

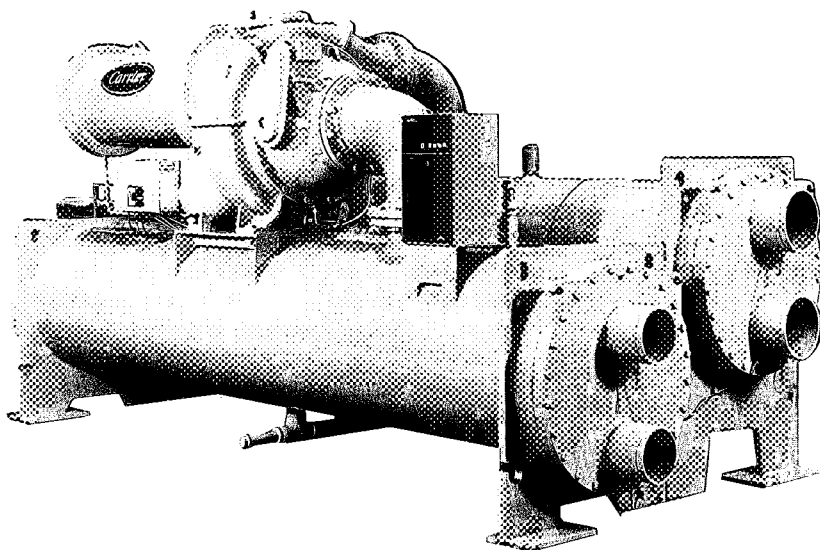


Product Data

19XR,XRT High-Efficiency Hermetic Centrifugal Liquid Chiller 50/60 Hz HFC-134a

19XR — 350 to 800 Nominal Tons (1230 to 2813 kW)
19XRT — 350 to 525 Nominal Tons (1230 to 1845 kW)

Evergreen™ CHILLERS



19XR

Carrier's Evergreen™ chillers offer the best value in high-efficiency chlorine-free centrifugal chillers.

Today's customers demand high-efficiency products with exceptional value. Carrier's Evergreen centrifugal chillers provide this value by achieving energy efficiency levels approaching 0.50 kW/ton (0.142 kW/kW) utilizing proven technology designed specifically for chlorine-free refrigerant. This combination ensures the most cost-effective, reliable solution for today's comfort cooling and process cooling applications. These high efficiencies can be achieved through the use of our optional patented turbine technology.

In a technological breakthrough that represents the only major change to the basic vapor compression refrigeration cycle since 1922, Carrier has significantly reduced the power consumption of HFC-134a positive-pressure chillers. The result is ultra-high energy efficiencies, giving the Evergreen chillers the highest efficiency of any chlorine-free chiller in the world.

Features/Benefits

The Evergreen chillers feature:

High energy efficiency — Innovative product designs, utilizing proven technology, result in high energy efficiency levels — approaching 0.50 kW/ton (0.142 kW/kW) for the 19XRT

Environmentally-preferred HFC-134a refrigerant — The Evergreen chillers use chlorine-free HFC-134a refrigerant with zero ozone-depletion potential. As the refrigerant

of choice for automotive and appliance manufacturers, HFC-134a production continues to rise, assuring a plentiful supply of refrigerant at reasonable prices in the years to come.

Positive pressure design — The Evergreen™ chiller's positive pressure design reduces the chiller size by up to 35% 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 system first cost

Mix-match capability — The chillers provide a complete line of compressors and heat exchangers, ensuring the optimal combination of machine components regardless of tonnage, lift, and efficiency specifications.

Modular construction — The cooler, condenser, and compressor assemblies are completely bolted together, making the Evergreen chillers ideally suited for replacement projects where ease of disassembly and reassembly at the jobsite are essential.

Marine container shipment (19XR only) — The compact design allows for open-top container shipment to export destinations, ensuring product quality while reducing shipping cost.

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. As a self-contained unit, the Evergreen chillers can be applied to applications that incorporate more than one type of refrigerant without the costly penalty of requiring additional remote storage systems.

Optional pumpdown unit — Combined with the refrigerant isolation valves listed above, the optional pumpdown unit eliminates complex connections to portable transfer systems, thereby reducing service costs. In addition, the optional pumpdown compressor meets EPA's vacuum level requirements that mandate minimizing refrigerant emissions during service.

Optional unit mounted starter — Available in low-voltage wye-delta and solid state, Carrier's unit mounted

starter provides a single point power connection, reducing machine installation time and expense

Hermetic compressor features:

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

Variable inlet guide vanes — The guide vanes are connected with aircraft-quality cable and controlled by a precise electronic actuator. Chilled water temperature is maintained within $\pm 5\text{ F}$ (3 C) of the desired set point without surge, cavitation, or undue vibration. The vanes regulate inlet flow to provide high efficiency through a wide, stable operating range without hot gas bypass.

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

Patented turbine technology — The 19XRT utilizes the pressure differential between the condenser and cooler to supplement motor power. This design recovers energy typically lost during the vapor compression cycle, significantly reducing power consumption. The turbine adds only one moving part to the proven 19XR compressor design, ensuring exceptional product reliability.

Stationary tunnel diffuser — The stationary diffuser requires

no moving or wearing parts, which increases product reliability. The tunnel design utilizes jet engine technology, increasing centrifugal compressor peak efficiency.

DynaGlide™ transmission — Consisting of steel-backed babbitt-lined sleeve bearings, Kingsbury type self-leveling tilting-pad thrust bearing, and single helical gear, this transmission ensures smooth, reliable operation over the life of the machine.

Electrically-driven oil pump — The pump provides the required supply of oil to the DynaGlide transmission during start-up, operation, and coast down. The pump is supplied by a separate power line, ensuring an adequate oil supply in the event of compressor power interruptions.

Microprocessor-controlled oil heater — The heater prevents excessive absorption of refrigerant into the oil during compressor shutdown, ensuring a plentiful supply of undiluted lubrication oil in the oil sump.

Refrigerant-cooled oil cooler — Refrigerant cooling eliminates field water piping, reducing installation expense.

Hermetic motors — The 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. Thus, hermetic motors require less inrush current and are smaller and

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Features/Benefits (cont)



lighter than comparable air-cooled motors.

In addition, Carrier's hermetic 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

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

Heat exchangers feature:

ASME certified construction — This standard requires the use of an independent agency to certify the design, qualification and testing of all heat exchangers, ensuring the ultimate in heat exchanger safety, reliability, and long life.

High performance tubing — Tubing with internally and externally enhanced fins improves machine performance by reducing the overall resistance to heat transfer.

Cooler tube expansion — Cooler tube expansion at intermediate support sheets prevents unwanted tube movement and vibration, thereby reducing the possibility of premature tube failure.

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

Condenser baffle — The 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 — Support sheets

prevent tube sagging and vibration, thereby increasing heat exchanger life

Refrigerant filter isolation valves

— These valves allow filter replacement without pumping down the chiller, which means less service time and less expense.

FLASC (Flash subcooler) — The subcooler, located in the bottom of the condenser, increases the refrigeration effect by cooling the condensed liquid refrigerant to a lower temperature; the result is reduced compressor power consumption.

AccuMeter™ (19XR only) — The AccuMeter system regulates refrigerant flow according to load conditions, providing a liquid seal at all operating conditions and eliminating unintentional hot gas bypass.

Microprocessor controls feature:

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

Local Interface Device (LID) — The LID, which can be configured to display units in English or metric, provides unparalleled ease of operation.

A 16-line by 40-character LCD (liquid crystal display) features 4 menu-specific soft keys. Default display offers all in one glance review of key chiller operation data, simplifying the interaction between machine and user.

Control options module — The module offers unique control expandability by allowing additional sensors to be connected to the PIC. This module also allows chilled water reset and demand limit set points to be controlled from a remote source.

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

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

Demand limiting — This 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 will hold chillers at their present capacity and prevent 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 — 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 — The test can be executed prior to start-up to verify that the entire control system is functioning properly.

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

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

Extensive service menu — Unauthorized access to the service menu can be password-protected. Built-in diagnostic capabilities assist in troubleshooting and recommend proper corrective action for pre-set alarms, resulting in greater up time.

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

Battery backup — Battery backup provides protection during power failures and eliminates time consuming control reconfiguration.

Encapsulated circuit boards are designed, built and tested in-house. Each board meets Carrier's stringent quality standards for superior reliability compared to open board designs.

Other control 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

Model number nomenclature



19XR 52 51 473 CQ H 62 -

Description

19XR — High Efficiency Hermetic Centrifugal Liquid Chiller

19XRT — Ultra High Efficiency Hermetic Centrifugal Liquid Chiller

Special Order Indicator

- — Standard
S — Special Order

Cooler Size

30-32 (Frame 3 XR)
35-37 (Frame 3 XR)
40-42 (Frame 4 XR)
45-47 (Frame 4 XR)
50-52 (Frame 5 XR)
55-57 (Frame 5 XR)
60-62 (Frame 6 XR)
65-67 (Frame 6 XR)
60-63 (Frame 6 XRT)

Motor Voltage Code

Code Volts-Phase-Hertz

60 — 200-3-60
61 — 230-3-60
62 — 380-3-60
63 — 416-3-60
64 — 460-3-60
65 — 575-3-60
66 — 2400-3-60
67 — 3300-3-60
68 — 4160-3-60
69 — 6900-3-60
50 — 230-3-50
51 — 346-3-50
52 — 400-3-50
53 — 3000-3-50
54 — 3300-3-50
55 — 6300-3-50

Condenser Size

30-32 (Frame 3 XR)
35-37 (Frame 3 XR)
40-42 (Frame 4 XR)
45-47 (Frame 4 XR)
50-52 (Frame 5 XR)
55-57 (Frame 5 XR)
60-62 (Frame 6 XR)
65-67 (Frame 6 XR)
60-63 (Frame 6 XRT)

Motor Efficiency Code

H — High Efficiency
S — Standard Efficiency*

Motor Code

CD DB
CE DC
CL DD
CM DE
CN DF
CP DG
CQ DH
DJ

Compressor Code

*Available for 19XR only



ASME
'U' Stamp



Carrier Corporation, TR-1 Plant
Registered to ISO 9001
Certificate No. A1028



ARI (Air Conditioning
and Refrigeration
Institute)
Performance Certified



Features/Benefits (cont)



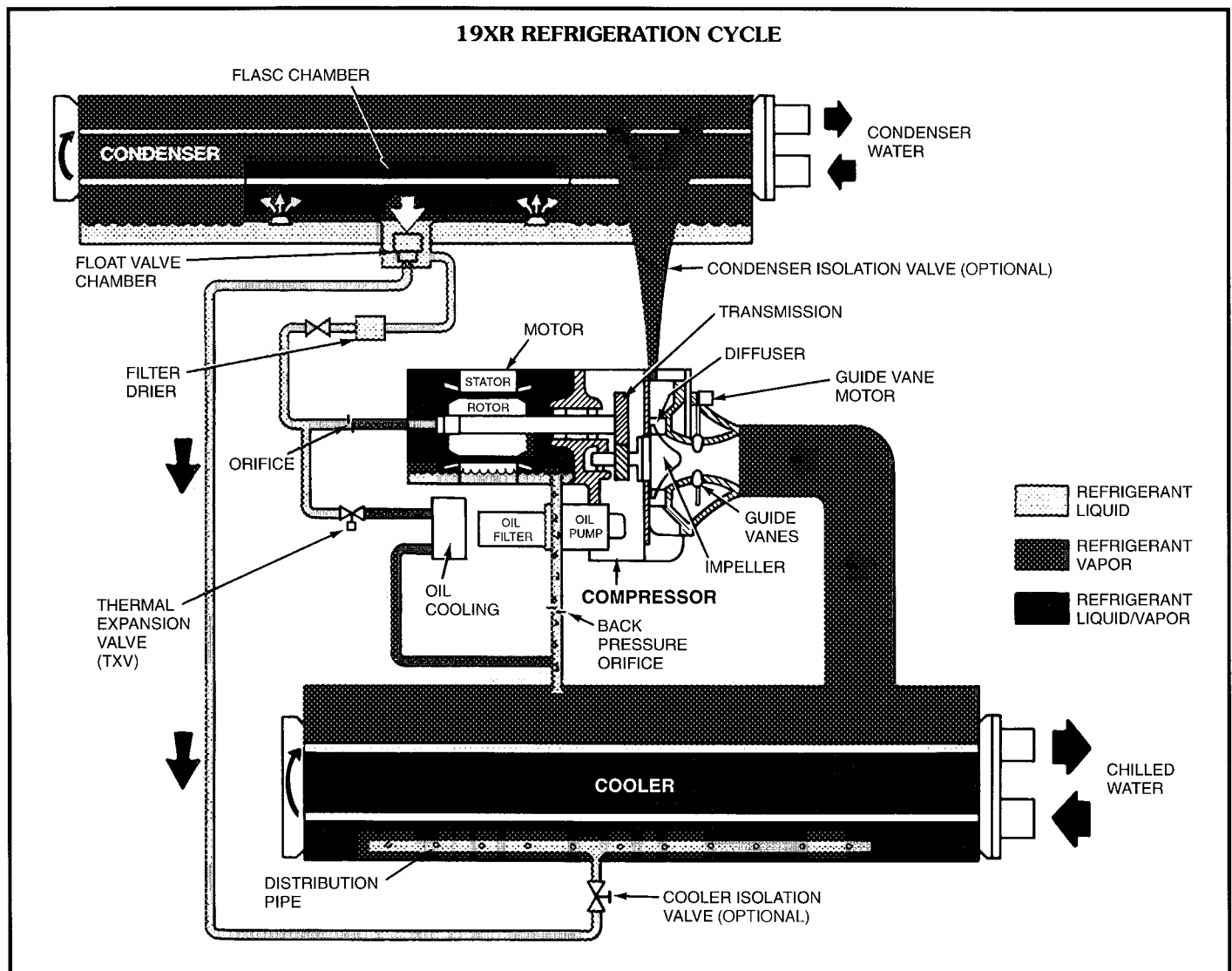
19XR Refrigeration Cycle

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 for 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 compressor into condenser.

Relatively cool (typically 65 to 90 F [18 to 32 C]) water flowing into the condenser tubes removes heat from the refrigerant and the vapor condenses to liquid.

The liquid refrigerant passes through orifices into the FLASC (Flash Subcooler) chamber. Since the FLASC chamber is at a lower pressure, part of the liquid refrigerant flashes to vapor, thereby cooling the remaining liquid. 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. Here a 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.



Features/Benefits (cont)



19XRT Refrigeration Cycle

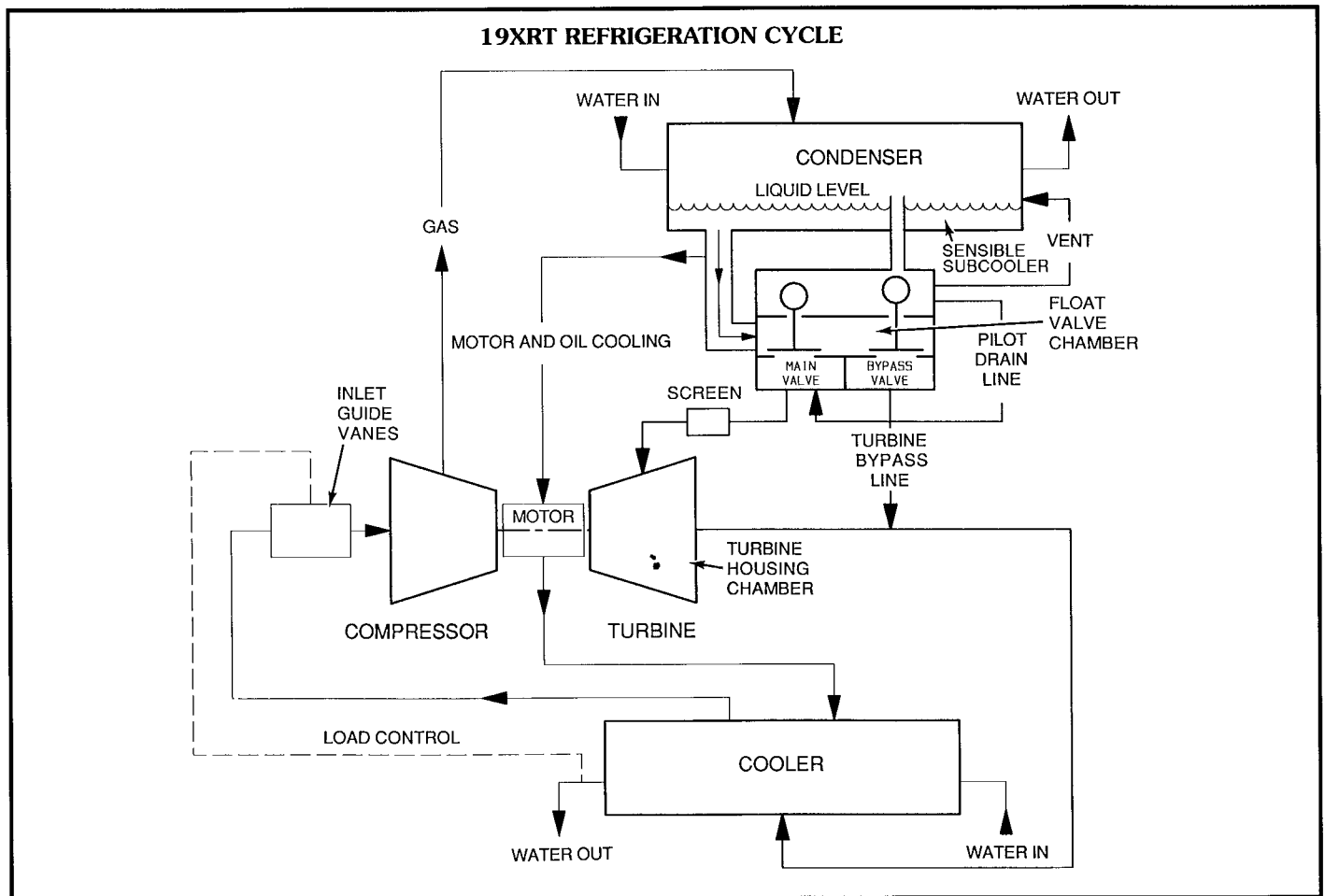
The compressor continuously draws refrigerant vapor from the cooler at a rate determined by the amount of guide vane opening. As the compressor suction reduces the pressure in the cooler, the remaining refrigerant boils at a low temperature (typically 38 to 42 F [3 to 6 C]). The energy required for boiling is obtained from the water flowing through the cooler tubes. When the heat energy is removed, the water becomes cold enough for use in an air conditioning chilled water loop or process liquid cooling system.

After taking heat from the water, the refrigerant vapor is compressed. Compression adds still more heat energy and the refrigerant is very warm (typically 130 to 160 F [54 to 71 C]) when it is discharged from the compressor into the condenser.

