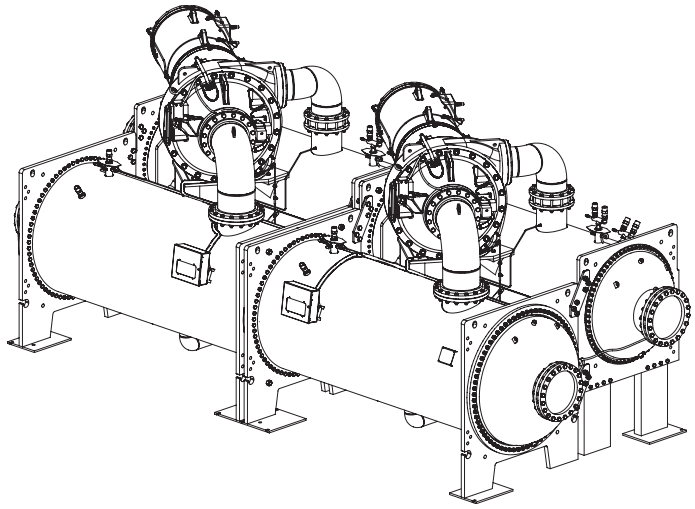
Product Data

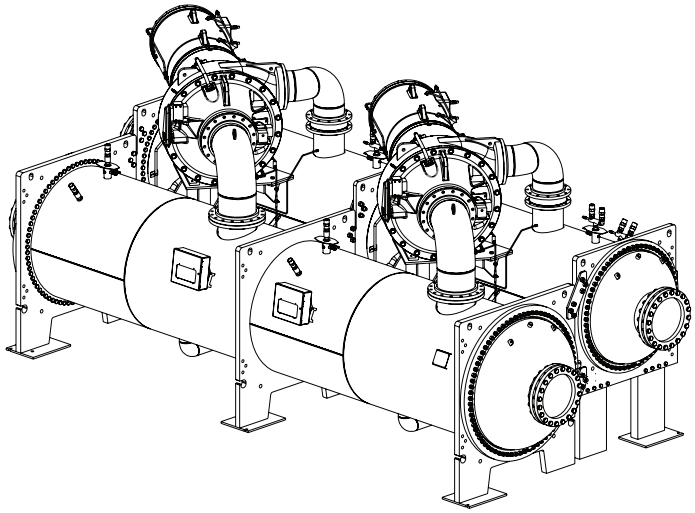
EVERGREEN® 19XRD
Modular and Integrated Dual Compressor Hermetic Centrifugal Liquid Chillers with HFC-134a Refrigerant 50/60 Hz

2500 to 3000 Nominal Tons
(8790 to 10 548 kW)

Evergreen® CHILLERS



19XRD with Modular Construction



19XRD with Integrated Construction

Evergreen® 19XRD centrifugal chillers offer:

- Dual independent refrigerant circuits
- The use of chlorine-free refrigerant HFC-134a, which is not affected by scheduled refrigerant phaseouts
- Semi-hermetic, refrigerant-cooled motors
- Modular or integrated construction for ease of installation
- Positive pressure construction

Features/Benefits

The Carrier-designed 19XRD chillers provide high efficiencies with dual compressors.

The 19XRD chiller's efficiencies are obtained at true operating conditions. Therefore, the effects of potential direct or indirect global warming are greatly diminished.

High efficiency

The 19XRD chillers leverage Carrier's proven centrifugal technology to provide reliable, efficient operation across a wide range of applications. Dual compressor and independent refrigerant circuits are arranged in an internal series counterflow pattern to increase redundancy and full load and part load efficiency while minimizing footprint.

Features/Benefits (cont)

The combination of the positive pressure design and two compressors running in series allows Carrier's 19XRD chillers to provide high efficiencies under real world operating conditions, including part load operation and cold condenser water temperatures. Low heat exchanger pressure drops reduce pumping energy, saving power and increasing overall plant efficiency.

Low starting current

The two compressors start up sequentially and therefore reduce the inrush current. Compared to a single compressor chiller, the 19XRD dual compressors reduce 40% of the inrush current.

Environmental leadership

Carrier has long been committed to the environment and its sustainability. The 19XRD chillers provide our customers with a high-efficiency, chlorine-free long-term solution unaffected by refrigerant phaseouts. Carrier's decision to utilize non-ozone depleting HFC-134a refrigerant provides our customers with a safe and environmentally sound choice without compromising efficiency.

Reliability

The 19XRD chiller's simple, single-stage positive-pressure compressor, coupled with ASME (American Society of Mechanical Engineers) or China national standard (GB) constructed heat exchangers, ensures reliability and sustainability. Hermetic motors operate in a clean-liquid, refrigerant-cooled environment. The hermetic design eliminates the problem of shaft seal leaks and refrigerant/oil loss.

Positive pressure design

The 19XRD chiller's positive pressure design reduces the chiller size compared to low-pressure designs. The smaller size minimizes the need for valuable mechanical room floor space. In addition, positive pressure designs eliminate the need for costly low-pressure containment devices, reducing the initial cost of the system.

Modular or integrated construction

For modular construction, the 19XRD chiller's two independent refrigerant circuits are bolted together. The cooler, condenser, and compressor assemblies for each independent circuit are also bolted together, making the modular 19XRD chillers ideally suited for replacement projects where ease of disassembly and reassembly at the jobsite is essential. For those projects where no assembly is prefered, the 19XRD integrated chiller is available fully assembled.

Optional refrigerant isolation valves

This system allows the refrigerant to be stored inside the chiller during servicing, reducing refrigerant loss and eliminating time-consuming transfer procedures. The self-contained 19XRD chiller does not require additional remote storage systems.

Hermetic compressor features

Single-stage design increases product reliability by eliminating the additional moving parts associated with multiple stage chillers, such as additional guide vanes and complex economizers.

Aerodynamically contoured impellers use high back sweep main blades with low-profile intermediate splitter blades. The impellers are aerodynamically contoured to improve compressor full-load and part-load operating efficiency.

Split ring diffusers allow for efficient, stable operation across a wide range of applications and loads.

Hermetic motors are hermetically sealed from the machine room. Cooling is accomplished by spraying liquid refrigerant on the motor windings. This highly efficient motor cooling method results in the use of smaller, cooler-running motors than could be realized with air-cooled designs of the same type.

In addition, the hermetic motor design eliminates:

- Compressor shaft seals that require maintenance and increase the likelihood of refrigerant leaks
- Shaft alignment problems that occur with open-drive designs during start-up and operation, when equipment temperature variations cause thermal expansion
- High noise levels that are common with air-cooled motors, which radiate noise to the machine room and adjacent areas
- Machine room cooling requirements associated with air-cooled motors, which dissipate heat to the machine room

Compressors are 100% run-tested to ensure proper operation of all compressor systems, including oil management, vibration, electrical, power transmission, and compression.

Heat exchanger features

The 19XRD chiller offers ASME or GB standards for pressure vessels. The option requires the use of an independent agency to certify the design, manufacture, and testing of all heat exchangers, ensuring the ultimate in heat exchanger safety, reliability, and long life.

Double-grooved tube sheet holes eliminate the possibility of leaks between the water and refrigerant system, increasing product reliability.

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Condenser baffle prevents direct impingement of high velocity compressor gas onto the condenser tubes. The baffle eliminates the related vibration and wear of the tubes and distributes the refrigerant flow evenly over the length of the vessel for improved efficiency.

Closely spaced intermediate support sheets prevent tube sagging and vibration, thereby increasing heat exchanger life.

Refrigerant filter drier isolation valves allow filter drier replacement without the expense of removing or transferring the refrigerant.

Thermowells and pressure transducers for evaporator and condenser temperature and pressure indication can be changed without removing or transferring the refrigerant charge, providing easier calibration and a reduction in service time and expense.

FLASC (flash subcooler), located in the bottom of the condenser, increases the refrigeration effect by cooling the condensed liquid refrigerant to a lower temperature. This results in reduced compressor power consumption.

AccuMeter™ system regulates refrigerant flow according to load conditions, providing a liquid seal at all operating conditions and eliminating unintentional hot gas bypass.

Integrated control features

The 19XRD integrated controller is an easy-to-use interface. Each controller integrates the operating data of both circuits, which makes chiller control and maintenance easier. For identical compressor configuration, each circuit can be designated as the lead circuit to balance the operating time of the compressors. Due to the lead/lag operation, chiller and system efficiency is improved. One circuit can run while the other is stopped for maintenance so operation will not be interrupted. The two redundant systems offer higher reliability for the chiller and system.

Direct Digital Product Integrated Control (PIC II) provides unmatched flexibility and functionality. Each unit integrates directly with the Carrier Comfort Network® (CCN) system, providing a system solution to controls applications.

International Chiller Visual Control (ICVC) can be configured to display units in English or metric and provides unparalleled ease of operation.

A VGA (video graphics array) 320 x 240 element LCD (liquid crystal display) features 4 menu-specific softkeys. The default display offers all in one glance review of key chiller operation data, simplifying the interaction between chiller and user.

Features include:

- Display of over 125 operating, status, and diagnostic messages for improved user interface
- Monitoring of over 100 functions and conditions to protect the chiller from abnormal conditions
- Modular pull-out/plug-in design, reducing wiring requirements and providing easy installation
- Low-voltage (24 v) design, providing the ultimate assurance of personal safety and control integrity

The display modes include 3 standard languages: English, Chinese, and Korean.

Automatic capacity override function unloads the compressor whenever key safety limits are approached, increasing unit life.

Chilled water reset can be accomplished manually or automatically from the building management system. The reset saves energy when warmer chilled water can be used.

Demand limiting feature limits the power draw of the chiller during peak loading conditions. When incorporated into the Carrier Comfort Network building automation system, a red line command holds chillers at their present capacity and prevents any other chillers from starting. If a load shed signal is received, the compressors are unloaded to avoid high demand charges whenever possible.

Ramp loading ensures a smooth pulldown of water loop temperature and prevents a rapid increase in compressor power consumption during the pulldown period.

Automated controls test can be executed prior to start-up to verify that the entire control system is functioning properly.

365-day real time clock feature allows the operator to program a yearly schedule for each week, weekends, and holidays.

Occupancy schedules can be programmed into the controller to ensure that the chiller only operates when cooling is required.

Extensive service menu features include password protection to prevent unauthorized access to the service menu. Built-in diagnostic capabilities assist in troubleshooting and recommend proper corrective action for preset alarms, resulting in greater operating time.

Alarm file maintains the last 25 time and date-stamped alarm and alert messages in memory. This function reduces troubleshooting time and cost.

Configuration data backup in nonvolatile memory provides protection during power failures and eliminates time consuming control reconfiguration.

Features/Benefits (cont)

19XRD refrigeration cycle

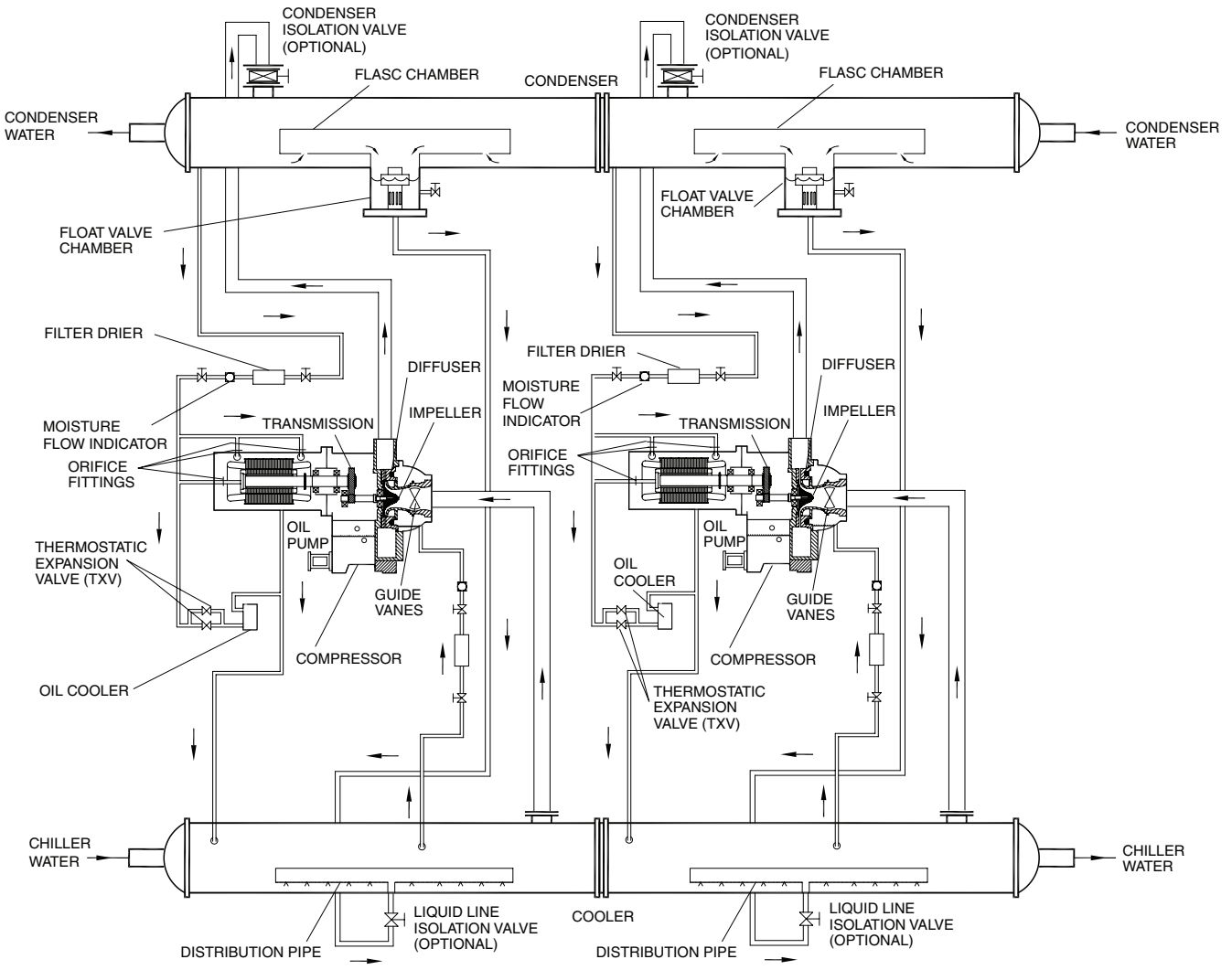
The 19XRD chiller includes two independent refrigerant cycles. In each cycle, the compressor continuously draws refrigerant vapor from the cooler at a rate set by the amount of guide vane opening. As the compressor suction reduces the pressure in the cooler, the remaining refrigerant boils at a fairly low temperature (typically 38 to 42 F [3 to 6 C]). The energy required for boiling is obtained from the water flowing through the cooler tubes. With heat energy removed, the water becomes cold enough to use in an air-conditioning circuit or process liquid cooling.

