



SARMAAFARIN

Air-Cooled Liquid Scroll Chillers

AEROACOUSTIC



Certificate No.: 9190.C308
FORM SSI - 30RAN (98)

30RAN
060-180

(211 to 633 Nominal KW)
60 to 180 Nominal Tons

SarmaAfarin AeroSnap 30RAN series have compatible design to meet the efficiency demands of today and the future by providing premium air-cooled chiller packages for contractors, consulting engineers and building owners.

30RAN Features:

- Positive displacement, scroll compressor.
- Chlorine free R134a HFC Refrigerant also compatible with R407C
- Easy to use Comfort Link controls and monitor.
- Foot print most efficient air cooled models.
- Full load ESEER up to ~11 and COP up to 3.2 so that might exceeds the EN energy requirement as A+.
- The AeroSnap 30RAN chillers deliver superior efficiency through the entire operating range to keep costs and demand charges down.

Description

30RAN liquid chillers are the best solution for commercial and industrial applications where installers, engineering and design departments and building owners require reduced installation costs, optimal performance and the highest quality. 30RAN's innovative chiller design provides savings at initial purchase, at installation, and for years afterward.

The 30RAN liquid chillers are designed to meet current and future requirements in terms of energy efficiency and operating sound levels. They use the best technologies available today.

- Ultra-quiet, high efficiency Scroll compressors
- Low pressure drop brazed plate heat exchangers
- Low noise generation fans
- PLC based control system
- Electronic expansion valve enabling operation at a lower condensing pressure and improved use of the evaporator heat exchange surface

Features/Benefits

Scroll Compressors are now the most used compression technology replacing reciprocating and screw compressors due to its undeniable superiority. Several, fully qualified multiple compressor assemblies (tandem and trio) are available to allow the use of scroll compressors into large capacity systems. Some of the benefits of this model are mentioned.

- Scroll axial and radial compliance for superior reliability and efficiency
- Wide scroll line-up for R407c and R134a
- Low TEWI (Total Equivalent Warming Impact)
- Low sound and vibration level
- Low oil circulation rate
- Qualified tandem and trio configurations for superior seasonal efficiency (ESEER)

Brazed plate evaporator

The compact, high efficiency Brazed Plate Heat

Exchanger (BPHE) is used. It offers excellent heat transfer performance with a compact size and low weight, reducing structural steel requirements on the job site. The heat exchanger is manufactured in a precisely controlled vacuum-brazing process that allows the filler material to form a brazed joint at every contact point between the plates, creating complex channels. It is important to note that the strainer is required for all brazed plate heat exchangers; therefore, not considering it from the beginning may lead to the selection of the incorrect pump for the system and an incorrect evaluation of the overall installation cost. So strainer should use to provide protection at the evaporator inlet, particularly at system start-up when construction debris may be present in the piping system.

Flow switch is included with the cooler. The switch is factory installed and tested and contains no moving parts for high reliability.

Condenser

Efficient air cooled condenser with large coil surface area maximizes the heat transfer. Additionally, the internally enhanced seamless copper tubes arranged in a staggered row pattern mechanically expanded into SSI wavy aluminum condenser fins makes the condenser too efficient to redundant the heat.

Condenser coils is mounted in V-shape with an open angle, allows quieter air flow across the coil.

The low-noise axial fans employed to move large volume of air at exceptionally low sound levels with virtually vibration-free operation. May the sound diffuser be applied.

Environmental Care

- R407C & R134a are safe, efficient, and environmentally balanced refrigerant and also responsible choice for protecting the earth's ozone layer.
- Leak-tight refrigerant circuit
- Reduction of leaks as no refrigerant connection is made at site.
- Verification of pressure transducers and temperature sensors without transferring refrigerant charge
- Discharge shut-off valve and liquid line service valve for simplified maintenance

PLC based Control

PLC Controller is an advanced numeric control system that combines intelligence with great operating simplicity. The control constantly monitors all machine parameters and precisely manages the operation of compressors, electronic expansion devices, fans and evaporator water pump for optimum energy efficiency

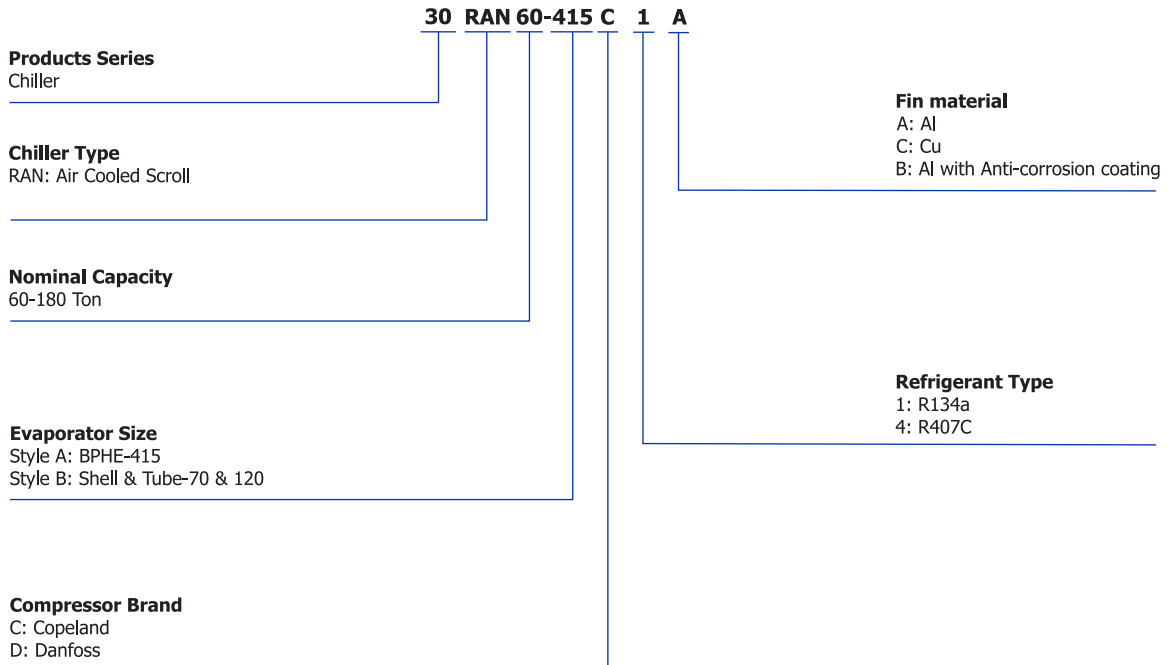
- Energy management
- Leaving or entering cooler water temperature controls chiller on/off.
- Continuously control compressor capacity to match required load

- Chiller PLC system can be integrated with building management system (BMS)
- Ease-of-use
- User interface with large screen for intuitive access to the operating parameters. The information is in clear text

Electronic expansion valve (EXV)

The EXV controls refrigerant flow to the cooler for different operating conditions by moving an orifice to increase or decrease the flow area through the valve based on microprocessor input. The orifice is positioned by a stepper motor and is monitored every 3 seconds.

