Unit Data		Model	Process Pump (hp)	Rated Voltage	Unit Data	
			MCA[2]	MOP[3]				MCA[2]	MOP[3]
NQVA05 with standard condenser fan	None 1.5 2 3 5	208/3/60	NQVA05 only available for 460/3/60		NQVA05 with high pressure variable speed EC condenser fan option	None 1.5 2 3 5	208/3/60	NQVA05 only available for 460/3/60	
	None 1.5 2 3 5	230/3/60				None 1.5 2 3 5	230/3/60		
	None 1.5 2 3 5	460/3/60	19 22 23 24 27	35 40 40 40 40		None 1.5 2 3 5	460/3/60	19 22 22 24 27	35 40 40 40 40
	None 1.5 2 3 5	575/3/60	NQVA05 only available for 460/3/60			None 1.5 2 3 5	575/3/60	NQVA05 only available for 460/3/60	
	None 1.5 2 3 5	400/3/50				None 1.5 2 3 5	400/3/50		
NQVA10 with standard condenser fans	None 2 3 5 7.5	208/3/60	78 86 89 95 103	150 150 150 175 175	NQVA10 with high pressure variable speed EC condenser fans option	None 2 3 5 7.5	208/3/60	78 86 89 95 102	150 150 150 175 175
	None 2 3 5 7.5	230/3/60	78 85 88 94 100	150 150 150 150 175		None 2 3 5 7.5	230/3/60	78 85 88 93 100	150 150 150 150 175
	None 2 3 5 7.5	460/3/60	42 46 47 50 53	80 80 80 80 90		None 2 3 5 7.5	460/3/60	42 45 47 50 53	80 80 80 80 90
	None 2 3 5 7.5	575/3/60	40 43 44 46 49	70 80 80 80 80		None 2 3 5 7.5	575/3/60	40 42 44 46 49	70 80 80 80 80
	None 2 3 5 7.5	400/3/50	43 46 47 50 54	80 80 80 90 90		None 2 3 5 7.5	400/3/50	42 45 47 50 53	80 80 80 80 90

[1]Allowable voltage is ± 10% from rated voltage.

[2]MCA is Minimum Circuit Amps, used for minimum wire size requirement.

[3]MOP is Maximum Overcurrent Protection, used for sizing main power protection device.

Air-Cooled Chiller Electrical Data (continued)

Model	Process Pump (hp)	Rated Voltage	Unit Data		Model	Process Pump (hp)	Rated Voltage	Unit Data	
			MCA[2]	MOP[3]				MCA[2]	MOP[3]
NQVA15 with standard condenser fan	None	208/3/60	116	200	NQVA15 with high pressure variable speed EC condenser fan option	None	208/3/60	119	225
	3		126	225		3		129	225
	5		133	225		5		135	225
	7.5		140	225		7.5		143	250
	10		147	250		10		149	250
	None	230/3/60	116	200		None	230/3/60	119	225
	3		125	225		3		128	225
	5		131	225		5		134	225
	7.5		138	225		7.5		141	225
	10		144	250		10		147	250
	None	460/3/60	81	150		None	460/3/60	82	150
	3		86	150		3		87	150
	5		88	150		5		90	150
	7.5		92	175		7.5		93	175
	10		95	175		10		96	175
	None	575/3/60	63	125		None	575/3/60	65	125
	3		67	125		3		68	125
	5		69	125		5		71	125
	7.5		72	125		7.5		74	125
	10		74	125		10		76	125
	None	400/3/50	80	150		None	400/3/50	82	150
	3		85	150		3		87	150
	5		87	150		5		90	150
	7.5		91	175		7.5		93	175
	10		94	175		10		96	175
NQVA20 with standard condenser fans	None	208/3/60	122	200	NQVA20 with high pressure variable speed EC condenser fans option	None	208/3/60	128	200
	5		139	200		5		145	225
	7.5		147	225		7.5		152	225
	10		153	225		10		159	225
	None	230/3/60	122	200		None	230/3/60	128	200
	5		138	200		5		143	200
	7.5		144	225		7.5		150	225
	10		150	225		10		156	225
	None	460/3/60	66	100		None	460/3/60	69	100
	5		73	110		5		76	110
	7.5		77	110		7.5		80	110
	10		80	110		10		83	125
	None	575/3/60	57	90		None	575/3/60	60	90
	5		63	100		5		66	100
	7.5		66	100		7.5		69	100
	10		68	100		10		71	100
	None	400/3/50	64	100		None	400/3/50	69	100
	5		71	110		5		76	110
	7.5		75	110		7.5		80	110
	10		78	110		10		83	125