After taking heat from the water, the refrigerant vapor is compressed. Compression adds still more heat energy and the refrigerant is quite warm (typically 98 to 102 F [37 to 40 C]) when it is discharged from the compressor into the condenser. Relatively cool (typically 65 to 95 F [18 to 35 C]) water flowing into the condenser tubes removes heat from the refrigerant, and the vapor condenses to liquid.

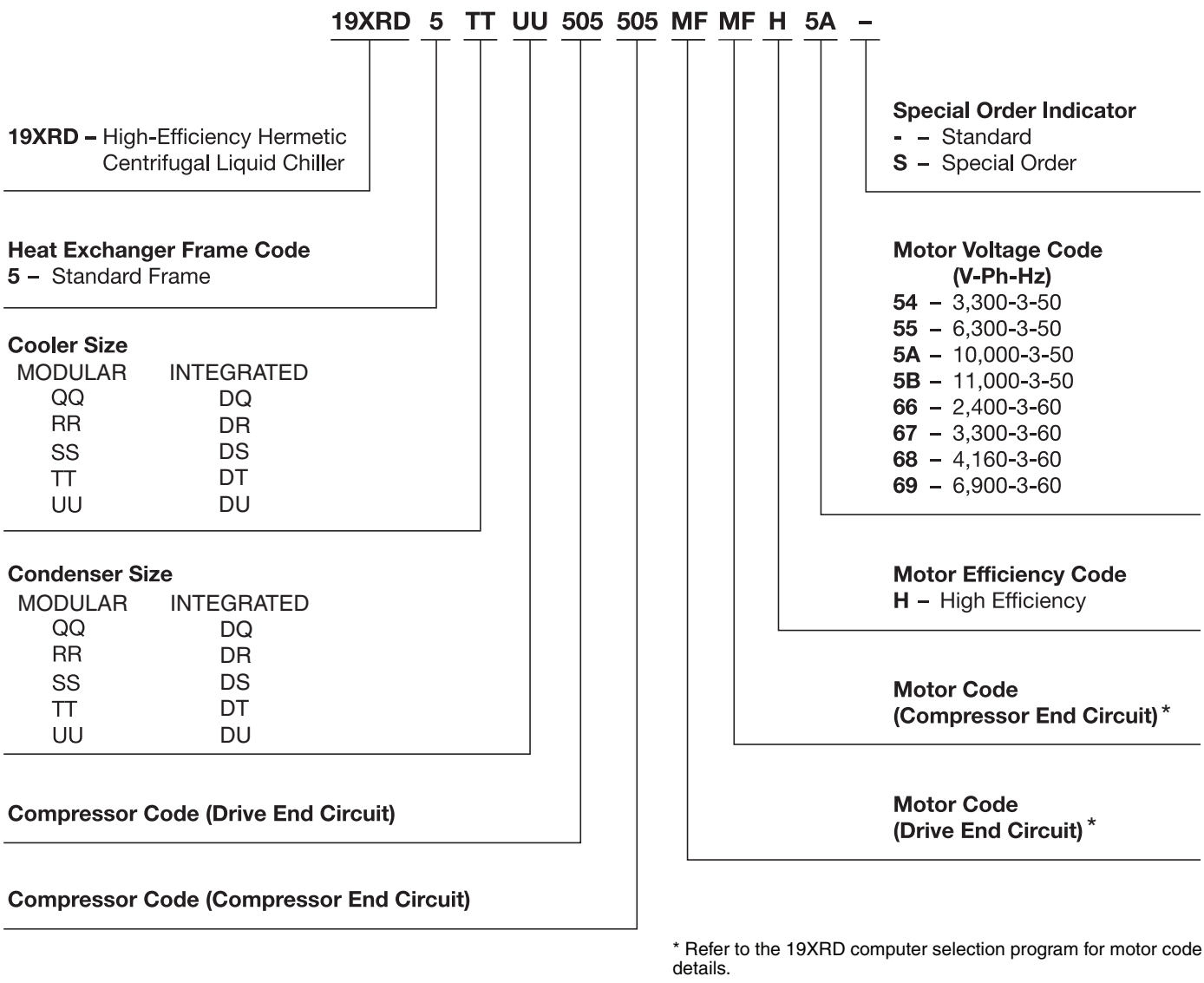
Some refrigerant flashes after it passes through the float valve and cools the remaining liquid in the FLASC (flash subcooler) chamber. The FLASC vapor is recondensed on the tubes which are cooled by entering condenser water. The liquid drains into a float valve chamber between the FLASC chamber and cooler. The AccuMeter™ float valve forms a liquid seal to keep FLASC chamber vapor from entering the cooler. When liquid refrigerant passes through the valve, some of it flashes to vapor in the reduced pressure on the cooler side. In flashing, it removes heat from the remaining liquid. The refrigerant is now at a temperature and pressure at which the cycle began. Refrigerant from the condenser also cools the oil.

For water-side operation, the chilled water enters the chiller on one end and flows through the drive end circuit. Then the chilled water flows through the compressor end circuit before exiting the chiller. The condenser water enters the opposite end of the chiller, flowing through the compressor end circuit then through the drive end circuit before exiting the chiller. This counterflow arrangement results in more efficient full load and part load operation. Leaving chilled water and entering condenser water piping connections are on one end of the machine, while entering chilled water and leaving condenser water piping connections are on the other.

19XRD REFRIGERATION CYCLE



Model number nomenclature

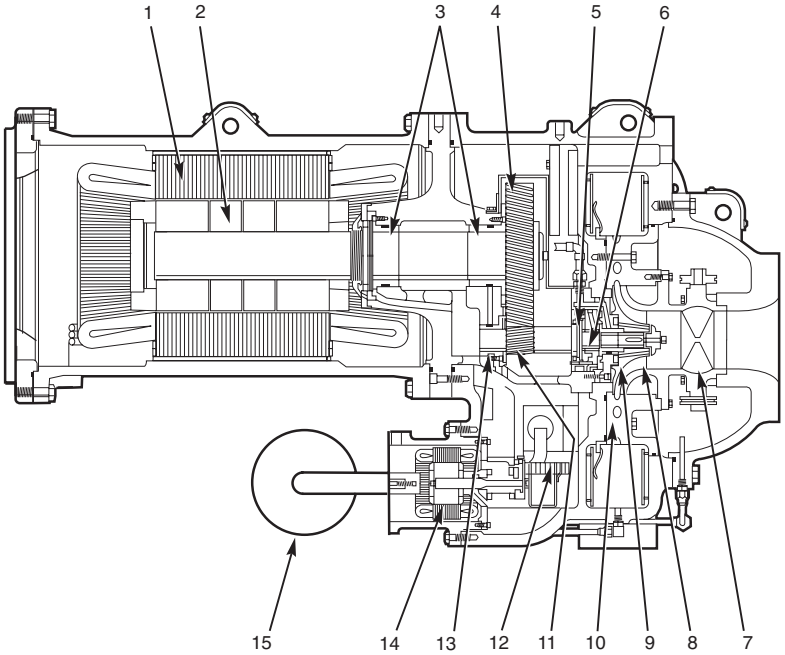


* Refer to the 19XRD computer selection program for motor code details.

NOTE: For modular chillers, when this literature refers to the "chiller" this means the entire machine, which consists of two modules and a pair of intermediate waterboxes. The two modules are described as a drive end module and a compressor end module to reflect the location of the waterbox cover. A "module" is made up of a set of heat exchangers (cooler and condenser), a compressor, a motor, an end bell cover, and other components (each with its own weight). A set of heat exchangers is made up of a cooler with a cooler waterbox cover and a condenser with a condenser waterbox cover.

Chiller components

COMPRESSOR COMPONENTS

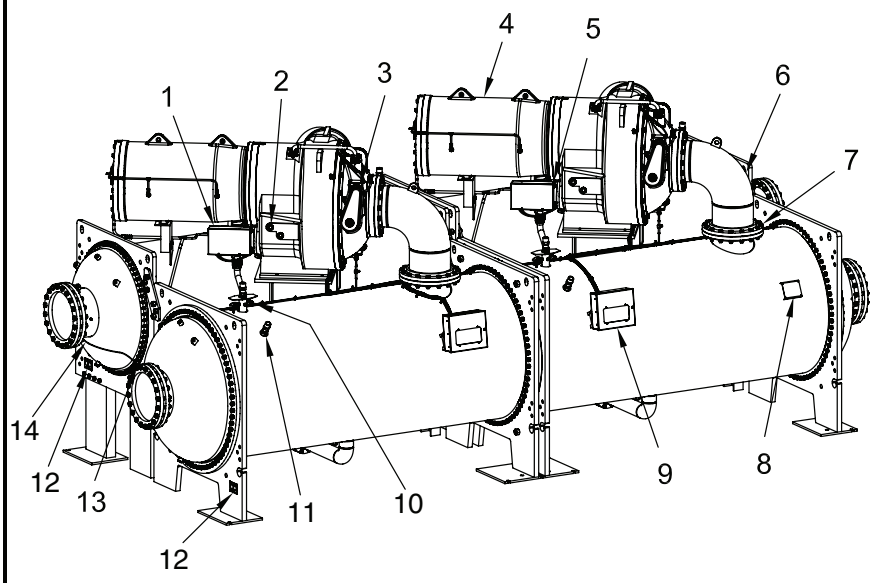


LEGEND

1 — Motor Stator
2 — Motor Rotor
3 — Motor Shaft Journal Bearings
4 — Low Speed Bull Gear
5 — High Speed Shaft Thrust Bearing
6 — High Speed Shaft Bearing
7 — Variable Inlet Guide Vanes
8 — Impeller Shroud
9 — Impeller
10 — Pipe Diffuser
11 — High Speed Pinion Gear
12 — Oil Heater
13 — High Speed Shaft Bearing
14 — Oil Pump Motor
15 — Oil Filter

19XRD CHILLER (Modular Unit Shown)

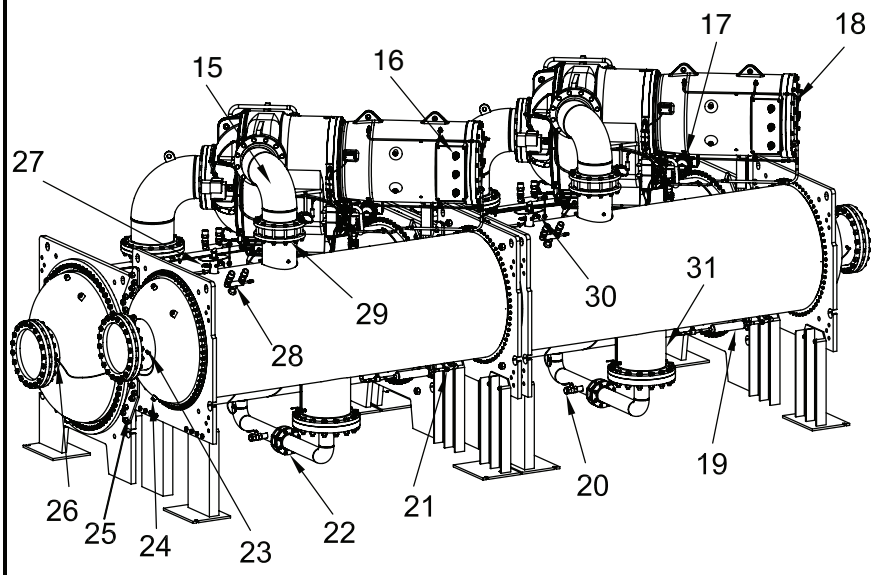
FRONT VIEW



LEGEND

1 — Auxiliary Power Panel
2 — Oil Level Sight Glass
3 — Guide Vane Actuator
4 — Motor Housing
5 — Refrigerant Oil Cooler (Hidden)
6 — Suction Elbow
7 — Typical Flange Connection
8 — Chiller Identification Nameplate
9 — International Chiller Visual Control (ICVC)
10 — Cooler Pressure Transducer
11 — Cooler Auto. Reset Relief Valves
12 — Pressure Vessel Nameplate
13 — Cooler Inlet Temperature Thermistor
14 — Condenser Outlet Temperature Thermistor
15 — Discharge Elbow
16 — Motor Power Terminal
17 — Oil Drain Valve
18 — Motor Sight Glass
19 — Refrigerant Filter/Drier
20 — Refrigerant Charging Valve
21 — Refrigerant Moisture/Flow Indicator
22 — Liquid Line Isolation Valve (Optional)
23 — Condenser Inlet Temperature Thermistor
24 — Typical Waterbox Drain Port
25 — Heat Exchanger Connection Plate
26 — Cooler Outlet Temperature Thermistor
27 — Condenser Pressure Transducer
28 — Condenser Auto Reset Relief Valves
29 — Discharge Isolation Valve (Optional)
30 — Pumpout Valve
31 — Liquid Float Valve Chamber

REAR VIEW



Physical data

19XRD MODULAR AND INTEGRATED UNITS COMPRESSOR AND MOTOR WEIGHTS FOR EACH CIRCUIT*
(High Efficiency, Frame Size 5†, Medium and High Voltage)

MOTOR CODE	VOLTAGE CODE	ENGLISH (lb)			SI (kg)		
		Compressor Weight**	Motor Weight	End Bell Cover Weight	Compressor Weight**	Motor Weight	End Bell Cover Weight
EL	54, 55	7285	4171	414	3307	1892	188
EP	54, 55	7285	4371	414	3307	1983	188
MD	5A	7285	4548	414	3307	2063	188
	5B	7285	4645	414	3307	2107	188
MF	5A	7285	4726	414	3307	2144	188
	5B	7285	4890	414	3307	2218	188

* Total compressor weight is the sum of the compressor aerodynamic components (compressor weight column), stator, rotor, and end bell cover weights.
† Compressor size number is the first digit of the compressor code. See Model Number Nomenclature on page 5.
**Compressor aerodynamic components weight only. Does not include motor weight.