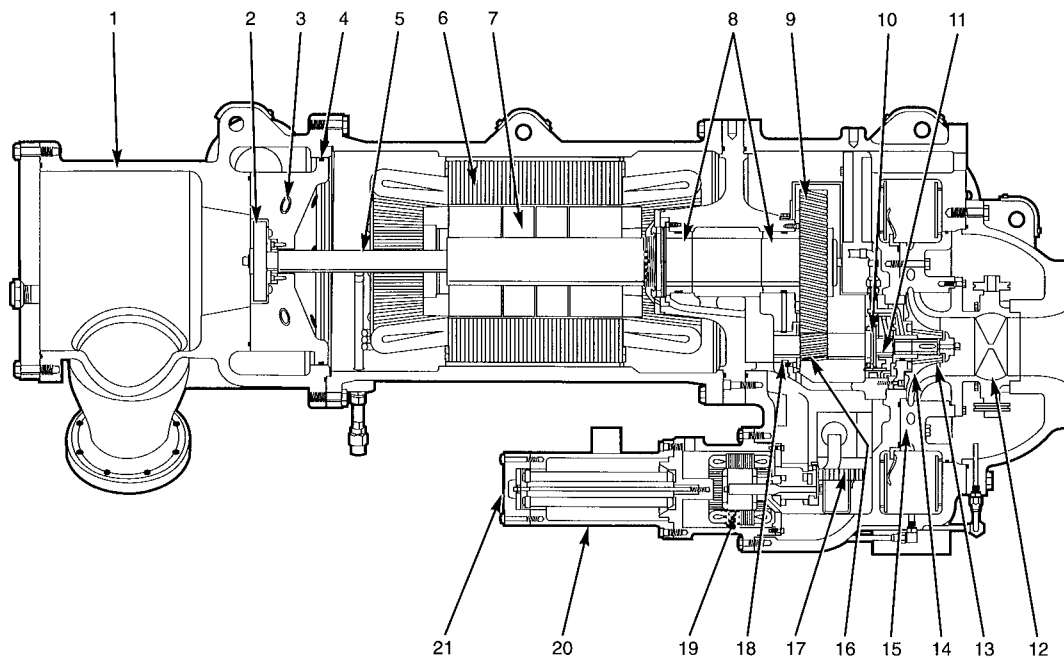
Relatively cool (typically 65 to 90 F [18 to 32 C]) water flowing through the condenser tubes removes heat from the refrigerant and the vapor condenses to a liquid. Further removal of heat from the refrigerant occurs in the lower chamber of the condenser, which is called the sensible subcooler. At this point, the liquid refrigerant is subcooled

by contact with the coolest (entering water) condenser tubes.

After leaving the sensible subcooler section of the condenser, the liquid refrigerant enters the float valve chamber. The main float valve maintains a liquid level in the subcooler to prevent hot gas bypass from the condenser to the cooler at part load conditions. A second valve in the float valve chamber opens at part load conditions when the liquid level increases in the condenser to bypass liquid from the float chamber directly to the cooler inlet. The liquid refrigerant then flows into the turbine housing chamber on the compressor. The liquid refrigerant passes through the turbine nozzles and impacts the turbine blades where energy is reclaimed as the refrigerant expands through the turbine to the lower cooler pressure. The turbine wheel is attached to the motor shaft which allows the turbine to supplement and reduce motor power requirements. At this point the refrigerant flashes to a mixture of gas and liquid which removes heat from the remaining liquid. This mixture flows back to the cooler where it is now at the same temperature and pressure at which the cycle began.



COMPRESSOR COMPONENTS*



LEGEND

- | | | |
|---------------------------|---------------------------------------|---------------------------------------|
| 1 — Turbine Housing | 8 — Motor Shaft Journal Bearings | 15 — Pipe Diffuser |
| 2 — Turbine Wheel | 9 — Low Speed Bull Gear | 16 — High Speed Pinion Gear |
| 3 — Turbine Nozzles | 10 — High Speed Shaft Thrust Bearing | 17 — Oil Heater |
| 4 — Turbine Nozzle Block | 11 — High Speed Shaft Journal Bearing | 18 — High Speed Shaft Journal Bearing |
| 5 — Motor Shaft Extension | 12 — Variable Inlet Guide Vanes | 19 — Oil Pump Motor |
| 6 — Motor Stator | 13 — Impeller Shroud | 20 — Oil Filter |
| 7 — Motor Rotor | 14 — Impeller | 21 — Oil Filter Cover |

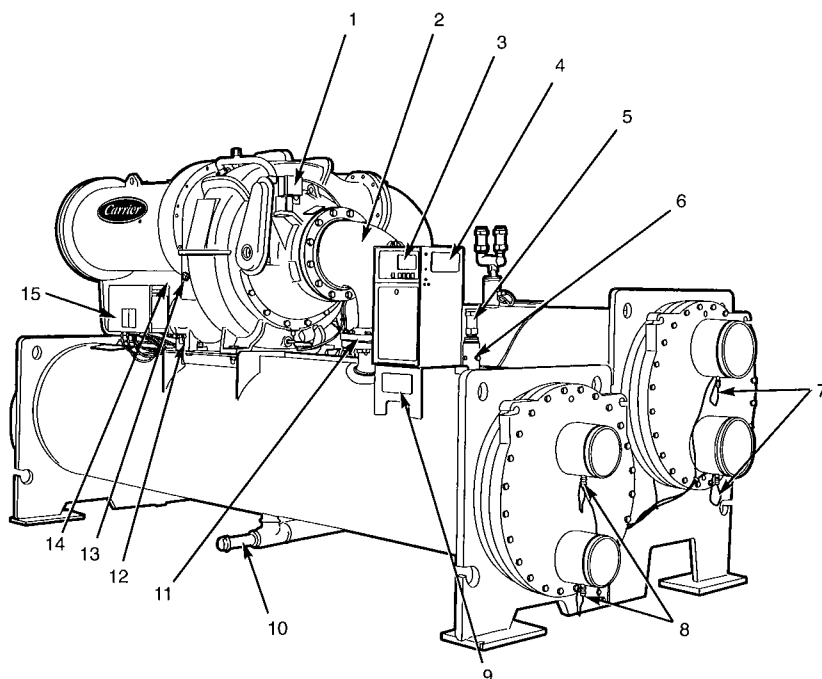
*Items 1 to 5 apply to 19XRT only

Machine component (cont)

19XR



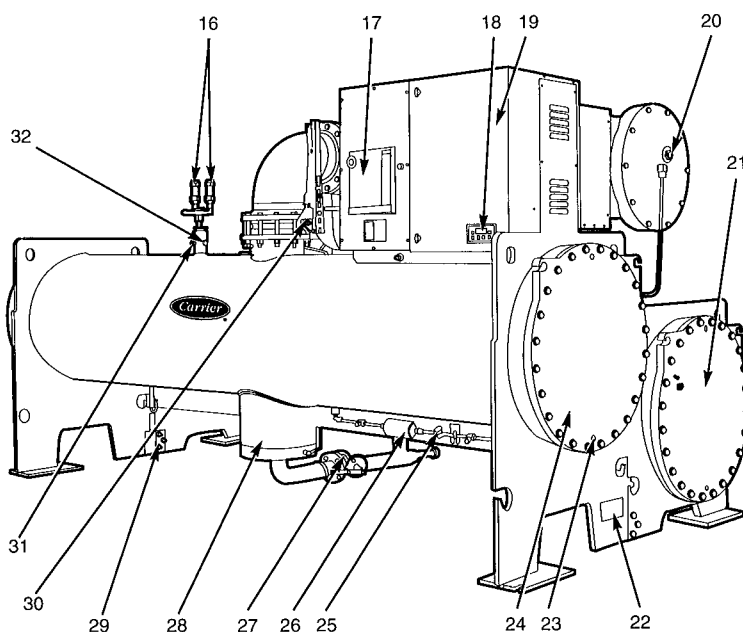
FRONT VIEW



LEGEND

- 1 — Guide Vane Actuator
- 2 — Suction Elbow
- 3 — Local Interface Display Control Panel
- 4 — Machine Identification Nameplate
- 5 — Cooler, Auto Reset Relief Valve
- 6 — Cooler Pressure Transducer
- 7 — Condenser In/Out Temperature Thermistors
- 8 — Cooler In/Out Temperature Thermistors
- 9 — ASME (American Society of Mechanical Engineers) Nameplate, Cooler
- 10 — Refrigerant Charging Valve
- 11 — Typical Flange Connection
- 12 — Oil Drain Valve
- 13 — Oil Level Sight Glasses
- 14 — Refrigerant Oil Cooler (Hidden)
- 15 — Auxiliary Power Panel

REAR VIEW

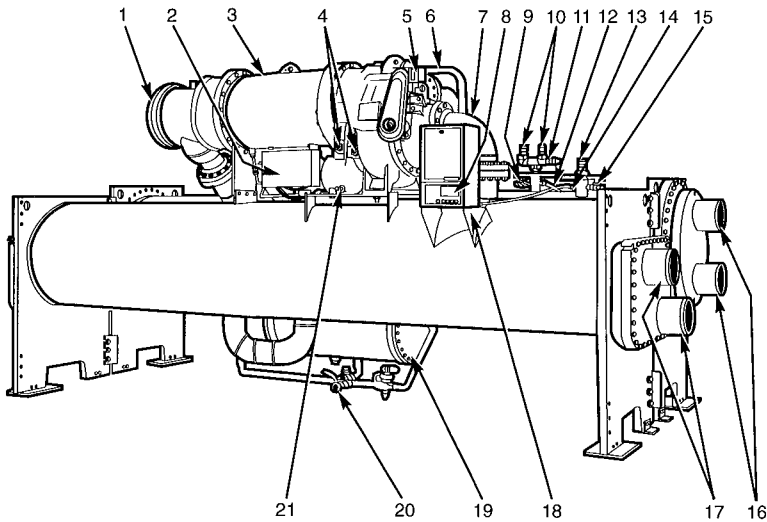


LEGEND

- 16 — Condenser Auto Reset Relief Valves
- 17 — Motor Circuit Breaker
- 18 — Solid-State Starter Control Display
- 19 — Unit-Mounted Starter (Optional), Solid-State Starter Shown
- 20 — Motor Sight Glass
- 21 — Cooler Return-End Waterbox Cover
- 22 — ASME Nameplate, Condenser
- 23 — Typical Waterbox Drain Port
- 24 — Condenser Return-End Waterbox Cover
- 25 — Refrigerant Moisture/Flow Indicator
- 26 — Refrigerant Filter/Drier
- 27 — Liquid Line Isolation Valve (Optional)
- 28 — Linear Float Valve Chamber
- 29 — Vessel Take-Apart Connector
- 30 — Discharge Isolation Valve (Optional)
- 31 — Pumpout Valve
- 32 — Condenser Pressure Transducer

19XRT

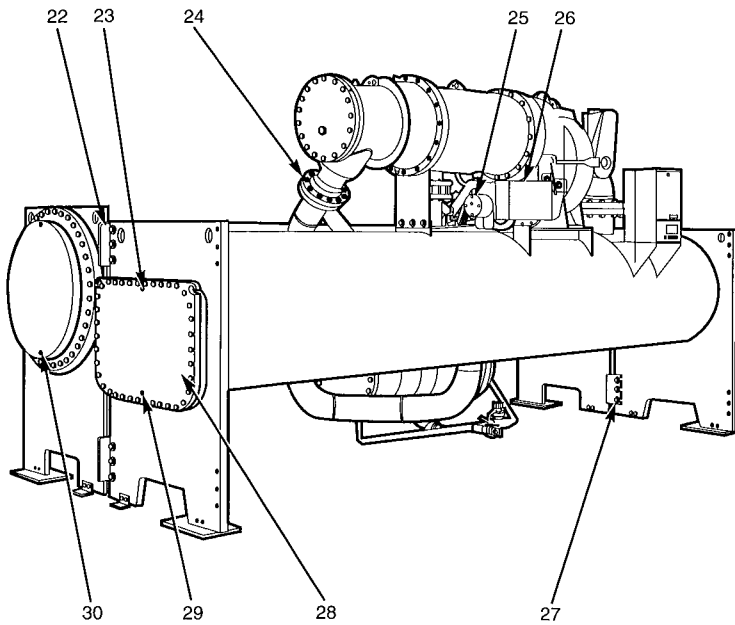
RIGHT END VIEW



LEGEND

- 1 — Turbine Housing
- 2 — Power Panel
- 3 — Motor Housing
- 4 — Oil Level Sight Glasses
- 5 — Guide Vane Actuator
- 6 — Demistor Vent Line
- 7 — Suction Elbow
- 8 — Local Interface Display Control Panel
- 9 — Pumpdown Valve
- 10 — Condenser Relief Valves
- 11 — Relief Transfer Valve
- 12 — Condenser Pressure Transducer
- 13 — Cooler Relief Valve
- 14 — Cooler Pressure Transducer
- 15 — Pumpdown Valve
- 16 — Condenser In/Out Temperature Thermistors
- 17 — Cooler In/Out Temperature Thermistors
- 18 — Machine Identification Nameplate Location
- 19 — Float Chamber
- 20 — Refrigerant Charging Valve
- 21 — Oil Drain Valve

LEFT END VIEW



LEGEND

- 22 — Take-Apart, Connector (Upper)
- 23 — Waterbox Vent Connection (Typical)
- 24 — Cooler Liquid Return Line
- 25 — Oil Filter Access Cover
- 26 — Refrigerant Oil Cooler
- 27 — Take-Apart, Rabbit-Fit Connector (Lower)
- 28 — Cooler Return-End Waterbox Cover
- 29 — Waterbox Drain Port (Typical)
- 30 — Condenser Return-End Waterbox Cover

Options and accessories



ITEM	OPTION*	ACCESSORY†
Shipped Factory Charged with Refrigerant	X	
One, 2, or 3 Pass Cooler or Condenser Waterside Construction	X	
Hot Gas Bypass	X	
Full 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), ASME Certified ††	X	
Cupronickel Marine Waterbox for Condenser, 300 psig (2068 kPa), ASME Certified, with Cupronickel Tube Sheets, Division Plate, and Nozzles and Zinc Anodes and Monel Couplings††	X	
Stainless Steel Marine Waterbox for Condenser, 300 psig (2068 kPa), ASME Certified with Stainless Steel Tube Sheets and Nozzles and Zinc Anodes and Monel Couplings††	X	
Flanged Cooler and/or Condenser Waterbox Nozzles‡	X	
.028 or .035 in. (0.711 or 0.889 mm) Internally/Externally Enhanced Copper Tubing — Cooler/Condenser	X	
.028 or .035 in. (0.711 or 0.889 mm) Smooth Bore/Externally Enhanced Copper Tubing — Cooler/Condenser	X	
.028 or .035 in. (0.711 or 0.889 mm) Smooth Bore/Externally Enhanced Cupronickel Tubing — Condenser	X	
.028 or .035 in. (0.711 or 0.889 mm) Internally/Externally Enhanced Cupronickel Tubing — Condenser	X	
.025 or .028 in. (0.635 or 0.711 mm) Wall Tubes, Titanium, Internally Enhanced, Condenser	X	
.023 or .028 in. (0.584 or 0.711 mm) Wall Tubes, Titanium, Smooth Bore, Condenser	X	
NEMA 12 Machine Including NEMA 12 Control¶	X	
Unit Mounted Low-Voltage Wye-Delta or Solid-State Starters	X	
Export Crating	X	
Customer Factory Performance Testing	X	
Extended Warranty (NAO only)	X	
Service Contract	X	
Control Options Module	X	
Control Options Module Upgrade Kit		X
Refrigerant Isolation Valves	X	
Unit Mounted Pumpout Unit	X	
Stand Alone Pumpout Unit		X
Separate Storage Tank and Pumpout Unit		X
Soleplate Package		X
Sensor Package		X
Differential Pressure Flow Switches — 150 and 300 psig		X
Discharge Line Sound Reduction Kit		X
Acoustical Sound Insulation Kit		X
Spring Isolator Kit		X

*Factory Installed

†Field Installed

**19XRT only

††Optional marine waterboxes available for 19XR only. Standard waterboxes for both 19XR and 19XRT are nozzle-in-head type, 150 psig (1034 kPa)

‡Standard waterbox nozzles are victaulic type. Flanged nozzles are available as an option with either nozzle-in-head type waterboxes or marine waterboxes
¶Available for 19XR only

STARTER FEATURES AND OPTIONS

ITEM	WYE-DELTA	SOLID STATE
NEMA 1 Enclosure with Integral Fan Cooling and Lockable Hinged Doors	S	S
Carrier Starter Management Module and 5 Pilot Relays	S	S
Branch Oil Pump Circuit Breaker	S	S
2 kVA Controls/Oil Heater Transformer with Branch Circuit Breaker	S	S
Microprocessor Based Overload Trip Protection	S*	S
Main Power Disconnect (Non-Fused Type) with Shunt Trip	S	N/A
Normal Interrupt Capacity Main Circuit Breaker with Shunt Trip	O	S
High Interrupt Capacity Main Circuit Breaker with Shunt Trip	O	O
Phase Loss/Reversal Imbalance Protection	S*	S
Ground Fault Protection	S*	S
Integral SCR Bypass Contactor	N/A	S
Three Phase Digital Ammeter	S*	S
Three Phase Analog Ammeter with Switch	O	O
Three Phase Digital Voltmeter	O†	S
Three Phase Analog Voltmeter with Switch	O	O
Three Phase Over/Under Voltage Protection	O†	S
Power Factor Digital Meter	O†	S
Frequency Digital Meter	O†	S
Digital Watt Meter	O†	N/A
Digital Watt Hour Meter	O†	N/A
Digital Power Factor Meter	O†	N/A
Digital Watt Demand Meter	O†	N/A
Digital Var Meter	O†	N/A
IQ Data Plus II	O†	N/A
Lightning Arrestor and Surge Capacitor Package	O	O
Kilowatt Transducer with 4 to 20 mA Output	O	O
Power Factor Correction Capacitors	O	O

LEGEND

N/A — Not Applicable
NEMA — National Electrical Manufacturers Association
S — Standard Feature
SCR — Silicon Control Rectifier
O — Optional

*Included in the Standard IQ 1000 II Motor Protection system

†Requires IQ Data Plus II

Physical data



COMPRESSOR/MOTOR WEIGHTS* — STANDARD EFFICIENCY AND HIGH EFFICIENCY MOTORS 19XR LOW AND MEDIUM VOLTAGE MOTORS†

MOTOR SIZE	ENGLISH						SI					
	Compressor Weight (lb)	Stator Weight** (lb)		Rotor Weight (lb)		End Bell Cover (lb)	Compressor Weight (kg)	Stator Weight (kg)		Rotor Weight (kg)		End Bell Cover (kg)
		60 Hz	50 Hz	60 Hz	50 Hz			60 Hz	50 Hz	60 Hz	50 Hz	
CD	2700	1286	1358	299	314	273	1224	583	616	136	142	124
CE	2700	1305	1377	306	320	273	1224	592	624	139	145	124
CL	2700	1324	1435	312	333	273	1224	600	651	141	151	124
CM	2700	1347	1455	316	339	273	1224	611	660	143	154	124
CN	2700	1358	1467	319	342	273	1224	616	665	145	155	124
CP	2700	1401	1479	331	345	273	1224	635	671	150	156	124
CQ	2700	1455	1479	345	345	273	1224	660	671	156	156	124

*Total compressor/motor weight is the sum of the compressor, suction and discharge elbow, stator, rotor, and end bell weights. Suction and discharge elbow weights are shown in component weights table, page 12.