[1]Allowable voltage is ± 10% from rated voltage.
[2]MCA is Minimum Circuit Amps, used for minimum wire size requirement.
[3]MOP is Maximum Overcurrent Protection, used for sizing main power protection device.

Air-Cooled Chiller Electrical Data (continued)

Model	Process Pump (hp)	Rated Voltage	Unit Data		Model	Process Pump (hp)	Rated Voltage	Unit Data	
			MCA[2]	MOP[3]				MCA[2]	MOP[3]
NQVA30 with standard condenser fans	None	208/3/60	188	300	NQAV30 with high pressure variable speed EC condenser fans option	None	208/3/60	196	300
	5		205	300		5		213	300
	7.5		212	300		7.5		221	350
	10		219	350		10		227	350
	None	230/3/60	188	300		None	230/3/60	196	300
	5		203	300		5		212	300
	7.5		210	300		7.5		218	350
	10		216	350		10		224	350
	None	460/3/60	117	200		None	460/3/60	121	200
	5		125	200		5		129	200
	7.5		128	200		7.5		132	200
	10		131	200		10		135	200
	None	575/3/60	94	150		None	575/3/60	98	150
	5		101	150		5		104	175
	7.5		103	175		7.5		107	175
	10		105	175		10		109	175
	None	400/3/50	112	175		None	400/3/50	119	200
	5		119	200		5		127	200
	7.5		123	200		7.5		130	200
	10		126	200		10		133	200

[1]Allowable voltage is ± 10% from rated voltage.

[2]MCA is Minimum Circuit Amps, used for minimum wire size requirement.

[3]MOP is Maximum Overcurrent Protection, used for sizing main power protection device.

Water-Cooled Condenser Chiller Electrical Data

Model	Process Pump (hp)	Rated Voltage	Unit Data MCA[2]	MOP[3]	Model	Process Pump (hp)	Rated Voltage	Unit Data MCA[2]	MOP[3]
NQVW05	None	208/3/60	NQVW05 only available for 460/3/60		NQVW10	None	208/3/60	73	150
	1.5					2		80	150
	2					3		83	150
	3					5		89	150
	5					7.5		97	175
	None	230/3/60				None	230/3/60	73	150
	1.5					2		79	150
	2					3		82	150
	3					5		88	150
	5					7.5		95	175
	None	460/3/60	17	35		None	460/3/60	39	70
	1.5		20	35		1.5		42	80
	2		21	35		2		44	80
	3		22	40		3		46	80
	5		25	40		5		50	80
	None	575/3/60	NQVW05 only available for 460/3/60			None	575/3/60	37	70
	1.5					2		40	70
	2					3		41	80
	3					5		43	80
	5					7.5		46	80
	None	400/3/50				None	400/3/50	39	70
	1.5					2		42	80
	2					3		44	80
	3					5		46	80
	5					7.5		50	80
NQVW15	None	208/3/60	108	200	NQVW20	None	208/3/60	106	175
	3		118	225		3		n/a	n/a
	5		124	225		5		123	200
	7.5		132	225		7.5		130	200
	10		138	225		10		137	200
	None	230/3/60	108	200		None	230/3/60	106	175
	3		117	225				n/a	n/a
	5		123	225		5		121	200
	7.5		130	225		7.5		128	200
	10		136	225		10		134	200
	None	460/3/60	76	150		None	460/3/60	57	90
	3		81	150				n/a	n/a
	5		84	150		5		64	100
	7.5		87	150		7.5		68	100
	10		90	175		10		71	110
	None	575/3/60	60	110		None	575/3/60	50	80
	3		64	125				n/a	n/a
	5		66	125		5		56	90
	7.5		69	125		7.5		59	90
	10		71	125		10		61	90
	None	400/3/50	76	150		None	400/3/50	57	90
	3		81	150				n/a	n/a
	5		84	150		5		64	100
	7.5		87	150		7.5		68	100
	10		90	175		10		71	110