19XRD MODULAR UNITS ADDITIONAL COOLER COMPONENT WEIGHTS

COMPONENT	FRAME 5 COMPRESSOR	
	lb	kg
Suction Elbow	407	185
Control Panel	34	15
Optional Cooler Inlet Isolation Valve	24	11

19XRD MODULAR UNITS ADDITIONAL CONDENSER COMPONENT WEIGHTS

COMPONENT	FRAME 5 COMPRESSOR	
	lb	kg
Discharge Elbow	325	147
Optional Discharge Isolation Valve	108	49

19XRD MODULAR UNITS HEAT EXCHANGER WEIGHTS FOR EACH MODULE (Standard NIH 150 psig Waterboxes)

CODE (FRAME CODE 5)	ENGLISH (lb)						SI (kg)					
	Dry Rigging Weight*		Machine Charge				Dry Rigging Weight*		Machine Charge			
	Cooler Only	Condenser Only	Refrigerant Weight		Water Weight		Cooler Only	Condenser Only	Refrigerant Weight		Water Weight	
			Cooler	Condenser	Cooler	Condenser			Cooler	Condenser	Cooler	Condenser
QQ	14,114	13,064	1612	886	2189	2121	6408	5931	732	402	994	963
RR	14,501	13,376	1648	869	2332	2242	6583	6073	748	395	1059	1018
SS	14,893	13,687	1767	853	2477	2362	6761	6214	802	387	1125	1072
TT	15,289	13,998	1884	836	2623	2483	6941	6355	855	380	1191	1127
UU	15,689	14,310	2002	820	2771	2603	7123	6497	909	372	1258	1182

*Rigging weights are for standard tubes of standard wall thickness (SUPER E2 and SPIKE FIN 3, 0.025-in. [0.635 mm]).

NOTES:
1. Weight is based on 0.025 in. (0.635 mm) wall standard tubing. Refer to E-Cat for special tubes.
2. All weights for standard 1-pass NIH (nozzle-in-head) design.

19XRD MODULAR UNITS ADDITIONAL HEAT EXCHANGER WEIGHTS FOR NIH 300 PSIG (2068 kPa) WATERBOXES*

CODE (FRAME CODE 5)	ENGLISH (lb)		SI (kg)	
	Cooler	Condenser	Cooler	Condenser
QQ	2242	1610	1018	731
RR	2242	1610	1018	731
SS	2242	1610	1018	731
TT	2242	1610	1018	731
UU	2242	1610	1018	731

*Add to cooler and condenser weights for total heat exchanger weights. Cooler and condenser weights may be found in the 19XRD Modular Units Heat Exchanger Weights for Each Module table above. The second digit of the heat exchanger code (first column) is the heat exchanger frame size.

19XRD MODULAR UNITS ADDITIONAL HEAT EXCHANGER WEIGHTS FOR MARINE WATERBOXES*

150 PSIG (1034 kPa) MARINE WATERBOXES

CODE (FRAME CODE 5)	ENGLISH (lb)		SI (kg)	
	Cooler	Condenser	Cooler	Condenser
QQ	2568	2141	1166	972
RR	2568	2141	1166	972
SS	2568	2141	1166	972
TT	2568	2141	1166	972
UU	2568	2141	1166	972

*Add to cooler and condenser weights for total heat exchanger weights. Cooler and condenser weights may be found in the 19XRD Modular Units Heat Exchanger Weights for Each Module table on page 8. The second digit of the heat exchanger code (first column) is the heat exchanger frame size.

300 PSIG (2068 kPa) MARINE WATERBOXES

CODE (FRAME CODE 5)	ENGLISH (lb)		SI (kg)	
	Cooler	Condenser	Cooler	Condenser
QQ	5535	4348	2513	1974
RR	5535	4348	2513	1974
SS	5535	4348	2513	1974
TT	5535	4348	2513	1974
UU	5535	4348	2513	1974

*Add to cooler and condenser weights for total heat exchanger weights. Cooler and condenser weights may be found in the 19XRD Modular Units Heat Exchanger Weights for Each Module table on page 8. The second digit of the heat exchanger code (first column) is the heat exchanger frame size.

19XRD MODULAR UNITS WATERBOX COVER AND INTERMEDIATE WATERBOX WEIGHTS

WATERBOX TYPE	ENGLISH (lb)				SI (kg)			
	Cooler		Condenser		Cooler		Condenser	
	Waterbox Cover	Intermediate Waterbox	Waterbox Cover	Intermediate Waterbox	Waterbox Cover	Intermediate Waterbox	Waterbox Cover	Intermediate Waterbox
NIH, 150 psig	1115	333	855	269	506	151	388	122
NIH, 300 psig	1452	333	1117	269	659	151	507	122
Marine, 150 psig	3683	333	2996	269	1672	151	1360	122
Marine, 300 psig	4745	333	3855	269	2154	151	1750	122

NOTE: Weight for a NIH (nozzle-in-head) 1-pass 150 psig cover is already included in the heat exchanger weights shown on page 8.

19XRD INTEGRATED UNITS HEAT EXCHANGER WEIGHTS (Standard NIH 150 psig Waterboxes)

CODE (FRAME CODE 5)	ENGLISH (lb)						SI (kg)					
	Dry Rigging Weight*		Machine Charge				Dry Rigging Weight*		Machine Charge			
	Cooler Only	Condenser Only	Refrigerant Weight		Water Weight		Cooler Only	Condenser Only	Refrigerant Weight		Water Weight	
			Cooler	Condenser	Cooler	Condenser			Cooler	Condenser	Cooler	Condenser
DQ	27,895	25,859	3224	1772	4378	4242	12,653	11,730	1462	804	1986	1924
DR	28,669	26,483	3296	1738	4664	4484	13,004	12,013	1495	788	2116	2034
DS	29,453	27,105	3534	1706	4954	4724	13,360	12,295	1603	774	2247	2143
DT	30,245	27,727	3768	1672	5246	4966	13,719	12,577	1709	758	2380	2253
DU	31,045	28,351	4004	1640	5542	5206	14,082	12,860	1816	744	2514	2361

*Rigging weights are for standard tubes of standard wall thickness (SUPER E2 and SPIKE FIN 3, 0.025-in. [0.635 mm]).

NOTES:
1. Weight is based on 0.025 in. (0.635 mm) wall standard tubing. Refer to E-Cat for special tubes.
2. All weights for standard 1-pass NIH (nozzle-in-head) design.

Physical data (cont)

19XRD INTEGRATED UNITS ADDITIONAL HEAT EXCHANGER WEIGHTS FOR NIH 300 PSIG (2068 kPa) WATERBOXES*

CODE (FRAME CODE 5)	ENGLISH (lb)		SI (kg)	
	Cooler	Condenser	Cooler	Condenser
DQ	1163	1224	528	555
DR	1207	1269	547	576
DS	1250	1315	567	596
DT	1295	1360	587	617
DU	1339	1405	607	637

*Add to cooler and condenser weights for total heat exchanger weights. Cooler and condenser weights may be found in the 19XRD Integrated Units Heat Exchanger Weights table on page 9. The second digit of the heat exchanger code (first column) is the heat exchanger frame size.

19XRD INTEGRATED UNITS ADDITIONAL HEAT EXCHANGER WEIGHTS FOR MARINE WATERBOXES*

150 PSIG (1034 kPa) MARINE WATERBOXES

CODE (FRAME CODE 5)	ENGLISH (lb)		SI (kg)	
	Cooler	Condenser	Cooler	Condenser
DQ	5136	4282	2330	1942
DR	5136	4282	2330	1942
DS	5136	4282	2330	1942
DT	5136	4282	2330	1942
DU	5136	4282	2330	1942

*Add to cooler and condenser weights for total heat exchanger weights. Cooler and condenser weights may be found in the 19XRD Integrated Units Heat Exchanger Weights table on page 9. The second digit of the heat exchanger code (first column) is the heat exchanger frame size.

300 PSIG (2068 kPa) MARINE WATERBOXES

CODE (FRAME CODE 5)	ENGLISH (lb)		SI (kg)	
	Cooler	Condenser	Cooler	Condenser
DQ	7260	6000	3293	2722
DR	7260	6000	3293	2722
DS	7260	6000	3293	2722
DT	7260	6000	3293	2722
DU	7260	6000	3293	2722

*Add to cooler and condenser weights for total heat exchanger weights. Cooler and condenser weights may be found in the 19XRD Integrated Units Heat Exchanger Weights table on page 9. The second digit of the heat exchanger code (first column) is the heat exchanger frame size.

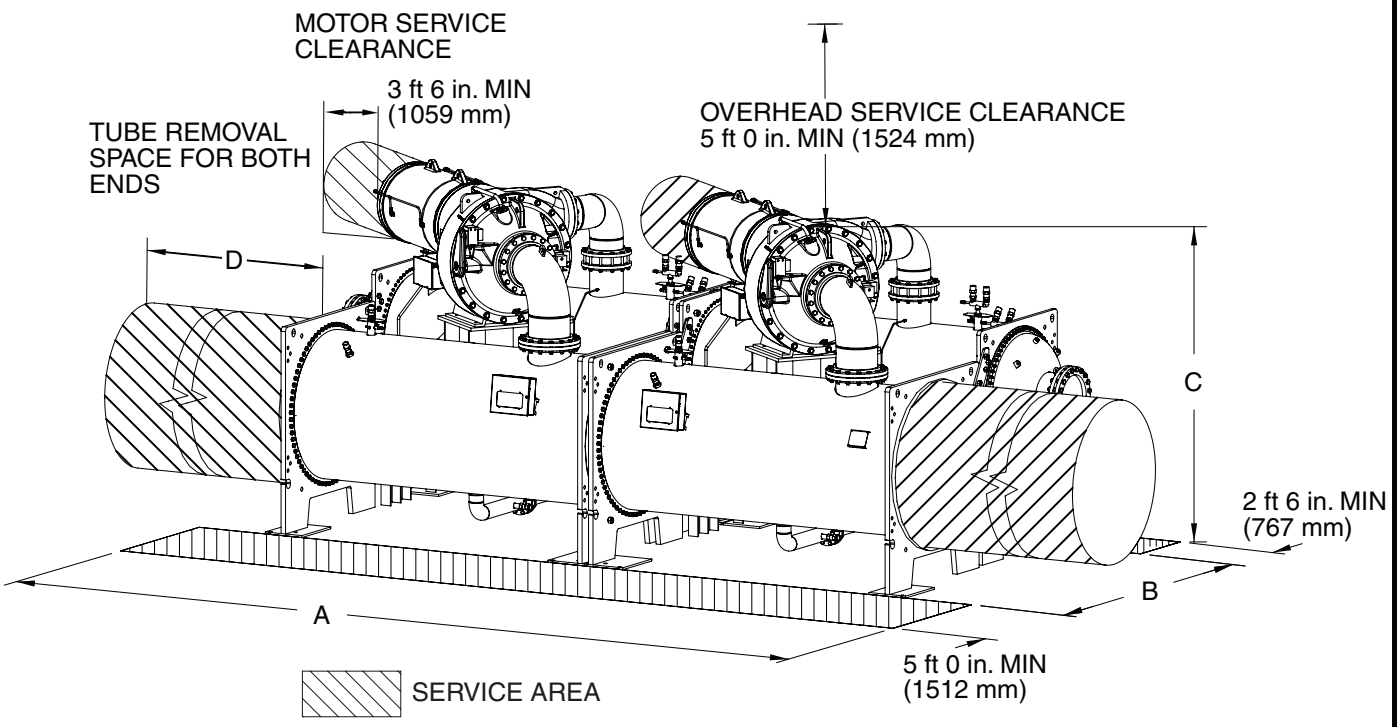
Options and accessories

ITEM	OPTION*	ACCESSORY†
Thermal Insulation (Except Waterbox Covers)	X	
Nozzle-in-Head Waterbox, 300 psig (2068 kPa)**	X	
Marine Waterboxes, 150 psig (1034 kPa)**	X	
Marine Waterboxes, 300 psig (2068 kPa)**	X	
0.028 or 0.035 in. (0.711 or 0.889 mm) Internally/Externally Enhanced Copper Tubing — Cooler	X	
0.028 or 0.035 in. (0.711 or 0.889 mm) Internally/Externally Enhanced Copper Tubing — Condenser	X	
Victaulic Connection	X	
ASME/UL Pressure Vessel Code/Electric Code	X	
China GB Pressure Vessel Code/Electric Code	X	
Factory Performance Testing or Customer Witness Test	X	
Refrigerant Isolation Valves	X	
Free-Standing Primary Reactor Starter		X
Free-Standing Solid-State Starter		X

*Factory installed.
†Field installed.
**Standard waterboxes are nozzle-in-head type, 150 psig (1034 kPa).