Model number nomenclature



UNIT 30RAN (BPHE Cooler) R134a	Capacity		Power	Full Capacity	
	kWR	TONS	kW	COP	EER
60-415	106.4	30.2	32.5	3.27	11.16
80-415	142.4	40.5	39.6	3.61	12.31
100-415	178.0	50.6	51.2	3.5	11.94
120-415	208.2	59.2	65.1	3.2	10.91
150-415	252.0	71.6	85.5	3	10.23
180-415	316.2	89.9	97.2	3.25	11.08

UNIT 30RAN (BPHE Cooler) R407C	Capacity		Power	Full Capacity	
	kWR	TONS	kW	COP	EER
60-415	169.8	48.3	44.8	3.8	12.96
80-415	208.8	59.4	63	3.32	11.32
100-415	253.2	72.0	84.4	3.0	10.23
120-415	313.8	89.2	94.5	3.33	11.36
150-415	375.6	106.8	126	2.99	10.2
180-415	466.8	132.7	148.2	3.15	10.74

LEGEND

COP- Coefficient of Performance **kWR**- kilowatt of Refrigeration
EER- Energy Efficiency Ratio

1. Rated in accordance with AHRI Standard 550/590 at standard rating conditions.
 2. Standard rating conditions are as follows:
 Chilled Water Entering Temperature: 54°F, Leaving Temperature: 44°F
 Condenser Entering Air Dry Bulb Temperature: 95°F (35°C)
 Fouling Factor: 0.00010 hr×ft²°F/Btu (0.000018 m²×°C/W)

UNIT 30RAN (Shell & Tube Cooler) R134a	Capacity		Power	Full Capacity	
	kWR	TONS	kW	COP	EER
80-70	154.0	43.8	40.2	3.83	13.06
100-70	183.2	52.1	51.4	3.56	12.14
120-70	210.0	59.7	65.1	3.23	11.01
150-120	261.0	74.2	86.4	3.02	10.3
180-120	321.6	91.4	97.5	3.3	11.25

UNIT 30RAN (Shell & Tube Cooler) R407C	Capacity		Power	Full Capacity	
	kWR	TONS	kW	COP	EER
80-70	211.2	60.0	63.6	3.32	11.32
100-70	243.6	69.3	84	2.9	9.89
120-70	298.8	85.0	93.9	3.18	10.84
150-120	367.2	104.4	126	2.91	9.92
180-120	445.2	126.6	147	3.03	10.33

LEGEND

COP- Coefficient of Performance

kWR- kilowatt of Refrigeration

EER- Energy Efficiency Ratio

1. Rated in accordance with AHRI Standard 550/590 at standard rating conditions.

2. Standard rating conditions are as follows:

Chilled Water Entering Temperature: 54°F, Leaving Temperature: 44°F

Condenser Entering Air Dry Bulb Temperature: 95°F (35°C)

Fouling Factor: 0.00010 hr×ft²°F/Btu (0.000018 m²×°C/W)

PHYSICAL DATA



R134a								
UNIT 30RAN	Style A	60-415	80-415	100-415	120-415	150-415	180-415	
	Style B	—	80-70	100-70	120-70	150-120	180-120	
Weight (lb)*	Al Fin	Style A	2516	3402	3766	4198	4611	5738
		Style B	—	4188	4463	4894	5778	6904
	Cu Fin	Style A	2612	3537	3901	4332	4746	5939
		Style B	—	4320	4596	5028	5913	7107
Refrigerant		R134a						
Compressor	No. Compressors	2	4	4	6	6	6	
	Danfoss							
	Total Oil Chg (gal)	4.46	8.49	8.49	12.74	12.74	13.38	
	Copeland	Applicable						
	%CAP Circuit 1	50	50	50	50	50	50	
	%CAP Circuit 2	50	50	50	50	50	50	
	No. Control Steps	2	4	4	6	6	6	
Cooler	Style A	Brazen Plate Heat Exchanger						
	Working Pressure (Psig)	435						
	Total Volume (gal)	6.67		11.05		16.29		
	Z415 No.	62		102		150		
	Water Connection (in)	2				2.5		
	Style B (optional)	Shell & Tube with Enhanced Copper Tubes						
	Working Pressure (Psig)	Refrigerant Side=235			Water Side=150			
	Shell, Net Volume (gal)	—	22.19			40.15		
	model (10 HA ...)	—	70			120		
	Water Connection (in)	—	4.5					
Condenser	Type	Fin and Enhanced Inner Grooved Tube, V-Type						
	Condenser Fan	Axial 800 mm diameter, Vertical discharge						
	Quantity	2	4	4	4	4	6	
	Total Airflow (CFM)	21800	43600	43600	43600	43600	65400	
	Power/Fan (kW)	≈2						
	Fan RPM	910						
	Row/FPI	4/14						
	Total face area (Sq. Ft)	47.08	94.16	94.16	94.16	94.16	141.24	
Dimensions*	Length(in.)	59.05	106.3	106.3	106.3	106.3	153.5	
	Width(in.)	91						
	Height(in.)	104						

*The weight and dimensions of units are approximate and may be subject to change.

PHYSICAL DATA



R407C									
UNIT 30RAN	Style A		60-415	80-415	100-415	120-415	150-415	180-415	
	Style B		—	80-70	100-70	120-70	150-120	180-120	
Weight (lb)*	Al Fin	Style A	2912	3402	3766	5053	5457	6592	
		Style B	—	4188	4463	5751	6625	7761	
	Cu Fin	Style A	3047	3537	3901	5255	5659	6862	
		Style B	—	4320	4596	5952	6836	8031	
Refrigerant			R407C						
Compressor	No. Compressors		2	4	4	6	6	6	
	Danfoss								
	Total Oil Chg (gal)		4.46	8.49	8.49	12.74	12.74	13.38	
	Copeland		Applicable						
	%CAP Circuit 1		50	50	50	50	50	50	
	%CAP Circuit 2		50	50	50	50	50	50	
	No. Control Steps		2	4	4	6	6	6	
Cooler	Style A		Brazen Plate Heat Exchanger						
	Working Pressure (Psig)		435						
	Total Volume (gal)		6.67		11.05		16.29		
	Z415 No.		62		102		150		
	Water Connection (in)		2				2.5		
	Style B (optional)		Shell & Tube						
	Working Pressure (Psig)		Refrigerant Side=235			Water Side=150			
	Shell, Net Volume (gal)		—		22.19		40.15		
	model (10 HA ...)		—		070		120		
	Water Connection (in)		—		4.5				
Condenser	Type		Fin and Enhanced Inner Grooved Tube, V-Type						
	Condenser Fan		Axial 800 mm diameter, Vertical discharge						
	Quantity		4	4	4	6	6	8	
	Total Airflow (CFM)		43600	43600	43600	65400	65400	87200	
	Power/Fan (kW)		1.94						
	Fan RPM		910						
	Row/FPI		4/14						
Total face area (Sq. Ft)		94.16	94.16	94.16	141.24	141.24	188.3		
Dimensions*	Length(in.)		106.3	106.3	106.3	153.5	153.5	200.8	
	Width(in.)		91						
	Height(in.)		104						

*The weight and dimensions of units are approximate and may be subject to change.

Style A Cooler Model	BPHE	62* Z415	102* Z415	150* Z415
Thickness	in	6.51	10.19	14.72
Weight (without connections)	lb	176.21	252.94	345.0
Total Heat Transfer Area	ft ²	133.95	223.24	330.34
Total Volume	gal	6.67	11.05	16.29
Heat Transfer Area/Plate	ft ²	2.23		
Horizontal Port Centers Distance	in	8.90		
Vertical Port Centers Distance	in	25.83		
Compressed Plate Pitch	in	0.094		
Plate Width	in	12.64		
Max. Working Pressure	psig	435.11		

Style B Cooler Model	10HA	70	120
Shell Net. Vol. [†]	gal	22	40
Shell OD	inch	12 3/4	16
Shell Length*	inch	81 3/4	81 3/4
Refrigerant Ckts.	No.	2	2
Max. Design Working Pressure	psig	Refrigerant side: 235 Water Side: 150	
Water Inlet & Outlet Connection	inch	4	4
Cooler Drain Connection	inch	3/4 MPT	3/4 MPT

[†]Includes nozzles.