[1]Allowable voltage is ± 10% from rated voltage.

[2]MCA is Minimum Circuit Amps, used for minimum wire size requirement.

[3]MOP is Maximum Overcurrent Protection, used for sizing main power protection device.

Water-Cooled Condenser Chiller Electrical Data (continued)

Model	Process Pump (hp)	Rated Voltage	Unit Data	
			MCA[2]	MOP[3]
NQVW30	None	208/3/60	163	250
	5		180	300
	7.5		188	300
	10		194	300
	None	230/3/60	163	250
	5		179	300
	7.5		185	300
	10		191	300
	None	460/3/60	103	175
	5		111	175
	7.5		114	175
	10		117	200
	None	575/3/60	83	150
	5		90	150
	7.5		92	150
	10		94	150
	None	400/3/50	101	175
	5		109	175
	7.5		112	175
	10		115	200

[1]Allowable voltage is ± 10% from rated voltage.

[2]MCA is Minimum Circuit Amps, used for minimum wire size requirement.

[3]MOP is Maximum Overcurrent Protection, used for sizing main power protection device.

Application Considerations

When designing a chilled water system it is important all aspects of the system are considered to ensure stable and reliable operation. The following provides some general guidelines for designing a system.

Foundation

Install the unit on a rigid, non-warping mounting pad, concrete foundation, or level floor suitable to support the full operating weight of the equipment. When installed the equipment must be level within ¼ inch over its length and width.

Chiller Unit Location

Proper ventilation is an important consideration when locating the condenser. In general, locate the unit in an area that will not rise above 110°F.

To ensure proper airflow and clearance space for proper operation and maintenance allow a minimum of 36 inches of clearance between the sides of the equipment and any walls or obstructions. Avoid locating piping or conduit over the unit to ensure easy access with an overhead crane or lift to lift out heavier components during replacement or service. In addition, ensure the condenser and evaporator refrigerant pressure relief valves can vent in accordance with all local and national codes.

Air-cooled chillers use the surrounding air for cooling the condenser and require free passage of air in and out of the chiller and provision for remove of the warm air from the area. Avoid areas that can create a "micro-climate" such as an alcove with east, north, and west walls that can be significantly warmer than surrounding areas. The condenser needs to have unrestricted airways so it can easily move cool air in and heated air away. Consider locating the condenser where fan noise and vibration transmission into nearby workspaces is unlikely.

Process Fluid Piping

Proper insulation of chilled process fluid piping is crucial to prevent condensation. The formation of condensation adds a substantial heat load to the chiller.

The importance of properly sized piping cannot be overemphasized. See the ASHRAE Handbook or other suitable design guide for proper pipe sizing. In general, run full size piping out to the process and reduce pipe size at connections as needed. One of the most common causes of unsatisfactory chiller performance is poor piping system design. Avoid long lengths of hoses, quick disconnect fittings, and manifolds wherever possible as they offer high resistance to water flow. When manifolds are required, install them as close to the use point as possible. Provide flow-balancing valves at each machine to assure adequate water distribution in the entire system.