Dimensions

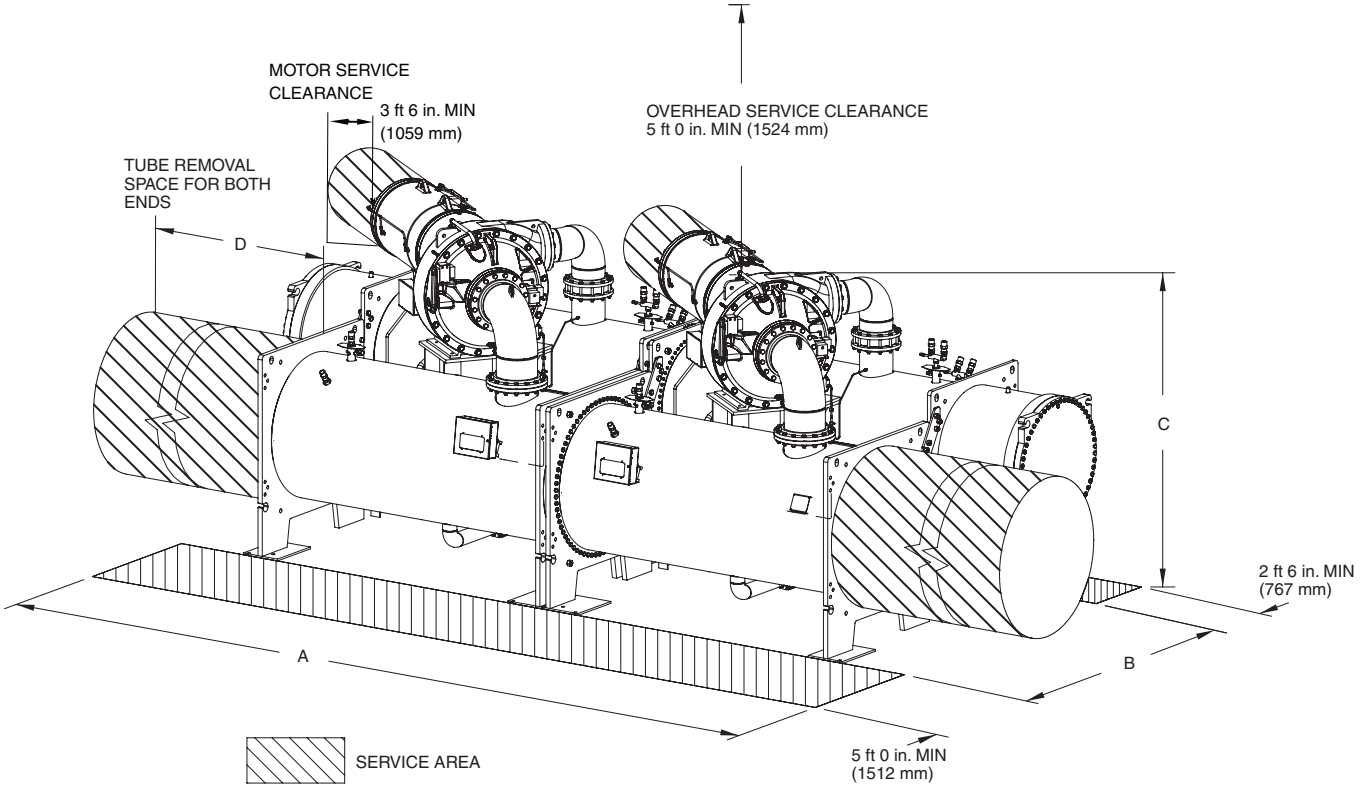
19XRD DIMENSIONS — NOZZLE-IN-HEAD WATERBOXES (Modular Unit Shown)



HEAT EXCHANGER SIZE (FRAME 5)	WATERBOX TYPE	WATER PRESSURE	DIMENSIONS							
			A (length)		B (width)		C (height)		D (clearance)	
			ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm
QQ, RR, SS, TT, UU	Nozzle-In-Head	150 psig (1034 kPa)	26-4	8032	10-8	3261	11-1	3365	13-8	4153
		300 psig (2068 kPa)	26-6	8067	10-8	3261	11-1	3365	13-8	4153
DQ, DR, DS, DT, DU	Nozzle-In-Head	150 psig (1034 kPa)	25-10 1/4	7881	10-8	3261	11-1	3365	13-8	4153
		300 psig (2068 kPa)	25-11 5/8	8067	10-8	3261	11-1	3365	13-8	4153

NOTES:
1. Service access should be provided per American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) 15, latest edition, National Fire Protection Association (NFPA) 70, and local safety code.
2. 'A' length dimensions shown are for standard 150 psig design and flange connections. The 300 psig design and flange connections will add length. See certified drawings.

19XRD DIMENSIONS — MARINE WATERBOXES (Modular Unit Shown)



19XRD DIMENSIONS

HEAT EXCHANGER SIZE (FRAME 5)	WATERBOX TYPE	WATER PRESSURE	DIMENSIONS							
			A (length)		B (width)		C (height)		D (clearance)	
			ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm
QQ, RR, SS, TT, UU	MARINE	150 psig (1034 kPa)	28-10	8789	11-6	3509	11-1	3365	13-8	4153
		300 psig (2068 kPa)	29-0	8833	11-6	3516	11-1	3365	13-8	4153
DQ, DR, DS, DT, DU	MARINE	150 psig (1034 kPa)	28-2 5/8	8600	11-6	3509	11-1	3365	13-8	4153
		300 psig (2068 kPa)	28-6 3/8	8696	11-6	3516	11-1	3365	13-8	4153

NOTES:
1. Service access should be provided per American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) 15, latest edition, National Fire Protection Association (NFPA) 70, and local safety code.
2. 'A' length dimensions shown are for standard 150 psig design and flange connections. The 300 psig design and flange connections will add length. See certified drawings.

Selection procedure

Compressor motor controllers

Compressor motors, as well as controls and accessories, require the use of starting equipment systems specifically designed for 19XRD chillers. Consult your local Carrier representative regarding design information for the selection of starters.

Performance data

19XRD HEAT EXCHANGER MIN/MAX FLOW RATES*

ENGLISH (Gpm)

COOLER CODE	FLOW RATE		CONDENSER CODE	FLOW RATE	
	Min	Max		Min	Max
DQ,QQ	3329	13,388	**DQ,QQ**	3763	15,136
DR,RR	3624	14,575	**DR,RR**	4006	16,112
DS,SS	3922	15,775	**DS,SS**	4248	17,087
DT,TT	4224	16,988	**DT,TT**	4491	18,063
DU,UU	4528	18,213	**DU,UU**	4733	19,038

SI (L/s)

COOLER CODE	FLOW RATE		CONDENSER CODE	FLOW RATE	
	Min	Max		Min	Max
DQ,QQ	210	845	**DQ,QQ**	237	955
DR,RR	229	920	**DR,RR**	253	1017
DS,SS	247	995	**DS,SS**	268	1078
DT,TT	266	1072	**DT,TT**	283	1140
DU,UU	286	1149	**DU,UU**	299	1201

*Flow rates based on standard tubes in the cooler and condenser. Minimum flow based on tube velocity of 3 ft/sec (0.91 m/sec); maximum flow based on tube velocity of 12 ft/sec (3.66 m/sec).

Electrical data

AUXILIARY RATINGS (OIL PUMP) (3 Phase, 50/60 Hz)

ITEM	AVERAGE kW	MIN/MAX MOTOR VOLTAGE/ FREQUENCY V-Ph-Hz	INRUSH kva	SEALED kva
OIL PUMP	1.50	346/440-3-50	8.30	1.76
	1.35	380/480-3-60	9.09	1.60

NOTE: FLA (Full Load Amps) = Sealed kva • 1000/$\sqrt{3}$ • volts

LRA (Locked Rotor Amps) = Inrush kva • 1000/$\sqrt{3}$ • volts

AUXILIARY RATINGS (CONTROLS, OIL SUMP HEATER)

ITEM	MIN/MAX POWER	SEALED kva	AVERAGE WATTS
CONTROLS	24-vac	0.12	120
OIL SUMP HEATER V-Ph-Hz	115-1-50/60	—	2200

NOTES:
1. Oil sump heater only operates when the compressor is off.
2. Power to oil heater/controls must be on circuits that can provide continuous service when the compressor is disconnected.

Controls

Integrated controls

The 19XRD controls maintain both compressor circuit operations at the best efficiency while maintaining the defined load. This is accomplished by designating one circuit as the lead and the other as the lag. The lead circuit has the primary responsibility of controlling capacity to meet the demand requirements. When the demand exceeds a configured limit, the lag compressor will start. The lag circuit is configured so that it will match the percent capacity of the lead. When the load reduces below a defined deadband, the lag circuit will be directed to stop, and the lead will increase capacity to meet the demand.

If the compressor in each circuit is configured identically, either circuit can be designated as the lead circuit to balance the operating hours. When the compressor for each circuit is not be configured identically to improve the chiller efficiency, the lead compressor is fixed. When unbalanced compressors are applied, the lead compressor can be defined by seasonal conditions.

To enable operation of one circuit during maintenance of the other circuit, the chiller system has been designed so that either circuit can operate when the other circuit is completely shut down. The system design includes control functions, safeties, and starters provided independently in each circuit. This is accomplished with the 19XRD software design, which maintains a synchronized overall chiller operational status at either control panel, regardless of its lead or lag position.

Control system

The microprocessor control on each Carrier centrifugal system is factory mounted, wired, and tested to ensure machine protection and efficient capacity control. In addition, the program logic ensures proper starting, stopping, and recycling of the chiller and provides a communication link to the Carrier Comfort Network® (CCN) system.

Features

Control system

- component test and diagnostic check
- programmable recycle allows chiller to recycle at optimum loads for decreased operating costs
- menu-driven keypad interface for status display, set point control, and system configuration
- CCN compatible
- primary and secondary status messages
- individual start/stop schedules for local and CCN operation modes
- recall of up to 25 alarm/alert messages with diagnostic help
- optional soft stop unloading closes guide vanes to unload the motor to the configured amperage level prior to stopping
- languages pre-programmed at factory for English, Chinese, or Korean (ICVC only)
- an ILT (international language translator) is available for conversion of extended ASCII characters

Safety cutouts

- bearing oil high temperature*
- motor high temperature*†
- refrigerant (condenser) high pressure*†
- refrigerant (cooler) low temperature*†
- lube oil low pressure
- compressor (refrigerant) discharge temperature*
- under voltage**
- over voltage**
- oil pump motor overload
- motor overload†
- motor acceleration time
- intermittent power loss
- compressor starter faults
- compressor surge protection*
- low level ground fault
  medium voltage — phase to ground
- cooler freeze protection

Capacity control

- leaving chilled water control
- entering chilled water control
- soft loading control by temperature or load ramping
- guide vane actuator module
- power (demand) limiter
- auto. chilled water reset

Interlocks

- manual/automatic remote start
- starting/stopping sequence
  pre-lube/post-lube
  pre-flow/post-flow
- compressor starter run interlock
- pre-start check of safeties and alerts
- low chilled water (load) recycle
- monitor/number compressor starts and run hours
- manual reset of safeties

Indications

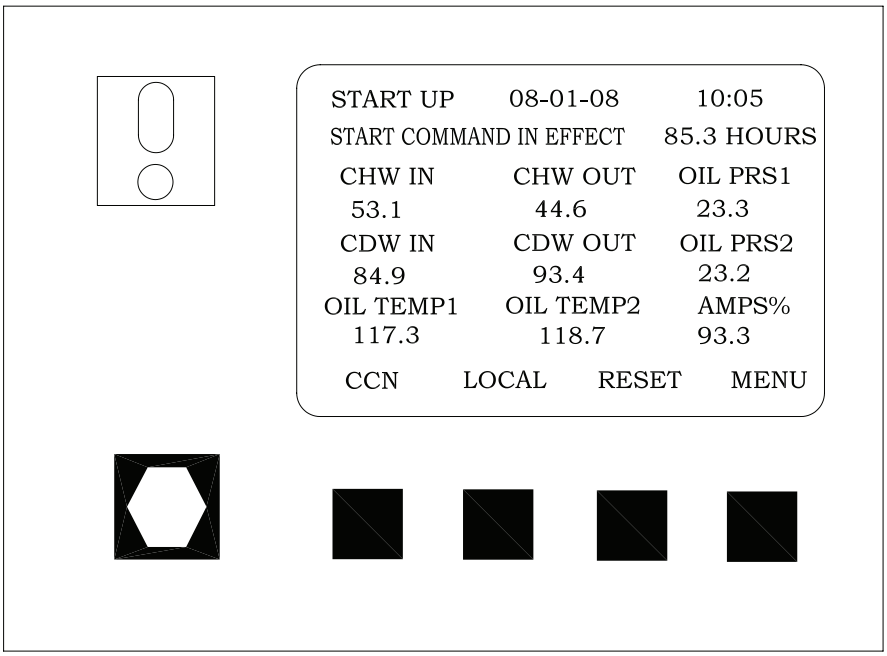
- chiller operating status message
- power-on
- pre-start diagnostic check
- compressor motor amps
- pre-alarm alert††
- alarm
- contact for remote alarm
- safety shutdown messages
- elapsed time (hours of operation)
- chiller input kW

*These can be configured by user to provide alert indication at user-defined limit.
†Override protection: Causes compressor to first unload and then, if necessary, shut down.
**Will not require manual reset or cause an alarm if auto-restart after power failure is enabled.
††By display code only.