†For high voltage motors, add the following: 300 lb (136 kg) to stator, 150 lb (68 kg) to rotor, and 40 lb (18 kg) to end bell.

**Stator weight includes stator and shell.

19XR LOW AND MEDIUM VOLTAGE MOTORS† (cont)

MOTOR SIZE	ENGLISH						SI					
	Compressor Weight (lb)	Stator Weight** (lb)		Rotor Weight (lb)		End Bell Cover (lb)	Compressor Weight (kg)	Stator Weight (kg)		Rotor Weight (kg)		End Bell Cover (kg)
		60 Hz	50 Hz	60 Hz	50 Hz			60 Hz	50 Hz	60 Hz	50 Hz	
DB	3750	1665	1681	361	391	167	1701	755	762	164	177	76
DC	3750	1681	1734	371	404	167	1701	762	786	168	183	76
DD	3750	1729	1765	401	411	167	1701	784	800	182	186	76
DE	3750	1734	1835	404	430	167	1701	786	832	183	195	76
DF	3750	1765	1882	423	444	167	1701	800	854	192	201	76
DG	3750	1835	1923	443	457	167	1701	832	872	201	207	76
DH	3750	1882	2207	444	575	167	1701	854	1001	201	261	76
DJ	3750	1923	2305	457	587	167	1701	872	1045	207	266	76

*Total compressor/motor weight is the sum of the compressor, suction and discharge elbow, stator, rotor, and end bell weights. Suction and discharge elbow weights are shown in component weights table, page 12.

†For high voltage motors, add the following: 300 lb (136 kg) to stator, 150 lb (68 kg) to rotor, and 40 lb (18 kg) to end bell.

**Stator weight includes stator and shell.

19XRT LOW AND MEDIUM VOLTAGE MOTORS†

MOTOR SIZE	ENGLISH						SI					
	Compressor Weight†† (lb)	Stator Weight** (lb)		Rotor Weight (lb)			Compressor Weight (kg)	Stator Weight (kg)		Rotor Weight (kg)		
		60 Hz	50 Hz	60 Hz	50 Hz			60 Hz	50 Hz	60 Hz	50 Hz	
CD	3850	1402	1477	331	355		1746	636	670	150	161	
CE	3850	1427	1502	334	363		1746	647	681	151	165	
CL	3850	1452	1552	347	379		1746	659	704	157	172	
CM	3850	1465	1577	351	387		1746	664	715	159	176	
CN	3850	1477	1584	355	391		1746	670	718	161	177	
CP	3850	1527	1602	371	395		1746	693	727	168	179	
CQ	3850	1577	1602	387	395		1746	715	727	176	179	

*Total compressor/motor weight is the sum of the compressor, suction and discharge elbow, stator, rotor, and end bell weights. Suction and discharge elbow weights are shown in component weights table, page 12.

†For high voltage motors, add the following: 300 lb (136 kg) to stator, 150 lb (68 kg) to rotor, and 40 lb (18 kg) to end bell.

**Stator weight includes stator and shell.

††Compressor weight includes turbine housing.

Physical data (cont)



COMPONENT WEIGHTS

COMPONENT	FRAME 3 COMPRESSOR*		FRAME 4 COMPRESSOR*	
	lb	kg	lb	kg
Suction Elbow	54	24	175	79
Discharge Elbow	46	21	157	71
Control Cabinet†	30	14	30	14
Optional Unit-Mounted Starter**	800	227	800	227
Optional Isolation Valves	115	52	115	52

*To determine compressor frame size, refer to 19XR/XRT Computer Selection Program

†Included in total cooler weight

**Weight of optional factory-mounted starter is not included and must be added to heat exchanger weight

19XR HEAT EXCHANGER WEIGHTS

CODE	ENGLISH						SI					
	Dry (Rigging) Weight (lb)*		Machine Charge				Dry (Rigging) Weight (kg)*		Machine Charge			
	Cooler Only	Condenser Only	Refrigerant Weight		Water Weight (lb)		Cooler Only	Condenser Only	Refrigerant Weight		Water Weight (kg)	
			Cooler	Condenser	Cooler	Condenser			Cooler	Condenser	Cooler	Condenser
30	3587	4204	350	280	464	464	1627	1907	159	127	210	210
31	3769	4409	420	280	531	543	1709	2000	190	127	241	246
32	3952	4610	490	280	598	621	1792	2091	222	127	271	282
35	3899	4591	400	330	511	513	1768	2082	181	150	232	233
36	4107	4825	480	330	587	603	1863	2188	218	150	266	273
37	4314	5054	550	330	663	692	1956	2292	249	150	301	314
40	5898	6071	560	280	746	804	2675	2753	254	127	338	365
41	6080	6268	630	280	812	881	2757	2843	286	127	368	400
42	6244	6461	690	280	873	955	2832	2930	313	127	396	433
45	6353	6636	640	330	821	888	2881	3010	290	150	372	403
46	6561	6861	720	330	897	975	2976	3112	327	150	407	442
47	6748	7080	790	330	966	1060	3060	3211	358	150	438	481
50	7015	7293	750	400	960	1066	3181	3307	340	181	435	483
51	7262	7490	840	400	1051	1142	3293	3397	381	181	477	518
52	7417	7683	900	400	1108	1217	3364	3484	408	181	502	552
55	7559	7990	850	490	1061	1181	3428	3624	385	222	481	536
56	7839	8214	960	490	1163	1267	3555	3725	435	222	527	575
57	8016	8434	1020	490	1228	1352	3635	3825	463	222	557	613
60	8270	8286	960	420	1205	1325	3751	3758	435	190	546	601
61	8462	8483	1040	420	1275	1402	3838	3847	472	190	578	636
62	8617	8676	1090	420	1332	1476	3908	3935	494	190	604	669
65	8943	9204	1100	510	1335	1472	4056	4174	499	231	605	668
66	9161	9428	1180	510	1414	1558	4155	4276	535	231	641	707
67	9338	9648	1250	510	1479	1643	4235	4376	567	231	671	745

*Rigging weights are for standard tubes of standard wall thickness (Turbo-B3 and Spikefin 2, 0.025-in [0.635 mm] wall)

NOTES:

- 1 Cooler includes the control panel (LID), suction elbow, and ½ the distribution piping weight
- 2 Condenser includes float valve and sump, discharge elbow, and ½ the distribution piping weight
- 3 For special tubes refer to the 19XR/XRT Computer Selection Program
- 4 All weights for standard 2 pass NIH (nozzle-in-head) design

19XRT HEAT EXCHANGER WEIGHTS

CODE	ENGLISH						SI					
	Dry (Rigging) Weight (lb)*		Refrigerant (lb)		Water (lb)		Dry (Rigging) Weight (kg)*		Refrigerant (kg)		Water (kg)	
	Cooler	Condenser	Cooler	Condenser	Cooler	Condenser	Cooler	Condenser	Cooler	Condenser	Cooler	Condenser
60	8,997	10,050	1230	1580	800	1023	4080	4558	558	717	363	464
61	9,462	10,610	1480	1580	933	1183	4291	4812	671	717	423	537
62	9,926	11,156	1720	1580	1065	1339	4502	5059	780	717	483	607
63	10,391	11,703	1970	1580	1198	1495	4712	5307	893	717	543	678

LEGEND

NIH — Nozzle-in-Head

*Rigging weights include optional .035-in (0.889 mm) wall copper tubes, NIH waterboxes with flanges. For specific machine weights, refer to the 19XRT Computer Selection Program

19XR — ADDITIONAL WEIGHT FOR MARINE WATERBOXES*

HEAT EXCHANGER FRAME, PASS	ENGLISH			SI		
	Psig	Rigging Weight (lb)	Water Weight (lb)	kPa	Rigging Weight (kg)	Water Weight (kg)
Frame 3, 1 and 3 Pass	150	730	700	1034	331	317
Frame 3, 2 Pass	150	365	350	1034	166	159
Frame 4, 1 and 3 Pass	150	1060	1025	1034	481	465
Frame 4, 2 Pass	150	530	510	1034	240	231
Frame 5, 1 and 3 Pass	150	1240	1160	1034	562	526
Frame 5, 2 Pass	150	620	580	1034	281	263
Frame 6, 1 and 3 Pass	150	1500	1350	1034	680	612
Frame 6, 2 Pass	150	750	675	1034	340	306
Frame 3, 1 and 3 Pass	300	860	700	2068	390	317
Frame 3, 2 Pass	300	430	350	2068	195	159
Frame 4, 1 and 3 Pass	300	1210	1025	2068	549	465
Frame 4, 2 Pass	300	600	510	2068	272	231
Frame 5, 1 and 3 Pass	300	1380	1160	2068	626	526
Frame 5, 2 Pass	300	690	580	2068	313	263
Frame 6, 1 and 3 Pass	300	1650	1350	2068	748	612
Frame 6, 2 Pass	300	825	675	2068	374	306

*Add to heat exchanger weights for total weights

NOTE: Weight shown is total for cooler and condenser. Cooler and condenser of the same frame size are of equal weight.

19XR WATERBOX COVER WEIGHTS

ENGLISH (lb)

HEAT EXCHANGER	WATERBOX DESCRIPTION	FRAME 3		FRAME 4		FRAME 5		FRAME 6	
		Standard Nozzles	Flanged	Standard Nozzles	Flanged	Standard Nozzles	Flanged	Standard Nozzles	Flanged
COOLER/CONDENSER	NIH, 1 Pass Cover, 150 psig	320	350	485	521	616	652	802	838
	NIH, 2 Pass Cover, 150 psig	320	350	487	540	590	663	770	843
	NIH, 3 Pass Cover, 150 psig	300	340	504	520	629	655	817	843
	NIH/MWB End Cover or MWB 1*, 2, or 3* Pass Cover, 150 psig	300	300	379	379	428	428	583	583
	MWB End Cover or MWB 1*, 2 or 3* Pass Cover, 300 psig	400	400	569	569	713	713	833	833

SI (kg)

HEAT EXCHANGER	WATERBOX DESCRIPTION	FRAME 3		FRAME 4		FRAME 5		FRAME 6	
		Standard Nozzles	Flanged	Standard Nozzles	Flanged	Standard Nozzles	Flanged	Standard Nozzles	Flanged
COOLER/CONDENSER	NIH, 1 Pass Cover, 150 psig	145	159	220	236	279	296	364	380
	NIH, 2 Pass Cover, 150 psig	145	159	221	245	268	301	349	382
	NIH, 3 Pass Cover, 150 psig	140	154	229	236	285	297	371	381
	NIH/MWB End Cover or MWB 1*, 2, or 3* Pass Cover, 150 psig	136	136	172	172	194	194	264	264
	MWB End Cover or MWB 1*, 2 or 3* Pass Cover, 300 psig	181	181	258	258	323	323	378	378

*Cooler only

LEGEND

NIH — Nozzle-in-Head
MWB — Marine Waterbox

NOTE: Weight for NIH 2-pass cover, 150 psig, are included in heat exchanger weights shown on page 12

19XRT WATERBOX COVER WEIGHTS

HEAT EXCHANGER	WATERBOX DESCRIPTION	ENGLISH				SI			
		Frame 6, Standard Nozzles		Frame 6, Flanged		Frame 6, Standard Nozzles		Frame 6, Flanged	
		150 psig	300 psig	150 psig	300 psig	1034 kPa	2068 kPa	1034 kPa	2068 kPa
COOLER	NIH, 1 Pass Cover	590	842	630	919	268	382	286	417
	NIH, 2 Pass Cover	586	832	642	904	266	378	291	410
	NIH, 3 Pass Cover	610	875	627	947	277	397	284	429
	NIH, Plain End Cover	479	616	—	—	218	280	—	—
CONDENSER	NIH, 1 Pass Cover	770	1087	820	1164	350	494	372	528
	NIH, 2 Pass Cover	806	1104	862	1216	366	501	391	551
	NIH, 3 Pass Cover	827	1148	844	1184	376	521	383	537
	NIH, Plain End Cover	687	901	—	—	312	409	—	—

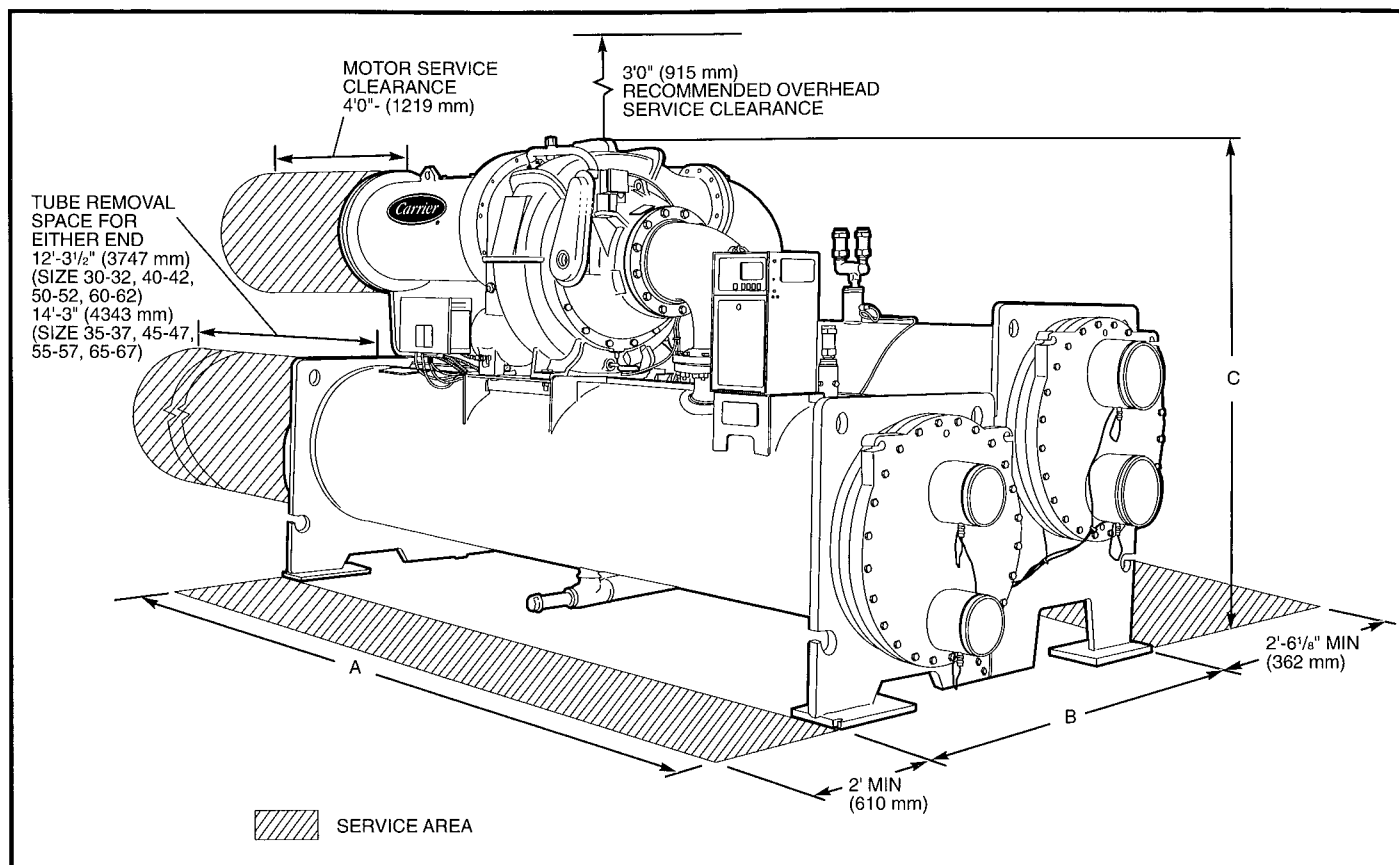
LEGEND

NIH — Nozzle-In-Head

NOTE: The waterbox cover weights are included in the heat exchanger weights shown on page 12

Dimensions

19XR



HEAT EXCHANGER SIZE	A (Length, with Nozzle-in-Head Waterbox)				B (Width)		C (Height)	
	2-Pass*		1 or 3 Pass†					
	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm
30 to 32	14-0 ⁷ / ₈	4290	14-7 ³ / ₈	4468	6-4 ³ / ₈	1941	7-2 ³ / ₁₆	2190
35 to 37	15-9 ³ / ₈	4811	16-4 ³ / ₈	4989	6-4 ³ / ₈	1941	7-2 ³ / ₁₆	2190
40 to 42	14-0 ⁷ / ₈	4290	14-7 ⁷ / ₈	4468	6-4 ³ / ₈	1941	7-2 ³ / ₁₆	2190
45 to 47	15-9 ³ / ₈	4811	16-4 ³ / ₈	4989	6-4 ³ / ₈	1941	7-2 ³ / ₁₆	2190
50 to 52	14-0 ⁷ / ₈	4290	14-7 ⁷ / ₈	4468	6-8 ⁷ / ₈	2055	7-2 ³ / ₁₆	2190
55 to 57	15-9 ³ / ₈	4811	16-4 ³ / ₈	4989	6-8 ⁷ / ₈	2055	7-2 ³ / ₁₆	2190
60 to 62	14-0 ⁷ / ₈	4290	14-7 ⁷ / ₈	4468	7-0	2123	7-4 ³ / ₁₆	2240
65 to 67	15-9 ³ / ₈	4811	16-4 ³ / ₈	4989	7-0	2123	7-4 ³ / ₁₆	2240

HEAT EXCHANGER SIZE	A (Length, Marine Waterbox — not shown)			
	2-Pass*		1 or 3 Pass†	
	ft-in.	mm	ft-in.	mm
30 to 32	15- 2 ⁷ / ₈	4642	16-11 ⁷ / ₈	5179
35 to 37	16-11 ³ / ₈	5166	18- 8 ³ / ₈	5700
40 to 42	15- 2 ⁷ / ₈	4642	16-11 ⁷ / ₈	5179
45 to 47	16-11 ³ / ₈	5166	18- 8 ³ / ₈	5700
50 to 52	15- 2 ⁷ / ₈	4642	16-11 ⁷ / ₈	5179
55 to 57	16-11 ³ / ₈	5166	18- 8 ³ / ₈	5700
60 to 62	15- 2 ⁷ / ₈	4642	16-11 ⁷ / ₈	5179
65 to 67	16-11 ³ / ₈	5166	18- 8 ³ / ₈	5700

FRAME SIZE	NOZZLE SIZE (in.) (Nominal Pipe Size)					
	Cooler			Condenser		
	1-Pass	2-Pass	3-Pass	1-Pass	2-Pass	3-Pass
3	10	8	6	10	8	6
4	10	8	6	10	8	6
5	10	8	6	10	10	8
6	10	10	8	10	10	8