*Between tube sheets.

PERFORMANCE DATA

CONDENSER ENTERING AIR TEMPERATURE (°F)																								
30RAN-Style A																								
LWT: 44 °F*																								
MODEL	85				95				105				115				120				125			
	CAP. (TON)	COMP. POWER INPUT (KW)	COOLER FLOW RATE (GPM)	CAP. (TON)	COMP. POWER INPUT (KW)	COOLER FLOW RATE (GPM)	CAP. (TON)	COMP. POWER INPUT (KW)	COOLER FLOW RATE (GPM)	CAP. (TON)	COMP. POWER INPUT (KW)	COOLER FLOW RATE (GPM)	CAP. (TON)	COMP. POWER INPUT (KW)	COOLER FLOW RATE (GPM)	CAP. (TON)	COMP. POWER INPUT (KW)	COOLER FLOW RATE (GPM)						
60-415	31.7	28.9	76.1	30.2	32.5	72.7	28.8	36.5	69.5	27.0	41	64.9	26.3	43.4	63.5	25.6	46.2	61.4						
80-415	42.3	35.4	101.5	40.5	39.6	97.2	38.5	44.4	92.5	36.5	49.8	87.6	35.4	52.6	84.9	34.2	55.8	82.1						
100-415	53.1	45.8	127.5	50.6	51.2	121.5	48.0	57.4	115.2	45.1	64.6	108.4	43.7	68.6	104.8	42.1	73	101.0						
120-415	61.9	58.0	148.6	59.2	65.1	142.1	56.1	72.9	134.7	52.9	81.6	126.9	51.2	86.7	122.8	49.5	91.8	118.7						
150-415	75.2	76.2	180.5	71.6	85.5	172.0	67.7	96	162.5	63.3	108.6	151.9	61.1	115.5	146.6	58.7	123	140.8						
180-415	94.2	86.7	226.0	90.0	97.2	215.8	85.5	108.9	205.1	80.7	121.8	193.6	78.5	129	188.3	75.9	136.2	182.2						

PERFORMANCE DATA

LWT: 44 °F*												
30RAN-Style A												
CONDENSER ENTERING AIR TEMPERATURE (°F)												
R407C	85			95			105			115		
	MODEL 30RAN	CAP. (TON)	COMP. INPUT (KW)	COOLER FLOW RATE (GPM)	CAP. (TON)	COMP. INPUT (KW)	COOLER FLOW RATE (GPM)	CAP. (TON)	COMP. INPUT (KW)	COOLER FLOW RATE (GPM)	CAP. (TON)	COMP. INPUT (KW)
60-415	50.9	39.5	122.2	48.3	44.8	115.9	46	51.1	110.5	42.25	57.6	101.6
80-415	62.7	55.6	150.5	59.4	63	142.5	56.0	71.6	134.3	52.2	82	125.3
100-415	76.8	74.4	184.2	72.0	84.4	172.8	66.9	96	160.5	61.7	110	148.2
120-415	94.2	83.4	226.0	89.2	94.5	214.1	83.9	107.4	201.4	78.1	123	187.5
150-415	114.1	111	273.9	106.8	126	256.3	99.5	143.4	238.7	91.8	163.8	220.3
180-415	139.7	131.4	335.3	132.7	148.2	318.5	123.3	169.2	296.0	113.6	192.6	272.7

PERFORMANCE DATA

CONDENSER ENTERING AIR TEMPERATURE (°F)																		
30RAN-Style B																		
LWT: 44 °F*																		
R134a	CONDENSER ENTERING AIR TEMPERATURE (°F)																	
	85			95			105			115			120			125		
MODEL	CAP. (TON)	COMP. POWER INPUT (KW)	COOLER FLOW RATE (GPM)	CAP. (TON)	COMP. POWER INPUT (KW)	COOLER FLOW RATE (GPM)	CAP. (TON)	COMP. POWER INPUT (KW)	COOLER FLOW RATE (GPM)	CAP. (TON)	COMP. POWER INPUT (KW)	COOLER FLOW RATE (GPM)	CAP. (TON)	COMP. POWER INPUT (KW)	COOLER FLOW RATE (GPM)	CAP. (TON)	COMP. POWER INPUT (KW)	COOLER FLOW RATE (GPM)
80-70	45.9	36.0	110.3	43.8	40.2	105.1	41.6	45	99.9	39.2	50.4	94.2	37.9	53.4	91.0	36.7	56.6	88.2
100-70	54.5	46	130.7	52.1	51.4	125.0	49.5	57.8	118.7	46.4	65	111.4	44.9	69	107.8	43.3	73.4	104.0
120-70	62.6	58.1	150.2	59.7	65.1	143.3	56.5	72.9	135.5	53.2	81.9	127.7	51.5	86.7	123.6	49.6	91.8	119.1
150-120	78.1	77.1	187.5	74.2	86.4	178.1	69.8	97.2	167.4	64.8	109.8	155.6	62.6	117	150.3	59.9	124.8	143.7
180-120	96.2	87	230.9	91.4	97.5	219.4	87	109.5	208.8	81.9	122.4	196.5	79.7	129.6	191.2	76.9	136.8	184.6

CONDENSER ENTERING AIR TEMPERATURE (°F)												
30RAN-Style B												
LWT: 44 °F*												
R407C	CONDENSER ENTERING AIR TEMPERATURE (°F)											
	85			95			105			115		
MODEL 30RAN	CAP. (TON)	COMP. POWER INPUT (KW)	COOLER FLOW RATE (GPM)	CAP. (TON)	COMP. POWER INPUT (KW)	COOLER FLOW RATE (GPM)	CAP. (TON)	COMP. POWER INPUT (KW)	COOLER FLOW RATE (GPM)	CAP. (TON)	COMP. POWER INPUT (KW)	COOLER FLOW RATE (GPM)
80-70	63.3	56.2	152.0	60.0	63.6	144.1	56.4	72.4	135.4	52.3	82.8	125.5
100-70	74.1	73.8	178.0	69.3	84	166.2	64.7	95.6	155.3	59.8	109.6	143.6
120-70	90.1	82.8	216.2	85.0	93.9	203.9	79.7	106.8	191.2	74.2	121.8	178.1
150-120	111.7	111	268.2	104.4	126	250.6	96.9	143.4	232.6	89.7	164.4	215.3
180-120	134.4	129.6	322.6	126.6	147	303.8	117.7	166.8	282.5	107.8	190.2	258.8

LEGEND

LCWT- Leaving chilled water temperature

CAP.- Capacity, tons of refrigeration

kW- Compressor motor Input at rated voltage (kW)

*Cooler water temperature rise of 10 °F

-For other rating conditions please contact SSI sales department



Figure 1 - 30RAN units dimensions

UNIT 30RAN (R134a)	Style A	60-415	80-415	100-415	120-415	150-415	180-415	
	Style B	–	80-70	100-70	120-70	150-120	180-120	
Lengt-L(mm)		1500	2700	2700	2700	2700	3900	
Width-W(mm)		2311						
Height-H(mm)		2640						
Weight (kg)	Al Fin	Style A	1141	1543	1708	1904	2092	2603
		Style B	–	1900	2024	2220	2621	3131
	Cu Fin	Style A	1185	1604	1769	1965	2153	2694
		Style B	–	1959	2085	2281	2682	3224