Process Fluid Temperature

The chiller can operate with a variety of different supply and return temperatures. The chiller is able to start and pull down with short-term entering fluid temperatures up to 20°F warmer than the maximum set point of the chiller. This allows the chiller to pull down the temperature of a reservoir or process fluid loop on start-up. Under normal operation, the entering water temperature must not exceed 10°F warmer than the maximum set point temperature of the chiller.

Process Fluid Flow Rate

The nominal performance of the chiller assumes a temperature rise of 10°F through the process. The chiller is capable of operating with different operating temperature differentials within certain flow limitations and with correction to capacity, pressure drops, and other operating parameters when selecting the proper unit for the application. The minimum flow rate to prevent fouling and to ensure the chiller stays within normal refrigerant operating conditions is approximately 1.2 gpm per nominal ton of cooling capacity. The fouling factor used to calculate the ratings of the vessels are 0.00010 Ft^2 • Hr • °F/Btu.

If the process flow requirement is less than 1.2 gpm per nominal ton of cooling capacity use a primary pumping loop for the lower flow at a higher temperature rise and a secondary pumping loop for a higher flow and lower temperature drop through the chiller. If a secondary pumping loop is used, the mixed temperature of coolant entering the evaporator must be a minimum of 5°F above the design set point of the chiller.

The maximum flow limitation is determined based upon a 5°F drop through the chiller at the maximum capacity of the chiller; however, the flows often times

result in impractical pressure drops through the chiller and are therefore not likely for system design. If the process flow requirement is higher than the maximum flow limitation use a bypass around the chiller or a primary pumping loop designed for the high flow at a lower temperature rise and a secondary pumping loop for a lower flow and high temperature drop through the chiller. If a secondary pumping loop is used, the mixed temperature of coolant entering the chiller must be a minimum 5°F above the design set point of the chiller.

The use of varying chiller flows is sometimes necessary; however, a dedicated evaporator circulation pump provides increased system stability. If the flow through the chiller is varied, the minimum fluid loop volume must be in excess of 3 gallons of coolant per ton of cooling and the flow rate must change at a rate of no greater than 10% per minute in order to maintain an acceptable level of temperature control. If the chiller sees a net rate of change greater than 10% per minute it may result in temporary supply temperature fluctuations greater than 1°F.

Condenser Water Temperature and Flow

All water-cooled condenser chillers include a factory mounted condenser water-regulating valve to regulate the flow of condenser water to maintain the proper refrigerant pressures. The minimum flow rate is approximately 0.5 gpm per nominal cooling ton to prevent fouling and to ensure the chiller stays within normal refrigerant operating conditions. The fouling factor used to calculate the ratings of the vessels are 0.00025 Ft^2 • Hr • °F/Btu.

The chiller will start and operate with an inlet water temperature between 55°F and 95°F. The actual flow requirements will vary. Lowering the condenser water supply temperature below 85°F is an effective way to reduce the overall cooling system input power requirements.

Condenser Air Temperature

All air-cooled condenser chillers are nominally designed to use 95°F ambient air for condenser cooling. Indoor-duty chillers have an ambient operating range of 60°F to 110°F and outdoor-duty chillers are available with either a 0°F to 110°F or -20°F to 110°F ambient range. The minimum ambient air temperature at which the chiller will start based on still air.

System Fluid Chemistry Requirements

The properties of water make it ideal for heat transfer applications. It is safe, non-flammable, non-poisonous, easy to handle, widely available, and inexpensive in most industrialized areas.

When using water as a heat transfer fluid it is important to keep it within certain chemistry limits to avoid unwanted side effects. Water is a "universal solvent" because it can dissolve many solid substances and absorb gases. As a result, water can cause the corrosion of metals used in a cooling system. Often water is in an open system (exposed to air) and when the water evaporates, the dissolved minerals remain in the process fluid. When the concentration exceeds the solubility of some minerals, scale forms. The life giving properties of water can also encourage biological growth that can foul heat transfer surfaces.