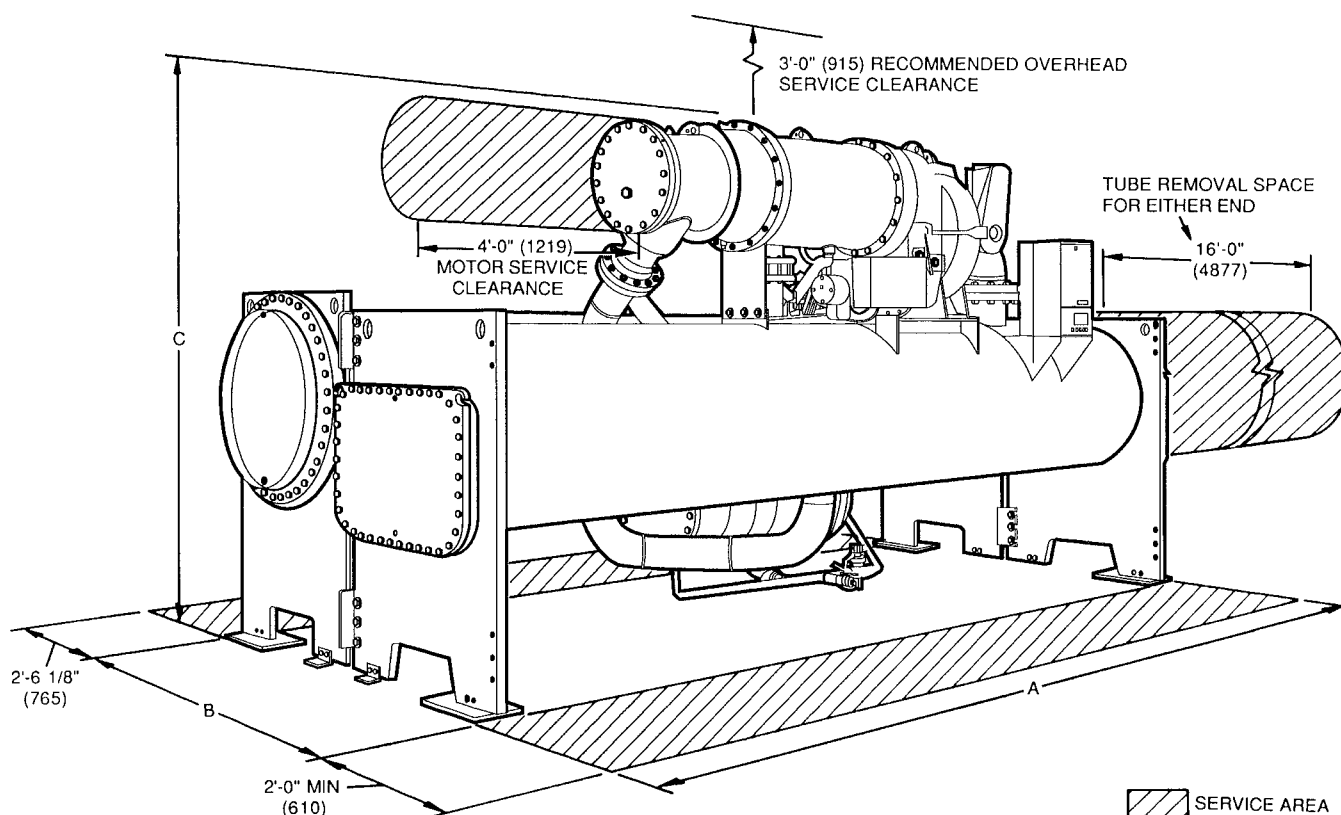
*Assumes both cooler and condenser nozzles on same end of chiller

†1 or 3 pass length applies if either (or both) cooler or condenser is a 1 or 3 pass design.

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. Allow at least 3 ft (915 mm) overhead clearance for service rigging
3. Certified drawings available upon request.

19XRT



WATERBOX AND NOZZLE TYPE	A (Length, with Nozzle-in-Head Waterbox)				B (Width)		C (Height)		NOZZLE SIZE (in.) (Nominal Pipe Size)				
	2 Pass*		1 or 3 Pass†						1-Pass	2-Pass	3-Pass		
	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm					
150 psig (1034 kPa) Std Nozzles	17-7½	5372	18-3½	5575	3	7-1	2159	8-5¼	16	2589	10	8	6
300 psig (2068 kPa) Std Nozzles	17-9	5410	18-5½	5626	1	7-1	2159	8-5¼	16	2589	10	8	6
150 psig (1034 kPa) Flanged Nozzles	17-7⅞	5382	18-4¼	5594		7-1	2159	8-5¼	16	2589	10	8	6
300 psig (2068 kPa) Flanged Nozzles	17-9⅞	5420	18-6¼	5645		7-1	2159	8-5¼	16	2589	10	8	6

*Assumes both cooler and condenser nozzles on same end of chiller

†1 or 3 pass length applies if either (or both) cooler or condenser is a 1 or 3 pass design

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 Allow at least 3 ft (915 mm) overhead clearance for service rigging
- 3 Certified drawings available upon request
- 4 () indicates millimeters.

Performance data



19XR HEAT EXCHANGER MIN/MAX FLOW RATES*

ENGLISH (Gpm)

COOLER		1 PASS		2 PASS		3 PASS	
Frame	Size	Min	Max	Min	Max	Min	Max
3	30	611	2444	305	1222	204	815
	31	733	2933	367	1466	244	978
	32	855	3422	428	1710	285	1141
	35	611	2444	305	1222	204	815
	36	733	2933	367	1466	244	978
	37	855	3422	428	1710	285	1141
4	40	989	3959	495	1979	330	1320
	41	1112	4448	556	2224	371	1482
	42	1222	4888	611	2444	407	1775
	45	989	3959	495	1979	330	1320
	46	1112	4448	556	2224	371	1482
	47	1222	4888	611	2444	407	1775
5	50	1316	5267	658	2634	439	1756
	51	1482	5927	741	2964	494	1976
	52	1586	6343	793	3171	529	2114
	55	1316	5267	658	2634	439	1756
	56	1482	5927	741	2964	494	1976
	57	1586	6343	793	3171	529	2114
6	60	1702	6807	851	3404	567	2269
	61	1830	7320	915	3660	610	2440
	62	1934	7736	967	3868	645	2579
	65	1702	6807	851	3404	567	2269
	66	1830	7320	915	3660	610	2440
	67	1934	7736	967	3868	645	2579

CONDENSER		1 PASS		2 PASS		3 PASS	
Frame	Size	Min	Max	Min	Max	Min	Max
3	30	646	2582	323	1291	215	861
	31	791	3162	395	1581	263	1054
	32	932	3731	466	1865	311	1244
	35	646	2582	323	1291	215	861
	36	791	3162	395	1581	263	1051
	37	932	3731	466	1865	311	1244
4	40	1096	4383	548	2192	365	1461
	41	1235	4940	618	2470	412	1647
	42	1371	5485	686	2743	457	1828
	45	1096	4383	548	2192	365	1461
	46	1235	4940	618	2470	412	1647
	47	1371	5485	686	2743	457	1828
5	50	1507	6029	754	3015	502	2010
	51	1646	6586	823	3293	549	2195
	52	1783	7131	891	3565	594	2377
	55	1507	6029	754	3015	502	2010
	56	1646	6586	823	3293	549	2195
	57	1783	7131	891	3565	594	2377
6	60	1919	7676	959	3838	640	2559
	61	2058	8232	1029	4116	686	2744
	62	2194	8777	1097	4389	731	2926
	65	1919	7676	959	3838	640	2559
	66	2058	8232	1029	4116	686	2744
	67	2194	8777	1097	4389	731	2926

SI (L/s)

COOLER		1 PASS		2 PASS		3 PASS	
Frame	Size	Min	Max	Min	Max	Min	Max
3	30	38	154	19	77	13	51
	31	46	185	23	92	15	62
	32	54	215	27	108	18	72
	35	38	154	19	77	13	51
	36	46	185	23	92	15	62
	37	54	215	27	108	18	72
4	40	62	249	31	125	21	83
	41	70	281	35	140	23	93
	42	77	307	38	154	26	112
	45	62	249	31	125	21	93
	46	70	281	35	140	23	93
	47	77	307	38	154	26	112
5	50	83	332	42	166	28	111
	51	93	374	47	187	31	125
	52	100	400	50	200	33	133
	55	83	332	42	166	28	111
	56	93	374	47	187	31	125
	57	100	400	50	200	33	133
6	60	107	429	54	215	36	143
	61	115	462	58	231	38	154
	62	122	488	61	244	41	163
	65	107	429	54	215	36	143
	66	115	462	58	231	38	154
	67	122	488	61	244	41	163

CONDENSER		1 PASS		2 PASS		3 PASS	
Frame	Size	Min	Max	Min	Max	Min	Max
3	30	41	163	20	81	14	54
	31	50	199	25	100	17	67
	32	59	235	29	118	20	79
	35	41	163	20	81	14	54
	36	50	199	25	100	17	67
	37	59	235	29	118	20	79
4	40	69	277	35	138	23	92
	41	78	312	39	156	26	104
	42	86	346	43	173	29	115
	45	69	277	35	138	23	92
	46	78	312	39	156	26	104
	47	86	346	43	173	29	115
5	50	95	380	48	190	32	127
	51	104	416	52	208	35	138
	52	112	450	56	225	37	150
	55	95	380	48	190	32	127
	56	104	416	52	208	35	138
	57	112	450	56	225	37	150
6	60	121	484	61	242	40	161
	61	130	519	65	260	43	173
	62	138	554	69	277	46	185
	65	121	484	61	242	40	161
	66	130	519	65	260	43	173
	67	138	554	69	277	46	185

19XRT HEAT EXCHANGER MIN/MAX FLOW RATES*

ENGLISH (Gpm)

COOLER		1 PASS		2 PASS		3 PASS	
Frame	Size	Min	Max	Min	Max	Min	Max
6	60	1032	4129	516	2064	344	1376
	61	1240	4959	620	2480	413	1653
	62	1447	5790	724	2895	482	1930
	63	1655	6621	828	3310	552	2207

CONDENSER		1 PASS		2 PASS		3 PASS	
Frame	Size	Min	Max	Min	Max	Min	Max
6	60	1187	4748	593	2374	396	1583
	61	1430	5718	715	2859	477	1906
	62	1666	6666	833	3333	555	2222
	63	1903	7613	952	3806	634	2538

SI (L/s)

COOLER		1 PASS		2 PASS		3 PASS	
Frame	Size	Min	Max	Min	Max	Min	Max
6	60	65	260	33	130	22	87
	61	78	313	39	156	26	104
	62	91	365	46	183	30	122
	63	104	418	52	209	35	139

CONDENSER		1 PASS		2 PASS		3 PASS	
Frame	Size	Min	Max	Min	Max	Min	Max
6	60	75	300	37	150	25	100
	61	90	361	45	180	30	120
	62	105	421	53	210	35	140
	63	120	480	60	240	40	160

*Flow rates based on standard tubes, cooler and condenser Minimum flow based on tube velocity of 3 ft/sec (91 m/sec); maximum based on 12 ft/sec (3 66 m/sec)

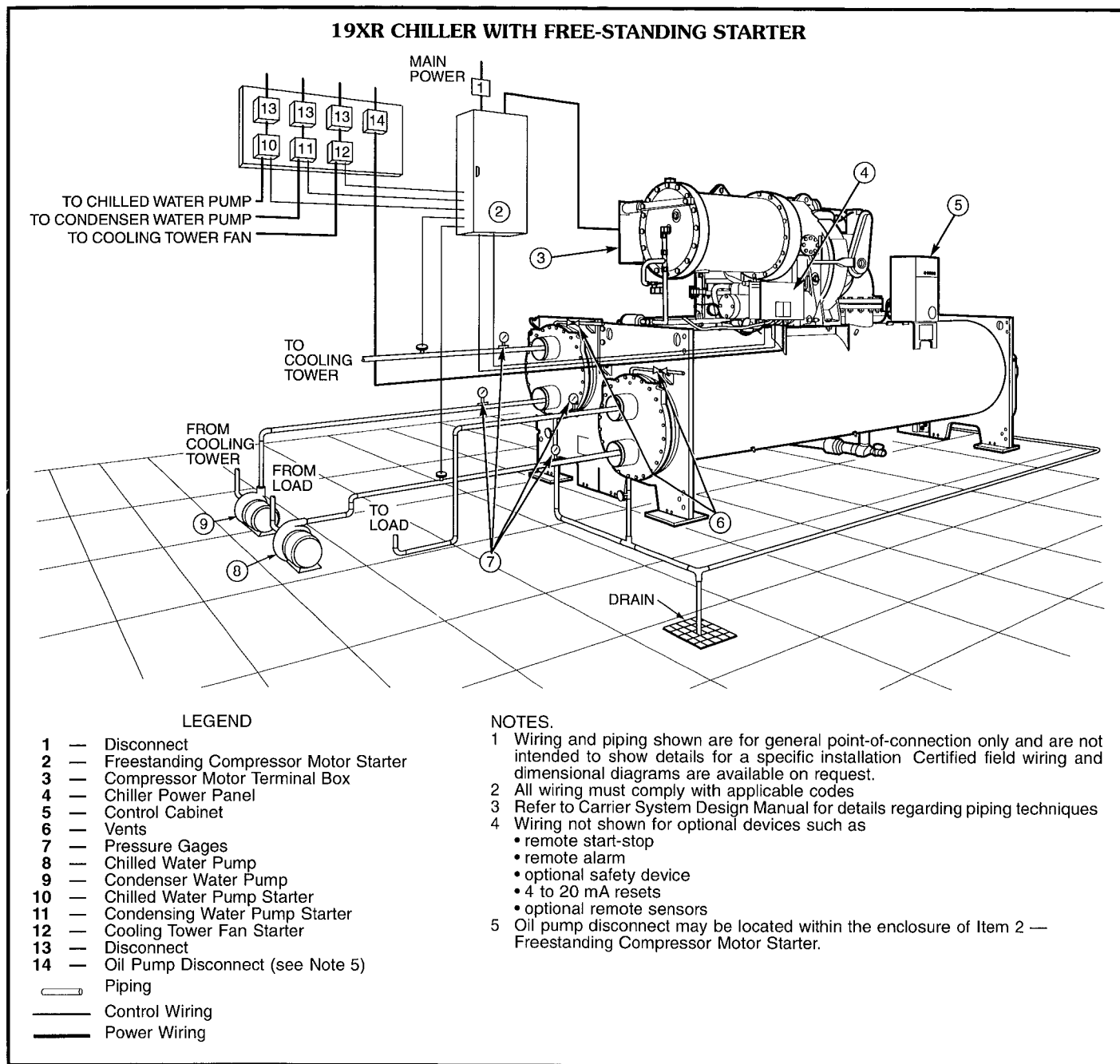
Compressor motor controllers

Compressor motors, as well as controls and accessories, require the use of starting equipment systems specifically designed for 19XR or 19XRT chillers. Refer to Carrier Engineering Requirement Z-375 or consult Carrier regarding design information for the selection of controllers.

Capacitors/power factors

Power factor considerations may indicate use of capacitors. Properly sized capacitors improve power factors, especially at part load. The 19XR or 19XRT Computer Selection program can select the proper capacitor size required for your application.

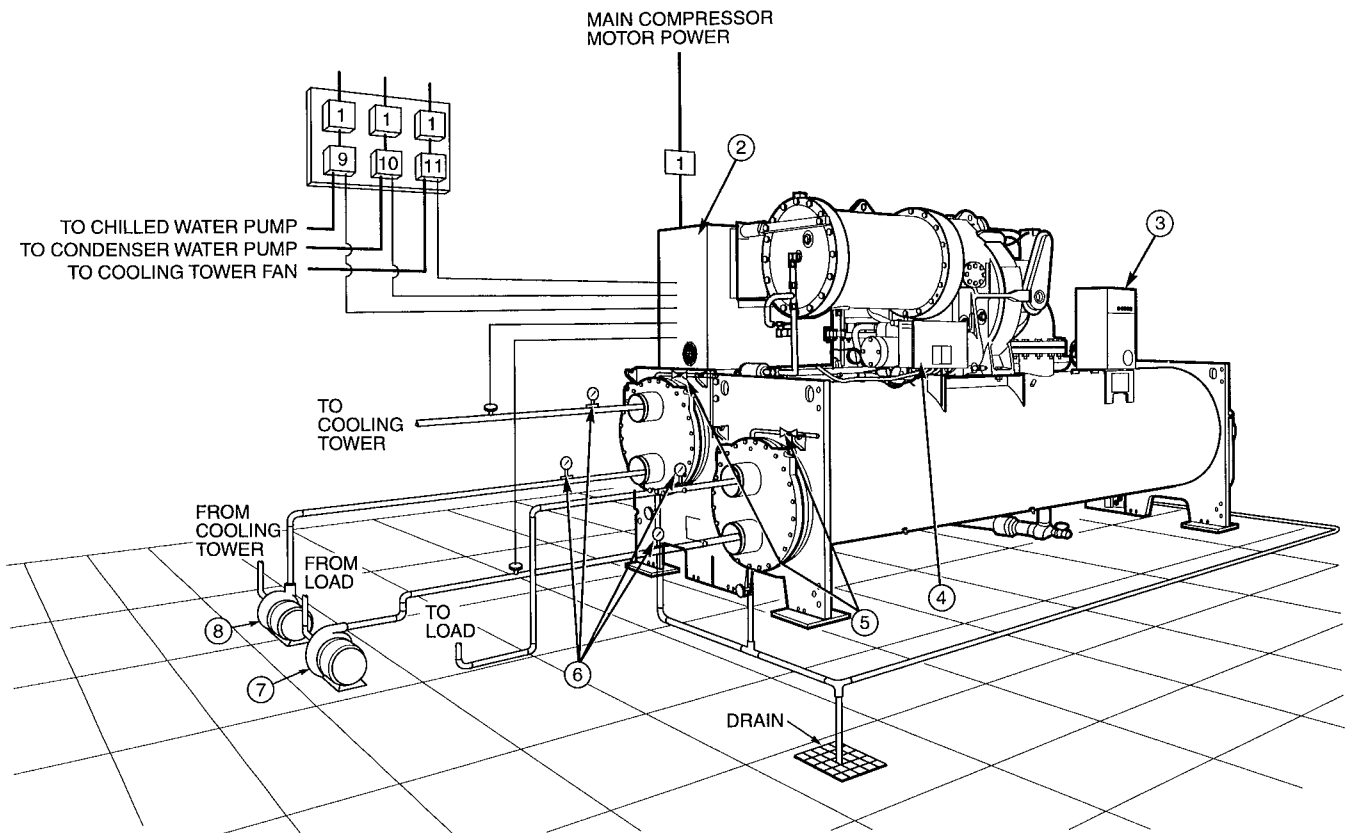
Typical piping and wiring



Typical piping and wiring (cont)