UNIT 30RAN (R407C)	Style A	60-415	80-415	100-415	120-415	150-415	180-415	
	Style B	–	80-70	100-70	120-70	150-120	180-120	
Lengt-L(mm)		2700	2700	2700	3900	3900	5100	
Width-W(mm)		2311						
Height-H(mm)		2640						
Weight (kg)	Al Fin	Style A	1321	1543	1708	2292	2475	2990
		Style B	–	1900	2024	2609	3005	3520
	Cu Fin	Style A	1382	1604	1769	2384	2567	3112
		Style B	–	1959	2085	2700	3101	3643

30RAN-Style A MODELS With R134a (380V-PW/Y/Δ-50Hz)		
UNIT 30RAN	UNIT 30RAN	
	TOTAL POWER(KW)	FLA(Amps)
60-415	50.1	85.8
80-415	63.6	125.2
100-415	80.8	148.5
120-415	99.6	199.1
150-415	130.8	230.1
180-415	147.9	254.2

30RAN-Style A MODELS With R407C (380V-PW/Y/Δ-50Hz)		
UNIT 30RAN	UNIT 30RAN	
	TOTAL POWER(KW)	FLA(Amps)
60-415	65.4	113.3
80-415	89.8	150.0
100-415	118.2	195.7
120-415	134.7	224.9
150-415	176.1	292.4
180-415	208.2	353.3

30RAN-Style B MODELS With R134a (380V-PW/Y/Δ-50Hz)		
UNIT 30RAN	UNIT 30RAN	
	TOTAL POWER(KW)	FLA(Amps)
80-70	64.4	128.7
100-70	81.2	149.2
120-70	99.6	199.3
150-120	132.6	232.0
180-120	148.5	255.2

30RAN-Style B MODELS With R407C (380V-PW/Y/Δ-50Hz)		
UNIT 30RAN	UNIT 30RAN	
	TOTAL POWER(KW)	FLA(Amps)
80-70	90.6	151.1
100-70	117.4	194.5
120-70	133.5	223.8
150-120	176.1	292.1
180-120	205.8	349.4

FLA – full load Amps

For selection of contactors, cables and fuses the MOC and MKW must be considered.