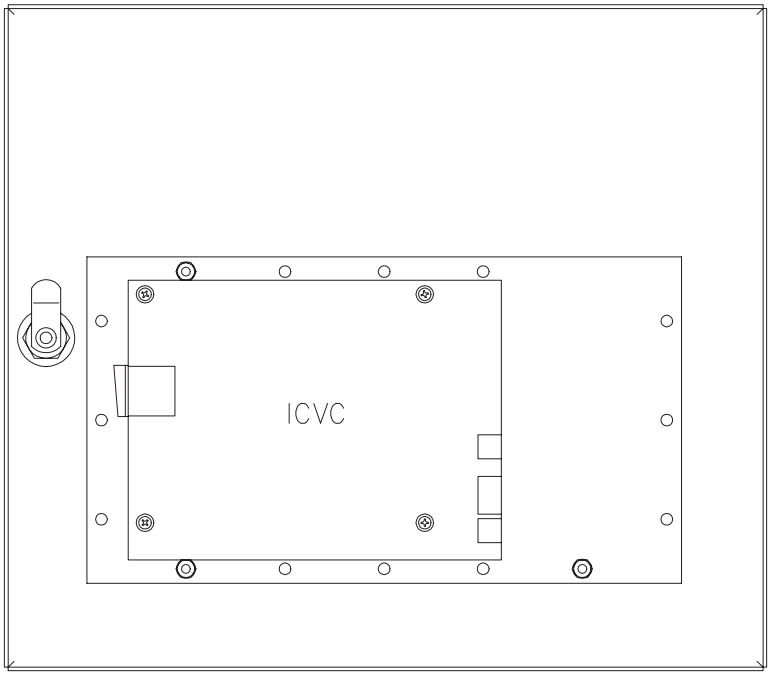
Controls (cont)

19XRD CONTROL PANEL DISPLAY (Front View)

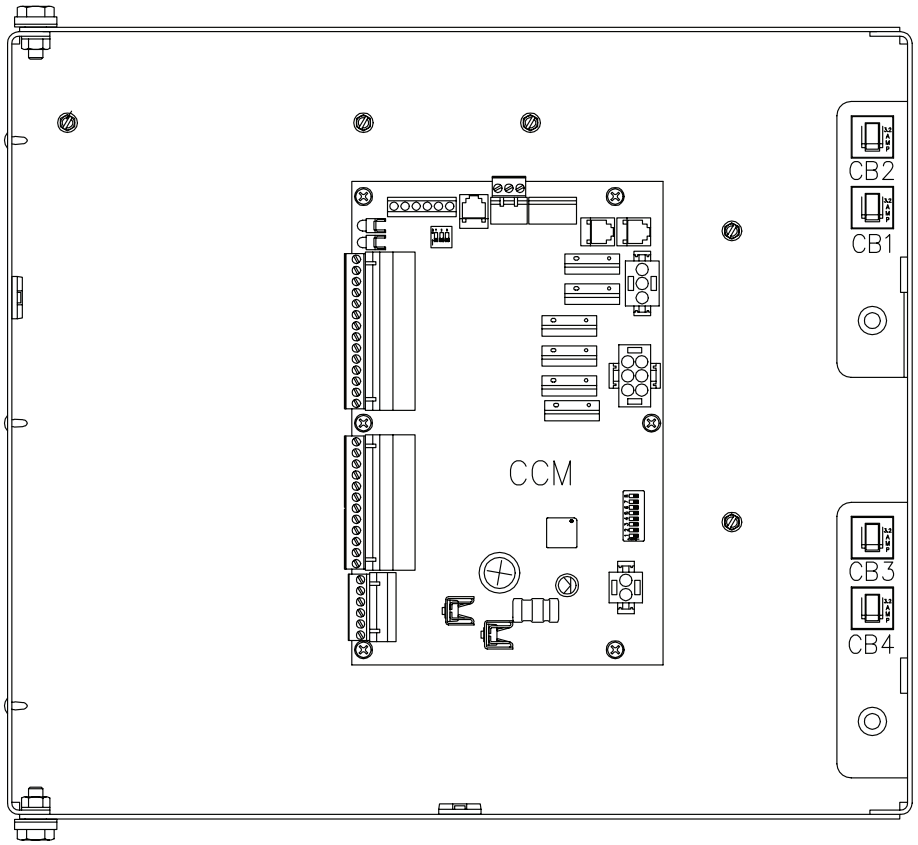
ICVC ENGLISH DISPLAY



19XRD INSIDE PANEL COVER



19XRD CONTROL PANEL COMPONENT LAYOUT

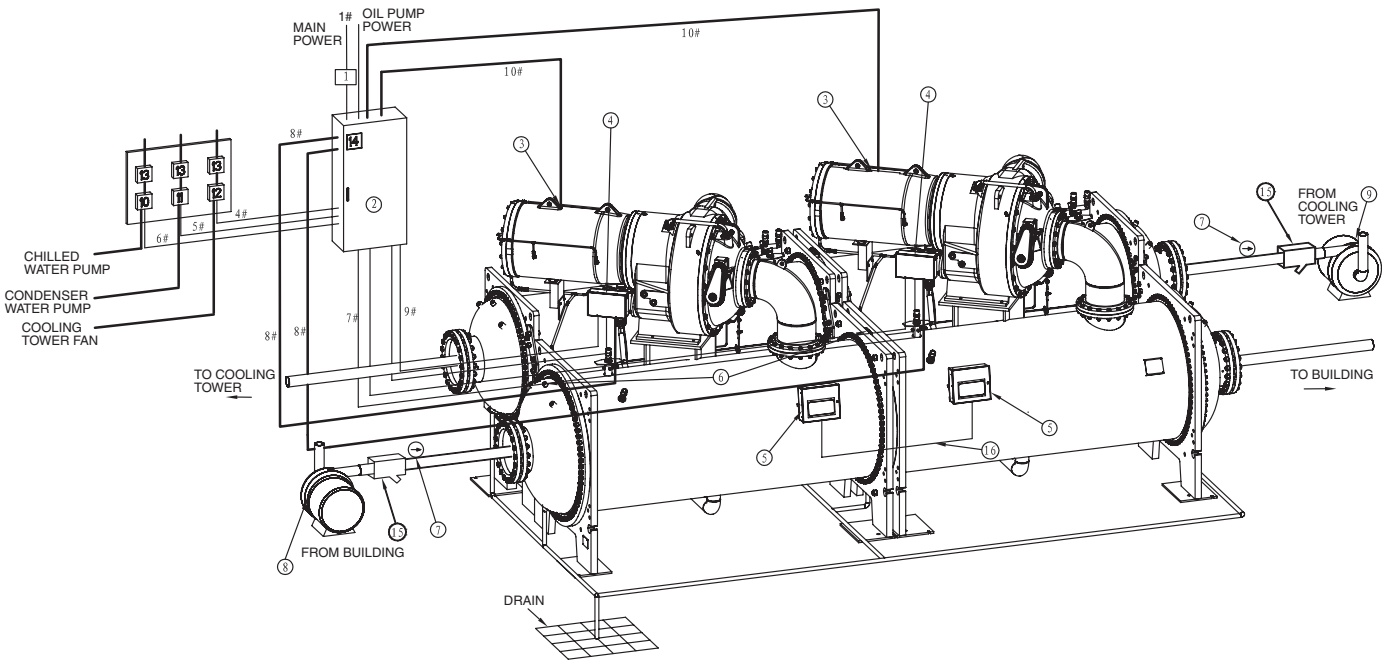


LEGEND

CB — Circuit Breaker
CCM — Chiller Control Module
ICVC — International Chiller Visual Control

Typical piping and wiring

19XRD CHILLER WITH FREE-STANDING STARTER (Modular Unit Shown)



LEGEND

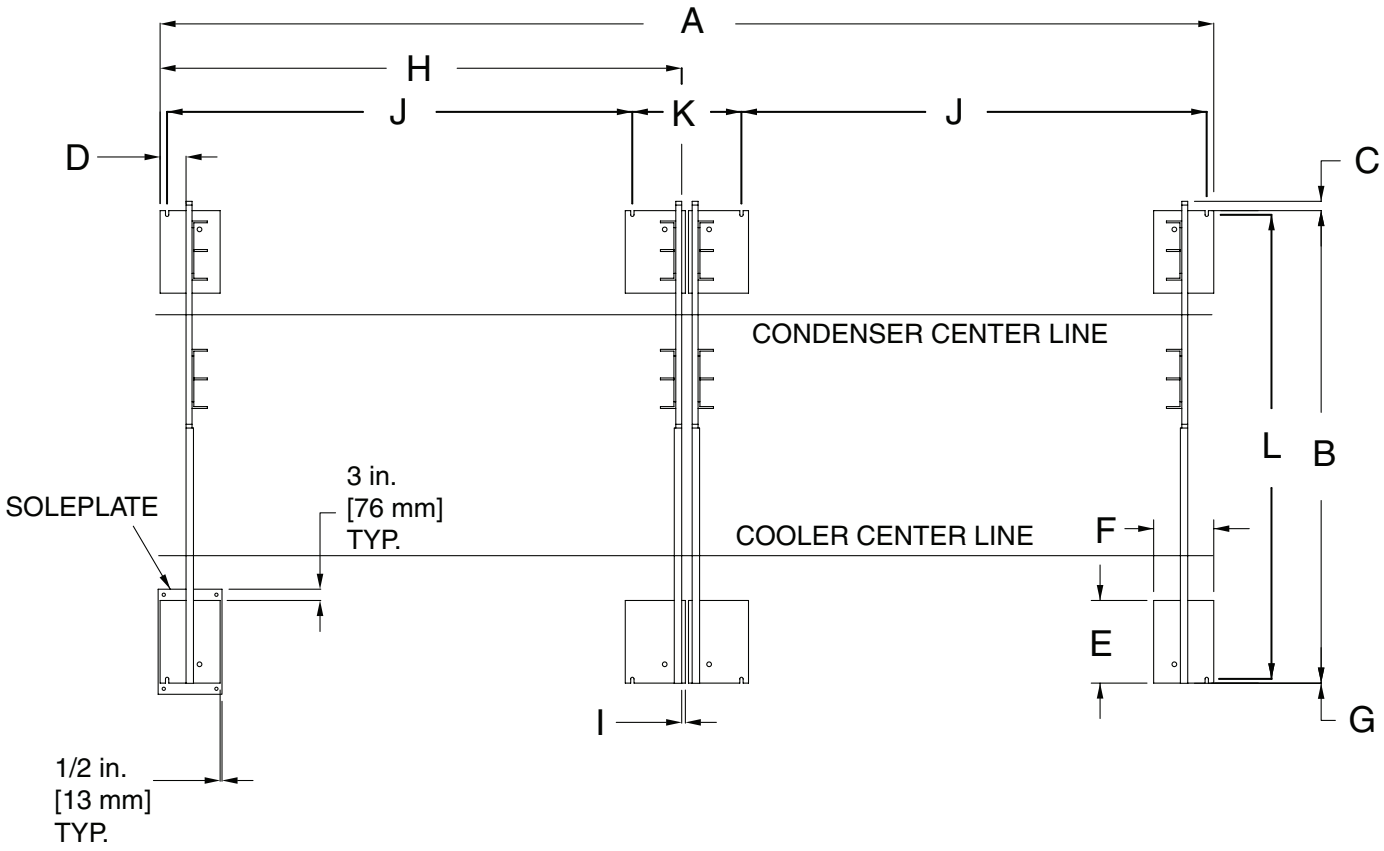
1 — Circuit Breaker
2 — Freestanding Starter
3 — Compressor Motor Terminal Box
4 — Power Panel
5 — Control Panel
6 — Vent
7 — Pressure Gage
8 — Chilled Water Pump
9 — Condenser Water Pump
10 — Chilled Water Pump Starter
11 — Condenser Water Pump Starter
12 — Cooling Tower Fan Starter
13 — Circuit Breaker
14 — Oil Pump Circuit Breaker
15 — Strainer
16 — Communication Wire
Piping
Control Wiring
Power Wiring

NOTES:
1. Wiring and piping shown are for general point-of-connection only and are not intended to show details for a specific installation. Certified field wiring and dimensional diagrams are available on request.
2. All wiring must comply with applicable codes.

WIRING LEGEND

WIRE NUMBER	DESCRIPTION	SPECIFICATION
1#	Power Supply	3 Phase High/Medium Voltage Main Power Supply Wire Ground Wire 3 Ph / 50 Hz / 346 to 440 V / 10A or 3 Ph / 60 Hz / 380 to 460 V / 10A Oil Pump Power Supply
4#	Starter to Cooling Tower Fan Starter	4 Pieces Control Wire (Optional)
5#	Starter to Condenser Water Pump Starter	2 Pieces Control Wire (Optional)
6#	Starter to Chilled Water Pump Starter	2 Pieces Control Wire (Optional)
7#	Starter to Oil Heater Contactor	2 Sets 115 V Power Wire 1 Piece Ground Wire
8#	Starter to Oil Pump Contactor	3 Ph / 50 Hz / 346 to 440 V / 5A Power Wire or 3 Ph / 60 Hz / 380 to 460 V / 5A Power Wire
9#	Starter to Power Panel Contactor	2 Sets 600V Shielded Wire
10#	Starter to Motor	2 Sets of 3 Phase High/Medium Voltage Power Wire 1 Piece Ground Wire

19XRD MODULAR UNIT MACHINE FOOTPRINT

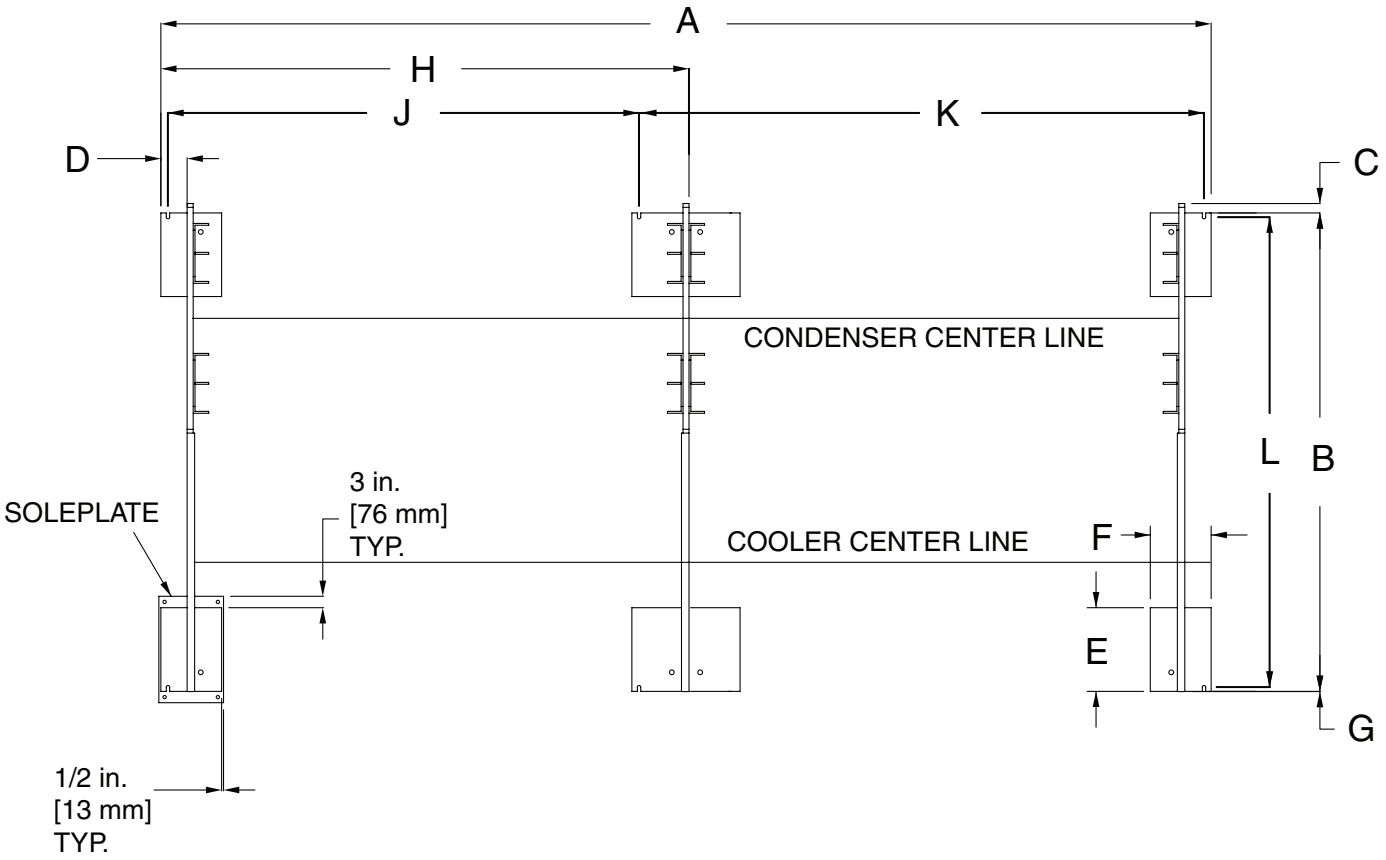


19XRD HEAT EXCHANGER CODE (SIZE 5)	DIMENSIONS (ft-in.)											
	A	B	C	D	E	F	G	H	I	J	K	L
QQ, RR, SS, TT, UU	23-5	10-6	3	9	1-10	1-4	5/64	11-8	1	10-4	1 1/2	10-4