19XR CHILLER WITH OPTIONAL UNIT-MOUNTED STARTER



LEGEND

- 1 — Disconnect
 - 2 — Unit Mounted Starter
 - 3 — Control Cabinet
 - 4 — Power Panel
 - 5 — Vents
 - 6 — Pressure Gages
 - 7 — Chilled Water Pump
 - 8 — Condenser Water Pump
 - 9 — Chilled Water Pump Starter
 - 10 — Condensing Water Pump Starter
 - 11 — Cooling Tower Fan Starter
- 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.
- 3 Refer to Carrier System Design Manual for details regarding piping techniques.
4. Wiring not shown for optional devices such as:
 - remote start-stop
 - remote alarm
 - optional safety device
 - 4 to 20 mA resets
 - optional remote sensors

Electrical data



60 Hz STANDARD EFFICIENCY MOTORS*														
Motor Size	Motor Electrical Characteristics	Low Volts							Medium Volts				High Volts	
		Max kW	200 v	230 v	380 v	416 v	460 v	575 v	Max kW	2400 v	3300 v	4160 v	Max kW	6900
CDS	RLA per kW		3.28	2.85	1.83	1.57	1.43	1.14		0.274	0.199	0.158		0.0975
	LRA Star	200	1135	1012	676	617	486	405	200	—	—	—	200	128
	LRA Delta		3545	3163	2112	1929	1519	1265		255	199	147		—
CES	RLA per kW		3.28	2.85	1.73	1.57	1.43	1.14		0.272	0.196	0.155		0.0973
	LRA Star	219	1395	1044	622	606	462	373	219	—	—	—	219	145
	LRA Delta		4359	3263	1945	1893	1443	1165		284	210	164		—
CLS	RLA per kW		3.28	2.85	1.73	1.55	1.43	1.14		0.272	0.200	0.157		0.0963
	LRA Star	243	1275	1173	749	708	546	398	243	—	—	—	243	164
	LRA Delta		3984	3665	2340	2212	1707	1245		281	227	178		—
CMS	RLA per kW		3.32	2.89	1.74	1.56	1.44	1.15		0.272	0.199	0.159		0.0963
	LRA Star	267	1349	1422	841	825	562	498	267	—	—	—	267	172
	LRA Delta		4215	4443	2628	2577	1757	1556		313	261	198		—
CNS	RLA per kW		3.28	2.85	1.73	1.56	1.43	1.14		0.272	0.198	0.156		0.0956
	LRA Star	295	1644	1333	865	874	663	610	295	—	—	—	295	183
	LRA Delta		5138	4167	2704	2731	2071	1908		346	287	215		—
CPS	RLA per kW		3.24	2.82	1.71	1.56	1.41	1.13		0.274	0.200	0.160		0.095
	LRA Star	323	1607	1430	851	859	719	601	323	—	—	—	323	196
	LRA Delta		5023	4468	2659	2684	2247	1878		378	320	237		—
CQS	RLA per kW		3.28	2.85	1.73	1.56	1.43	1.14		0.274	0.198	0.160		0.0947
	LRA Star	360	1912	1639	948	1064	1000	672	360	—	—	—	360	209
	LRA Delta		5976	5121	2963	3325	3125	2098		457	329	268		—

60 Hz STANDARD EFFICIENCY MOTORS* (cont)													
Motor Size	Motor Electrical Characteristics	Low Volts						Medium Volts				High Volts	
		Max kW	200 v	230 v	380 v	460 v	575 v	Max kW	2400 v	3300 v	4160 v	Max kW	6900
DBS	RLA per kW		3.19	2.79	1.70	1.40	1.12		0 27	0 20	0 16		—
	LRA Star	363	1791	1731	1118	866	750	344	—	—	—	344	—
	LRA Delta		5597	5410	3494	2705	2345		418	314	241		—
DCS	RLA per kW		3.24	2.79	1.69	1.39	1.12		0 27	0 20	0 16		—
	LRA Star	388	2325	1711	1104	855	741	369	—	—	—	369	—
	LRA Delta		7266	5347	3449	2673	2314		480	329	277		—
DDS	RLA per kW		3.21	2.79	1.69	1.39	1.12		0 27	0 20	0 16		0 09
	LRA Star	418	2265	1868	1075	934	732	398	—	—	—	398	—
	LRA Delta		7078	5836	3361	2918	2286		515	367	297		237
DES	RLA per kW		3.24	2.83	1.70	1.42	1.12		0 27	0 19	0 15		0 09
	LRA Star	443	2352	2135	1117	1068	750	421	—	—	—	421	—
	LRA Delta		7350	6672	3491	3336	2343		555	377	320		234
DFS	RLA per kW		3.25	2.83	1.71	1.42	1.12		0 27	0 20	0 16		0 09
	LRA Star	478	2272	2112	1265	1056	838	453	—	—	—	453	—
	LRA Delta		7101	6599	3952	3300	2620		570	435	329		255
DGS	RLA per kW		—	—	1.67	1.38	1.11		0 27	0 20	0 16		0 09
	LRA Star	523	—	—	1237	1179	946	497	—	—	—	497	—
	LRA Delta		—	—	3867	3684	2956		636	440	367		270
DHS	RLA per kW		—	—	1.68	1.38	1.10		0 28	0 20	0 16		0 09
	LRA Star	561	—	—	1583	1131	1008	533	—	—	—	533	—
	LRA Delta		—	—	4945	3533	3151		704	496	406		302
DJS	RLA per kW		—	—	1.68	1.38	1.12		0 27	0 20	0 16		0.09
	LRA Star	597	—	—	1593	1181	944	568	—	—	—	568	—
	LRA Delta		—	—	4977	3690	2951		719	522	415		323

LEGEND

kW — Compressor Motor Power Input (Kilowatts)
 LRA — Locked Rotor Amps
 OLTA — Overload Trip Amps (= RLA x 1.08)
 RLA — Rated Load Amps

*19XR only

NOTES:

1 Standard Voltages:

60 HZ		50 HZ	
Volt	For use on supply voltages	Volt	For use on supply voltages
200	200 to 208 v systems	230	220 to 240 v systems
230	220 to 240 v systems	346	320 to 360 v systems
380	360 to 400 v systems	400	380 to 415 v systems
416	401 to 439 v systems	3000	2900 to 3100 v systems
460	440 to 480 v systems	3300	3200 to 3400 v systems
575	550 to 600 v systems	6300	6000 to 6600 v systems
2400	2300 to 2500 v systems		
3300	3150 to 3450 v systems		
4160	4000 to 4300 v systems		
6900	6600 to 7200 v systems		

Motor nameplates can be stamped for any voltage within the listed supply/voltage range. Chillers shall not be selected at voltages above or below the listed supply voltage range.

2 To establish electrical data for your selected voltage, if other than listed voltage, use the following formula:

$$RLA = \text{listed RLA} \times \frac{\text{listed voltage}}{\text{selected voltage}}$$

$$OLTA = \text{listed OLTA} \times \frac{\text{listed voltage}}{\text{selected voltage}}$$

$$LRA = \text{listed LRA} \times \frac{\text{selected voltage}}{\text{listed voltage}}$$

EXAMPLE: Find the rated load amperage for a motor listed at 1.14 amps per kW input and 550 volts.

$$RLA = 1.14 \times \frac{575}{550} = 1.19$$

Electrical data (cont)



60 Hz HIGH EFFICIENCY MOTORS								
Motor Size	Motor Electrical Characteristics	Low Volts						
		Max kW	200 v	230 v	380 v	416 v	460 v	575 v
CDH	RLA per kW	200	3 222	2 877	1 804	1 679	1 438	1 167
	LRA Star		1518	1580	1039	1016	782	618
	LRA Delta		5264	5392	3568	3495	2696	2134
CEH	RLA per kW	219	3 222	2 867	1 806	1 673	1 433	1 174
	LRA Star		1680	1694	1146	1100	847	699
	LRA Delta		5814	5836	3938	3787	2923	2412
CLH	RLA per kW	243	3 308	2 861	1 849	1 623	1 431	1 167
	LRA Star		2232	1874	1366	1071	926	759
	LRA Delta		7670	6457	4698	3694	3228	2620
CMH	RLA per kW	267	3 426	2 882	1 803	1 59	1 437	1 195
	LRA Star		2825	2143	1348	1058	1046	912
	LRA Delta		9704	7375	4649	3853	3606	3149
CNH	RLA per kW	295	3 343	2 836	1 757	1 686	1 416	1 167
	LRA Star		2896	2116	1332	1456	1031	901
	LRA Delta		9613	7295	4604	5012	3572	3110
CPH	RLA per kW	323	3.25	2 833	1 739	1 614	1 401	1 154
	LRA Star		2650	2358	1408	1381	1090	951
	LRA Delta		9158	8118	4867	4766	3777	3292
CQH	RLA per kW	360	3 185	2 875	1 728	1 592	1.44	1 177
	LRA Star		2518	2889	1527	1463	1447	1169
	LRA Delta		8728	9955	5277	5051	4998	4035

60 Hz HIGH EFFICIENCY MOTORS (cont)														
Motor Size	Motor Electrical Characteristics	Low Volts							Medium Volts				High Volts	
		Max kW	200 v	230 v	380 v	416 v	460 v	575 v	Max kW	2400 v	3300 v	4160 v	Max kW	6900
DBH	RLA per kW	448	0.449	0.117	1 7	1 569	1.39	1 142	448	0 275	0.2	0.159	448	—
	LRA Star		2649	2787	1260	1263	1091	945		634	473	369		—
	LRA Delta		9164	9597	4385	4381	3787	3280		—	—	—		—
DCH	RLA per kW	379	0.623	0 224	1 696	1 563	1 436	1 149	379	0 275	0.201	0 159	379	—
	LRA Star		2840	2684	1351	1327	1346	1074		694	523	403		—
	LRA Delta		9814	9266	4694	4604	4658	3715		—	—	—		—
DDH	RLA per kW	409	0.784	0 424	1 705	1 57	1 441	1 154	409	0.273	0 197	0 157	409	0.096
	LRA Star		2807	2893	1518	1461	1449	1159		710	490	409		298
	LRA Delta		9723	9985	5269	5061	5025	4001		—	—	—		—
DEH	RLA per kW	434	0.969	0 601	1 761	1 588	1 431	1 145	434	0 271	0.199	0 157	434	0.096
	LRA Star		2615	2648	1583	1363	1180	936		704	541	410		319
	LRA Delta		9151	9236	5525	4754	4129	3279		—	—	—		—
DFH	RLA per kW	469	1 19	0 752	1 731	1 602	1 437	1 176	469	0 271	0.199	0.157	469	0.098
	LRA Star		3351	2846	1612	1611	1396	1251		772	595	447		354
	LRA Delta		11638	9916	5633	5617	4871	4357		—	—	—		—
DGH	RLA per kW	509	—	—	1 713	1 581	1 456	1 157	509	0 269	0.197	0.155	509	0.096
	LRA Star		—	—	1695	1661	1681	1287		787	627	458		393
	LRA Delta		—	—	5921	5798	5860	4498		—	—	—		—
DHH	RLA per kW	546	—	—	1 732	1 572	1 444	1 148	546	0 271	0 199	0.156	546	0.095
	LRA Star		—	—	1932	1659	1682	1290		932	702	536		392
	LRA Delta		—	—	6738	5810	5864	4507		—	—	—		—
DJH	RLA per kW	559	—	—	—	—	—	—	559	0 271	0.198	0.156	559	0 095
	LRA Star		—	—	—	—	—	—		1001	751	581		425
	LRA Delta		—	—	—	—	—	—		—	—	—		—

LEGEND

kW — Compressor Motor Power Input (Kilowatts)
LRA — Locked Rotor Amps
OLTA — Overload Trip Amps (= RLA x 1 08)
RLA — Rated Load Amps

*19XR only

NOTES:

1 Standard Voltages:

60 HZ		50 HZ	
Volt	For use on supply voltages	Volt	For use on supply voltages
200	200 to 208 v systems	230	220 to 240 v systems
230	220 to 240 v systems	346	320 to 360 v systems
380	360 to 400 v systems	400	380 to 415 v systems
416	401 to 439 v systems	3000	2900 to 3100 v systems
460	440 to 480 v systems	3300	3200 to 3400 v systems
575	550 to 600 v systems	6300	6000 to 6600 v systems
2400	2300 to 2500 v systems		
3300	3150 to 3450 v systems		
4160	4000 to 4300 v systems		
6900	6600 to 7200 v systems		

Motor nameplates can be stamped for any voltage within the listed supply/voltage range. Chillers shall not be selected at voltages above or below the listed supply voltage range.

2 To establish electrical data for your selected voltage, if other than listed voltage, use the following formula:

$$RLA = \text{listed RLA} \times \frac{\text{listed voltage}}{\text{selected voltage}}$$

$$OLTA = \text{listed OLTA} \times \frac{\text{listed voltage}}{\text{selected voltage}}$$

$$LRA = \text{listed LRA} \times \frac{\text{selected voltage}}{\text{listed voltage}}$$

EXAMPLE: Find the rated load amperage for a motor listed at 1 14 amps per kW input and 550 volts

$$RLA = 1 14 \times \frac{575}{550} = 1 19$$

50 Hz STANDARD EFFICIENCY MOTORS*

Motor Size	Motor Electrical Characteristics	Low Volts				Medium Volts			High Volts	
		Max kW	230 v	346 v	400 v	Max kW	3000 v	3300 v	Max kW	6300
CDS	RLA per kW	196	2.82	1.87	1.62	196	0 212	0 199	196	0 1035
	LRA Star		924	673	563		—	—		124
	LRA Delta		2887	2102	1761		194	194		—
CES	RLA per kW	214	2.85	1.90	1.64	214	0 219	0 197	214	0 1042
	LRA Star		1165	780	665		—	—		143
	LRA Delta		3640	2436	2078		214	212		—
CLS	RLA per kW	239	2.82	1.87	1.62	239	0 212	0 196	239	0 1046
	LRA Star		1197	812	721		—	—		169
	LRA Delta		3740	2536	2252		241	236		—
CMS	RLA per kW	263	2.79	1.85	1.60	263	0 220	0 200	263	0 1042
	LRA Star		1542	833	730		—	—		180
	LRA Delta		4819	2603	2280		258	254		—
CNS	RLA per kW	290	2.79	1.85	1.70	290	0 216	0 194	290	0 1034
	LRA Star		1446	854	896		—	—		191
	LRA Delta		4518	2670	2800		291	285		—
CPS	RLA per kW	318	2.82	1.87	1.62	318	0 215	0 197	318	0 1031
	LRA Star		1534	1020	951		—	—		208
	LRA Delta		4794	3187	2973		325	292		—
CQS	RLA per kW	355	2.79	1.96	1.60	355	0 213	0 194	355	0 1031
	LRA Star		1542	1303	951		—	—		216
	LRA Delta		4819	4071	2973		346	343		—

50 Hz STANDARD EFFICIENCY MOTORS (cont)*

Motor Size	Motor Electrical Characteristics	Low Volts				Medium Volts			High Volts	
		Max kW	230 v	346 v	400 v	Max kW	3000 v	3300 v	Max kW	6300
DBS	RLA per kW	341	2.85	1.91	1.64	344	0 22	0 20	344	—
	LRA Star		1730	1240	998		—	—		—
	LRA Delta		5407	3875	3118		331	324		—
DCS	RLA per kW	366	2.83	1.90	1.64	369	0 22	0 20	369	—
	LRA Star		1708	1224	985		—	—		—
	LRA Delta		5337	3825	3079		382	346		—
DDS	RLA per kW	394	2.79	1.86	1.62	398	0 22	0 20	398	0 10
	LRA Star		1554	1149	1048		—	—		230
	LRA Delta		4857	3591	3274		414	380		—
DES	RLA per kW	417	2.80	1.86	1.62	421	0 22	0 20	421	0 10
	LRA Star		1798	1136	1076		—	—		256
	LRA Delta		5618	3551	3362		412	424		—
DFS	RLA per kW	449	2.75	1.83	1.58	453	0 22	0 20	453	0 10
	LRA Star		1973	1251	1146		—	—		281
	LRA Delta		6165	3910	3581		273	269		—
DGS	RLA per kW	493	2.76	1.83	1.58	498	0 21	0 19	498	0 10
	LRA Star		2496	1355	1212		—	—		294
	LRA Delta		7799	4235	3787		493	477		—
DHS	RLA per kW	528	2.74	1.82	1.58	533	0 21	0 19	533	0 10
	LRA Star		2397	1517	1318		—	—		322
	LRA Delta		7490	4741	4118		517	511		—
DJS	RLA per kW	563	—	1.85	1.60	569	0 2	0 19	569	0 10
	LRA Star		—	1538	1552		—	—		348
	LRA Delta		—	4806	4850		570	551		—

50 Hz HIGH EFFICIENCY MOTORS

Motor Size	Motor Electrical Characteristics	Low Volts			
		Max kW	230 v	346 v	400 v
CDH	RLA per kW	196	2 938	2 032	1 727
	LRA Star		1477	1145	929
	LRA Delta		5115	3952	3210
CEH	RLA per kW	214	2 934	1 964	1 721
	LRA Star		1601	1111	1003
	LRA Delta		6645	3843	3459
CLH	RLA per kW	239	2 9	1 927	1 655
	LRA Star		1730	1154	954
	LRA Delta		5994	4006	3311
CMH	RLA per kW	263	2 915	1 929	1 627
	LRA Star		1959	1253	928
	LRA Delta		6765	4343	3227
CNH	RLA per kW	290	2 865	1 898	1 702
	LRA Star		1922	1233	1278
	LRA Delta		6663	4278	4417
CPH	RLA per kW	318	2 828	1 912	1 671
	LRA Star		1897	1385	1263
	LRA Delta		6592	4801	4370
CQH	RLA per kW	355	2 873	1 889	1 651
	LRA Star		2243	1384	1263
	LRA Delta		7751	4812	4389

Electrical data (cont)



50 Hz HIGH EFFICIENCY MOTORS (cont)										
Motor Size	Motor Electrical Characteristics	Low Volts				Medium Volts			High Volts	
		Max kW	230 v	346 v	400 v	Max kW	3000 v	3300 v	Max kW	6300
DBH	RLA per kW	424	0.48	1.909	1.673	424	0.217	0.198	424	—
	LRA Star		1950	1248	1184		440	395		—
	LRA Delta		6766	4345	4120		—	—		—
DCH	RLA per kW	366	0.078	1.921	1.651	366	0.216	0.196	366	—
	LRA Star		0.897	1388	1157		468	423		—
	LRA Delta		6600	4789	4031		—	—		—
DDH	RLA per kW	392	0.313	1.903	1.657	392	0.217	0.196	392	0.103
	LRA Star		2213	1370	1247		506	450		278
	LRA Delta		7674	4762	4352		—	—		—
DEH	RLA per kW	415	0.447	1.927	1.646	415	0.216	0.197	415	0.104
	LRA Star		2449	1568	1232		546	523		304
	LRA Delta		8499	5445	4301		—	—		—
DFH	RLA per kW	446	0.617	1.934	1.649	446	0.215	0.195	446	0.103
	LRA Star		2474	1658	1318		580	510		302
	LRA Delta		8636	5780	4605		—	—		—
DGH	RLA per kW	491	—	1.933	1.656	491	0.215	0.197	491	0.102
	LRA Star		—	1780	1473		624	615		321
	LRA Delta		—	6213	5141		—	—		—
DHH	RLA per kW	524	—	1.901	1.665	524	0.213	0.193	524	0.103
	LRA Star		—	1830	1733		561	832		634
	LRA Delta		—	6393	6041		—	—		—
DJH	RLA per kW	551	—	0.076	1.655	551	0.21	0.194	551	0.103
	LRA Star		—	1830	1733		851	928		403
	LRA Delta		—	6408	6052		—	—		—

LEGEND

kW — Compressor Motor Power Input (Kilowatts)
LRA — Locked Rotor Amps
OLTA — Overload Trip Amps (= RLA x 1.08)
RLA — Rated Load Amps

*19XR only

NOTES:

1 Standard Voltages:

60 HZ		50 HZ	
Volt	For use on supply voltages	Volt	For use on supply voltages
200	200 to 208 v systems	230	220 to 240 v systems
230	220 to 240 v systems	346	320 to 360 v systems
380	360 to 400 v systems	400	380 to 415 v systems
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460	440 to 480 v systems	3300	3200 to 3400 v systems
575	550 to 600 v systems	3600	6000 to 6600 v systems
2400	2300 to 2500 v systems		
3300	3150 to 3450 v systems		
4160	4000 to 4300 v systems		
6900	6600 to 7200 v systems		

Motor nameplates can be stamped for any voltage within the listed supply/voltage range. Chillers shall not be selected at voltages above or below the listed supply voltage range.