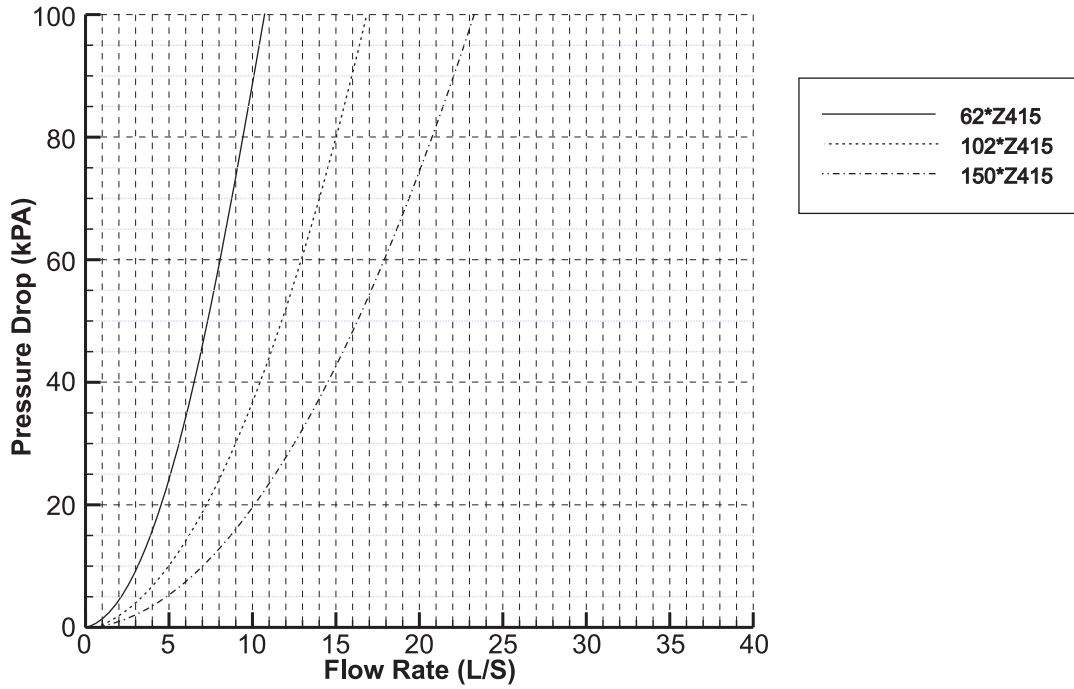


Figure 2 - Style A (BPHE) Cooler Pressure Drop Chart, SI units

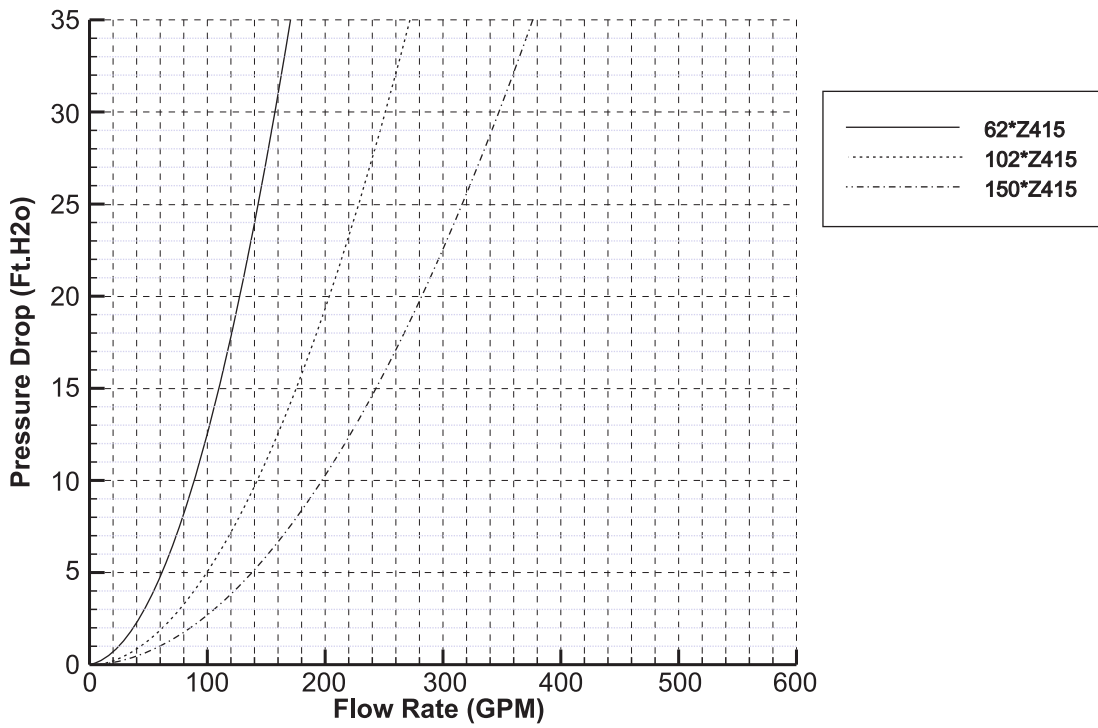


Figure 3 - Style A (BPHE) Cooler Pressure Drop Chart, English units

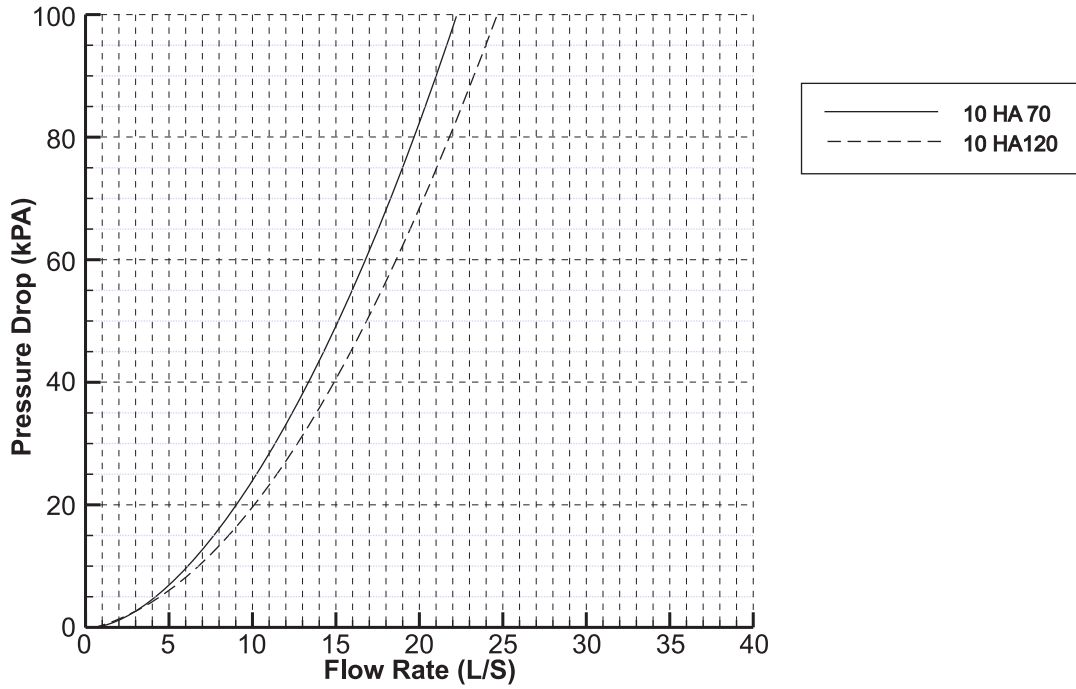


Figure 4 - Style B (Shell & Tube) Cooler Pressure Drop Chart, SI units

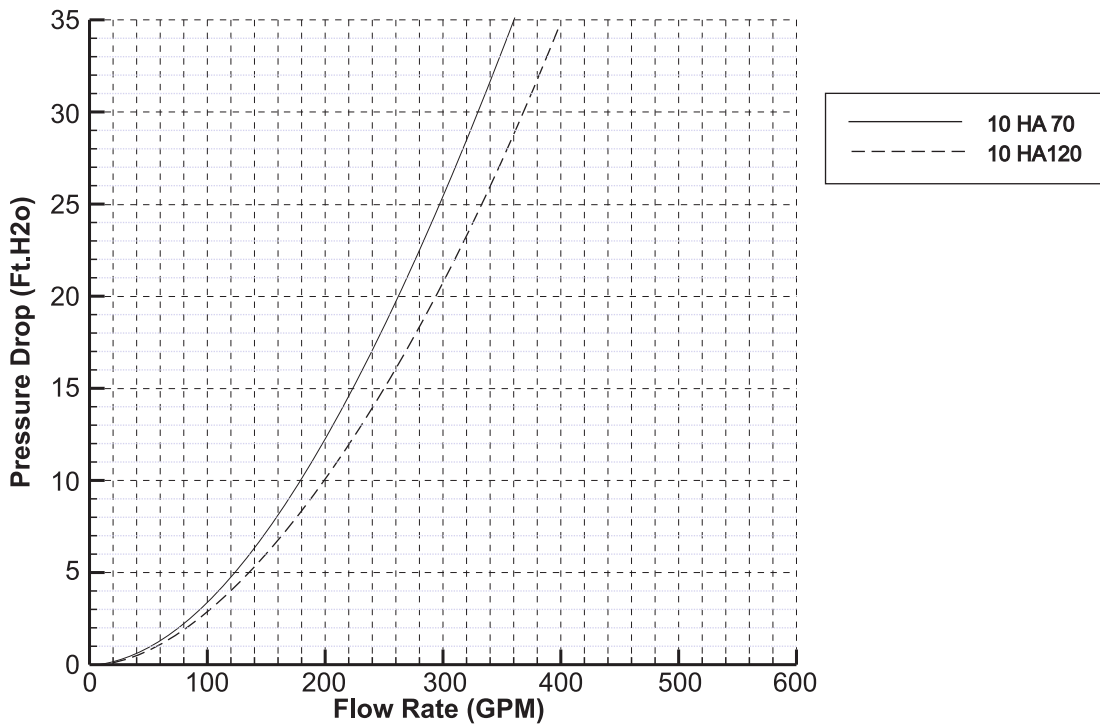
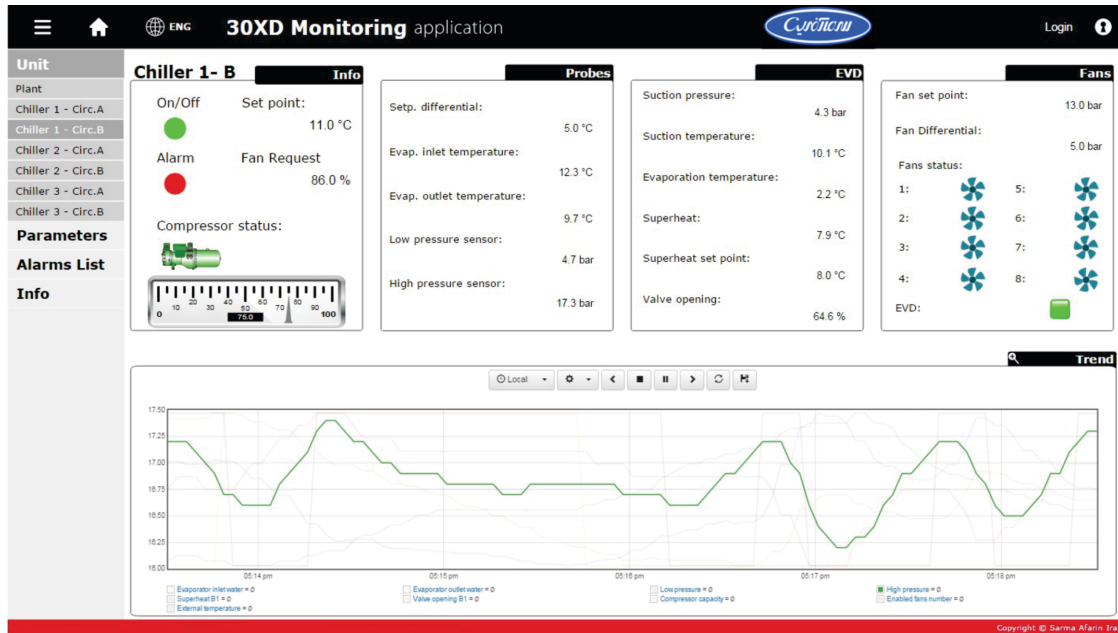


Figure 5 - Style B (Shell & Tube) Cooler Pressure Drop Chart, English units

The remote monitoring system is provided by Sarmafarin on its chillers and packages on request of customers. By directly connecting the monitoring system to the main control unit, all information and alarms can be transmitted to any location via a fixed connection line. Real time monitoring of operating conditions on installed units, recording of data in abnormal situations, maintenance management and

setting desired temperature in the home from a smart phone, are just some of many opportunities provided to designers and users of home systems at any time and from anywhere. Storing customer information for at least one year has a significant impact on the proper functioning and operational life of the system, making it easier to maintain the system.