To avoid the unwanted side effects associated with water cooling, proper chemical treatment and preventive maintenance is required for continuous plant productivity.

Unwanted Side Effects of Improper Water Quality

- Corrosion
- Scale
- Fouling
- Biological Contamination

Cooling Water Chemistry Properties

- Electrical Conductivity
- pH
- Alkalinity
- Total Hardness
- Dissolved gases

Chillers at their simplest have two main heat exchangers: one that absorbs the heat from the process (evaporator) and one that removes the heat from the chiller (condenser). All our chillers use stainless steel brazed plate evaporators. Our air-cooled chillers use air to remove heat from the chiller; however, our water-cooled chillers use either a tube-in-tube or shell-in-tube condenser which has copper refrigerant tubes and a steel shell. These, as are all heat exchangers, are susceptible to fouling of heat transfer surfaces due to scale or debris. Fouling of these surfaces reduces the heat-transfer surface area while increasing the fluid velocities and pressure drop

through the heat exchanger. All of these effects reduce the heat transfer and affect the efficiency of the chiller.

The complex nature of water chemistry requires a specialist to evaluate and implement appropriate sensing, measurement and treatment needed for satisfactory performance and life. The recommendations of the specialist may include filtration, monitoring, treatment and control devices. With the ever-changing regulations on water usage and treatment chemicals, the information is usually up-to-date when a specialist in the industry is involved.

Fill Water Chemistry Requirements

Water Characteristic	Quality Limitation
Alkalinity (HCO3-)	70-300 ppm
Aluminum (Al)	Less than 0.2 ppm
Ammonium (NH3)	Less than 2 ppm
Chlorides (Cl-)	Less than 300 ppm
Electrical Conductivity	10-500µS/cm
Free (aggressive) Carbon Dioxide (CO2)†	Less than 5 ppm
Free Chlorine(Cl2)	Less than 1 PPM
HCO3-/SO42-	Greater than 1.0
Hydrogen Sulfide (H2S)	Less than 0.05 ppm
Iron (Fe)	Less than 0.2 ppm
Manganese (Mn)	Less than 0.1 ppm
Nitrate (NO3)	Less than 100 ppm
pH	7.5-9.0
Sulfate (SO42-)	Less than 70 ppm
Total Hardness (dH)k	4.0-8.5

† Dissolved carbon dioxide calculation is from the pH and total alkalinity values shown below or measured on the site using a test kit. Dissolved Carbon Dioxide, PPM = TA x $2^{[(6.3-pH)/0.3]}$ where TA = Total Alkalinity, PPM as $CaCO_3$

Recommended Glycol Solutions

Chilled Water Temperature	Percent Glycol By Volume
50°F (10°C)	Not required
45°F (7.2°C)	5 %
40°F (4.4°C)	10 %
35°F (1.7°C)	15 %
30°F (-1.1°C)	20 %
25°F (-3.9°C)	25 %
20°F (-6.7°C)	30 %

CAUTION: When your application requires the use of glycol, use industrial grade glycol specifically designed for heat transfer systems and equipment. Never use glycol designed for automotive applications. Automotive glycols typically have additives engineered to benefit the materials and conditions found in an automotive engine; however, these additives can gel and foul heat exchange surfaces and result in loss of performance or even failure of the chiller. In addition, these additives can react with the materials of the pump shaft seals resulting in leaks or premature pump failures.

WARNING: Ethylene Glycol is flammable at higher temperatures in a vapor state. Carefully handle this material and keep away from open flames or other possible ignition sources.

Strainers

Each evaporator is provided with a 20 mesh inlet strainer to protect the evaporator. All water-cooled condensers should be filtered with a minimum of a 20 mesh filtering system to protect the condenser from contamination.

THERMAL CARE
5680 W. Jarvis Ave • Niles, IL 60714
847-966-2260 • info@thermalcare.com
www.thermalcare.com