2 To establish electrical data for your selected voltage, if other than listed voltage, use the following formula:

$$RLA = \text{listed RLA} \times \frac{\text{listed voltage}}{\text{selected voltage}}$$

$$OLTA = \text{listed OLTA} \times \frac{\text{listed voltage}}{\text{selected voltage}}$$

$$LRA = \text{listed LRA} \times \frac{\text{selected voltage}}{\text{listed voltage}}$$

EXAMPLE: Find the rated load amperage for a motor listed at 1.14 amps per kW input and 550 volts.

$$RLA = 1.14 \times \frac{575}{550} = 1.19$$

AUXILIARY RATINGS (3 Phase, 50/60 Hz)

ITEM	AVERAGE kW	DESIGN CENTER VOLTAGE V-PH-HZ	MIN/MAX MOTOR VOLTAGE	INRUSH kva	SEALED kva
OIL PUMP	1.35	220-3-60	200/240	9.34	1.65
	1.35	430-3-60	380/480	9.09	1.60
	1.35	563-3-60	507/619	24.38	2.08
	1.50	230-3-50	220/240	11.15	1.93
	1.50	393-3-50	346/440	8.30	1.76

NOTE: FLA = Sealed kva • 1000/√3 • volts

LRA = Inrush kva • 1000/√3 • volts

AUXILIARY RATINGS (115/230 Volt, 1 Phase, 50/60 Hz)

ITEM	POWER	SEALED kva	AVERAGE WATTS
CONTROLS	24 V DC	0.16	160
OIL SUMP HEATER	115-230/1/50-60	—	1200

NOTES:

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

Microprocessor controls

Microprocessor controls provide the safety, interlock, capacity control, and indications necessary to operate the chiller in a safe and efficient manner.

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 machine and provides a communication link to the Carrier Comfort Network (CCN)

Features

Control system

- Component Test and Diagnostic Check
- Programmable Recycle Allows Machine 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
- Two Chiller Lead/Lag with Third Chiller Standby is Standard on the PIC Software
- Optional Soft Stop Unloading Closes Guide Vanes to Unload the Motor to the Configured Amperage Level Prior to Stopping

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
- Cooler and Condenser Water Flow††
- Motor Overload†
- Motor Acceleration Time
- Intermittent Power Loss
- Compressor Starter Faults
- Compressor Surge Protection*

Capacity Control

- Leaving Chilled Water Control
- Entering Chilled Water Control
- Soft Loading Control by Temperature or Load Ramping
- Guide Vane Actuator Module
- Hot Gas Bypass Valve
- 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
 - Oil Pump 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.

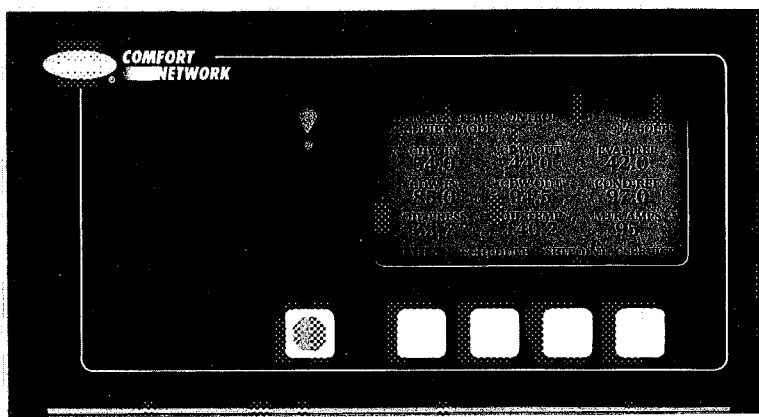
**Will not require manual reset or cause an alarm if auto-restart after power failure is enabled.

††Required: Field or factory supplied flow switch (installed at jobsite).

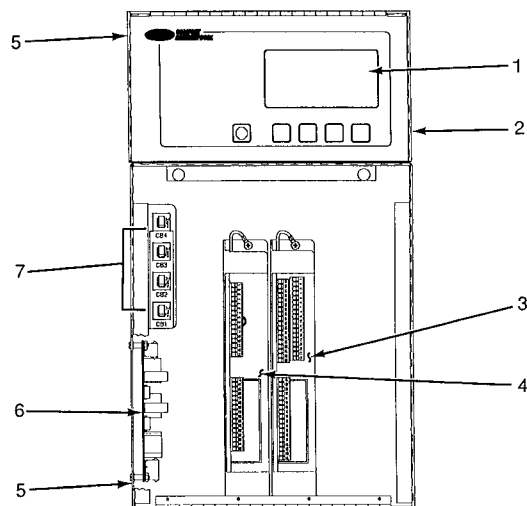
||By display code only.

¶kW transducer must be supplied in motor starter.

MICROPROCESSOR CONTROL CENTER



19XR CONTROL CENTER WITH OPTIONS (FRONT VIEW)

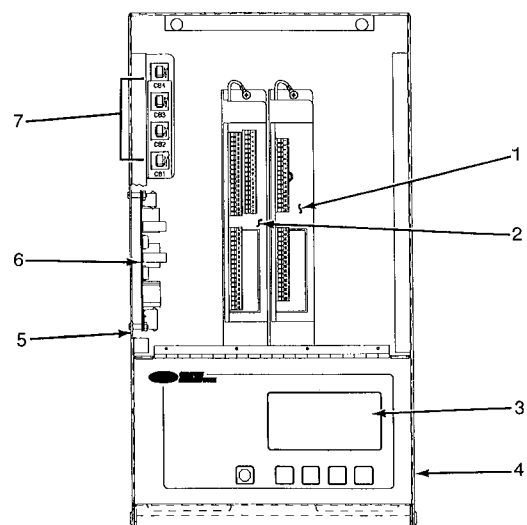


LEGEND

LID — Local Interface Device
PIC — Product Integrated Controls
PSIO — Processor Sensor Input/Output Module

- 1 — LID Input/Output Interface Panel Display
- 2 — LID Light and Power Supply (Hidden)
- 3 — PSIO (The PSIO is the Central Processor of the PIC)
- 4 — Optional 8-Input Module for Spare Inputs to Control Interface (One of Two Available)
- 5 — Power Transformer
- 6 — 6-Pack Relay Board
- 7 — Circuit Breakers (4)

19XRT CONTROL CENTER WITH OPTIONS (FRONT VIEW)

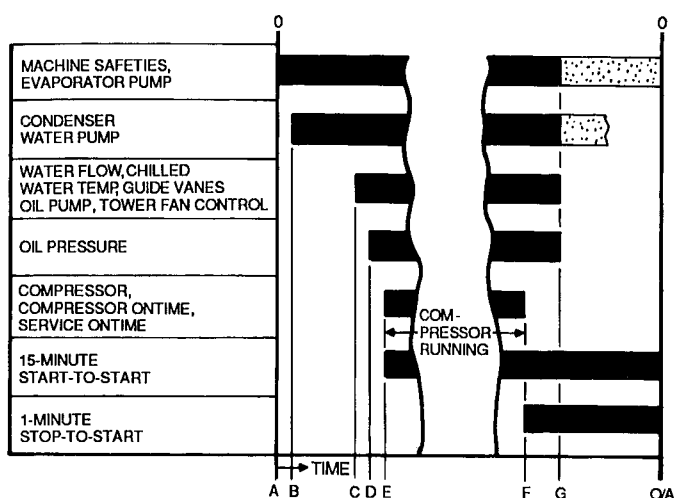


LEGEND

LID — Local Interface Device
PIC — Product Integrated Controls
PSIO — Processor Sensor Input/Output Module

- 1 — Optional 8-Input Module for Spare Inputs to Control Interface (One of Two Available)
- 2 — PSIO (The PSIO is the Central Processor of the PIC)
- 3 — LID Input/Output Interface Panel Display
- 4 — LID Light and Power Supply (Hidden)
- 5 — Power Transformer
- 6 — 6-Pack Relay Board
- 7 — Circuit Breakers (4)

CONTROL SEQUENCE



- A — START INITIATED — Prestart checks made; evaporator pump started
- B — Condenser water pump started (5 seconds after A).
- C — Water flows verified (30 seconds to 5 minutes maximum). Chilled water temperatures checked against control point. Guide vanes checked for closure. Oil pump started, tower fan control enabled.
- D — Oil pressure verified (30 seconds minimum to 300 seconds maximum after C)
- E — Compressor motor starts, compressor ontime and service ontime starts, 15-minute inhibit timer starts (10 seconds after D).
- F — SHUTDOWN INITIATED — Compressor motor stops, compressor ontime and service ontime stops, 1-minute inhibit timer starts
- G — Oil pump and evaporator pumps deenergized (60 seconds after F) Condenser pump and tower fan control may continue to operate if condenser pressure is high. Evaporator pump may continue if in RECYCLE mode.
- O/A — Restart permitted (both inhibit timers expired) (minimum of 15 minutes after E, minimum of 1 minute after F)

Control sequence

To start: Local start-up (manual start-up) is initiated by pressing the LOCAL menu softkey which is indicated on the default local interface device (LID) screen. Time schedule 01 must be in the occupied mode and the internal 15-minute start-to-start and the 1-minute stop-to-start inhibit timers must have expired. All pre-start safeties are checked to verify that all prestart alerts and safeties are within limits (if one is not an indication of the fault will be displayed and the start aborted). The signal is sent to start the chilled water pump. Five seconds later, the condenser water pump is energized. Thirty seconds later the controls check to see if flow has been confirmed by the closure of the chilled water and condenser water flow switches. If not confirmed, it will continue to monitor flows for a maximum of five minutes. If satisfied, it checks the chilled water temperature against the control point. If the temperature is less than or equal to the chilled water control point the condenser water pump will turn off and the controls will go into a recycle mode.

If the water/brine temperature is high enough the start-up sequence continues on to check the guide vane position. If the guide vanes are more than 6% open, start-up waits until the vanes are closed. If the vanes are closed and the oil pump pressure is less than 3 psi (21 kPa), the oil pump and tower fan relay will be energized. The controls will wait 30 seconds for the oil pressure to reach a maximum of 18 psi (924 kPa). After oil pressure is verified, the controls wait 15 seconds. Then the compressor start relay is energized to start the compressor. Compressor ontime and service ontime "timers" start and the 15-minute start-to-start timer will start 15 seconds after oil pressure was verified.

Once started: The controls will enter the ramp loading mode to slowly open the guide vanes to prevent a rapid increase in compressor power consumption. Once completed the controls will enter the capacity control mode. Any failure, after the compressor is energized, that results in a safety

shutdown will energize the alarm light, advance the starts in 12 hours counter by one, and display the applicable shutdown status on the liquid-crystal display (LCD) screen.

Shutdown sequence: Shutdown of the chiller can occur if any of the following events happen:

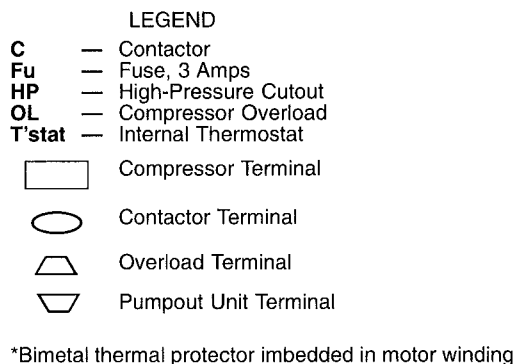
- The Stop button is pressed for at least one second
- A recycle shutdown was initiated
- Time schedule has gone into unoccupied mode
- Machine protective limit has been reached and machine is in alarm
- The start/stop status is overridden to stop from the CCN network or LID

Once the controls are placed in shutdown mode the shutdown sequence first stops the compressor by deactivating the start relay. The guide vanes are then brought to the closed position. Compressor ontime and service ontime stops. The oil pump relay and chilled water/brine pump are shut down 60 seconds after the compressor stops. The condenser water pump will be shut down when the refrigerant temperature or entering condenser water is below pre-established limits. The 1-minute stop-to-start will now start to count down.

If optional soft stop unloading is activated once the Stop button is pressed or the remote contacts close, the guide vanes will close, the motor will unload to a configured amperage level, and the machine will shut down. The display will indicate "Shutdown in Progress"

If the compressor motor load is greater than 10% after shutdown, or the starter contacts remain energized, the oil pump and chilled water pump remain energized and the alarm is displayed.

Restart: Restart is permitted after both inhibit timers have expired. If shutdown was due to a safety shutdown the reset button must be depressed prior to restarting the chiller.



NOTES FOR TYPICAL FIELD WIRING SCHEMATICS (PAGES 28 -31)

NOTES

I GENERAL

- 1 0 Starters shall be designed and manufactured in accordance with Carrier Engineering Requirement Z-375
- 1.1 All field-supplied conductors, devices, field-installation wiring, and termination of conductors and devices must be in compliance with all applicable codes and job specifications
- 1.2 The routing of field-installed conduit and conductors and the location of field-installed devices must not interfere with equipment access or the reading, adjusting, or servicing of any component
- 1.3 Equipment, installation, and all starting and control devices must comply with details in equipment submittal drawings and literature.
- 1.4 Contacts and switches are shown in the position they would assume with the circuit deenergized and the chiller shut down.
- 1.5 **WARNING** — Do not use aluminum conductors
- 1.6 Installer is responsible for any damage caused by improper wiring between starter and machine

II POWER WIRING TO STARTER

- 2.0 Power conductor rating must meet minimum unit nameplate voltage and compressor motor RLA
When (3) conductors are used:
Minimum ampacity per conductor = $1.25 \times \text{compressor RLA}$
When (6) conductors are used:
Minimum ampacity per conductor = $0.721 \times \text{compressor RLA}$
- 2.1 Lug adapters may be required if installation conditions dictate that conductors be sized beyond the minimum ampacity required. Contact starter supplier for lug information
- 2.2 Compressor motor and controls must be grounded by using equipment grounding lugs provided inside starter enclosure

III CONTROL WIRING

- 3.0 Field supplied control conductors to be at least 18 AWG or larger
- 3.1 Chilled water and condenser water flow switch contacts, optional remote start device contacts, and optional spare safety device contacts must have 24 vdc rating. Max current is 60 ma, nominal current is 10 ma. Switches with gold plated bifurcated contacts are recommended
- 3.2 Remove jumper wire between 12A and 12B before connecting auxiliary safeties between these terminals
- 3.3 Pilot relays can control cooler and condenser pump and tower fan motor contactor coil loads rated 10 amps at 115 vac up to 3 amps at 600 vac. Control wiring required for Carrier to start pumps and tower fan motors must be provided to assure machine protection. If primary pump and tower fan motor are controlled by other means, also provide a parallel means for control by Carrier. Do not use starter control transformer as the power source for pilot relay loads.
- 3.4 Do not route control wiring carrying 30 v or less within a conduit which has wires carrying 50 v or higher or alongside wires carrying 50 v or higher
- 3.5 Voltage selector switch in machine power panel is factory set for 115 v control power source. When 230 v control power source is used, set switch to 230 v position.
- 3.6 Control wiring cables between starter and power panel must be shielded with minimum rating of 600 v, 80 C. Ground shield at starter
- 3.7 If optional oil pump circuit breaker is not supplied within the starter enclosure as shown, it must be located within sight of the machine with wiring routed to suit