Features and Benefits of Monitoring

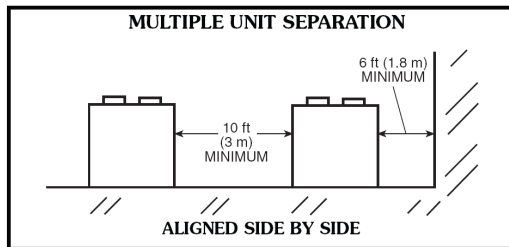
- Observation of important parameters at any moment
- Displaying the current status of system on a chart based on live data
- Recording important values in the case of abnormal events
- Quick diagnosis of system faults and troubleshooting from anywhere
- Customized pages for the customer
- Selecting important parameters, notifications and warnings by the custom
- Applicable settings via PC or Smart phone
- Different access levels with specific passwords for users
- Collecting and building an annual archive of information



Chiller location and clearances

The 30RAN unit must be installed outdoors. Do not locate near sound-sensitive areas without proper acoustic consideration. For applications requiring mounting a chiller on a building rooftop, consideration should be given to using rubber-in-shear or spring isolators to minimize structure borne transmission. Unit must be level when installed to ensure proper oil return to the compressors. Clearances must be provided around chillers for airflow, service and local code requirements. Chiller fan discharge must be at least as high as adjacent solid walls. Installation in pits is not recommended. Ensure adequate clearance between adjacent chillers is maintained.

When chillers are arranged in parallel, a minimum of 10 ft (3048 mm) between chillers is recommended. Acceptable clearance between the chiller and a single wall may be reduced to 3 ft (914.4 mm) on one side or end opposite the control panel without sacrificing performance as long as the remaining three sides are unrestricted. Clearances between chillers in dual chiller applications may be reduced to 6 ft (1.8 m) without sacrificing performance provided the remaining sides are unrestricted.



Parallel chillers

When chiller capacities greater than can be supplied by a single 30RAN chiller is required, or where standby capability is desired, chillers may be installed in parallel. Units may be of the same or different sizes with this piping arrangement.

However, cooler flow rates must be balanced to ensure proper flow to each chiller.

Unit software is capable of controlling two parallel units as a single plant by making use of the dual chiller control feature.

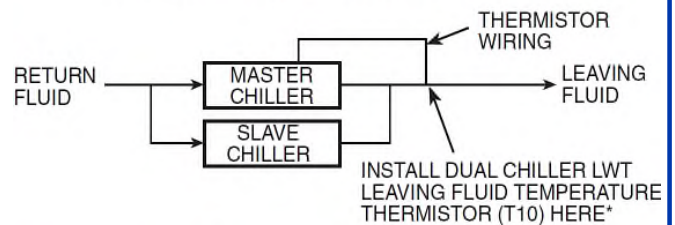
If the dual chiller algorithm is used, and the machines are installed in parallel, one chiller must be configured as the master chiller and the other as the slave. With this configuration, an additional chilled water temperature thermistor must be installed for each chiller.

Parallel chiller control with dedicated pumps is recommended.

The chiller must start and stop its own water pump located in its own piping. Check valves are required at the discharge of each pump. If pumps are not dedicated for each chiller, then isolation valves are

required. Each chiller must open and close its own isolation valve through the unit control (the valve must be connected to the pump outputs).

PARALLEL CHILLER INSTALLATION



Series chillers

Where a large temperature drop (greater than 20°F [11.1°C]) is desired, or where chiller capacities greater than what can be supplied by a single 30RAN chiller are required, or where standby capability is required, chillers may be installed in series. The leaving fluid temperature sensors need not be relocated. However, the cooler minimum entering fluid temperature limitations should be considered for the chillers located downstream of other chillers.

Dual chiller control

There are several advantages to this type of control:

- Redundancy (multiple circuits)
- Better low load control (lower tonnage capability)
- Lower rigging lift weights (2 machines rather than 1 large machine)
- Chiller lead-lag operation (evens the wear between the two machines)

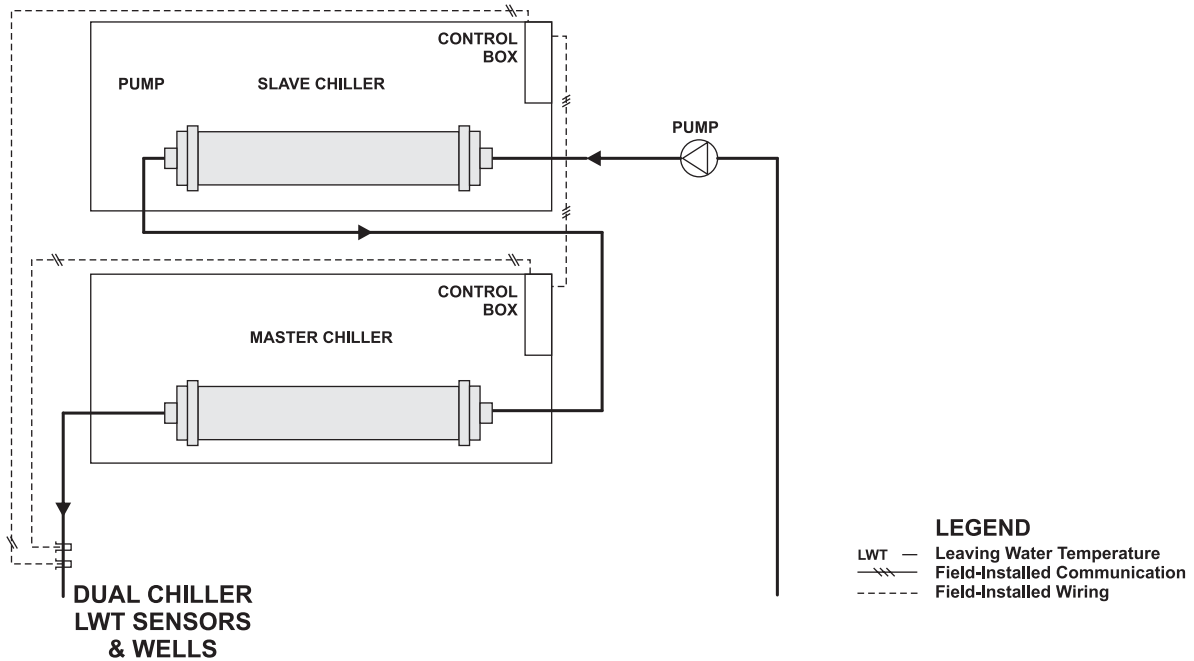
Parallel dual chiller operation —

Parallel chiller operation is the recommended option for dual chiller control. In this case, each chiller must control its own dedicated pump or isolation valve. Balancing valves are recommended to ensure proper flow in each chiller. Two field supplied and installed leaving water temperature sensors are required, one for each module, for this function to operate properly. Consider adding additional isolation valves to isolate each chiller to allow for service on a machine, and still allow for partial capacity from the other chiller.