19XRD HEAT EXCHANGER CODE (SIZE 5)	DIMENSIONS (mm)											
	A	B	C	D	E	F	G	H	I	J	K	L
QQ, RR, SS, TT, UU	7129	3196	64	216	559	406	2	3554	25	3147	38	3139

Application data (cont)

19XRD INTEGRATED UNIT MACHINE FOOTPRINT

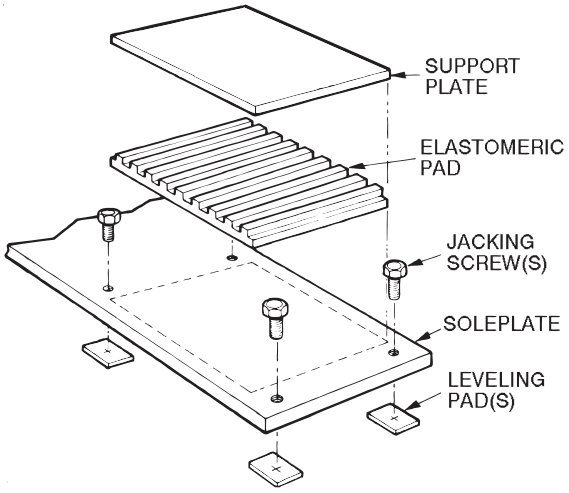


19XRD HEAT EXCHANGER CODE (SIZE 5)	DIMENSIONS (ft-in.)										
	A	B	C	D	E	F	G	H	J	K	L
DQ, DR, DS, DT, DU	22-9	10-6	2 1/2	5 7/8	1-10	1-4	5/64	11-5	11-7	10-10	10-4

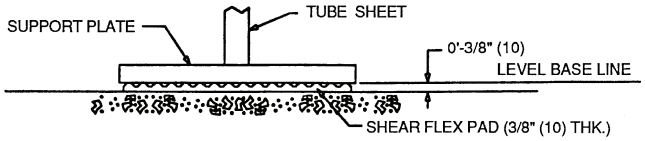
19XRD HEAT EXCHANGER CODE (SIZE 5)	DIMENSIONS (mm)										
	A	B	C	D	E	F	G	H	J	K	L
DQ, DR, DS, DT, DU	6926	3196	63	150	558	406	2	3483	3532	3306	3139

19XRD ISOLATION PACKAGE

TYPICAL ISOLATION WITH SOLEPLATE

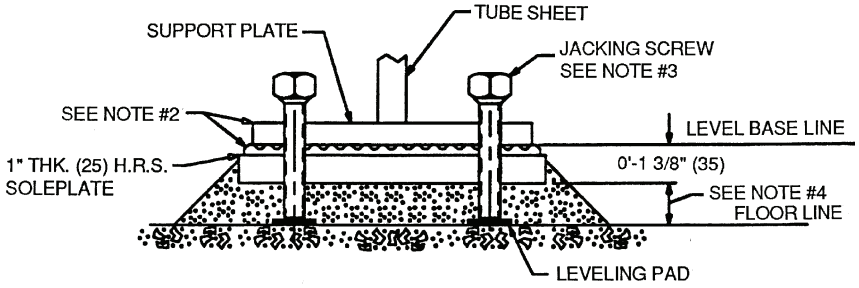


TYPICAL ISOLATION WITHOUT SOLEPLATE



NOTE: Isolation package includes 8 shear flex pads.

SOLEPLATE DETAIL

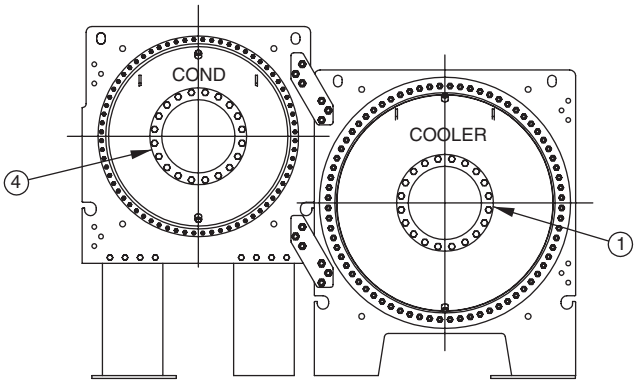


NOTES:
1. Dimensions in ( ) are in millimeters.
2. Standard soleplate package includes 8 soleplates, 32 jacking screws and leveling pads. Requires isolation package.
3. Jacking screws to be removed after grout has set.
4. Thickness of grout will vary, depending on the amount necessary to level chiller. Use only pre-mixed non-shrinking grout, Ceilcote 748 or Chemrex Embelo 636 Plus Grout 636, 0′-1 1/2″ (38.1) to 0′-2 1/4″ (57) thick.

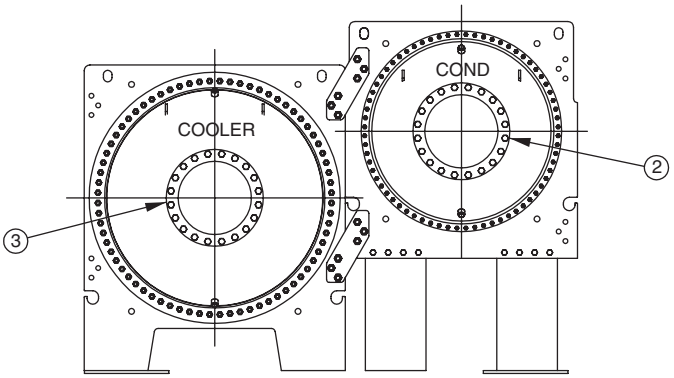
Application data (cont)

19XRD NOZZLE ARRANGEMENTS

NOZZLE-IN-HEAD WATERBOXES



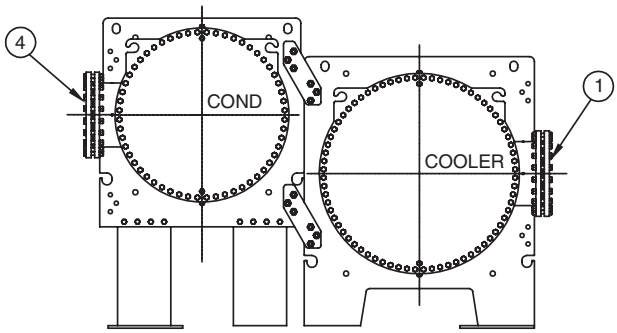
DRIVE END



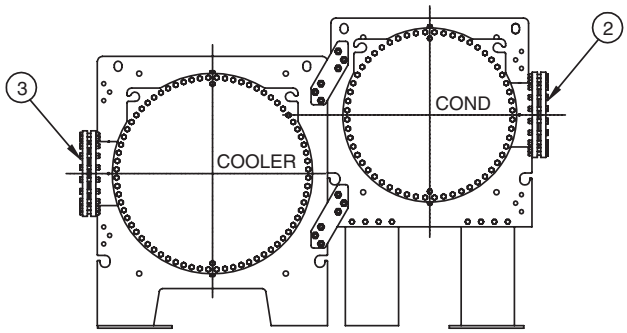
COMPRESSOR END

WATERBOX	PASS	In	Out	Arrangement Code
COOLER	1	1	3	A
CONDENSER	1	2	4	P

MARINE WATERBOXES



DRIVE END

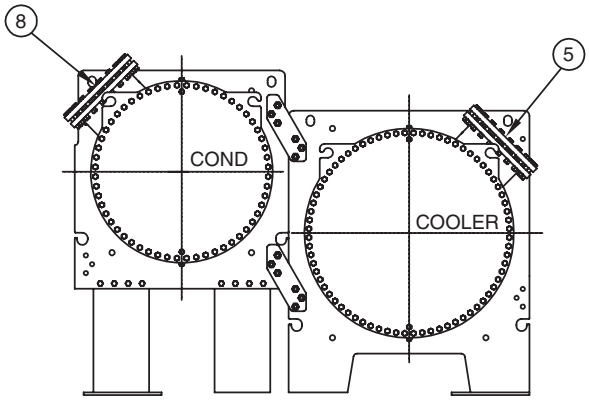


COMPRESSOR END

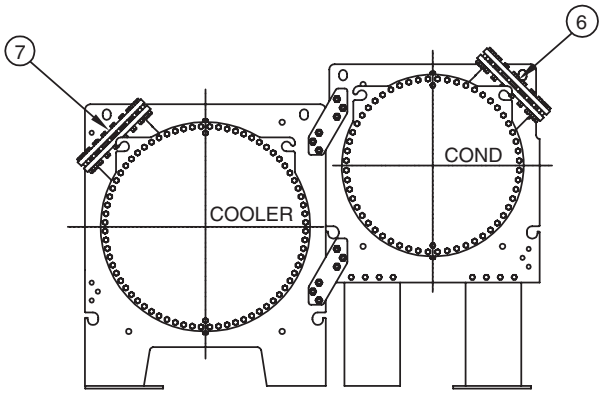
WATERBOX	PASS	In	Out	Arrangement Code
COOLER	1	1	3	A
		5	7	B
CONDENSER	1	2	4	P
		6	8	Q

19XRD NOZZLE ARRANGEMENTS (cont)

MARINE WATERBOXES (cont)



DRIVE END



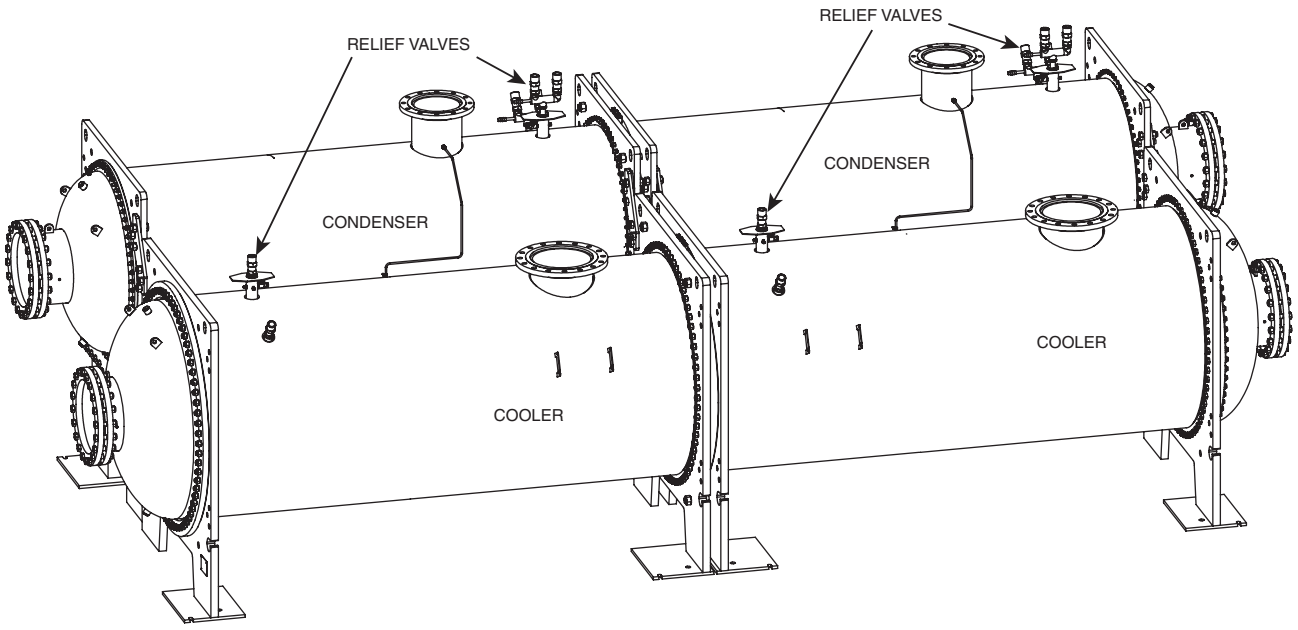
COMPRESSOR END

WATERBOX	PASS	In	Out	Arrangement Code
COOLER	1	1	3	A
		5	7	B
CONDENSER	1	2	4	P
		6	8	Q