IV POWER WIRING BETWEEN STARTER AND COMPRESSOR

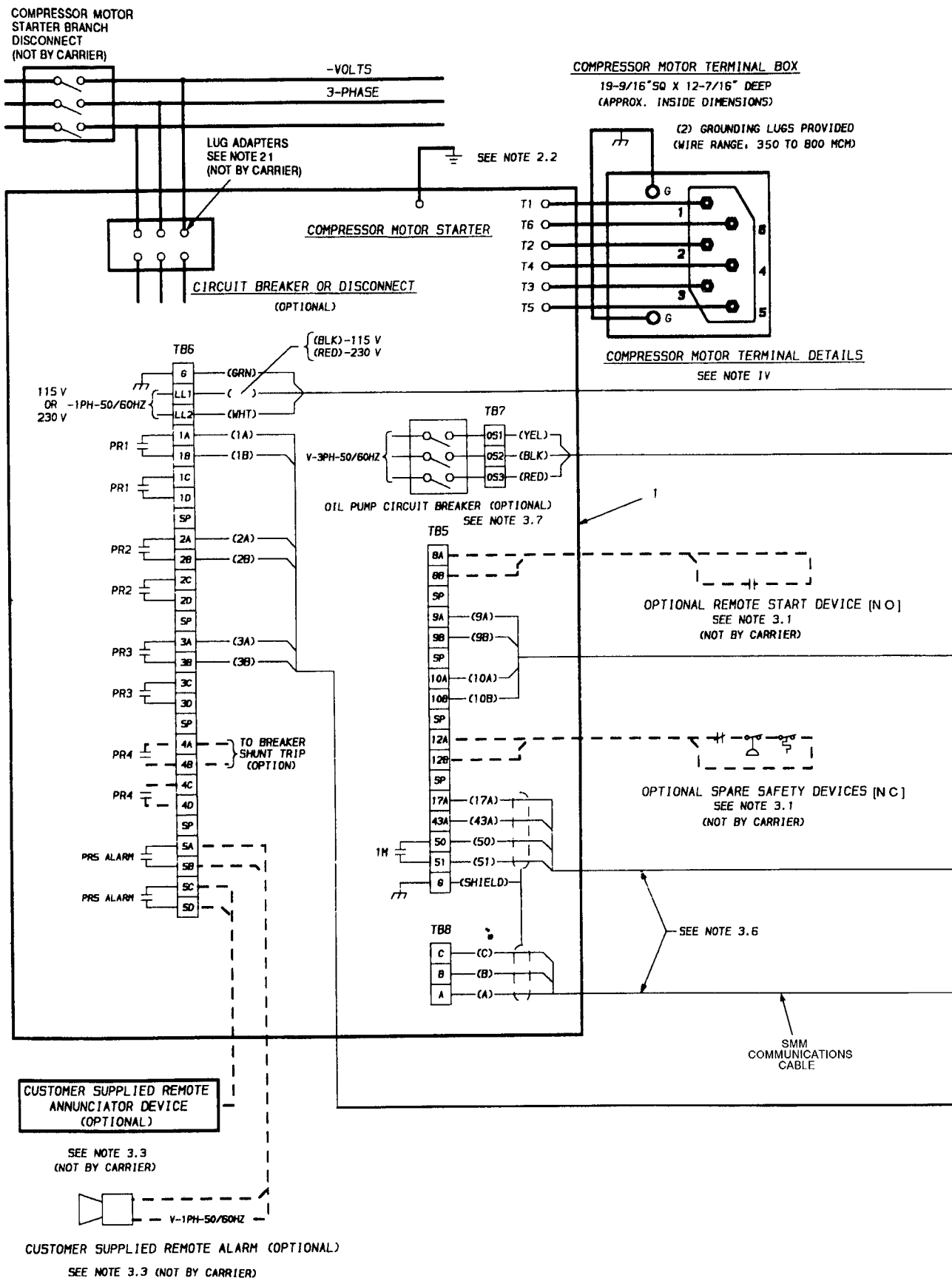
MOTOR

- 4 0 Low voltage (600 v or less) compressor motors have (6) $\frac{3}{4}$ in terminal studs (lead connectors not supplied by Carrier). Either 3 or 6 leads must be run between compressor motor and starter, depending on type of motor starter employed. If only 3 leads are required, jumper motor terminals as follows: 1 to 6, 2 to 4, 3 to 5. Center to center distance between terminals is $2\frac{15}{16}$ inches. Compressor motor starter must have nameplate stamped as conforming with Carrier requirement Z-375.
- 4 1 When more than one conduit is used to run conductors from starter to compressor motor terminal box, one conductor from each phase must be in each conduit to prevent excessive heating (e.g., conductors to motor terminals 1, 2 & 3 in one conduit, and those to 4, 5 & 6 in another)
- 4 2 Compressor motor power connections can be made through top, top rear or sides of compressor motor terminal box using holes cut by contractor to suit conduit. Flexible conduit should be used for the last few feet to the terminal box for unit vibration isolation. Use of stress cones or 12 conductors larger than 500 MCM may require an oversize (special) motor terminal box (not supplied by Carrier). Lead connections between 3-phase motors and their starters must not be insulated until Carrier personnel have checked compressor and oil pump rotations
- 4 3 Compressor motor frame to be grounded in accordance with the National Electrical Code (NFPA-70) and applicable codes. Means for grounding compressor motor is a pressure connector for #4 to 500 MCM wire, supplied and located in the back lower left side corner of the compressor motor terminal box
- 4.4 Do not allow motor terminals to support weight of wire cables. Use cable supports and strain reliefs as required.
- 4 5 Use backup wrench when tightening lead connectors to motor terminal studs. Torque to 45 lb-ft max

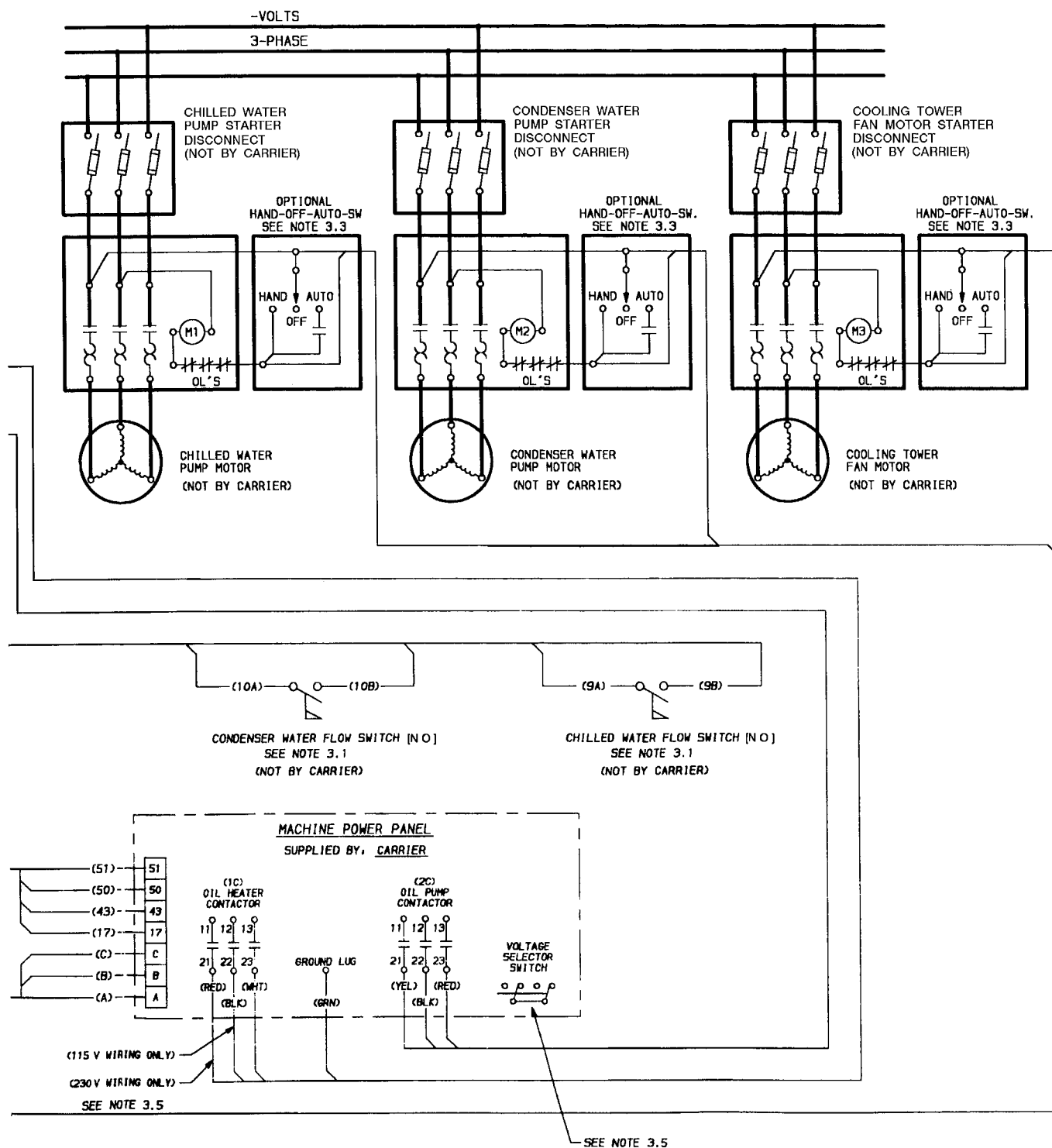
Typical field wiring



19XR, 19XRT TYPICAL FIELD WIRING WITH FREE-STANDING STARTER



19XR, 19XRT TYPICAL FIELD WIRING WITH FREE-STANDING STARTER (cont)



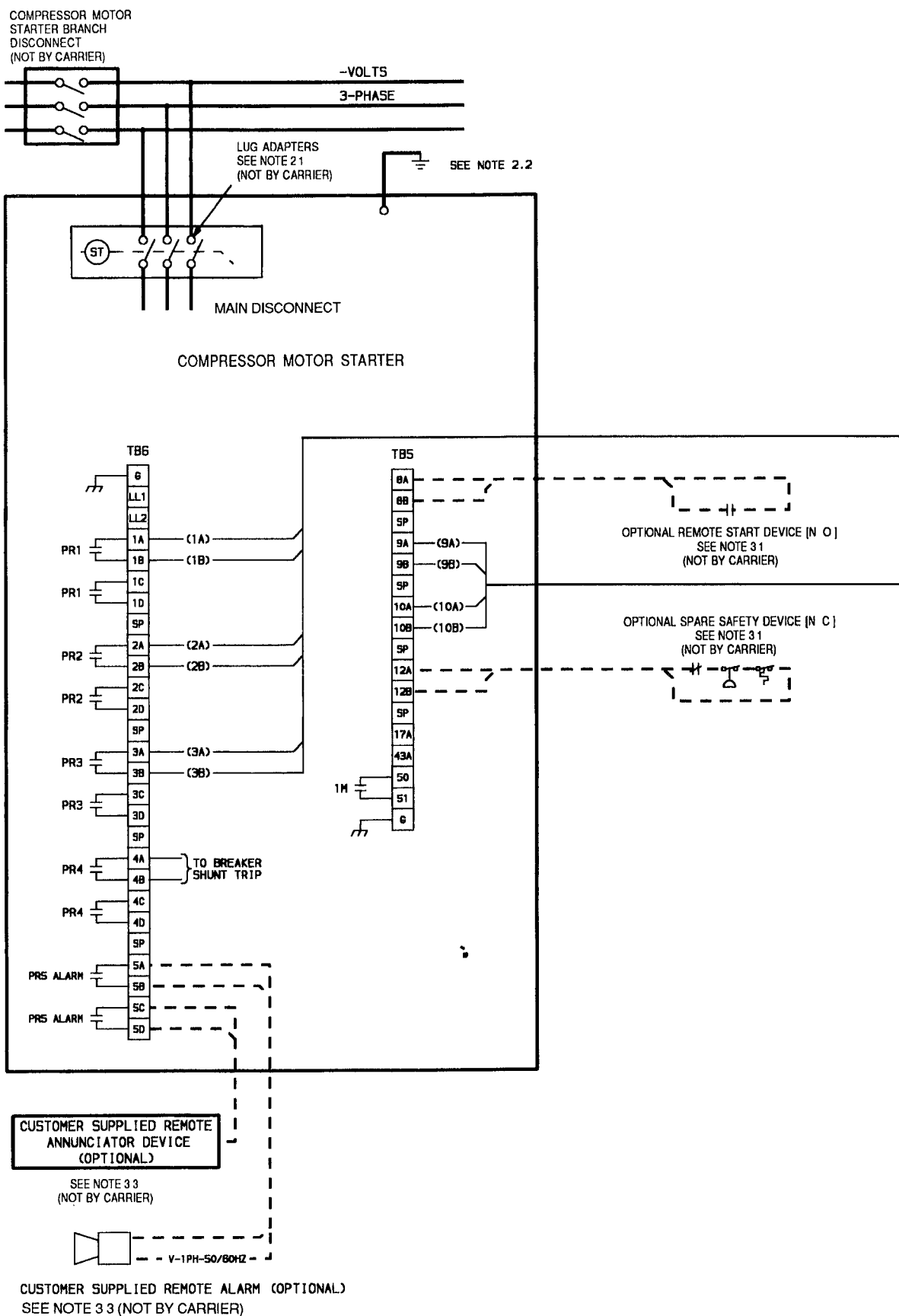
LEGEND

- AWG — American Wire Gage
- RLA — Rated Load Amps
- SMM — Starter Management Module
- Required Power Wiring
- Required Control Wiring
- Options Wiring

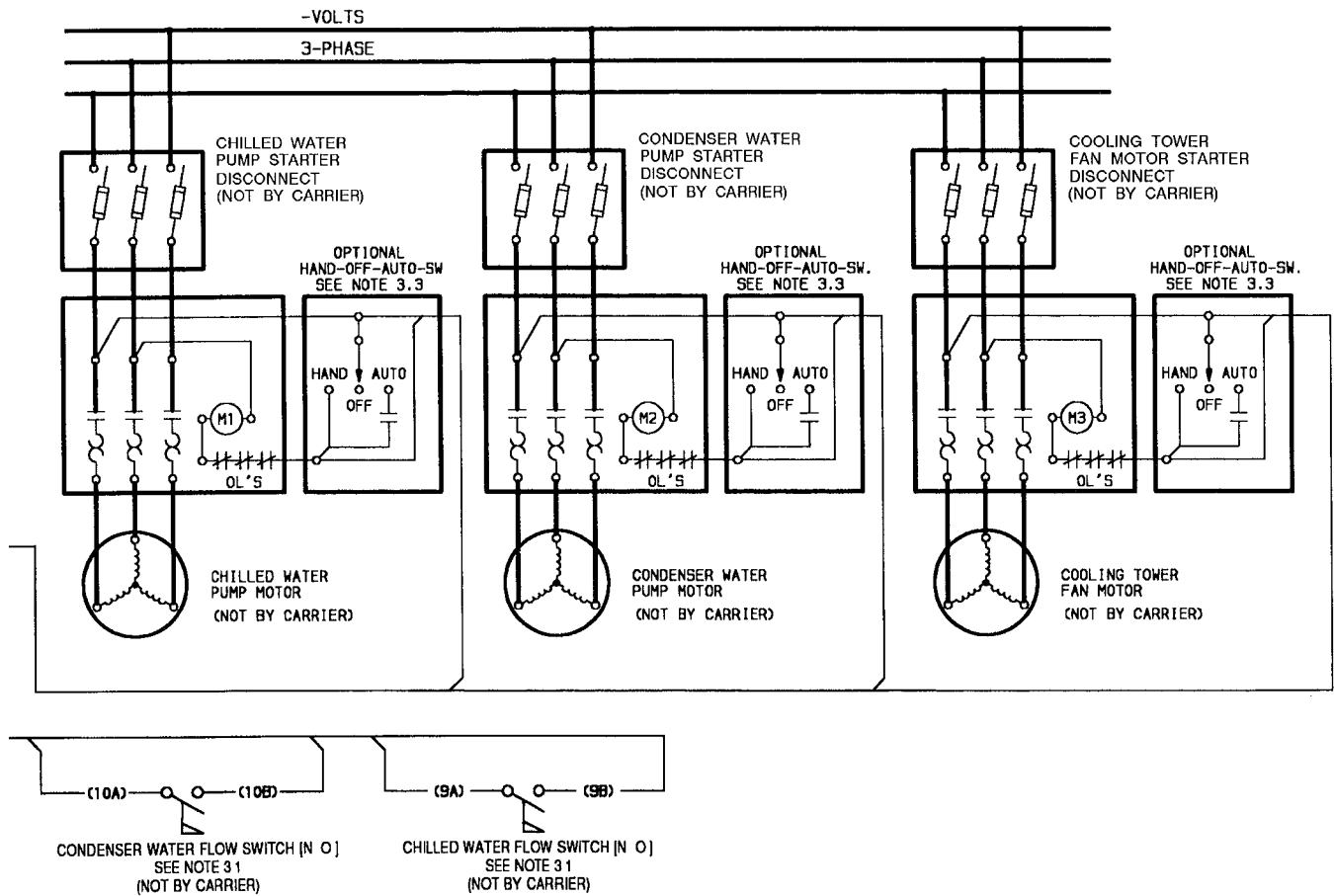
Typical field wiring (cont)



19XR, 19XRT TYPICAL FIELD WIRING WITH OPTIONAL UNIT-MOUNTED STARTER



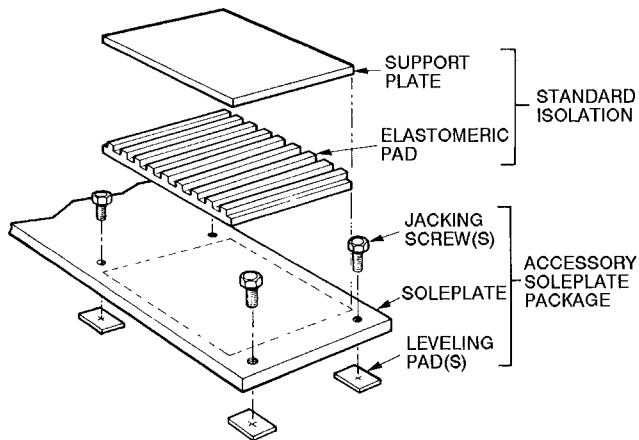
19XR, 19XRT TYPICAL FIELD WIRING WITH OPTIONAL UNIT-MOUNTED STARTER (cont)



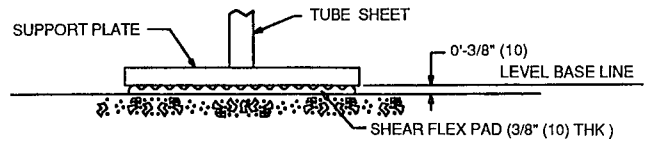
LEGEND

- AWG — American Wire Gage
- NO — Normally Open
- NC — Normally Closed
- PR — Pilot Relay
- RLA — Rated Load Amps
- ST — Shunt Trip
- TB — Terminal Block
- Required Power Wiring
- Required Control Wiring
- - - Options Wiring

TYPICAL ISOLATION



STANDARD ISOLATION

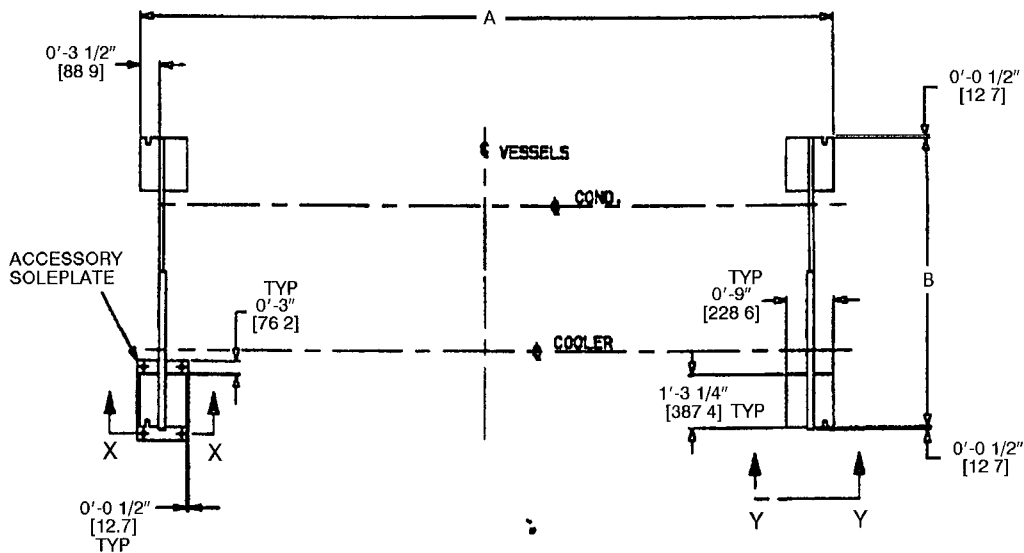


VIEW Y-Y

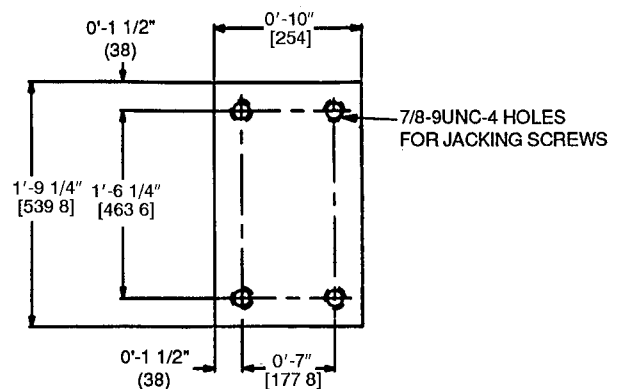
ISOLATION WITH ISOLATION PACKAGE ONLY
(STANDARD)