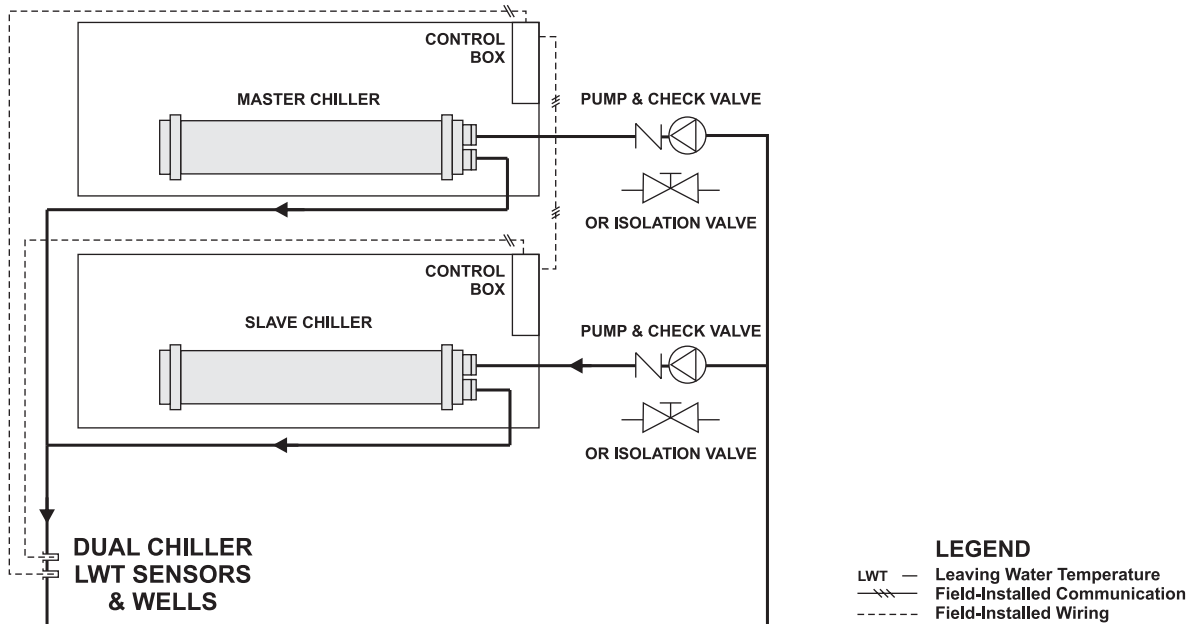
Series dual chiller operation —

Series chiller operation is an alternate control. Certain applications might require that the two chillers be connected in series.

PARALLEL DUAL CHILLER OPERATION



PARALLEL DUAL CHILLER OPERATION



Cooler water temperature

1. Maximum leaving chilled water (fluid) temperature (LCWT) for the unit is 60°F (15.5°C). It is recommended that entering-fluid temperature not exceed 95°F (35°C).

2. Minimum LCWT for fresh water applications is 40°F (4.4°C). For leaving fluid temperatures below 39.9°F (4.4°C) an inhibited antifreeze solution in the fluid loop is required.

NOTE: Water flowing through cooler should not exceed 100°F (38°C).

Cooler flow/range

Ratings and performance data in this publication are for a cooling temperature rise of 10°F (5°C). The 30RAN chillers may be operated at a different temperature rise, providing flow limits are not exceeded and corrections to system guidelines are made. A high flow rate is generally limited by the maximum pressure drop that can be tolerated by the unit. The 30RAN chillers are designed for temperature rise of 5° to 20°F (2.8° to 11.1°C). To obtain the rating if a temperature rise other than 10° F (5°) is used consult with SARMAAFARIN.

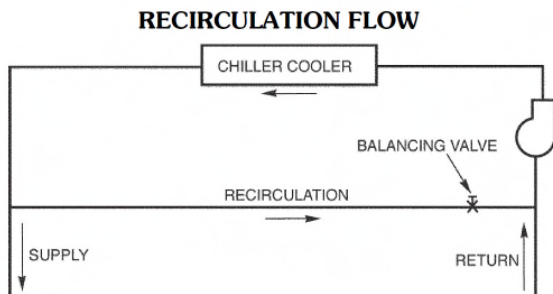
Minimum cooler flow (maximum cooler temperature rise)

When system design conditions require a lower flow (or higher rise) than the minimum allowable cooler flow, follow the recommendations below.

Multiple smaller chillers may be applied in series, each providing a portion of the design temperature rise.

Cooler fluid may be recirculated to raise the flow rate to the chiller. The mixed temperature entering the cooler must be maintained to a minimum of at least 5°F (2.8°C) above the LCWT and to a maximum of no more than 20°F (11.1°C) above the LCWT.

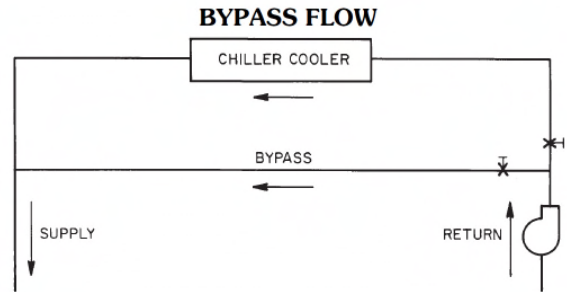
NOTE: Recirculation flow is shown below.



Maximum cooler flow

The maximum cooler flow (approximately 5°F [2.8°C] rise) results in a practical maximum pressure drop through cooler. Return fluid may bypass the cooler to keep the

pressure drop through the cooler within acceptable limits. This permits a higher delta T with lower fluid flow through cooler and mixing after the cooler.



Cooler freeze protection

Freeze protection for the cooler is standard on all 30RAN air-cooled chillers. Use cooler heater if require. Since power is sometimes lost for extended periods during winter storms, freeze protection provided by heater tapes will be effective only if a back-up power supply can be assured for the unit's control circuit, heater and cooler pump. If not protected with an antifreeze solution, draining the cooler and outdoor piping is recommended if the system will not be used during freezing weather conditions.

Two conditions that must be considered when determining antifreeze concentration are leaving water set point and ambient freeze conditions. Both of these parameters can help determine the recommended concentration level.

Higher concentration must be used to adequately protect the machine.

NOTE: Use only antifreeze solutions approved for heat exchanger duty.

For applications in which the leaving water temperature set point is less than 40°F (4.4°C), a suitable inhibited antifreeze solution must be used. The solution concentration must be sufficient to protect the chilled water loop to a freeze protection (first crystals) concentration of at least 15°F (8.3°C) below the leaving water temperature set point. If the chiller refrigerant or fluid lines are in an area where ambient conditions fall below 34°F (1°C), it is required that an antifreeze solution be added to protect the unit and fluid piping to a temperature of 15°F (8.3°C) below the lowest anticipated ambient temperature.

Cooler fouling factor

The fouling factor used to calculate tabulated ratings is 0.0001 ft² hr °F/Btu (.000018 m² °C/W). As fouling factor is increased, both unit capacity and EER decrease.

The impact of the fouling factor on performance varies significantly with chiller size and application conditions. Use table below for performance with other fouling factors.

Performance Adjustment Factor	Evaporator Fouling Factor ft ² hr °F/Btu (m ² °C/W)							
	0.0001 (0.018)		0.00025 (0.044)		0.00075 (0.132)		0.00175 (0.308)	
Chilled water Delta T °F	Cap.	Power	Cap.	Power	Cap.	Power	Cap.	Power
	10	1.000	1.000	0.990	0.998	0.957	0.991	0.898

High ambient temperature operation

High outdoor ambient chiller start-up and operation is possible for standard 30RAN chillers with R134a refrigerant at ambient temperatures up to 125.6°F (52°C) at nominal voltage and also for 30RAN chillers with R407c refrigerant at ambient temperatures up to 115°F (46.1°C) at nominal voltage.