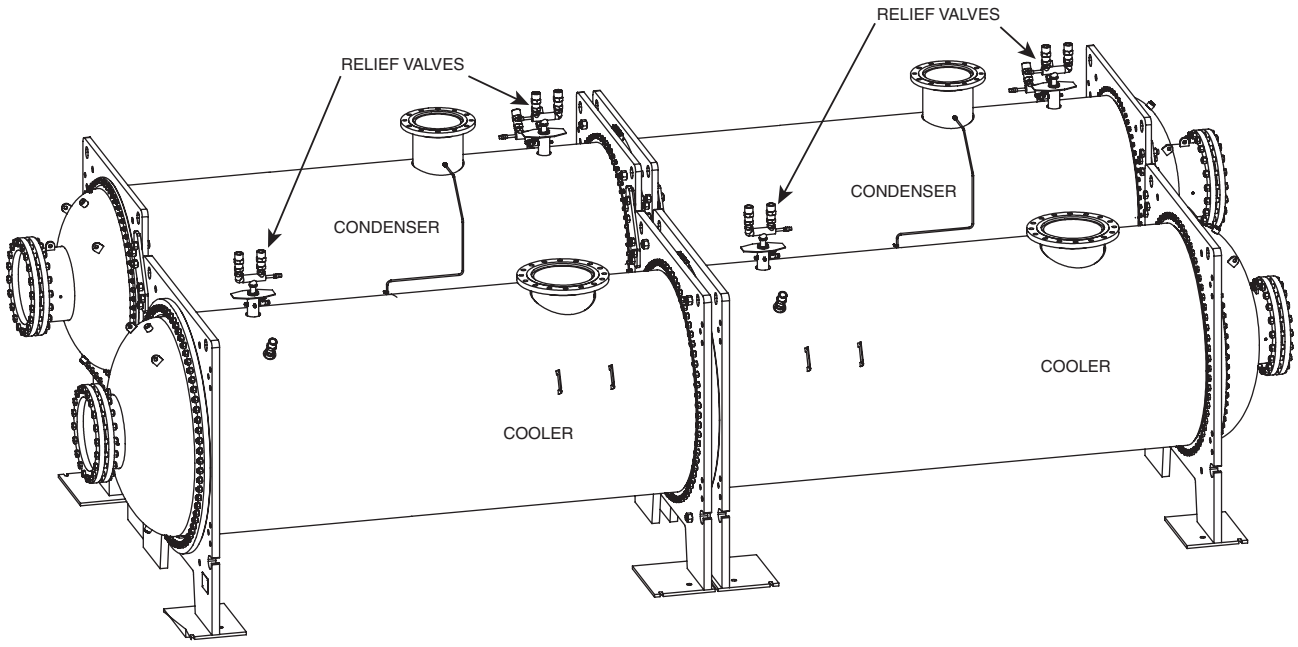
Application data (cont)

RELIEF VALVE ARRANGEMENTS (Modular Units Shown)

UNITS WITH OPTIONAL ISOLATION VALVE



UNITS WITHOUT OPTIONAL ISOLATION VALVE



19XRD NOZZLE SIZES

FRAME SIZE	PASS	NOMINAL PIPE SIZE (in.)		ACTUAL PIPE ID (in.)	
		Cooler	Condenser	Cooler	Condenser
5	1	18	18	17.7	17.7

Vent and drain connections

Nozzle-in head waterboxes have vent and drain connections on covers. Marine waterboxes have vent and drain connections on waterbox shells.

Provide high points of the chiller piping system with vents and the low points with drains. If shutoff valves are provided in the main water pipes near the unit, a minimal amount of system water is lost when the heat exchangers are drained. This reduces the time required for drainage and saves on the cost of re-treating the system water.

It is recommended that pressure gages be provided at points of entering and leaving water to measure pressure drop through the heat exchanger. Gages may be installed in each waterbox. Pressure gages installed at the vent and drain connections do not include nozzle pressure losses.

Use a reliable differential pressure gage to measure pressure differential when determining water flow. Regular gages of the required pressure range do not have the accuracy to provide accurate measurement of flow conditions.

ASME stamping

All 19XRD heat exchangers with the ASME option are constructed in accordance with ASHRAE (American Society of Heating, Refrigeration, and Air Conditioning Engineers) 15 Safety Code for Mechanical Refrigeration (latest edition). This code, in turn, requires conformance with ASME (American Society of Mechanical Engineers) Code for Unfired Pressure Vessels wherever applicable. Each heat exchanger is ASME 'U' stamped on the refrigerant side of each vessel.

Also available as an option for the 19XRD chiller is the China nation pressure vessel standard (GB standard).

Relief valve discharge pipe sizing

Relief-valve discharge piping size should be calculated per the current version of the ASHRAE 15, latest edition.

HEAT EXCHANGER	FRAME SIZE	RELIEF VALVE ESCAPE SIZE (NPT)
COOLER	5	1-1/4″
CONDENSER	5	1-1/4″

Carrier further recommends that an oxygen sensor be installed to protect personnel. Sensor should be able to sense the depletion or displacement of oxygen in the machine room below 19.5% volume oxygen per ASHRAE 15, latest edition.

Design pressures

Design and test pressures for heat exchangers are listed below.

DESIGN AND TEST PRESSURES
150 PSIG (1034 KPA UNITS)

PRESSURES	SHELL SIDE (Refrigerant)		STANDARD TUBE SIDE (Water)	
	psig	kPa	psig	kPa
Leak Test at Design Pressure*	185	1276	150	1034
Hydrostatic	—	—	195	1344
Proof Test*	204	1407	—	—

300 PSIG (2068 KPA UNITS)

PRESSURES	SHELL SIDE (Refrigerant)		OPTIONAL TUBE SIDE (Water)	
	psig	kPa	psig	kPa
Leak Test at Design Pressure*	185	1276	300	2068
Hydrostatic	—	—	390	2690
Proof Test*	204	1407	—	—

*Nitrogen/Helium.

Factory insulation

The factory insulation option for the 19XRD chiller includes the following areas: cooler; suction line up to the compressor suction housing; compressor motor and motor cooling return lines; several small oil cooling and oil return system lines and the liquid line. Insulation applied at the factory is $^3/_4$ in. (19 mm) thick.

Insulation at jobsite — As indicated in the Condensation vs Relative Humidity table, the factory insulation provides excellent protection against condensation under most operating conditions. If temperatures in the equipment area exceed the maximum design conditions, extra insulation is recommended.

High humidity jobsite locations may require field supplied and installed insulation on the float chamber, suction housing, and the lower half of the condenser.

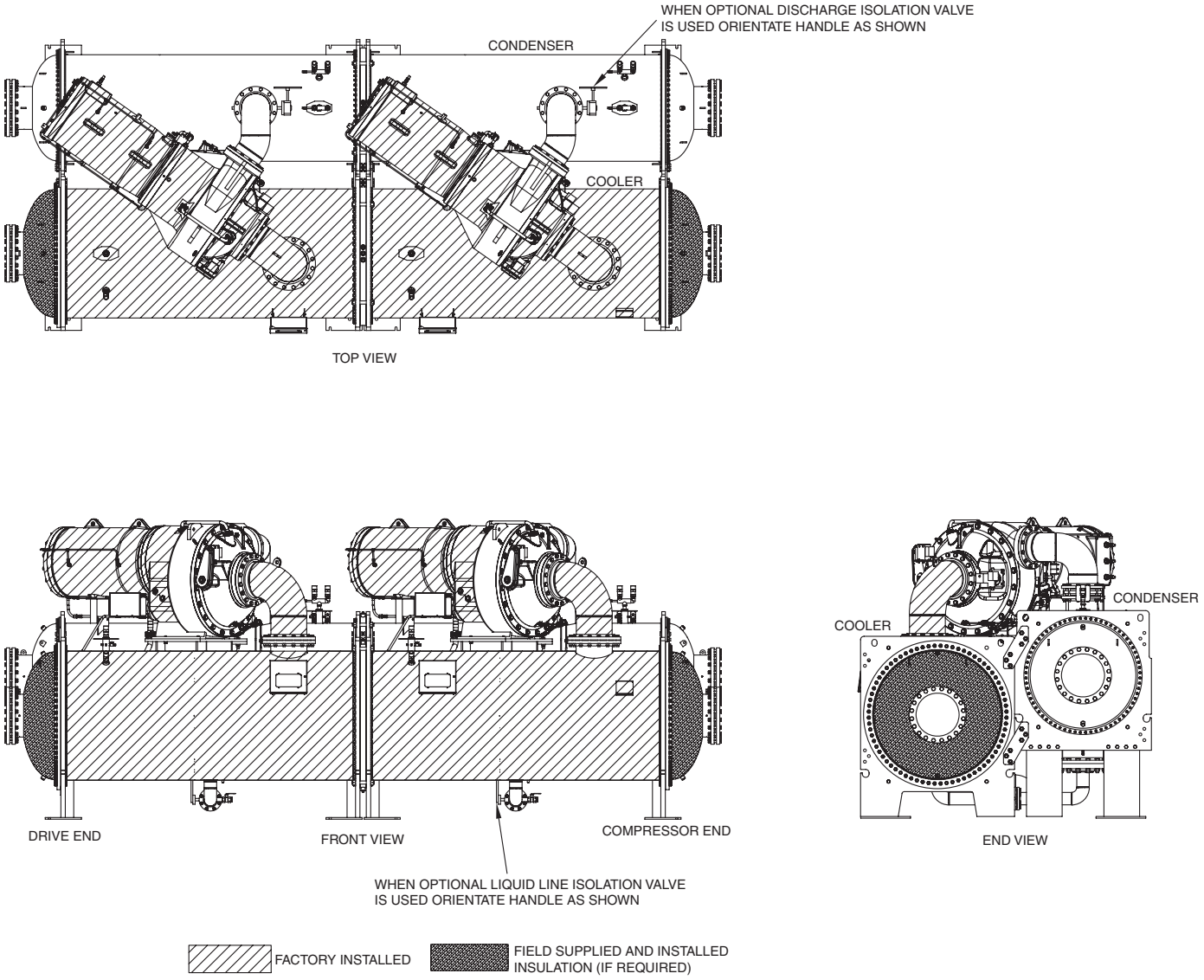
CONDENSATION VS RELATIVE HUMIDITY*

AMOUNT OF CONDENSATION	ROOM DRY-BULB TEMP		
	80 F (27 C)	90 F (32 C)	100 F (38 C)
	% Relative Humidity		
None	80	76	70
Slight	87	84	77
Extensive	94	91	84

*These approximate figures are based on 35 F (1.7 C) saturated suction temperature. A 2° F (1.1° C) change in saturated suction temperature changes the relative humidity values by 1% in the same direction.

Application data (cont)

19XRD FACTORY-INSTALLED INSULATION AREA (Modular Units Shown)



Guide specifications

Packaged Hermetic Centrifugal Liquid Chiller

HVAC Guide Specifications

Size Range:

2500 to 3000 Tons
(8790 to 10548 kW) Nominal

Carrier Model Number:

19XRD

Part 1 — General

1.01 SYSTEM DESCRIPTION

A. Microprocessor-controlled liquid chiller shall use a single stage, semi-hermetic centrifugal compressor using refrigerant HFC-134a. Chiller shall consist of two compressors and two individual refrigerant cycles which shall increase redundancy.

B. If a manufacturer proposes a liquid chiller using HCFC-123 refrigerant, then the manufacturer shall include in the chiller price:

1. A vapor activated alarm system shall be capable of responding to HCFC-123 levels of 10 ppm Allowable Exposure Limit (AEL).
2. External refrigerant storage tank and pumpout unit.
3. Zero emission purge unit capable of operating even when the chiller is not operating.
4. Back-up relief valve to rupture disk.
5. Chiller pressurizing system to prevent leakage of noncondensables into chiller during shutdown periods.
6. Plant room ventilation.

1.02 QUALITY ASSURANCE

A. Chiller performance shall be rated in accordance with ARI Standard 550/590-2003.

B. Equipment and installation shall be in compliance with ANSI/ASHRAE 15 (latest edition).

C. Cooler and condenser refrigerant side shall be designed and compliant with ASME Section VIII, division 1 code for unfired pressure vessels or shall be designed and compliant with China GB code 150/151.

D. Chiller shall be designed and constructed to meet UL listing (below 6 kV) requirements. China GB code shall be available as an option.

E. Centrifugal compressor impellers shall be dynamically balanced and over-speed tested by the manufacturer at a minimum of 120% design operating speed. Each compressor assembly shall undergo a mechanical run-in test to verify vibration levels, oil pressures, and temperatures are within acceptable limits.

Each compressor assembly shall be proof tested at a minimum 204 psig (1406 kPa) and leak tested at 185 psig (1276 kPa) with a tracer gas mixture.

F. Entire chiller assembly shall be proof tested at 204 psig (1406 kPa) and leak tested at 185 psig (1276 kPa) with a tracer gas mixture on the refrigerant side. The water side of each heat exchanger shall be hydrostatically tested at 1.3 times rated working pressure.

G. Prior to shipment, the chiller automated controls test shall be executed to check for proper wiring and ensure correct controls operation.

H. The 19XRD selection program shall be rated in accordance with ARI Standard 550/590-2003.

1.03 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled in accordance with manufacturer's instructions.

B. Unit shall be shipped with all refrigerant piping and control wiring factory installed.

C. Unit shall be shipped charged with oil and full charge of refrigerant HFC-134a or a nitrogen holding charge as specified on the equipment schedule.

D. Unit shall be shipped with firmly attached labels that indicate name of manufacturer, chiller model number, chiller serial number, and refrigerant used.

E. Unit shall be shipped in either modular configuration (2 pieces for field-assembly) or integrated configuration (one piece assembled).

F. If the chiller is to be exported, the unit shall be sufficiently protected from the factory against sea water corrosion to be suitable for shipment in a standard open top, ocean shipping container (if chiller is to be disassembled only).

1.04 WARRANTY

Warranty shall include parts and labor for one year after start-up or 18 months from shipment, whichever occurs first. A refrigerant warranty shall be provided for a period of five years.

Part 2 — Products

2.01 EQUIPMENT

A. General:

Factory assembled liquid chiller shall consist compressor, motor, lubrication system, cooler, condenser, initial oil charge, microprocessor control system, and documentation required prior to start-up.

B. Compressor:

1. Two centrifugal compressor of the high performance, single-stage type.
2. Compressor, motor, and transmission shall be hermetically sealed into a common assembly and arranged for easy field servicing.
3. Internal compressor parts must be accessible for servicing without removing the compressor base from the chiller. Connections to the compressor casing shall use O-rings instead of gaskets to reduce the occurrence of refrigerant leakage. Connections to the compressor shall be flanged or bolted for easy disassembly.
4. Pressure transducers shall be capable of field calibration to ensure accurate readings and to

avoid unnecessary transducer replacement. Transducers shall be serviceable without the need for refrigerant charge removal or isolation.