Low ambient temperature operation

Units will start and operate down to 32°F (0°C) as standard.

Start-up and operation down to as low as -20°F (-29°C) ambient temperature for sizes require the inclusion of either low ambient head pressure control. Wind baffles are also required for such low-temperature applications.

Inhibited propylene glycol or other suitable corrosion-resistant anti-freeze solution must be field supplied and installed in all units for unit operation below 32°F (0°C). Solution must be added to fluid loop to protect loop down to 15°F (8.3 °C) below minimum operating ambient temperature.

Concentration should be based on expected minimum temperature and either "Burst" or "Freeze" protection levels. At least 6 gal per ton (6.5 L per kW) of fluid volume is the recommended minimum for a moderate system load.

Altitude correction factors

Correction factors must be applied to standard ratings at altitudes above 2000 ft (609.6 m) using the following multipliers:

Altitude		Capacity Multiplier	Compressor Power Multiplier
(ft)	(m)		
2,000	609.6	0.99	1.01
4,000	1219.2	0.98	1.02
6,000	1828.8	0.97	1.03
8,000	2438.4	0.96	1.04
10,000	3048	0.95	1.0

Water system cleaning

Proper water system cleaning is of vital importance. Excessive particulates in the water system can cause excessive pump seal wear, reduce or stop flow, and cause damage of other components. Water quality should be maintained within the limits indicated in the Water Quality Characteristics and Limitations table.

1. Install a temporary bypass around the chiller to avoid circulating dirty water and particulates into the pump and chiller during the flush. Use a temporary circulating pump during the cleaning process. Also, be sure that there is capability to drain the system fully after cleaning.

2. Be sure to use a cleaning agent that is compatible with all system materials. Be especially careful if the system contains any galvanized or aluminum components.

Both detergent-dispersant and alkaline dispersant cleaning agents are available.

3. It is a good idea to fill the system through a water meter. This provides a reference point for the future for loop volume readings, but it also establishes the correct quantity of cleaner needed in order to get the required concentration.

4. Use a feeder/transfer pump to mix the solution and fill the system. Circulate the cleaning system for the length of time recommended by the cleaning agent manufacturer.

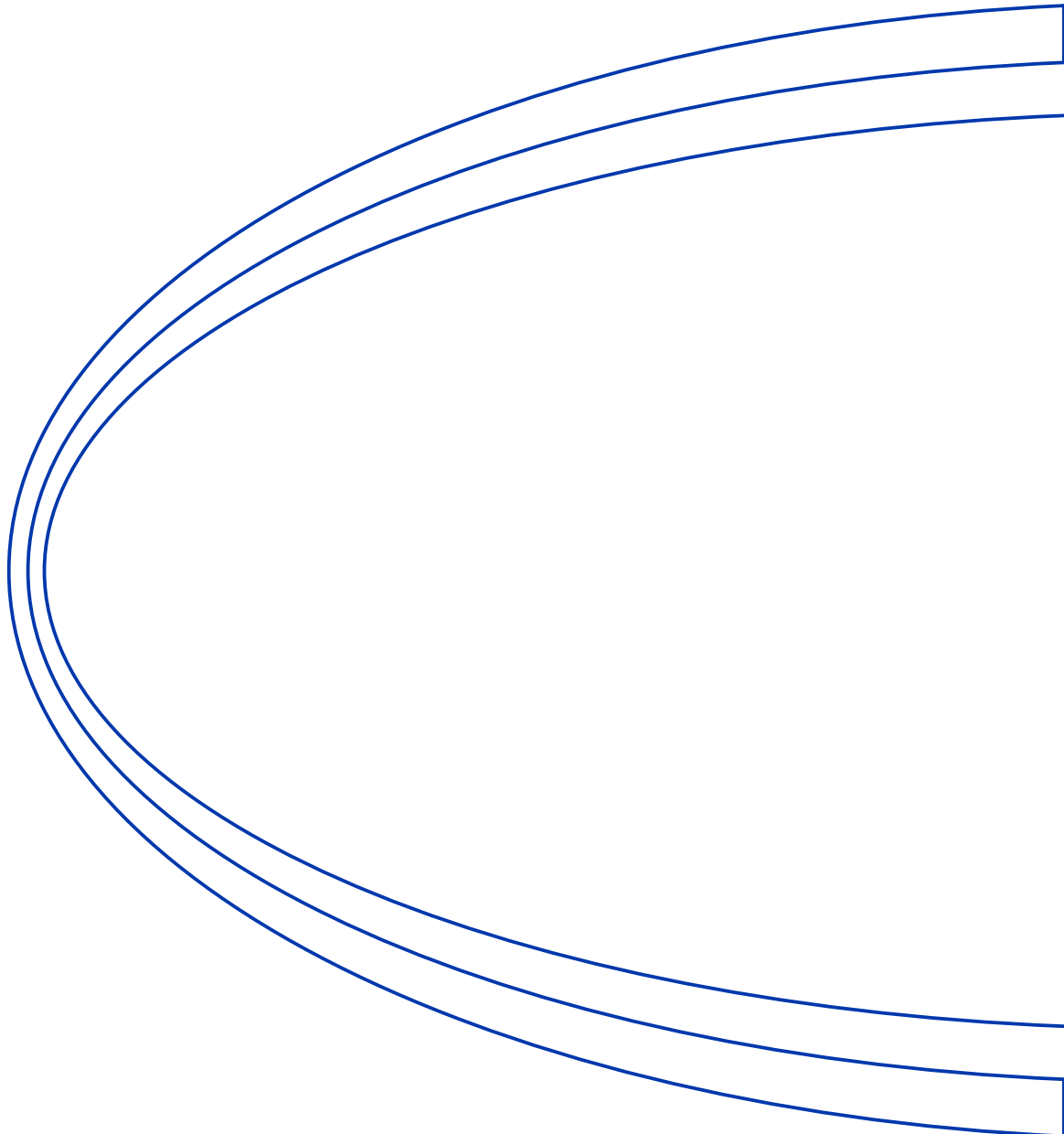
a. After cleaning, drain the cleaning fluid and flush the system with fresh water.

b. A slight amount of cleaning residue in the system can help keep the desired, slightly alkaline, water pH of 8 to 9. Avoid a pH greater than 10, since this will adversely affect pump seal components.

c. A side stream filter is recommended during the cleaning process. Filter side flow rate should be enough to filter the entire water volume every 3 to 4 hours. Change filters as often as necessary during the cleaning process.

d. Remove temporary bypass when cleaning is complete.

WATER CHARACTERISTIC	QUALITY LIMITATION
Alkalinity (HCO ₃)	70 - 300 ppm
Sulfate (So ₄ ²⁻)	Less than 70 ppm
HCO ₃ /So ₄ ²⁻	Greater than 1.0
Electrical Conductivity	10 - 500 S/cm
pH	7.5 - 9.0
Ammonium (NH ₃)	Less than 2 ppm
Chlorides (Cl)	Less than 300 ppm
Free chlorine (Cl ₂)	Less than 1 ppm
Hydrogen Sulfide (H ₂ S)*	Less than 0.05 ppm
Free (aggressive) Carbon Dioxide (Co ₂)	Less than 5 ppm
Total Hardness (dH)	4.0 - 8.5
Nitrate (No ₃)	Less than 100 ppm
Iron (Fe)	Less than 0.2 ppm
Aluminum (Al)	Less than 0.2 ppm
Manganese (Mn)	Less than 0.1 ppm



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