5. Transmission shall be single ratio, single helical, parallel shaft speed increaser. Gears shall conform to AGMA Standards, Quality II.
6. Journal bearings shall be of the steel backed babbitt lined type. The thrust bearing shall be tilting pad or rolling element type.
7. Centrifugal compressors shall use variable inlet guide vanes to provide capacity modulation while also providing pre-whirl of the refrigerant vapor entering the impeller for more efficient compression at all loads.
8. Centrifugal compressors shall be provided with a factory-installed lubrication system to deliver oil under pressure to bearings and transmission. Included in the system shall be:
   a. Hermetic driven rotary vane oil pump with factory-installed motor contactor with overload protection.
   b. Refrigerant-cooled oil cooler.
   c. Oil pressure regulator.
   d. Oil filter with isolation valves to allow filter change without removal of refrigerant charge.
   e. Oil sump heater controlled from unit microprocessor.
   f. Oil reservoir temperature sensor with main control center digital readout.
   g. Compressor shall be fully field serviceable.
9. Split ring diffuser shall be designed for operation at normal and high lift conditions.

C. Motor:

1. Compressor motor shall be of the semi-hermetic, liquid refrigerant cooled, squirrel cage, induction type suitable for voltage shown on the equipment schedule.
2. If an open drive motor is provided, a compressor shaft seal leakage containment system shall be provided:
   a. An oil reservoir shall collect oil and refrigerant that leaks past the seal.
   b. A float device shall be provided to open when the reservoir is full, directing the refrigerant/oil mixture back into the compressor housing.
   c. A refrigerant sensor shall be located next to the open drive seal to detect leaks.
3. Motors shall be suitable for operation in a refrigerant atmosphere and shall be cooled by atomized refrigerant in contact with the motor windings.
4. Motor stator shall be arranged for service or removal with only minor compressor disassembly and without removing main refrigerant piping connections.
5. Full load operation of the motor shall not exceed nameplate rating.
6. One motor winding temperature sensor (and one spare) shall be provided.
7. Should the mechanical contractor choose to provide a chiller with an open motor instead of the specified semi-hermetic motor, the contractor shall install additional cooling equipment to dissipate the motor heat as per the following formula:

   Btuh = (FLkW motor) (0.05) (3413)

   Btuh = (FLkW motor) (171)

   and, alternately

   Tons = Btuh / 12,000

   The additional piping, valves, air-handling equipment, insulation, wiring, switchgear changes, ductwork, and coordination with other trades shall be the responsibility of the mechanical contractor. Shop drawings reflecting any changes to the design shall be included in the submittal, and incorporated into the final as-built drawings for the project.
8. Also, if an open motor is provided, a mechanical room thermostat shall be provided and set at 104 F (40 C). If this temperature is exceeded, the chillers shall shut down and an alarm signal shall be generated to the central Energy Management System (EMS) display module prompting the service personnel to diagnose and repair the cause of the over temperature condition. The mechanical contractor shall be responsible for all changes to the design, including coordination with temperature control, electrical and other trades. In addition, the electrical power consumption of any auxiliary ventilation and/or mechanical cooling required to maintain the mechanical room conditions stated above shall be considered in the determination of conformance to the scheduled chiller energy efficiency requirement.

D. Cooler and Condenser:

1. Cooler shall be of shell and tube type construction with single pass. Units shall be fabricated with high-performance tubing, steel shell, and tube sheets with fabricated steel waterboxes.
   a. Waterbox shall be nozzle-in-head waterbox (150 psig).
   b. Waterbox shall have standard nozzle flange compliant with ASME or China GB code.
2. Condenser shall be of shell and tube type construction with single pass. Units shall be fabricated with high-performance tubing, steel shell, and tube sheets with fabricated steel waterboxes.

a. Waterbox shall be nozzle-in-head type waterbox (150 psig).

b. Waterbox shall have standard nozzle flange compliant with ASME or China GB code.

3. Waterboxes shall have vents, drains, and covers to permit tube cleaning within the space shown on the drawings. A thermistor type temperature sensor shall be factory installed in each water nozzle.

4. Tubes shall be individually replaceable from the end of the heat exchanger without affecting the strength and durability of the tube sheet and without causing leakage in adjacent tubes.

5. Tubing shall be copper, high-efficiency type, with integral internal and external enhancement unless otherwise noted. Tubes shall be nominal $^3/_4$-in. OD with nominal wall thickness of 0.025 in. measured where the tubes are in contact with the end tube sheets unless otherwise noted. Tubes shall be rolled into tube sheets and shall be individually replaceable. Tube sheet holes shall be double grooved for joint structural integrity.

6. Cooler shall be designed to prevent liquid refrigerant from entering the compressor. Devices that introduce pressure losses (such as mist eliminators) shall not be acceptable because they are subject to structural failures that can result in extensive compressor damage.

7. The condenser shell shall include a FLASC (flash subcooler) which cools the condensed liquid refrigerant to a reduced temperature, thereby increasing the refrigeration cycle efficiency.

8. A relief valve shall be installed on each heat exchanger.

E. Refrigerant Flow Control:

To improve part load efficiency, liquid refrigerant shall be metered from the condenser to the cooler using a float-type metering valve to maintain the proper liquid level of refrigerant in the heat exchangers under both full and part load operating conditions.

The float valve chamber shall have a bolted access cover to allow field inspection and the float valve shall be field serviceable.

F. Controls, Safeties, and Diagnostics:

1. Controls:

a. The chiller shall be provided with a factory installed and wired microprocessor control center. The control center shall include a 16-line by 40-character liquid crystal display, 4 function keys, stop button, and alarm light. The microprocessor can be configured for either English or SI units. The chiller control shall consist of two individual ICVC (international chiller visual control) devices and is programmed for lead-lag operation.

b. All chiller and starter monitoring shall be displayed at the chiller control panel.

c. The controls shall make use of non-volatile memory.

d. The chiller control system shall have the ability to interface and communicate directly to the building control system.

e. The default standard display screen shall simultaneously indicate the following minimum information:

1) date and time of day
2) 24-character primary system status message
3) 24-character secondary status message
4) chiller operating hours
5) entering chilled water temperature
6) leaving chilled water temperature
7) entering condenser water temperature
8) leaving condenser water temperature
9) oil supply pressure
10) oil sump temperature
11) percent motor rated load amps (RLA)

f. In addition to the default screen, status screens shall be accessible to view the status of every point monitored by the control center including:

1) evaporator pressure
2) condenser pressure
3) bearing oil supply temperature
4) compressor discharge temperature
5) motor winding temperature
6) number of compressor starts
7) control point settings
8) discrete output status of various devices
9) compressor motor starter status
10) optional spare input channels
11) line current and voltage for each phase
12) frequency, kW, kW-hr, demand kW

g. Schedule Function:

The chiller controls shall be configurable for manual or automatic start-up and shutdown. In automatic operation mode, the controls shall be capable of automatically starting and stopping the chiller according to a stored user programmable occupancy schedule. The controls shall include built-in provisions for accepting:

1) A minimum of two 365-day occupancy schedules.
2) Minimum of 8 separate occupied/unoccupied periods per day.
3) Daylight savings start/end.
4) 18 user-defined holidays.
5) Means of configuring an occupancy timed override.
6) Chiller start-up and shutdown via remote contact closure.

h. Service Function:

The controls shall provide a password protected service function which allows authorized individuals to view an alarm history file which shall contain the last 25 alarm/alert messages with time and date stamp. These messages shall be displayed in text form, not codes.

i. Dual Compressor Control:

The control system shall cycle the chillers in a manner to maintain optimal chiller efficiency while properly maintaining the leaving chiller set point. The sequencing of the compressors shall be configurable by the user. The control system shall allow operation of one compressor when the other compressor is powered off for service.

j. Network Window Function:

Each chiller control panel shall be capable of viewing multiple point values and statuses from other like controls connected on a common network, including controller maintenance data. The operator shall be able to alter the remote controller's set points or time schedule and to force point values or statuses for those points that are operator forcible. The control panel shall also have access to the alarm history file of all like controllers connected on the network.

k. Pump Control:

Upon request to start the compressor, the control system shall start the chilled water pump, condenser water pumps and verify that flows have been established.

l. Ramp Loading:

A user-configurable ramp loading rate, effective during the chilled water temperature pulldown period, shall control the rate of guide vane opening to prevent a rapid increase in compressor power consumption. The controls shall allow configuration of the ramp loading rate in either degrees/minute of chilled water temperature pulldown or percent motor amps/minute. During the ramp loading period, a message shall be displayed informing the operator that the chiller is operating in ramp loading mode.

m. Chilled Water Reset:

The control center shall allow reset of the chilled water temperature set point based on any one of the following criteria:

1) Chilled water reset based on an external 4 to 20 mA signal.
2) Chilled water reset based on a remote temperature sensor (such as outdoor air).
3) Chilled water reset based on water temperature rise across the evaporator.

n. Demand Limit:

The control center shall limit amp draw of the compressor to the rated load amps or to a lower value based on one of the following criteria:

1) Demand limit based on a user input ranging from 40% to 100% of compressor rated load amps.
2) Demand limit based on external 4 to 20 mA signal.

o. Controlled Compressor Shutdown:

The controls shall be capable of being configured to soft stop the compressor. When the stop button is pressed or remote contacts open with this feature active, the guide vanes shall close to a configured amperage level and the machine shall then shut down. The display shall indicate "shutdown in progress."

2. Safeties:

a. Unit shall automatically shut down when any of the following conditions occur: (Each of these protective limits shall require manual reset and cause an alarm message to be displayed on the control panel screen, informing the operator of the shutdown cause.)

1) motor overcurrent
2) over voltage*
3) under voltage*
4) single cycle dropout*
5) bearing oil high temperature
6) low evaporator refrigerant temperature
7) high condenser pressure
8) high motor temperature
9) high compressor discharge temperature
10) low oil pressure
11) prolonged surge
12) loss of cooler water flow
13) loss of condenser water flow
14) starter fault

*Shall not require manual reset or cause an alarm if auto-restart after power failure is enabled.

b. The control system shall detect conditions that approach protective limits and take self-corrective action prior to an alarm occurring. The system shall automatically reduce chiller capacity when any of the following parameters are outside their normal operating range:

1) high condenser pressure
2) high motor temperature
3) low evaporator refrigerant temperature
4) high motor amps.

c. During the capacity override period, a pre-alarm (alert) message shall be displayed informing the operator which condition is causing the capacity override. Once the condition is again within acceptable limits, the override condition shall be terminated and the chiller shall revert to normal chilled water control. If during either condition the protective limit is reached, the chiller shall shut down and a message shall be displayed informing the operator which condition caused the shutdown and alarm.

d. Internal built-in safeties shall protect the chiller from loss of water flow. Differential pressure switches shall not be allowed to be the only form of freeze protection.

3. Diagnostics and Service:

A self diagnostic controls test shall be an integral part of the control system to allow quick identification of malfunctioning components.

Once the controls test has been initiated, all pressure and temperature sensors shall be checked to ensure they are within normal operating range. A guide vane actuator test shall open and close the guide vanes to check for proper operation. The operator manually acknowledges proper guide vane operation prior to proceeding to the next test.

In addition to the automated controls test, the controls shall provide a manual test which permits selection and testing of individual control components and inputs. A thermistor test and transducer test shall display on the control screen the actual reading of each transducer and each thermistor installed on the chiller. All out-of-range sensors shall be identified.

G. Electrical Requirements:

1. Electrical contractor shall supply and install main electrical power line, disconnect switches, circuit breakers, and electrical protection devices per local code requirements and as indicated necessary by the chiller manufacturer.
2. Electrical contractor shall wire local electrical power line to the starter and the starter power circuit to the chiller compressor motor.
3. Electrical contractor shall wire the starter control circuit and chiller power panel control circuit to the chiller control circuit.
4. Electrical contractor shall wire the chilled water pump, condenser water pump, and tower fan control circuit to the chiller control circuit.
5. Electrical contractor shall supply and install electrical wiring and devices required to interface the chiller controls with the building control system if applicable.
6. Electrical power shall be supplied to the unit at the voltage, phase, and frequency listed in the equipment schedule.

H. Piping Requirements — Instrumentation and Safeties:

Mechanical contractor shall supply and install pressure gages in readily accessible locations in piping adjacent to the chiller such that they can be easily read from a standing position on the floor. Scale range shall be such that design values shall be indicated at approximately mid-scale.

Gages shall be installed in the entering and leaving water lines of the cooler and condenser.

I. Vibration Isolation:

Chiller manufacturer shall furnish neoprene isolator pads for mounting equipment on a level concrete surface.

Chiller manufacturer shall also furnish a soleplate package consisting of soleplates, jacking screws, leveling pads, and neoprene pads.

J. Start-up:

1. The chiller manufacturer shall provide a factory-trained representative, employed by the chiller manufacturer, to perform the start-up procedures as outlined in the Start-up, Operation and Maintenance manual provided by the chiller manufacturer.
2. Manufacturer shall supply the following literature:
   a. Start-up, operation and maintenance instructions.
   b. Installation instructions.
   c. Field wiring diagrams.
   d. One complete set of certified drawings.

K. Special Features:

1. Cooler and Condenser Tubes:

Contact local Carrier representative for other tube offerings.

2. Nozzle-In-Head, 300 psig (2068 kPa):

Unit manufacturer shall furnish nozzle-in-head style waterboxes on the cooler and/or condenser rated at 300 psig (2068 kPa).

3. Marine Waterboxes, 150 psig (1034 kPa):

Unit manufacturer shall furnish marine style waterboxes on cooler and/or condenser rated at 150 psig (1034 kPa).

4. Marine Waterboxes, 300 psig (2068 kPa):

Unit manufacturer shall furnish marine style waterboxes on cooler and/or condenser rated at 300 psig (2068 kPa).

5. Optional Compressor Discharge Isolation Valve and Liquid Line Ball Valve:

These items shall be factory installed to allow isolation of the refrigerant charge in the condenser for servicing the compressor.

6. Free-Standing Starters:

Starters shall be provided as an option, pre-engineered from the supplier. Dual compressor chiller starters shall have single main power connection with an option for single point

power for all low voltage components. The design of the starter shall allow redundant operation of one circuit when the other is electrically disconnected. Configurations shall include direct on line, solid state and primary reactor.