NOTE: Isolation package includes 4 shear flex pads

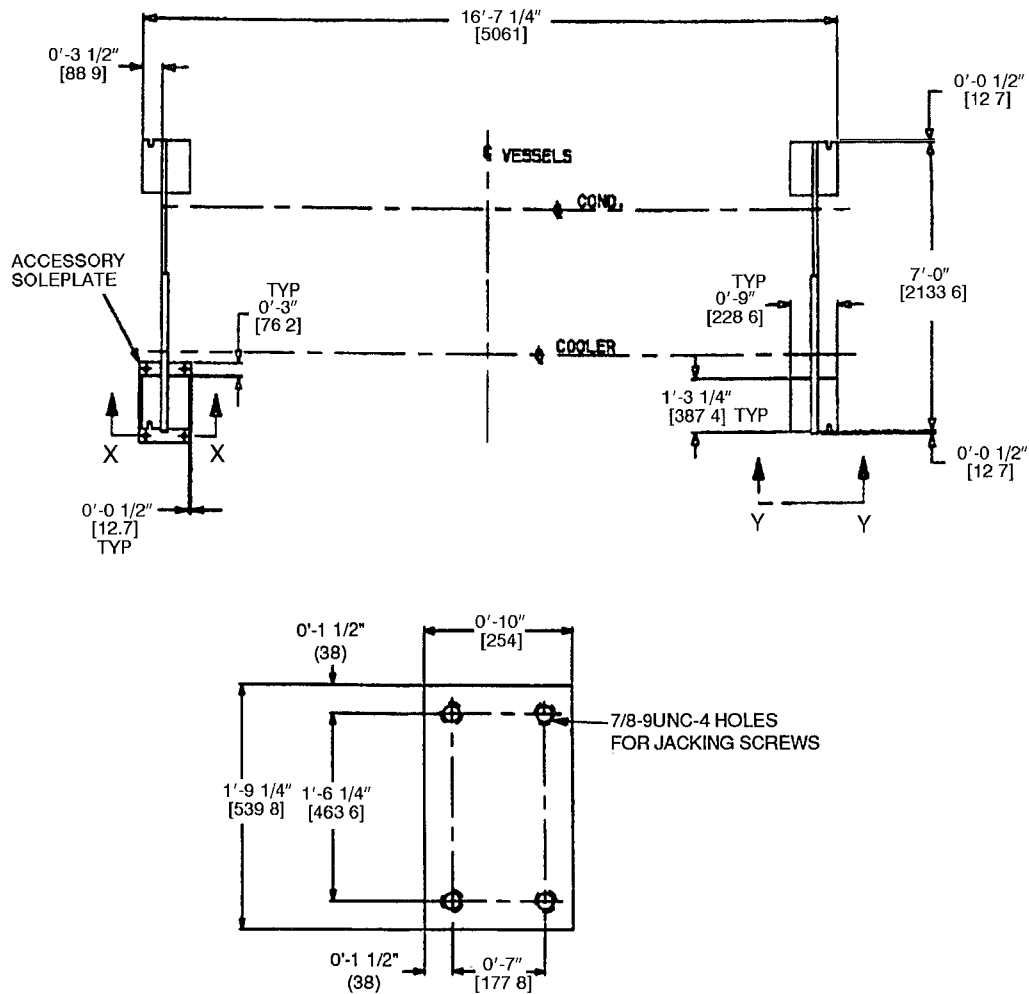
19XR ISOLATION WITH ACCESSORY SOLEPLATE PACKAGE



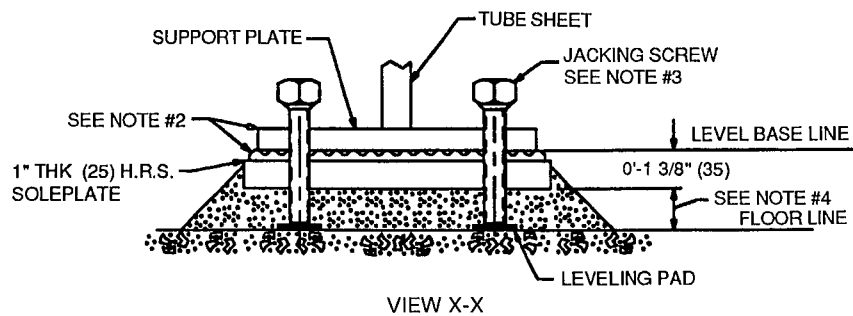
HEAT EXCHANGER SIZE	DIMENSIONS (ft.-in.)	
	A	B
30-32	12-10 $\frac{3}{4}$	5-4 $\frac{3}{4}$
35-37	14- 7 $\frac{1}{4}$	5-4 $\frac{3}{4}$
40-42	12-10 $\frac{3}{4}$	6-0
45-47	14- 7 $\frac{1}{4}$	6-0
50-52	12-10 $\frac{3}{4}$	6-5 $\frac{1}{2}$
55-57	14- 7 $\frac{1}{4}$	6-5 $\frac{1}{2}$
60-62	12-10 $\frac{3}{4}$	6-9 $\frac{1}{2}$
65-67	14- 7 $\frac{1}{4}$	6-9 $\frac{1}{2}$



19XRT ISOLATION WITH ACCESSORY SOLEPLATE PACKAGE



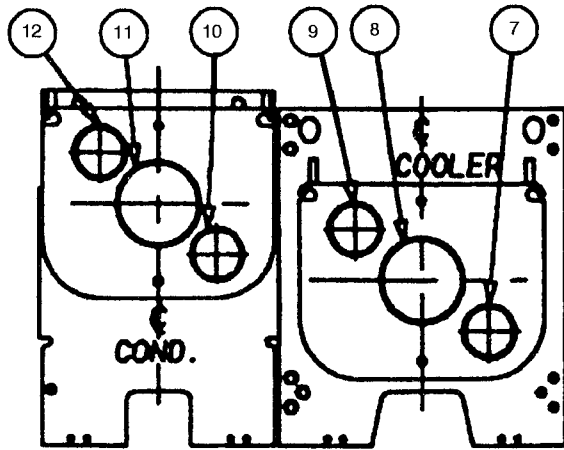
ACCESSORY SOLEPLATE DETAIL



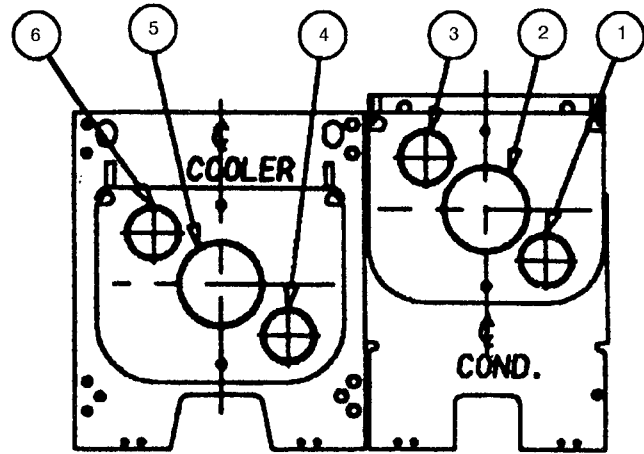
NOTES:

- 1 Dimensions in () are in millimeters.
- 2 Accessory soleplate package includes 4 soleplates, 16 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, Celcote HT-648 or Master Builders 636, 0'-1 1/2" (38 1) to 0'-2 1/4" (57) thick.

19XR NOZZLE ARRANGEMENTS NOZZLE-IN-HEAD WATERBOXES

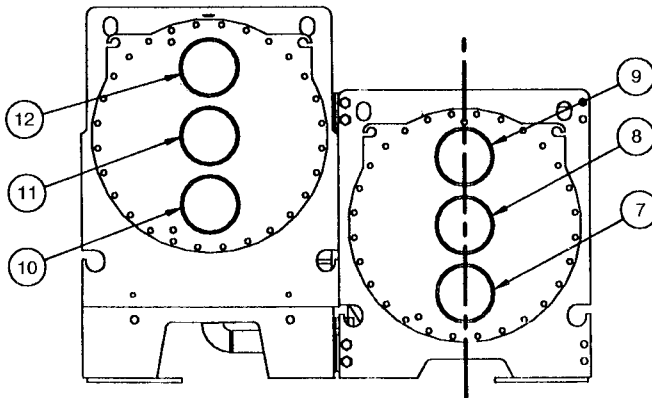


DRIVE END

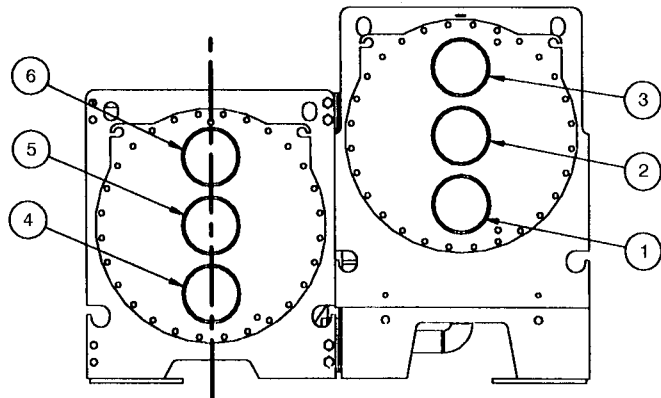


COMPRESSOR END

FRAME 3



DRIVE END



COMPRESSOR END

FRAME 4, 5 AND 6

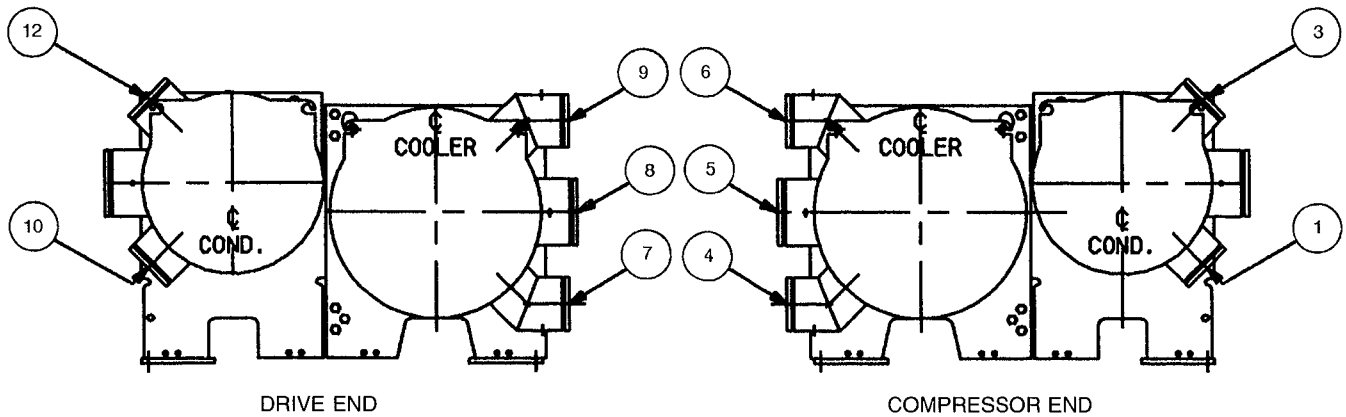
NOZZLE ARRANGEMENT CODES

PASS	COOLER WATERBOXES		
	In	Out	Arrangement Code*
1	8	5	A
	5	8	B
2	7	9	C
	4	6	D
3	7	6	E
	4	9	F

PASS	CONDENSER WATERBOXES		
	In	Out	Arrangement Code*
1	11	2	P
	2	11	Q
2	10	12	R
	1	3	S
3	10	3	T
	1	12	U

*Refer to certified drawings.

19XR NOZZLE ARRANGEMENTS (cont) **MARINE WATERBOXES**



NOZZLE ARRANGEMENT CODES

PASS	COOLER WATERBOXES			CONDENSER WATERBOXES		
	In	Out	Arrangement Code	In	Out	Arrangement Code
1	8	5	A	—	—	—
	5	8	B	—	—	—
2	7	9	C	10	12	R
	4	6	D	1	3	S
3	7	6	E	—	—	—
	4	9	F	—	—	—

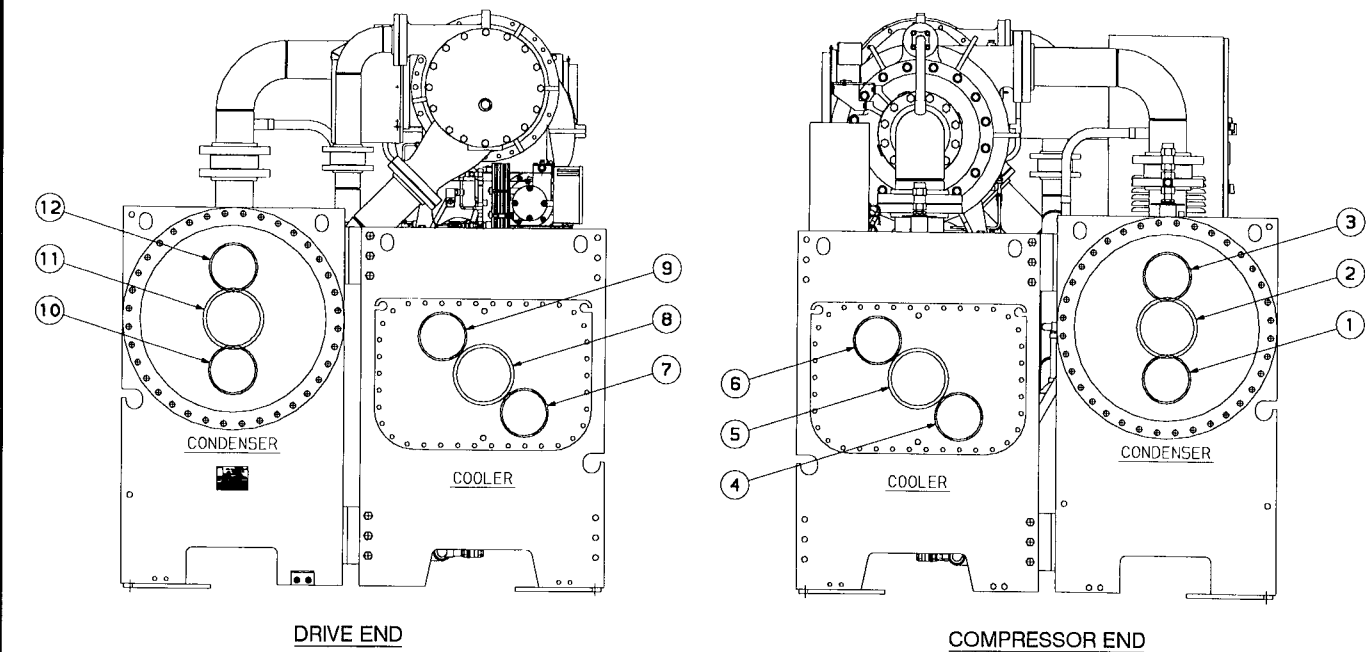
WATERBOX NOZZLE SIZES (NIH AND MWB)

FRAME	PASS	NOMINAL PIPE SIZE (in.)		ACTUAL PIPE ID. (in.)	
		Cooler	Condenser	Cooler	Condenser
3	1	10	10	10.020	10.020
	2	8	8	7.981	7.981
	3	6	6	6.065	6.065
4	1	10	10	10.020	10.020
	2	8	8	7.981	7.981
	3	6	6	6.065	6.065
5	1	10	10	10.020	10.020
	2	8	10	7.981	10.020
	3	6	8	6.065	7.981
6	1	10	10	10.020	10.020
	2	10	10	10.020	10.020
	3	8	8	7.981	7.981

LEGEND

ID — Inside Diameter
NIH — Nozzle-in-Head
MWB — Marine Waterbox

19XRT NOZZLE ARRANGEMENTS



NOZZLE ARRANGEMENT CODES

PASS	COOLER WATERBOXES		
	In	Out	Arrangement Code
1	8	5	A
	5	8	B
2	7	9	C
	4	6	D
3	7	6	E
	4	9	F

PASS	CONDENSER WATERBOXES		
	In	Out	Arrangement Code
1	11	2	P
	2	11	Q
2	10	12	R
	1	3	S
3	10	3	T
	1	12	U

WATERBOX NOZZLE SIZES

FRAME	PASS	NOMINAL PIPE SIZE (in.)		ACTUAL PIPE ID (in.)	
		Cooler	Condenser	Cooler	Condenser
6	1	10	10	10 020	10 020
	2	8	8	7.981	7 981
	3	6	6	6 065	6.065

LEGEND
ID — Inside Diameter

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 machine 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 as shown in Pressure Gage Location table. 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 are insensitive and do not provide accurate measurement of flow conditions.

PRESSURE GAGE LOCATION

NUMBER OF PASSES	GAGE LOCATION (Cooler or Condenser)
1 or 3	One gage in each waterbox
2	Two gages in waterbox with nozzles

ASME stamping

All 19XR and 19XRT heat exchangers 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.

Relief valve discharge pipe sizing

The 19XR and 19XRT are equipped with 3 relief valves: 2 relief valves are located on all 19XR and 19XRT condensers; 1 relief valve is located on all 19XR and 19XRT coolers. The condenser relief valves include a transfer valve.

Relief-valve discharge piping size should be calculated per the current version of the ASHRAE 15, latest edition, code using the tabulated C factors for each vessel shown in tables below. Relief valve size is 1 1/4 in. FPT.

19XR

VESSEL	VESSEL SIZE	C FACTOR (lb air/Min)
COOLER	30-32	43.8
	35-37	49.9
	40-42	50.4
	45-47	57.4
	50-52	53.7
	55-57	61.1
	60-62	57.0
	65-67	64.9
CONDENSER	30-32	41.8
	35-37	47.6
	40-42	47.1
	45-47	53.7
	50-52	51.2
	55-57	58.3
	60-62	55.3
	65-67	63.0

19XRT

VESSEL	VESSEL SIZE	C FACTOR (lb air/Min)
COOLER	60-63	74.7
CONDENSER	60-63	69.9

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.

Application data (cont)



Design pressures

Design and test pressures for heat exchangers are listed below.

DESIGN AND TEST PRESSURES

19XR

PRESSURES	SHELL SIDE (Refrigerant)		STANDARD TUBE SIDE (Water)		OPTIONAL TUBE SIDE (Water)	
	psig	kPa	psig	kPa	psig	kPa
Leak Test at Design Pressure*	185	1276	150	1034	300	2068
Hydrostatic	—	—	225	1551	450	3103
Proof Test*	232	1600	—	—	—	—

19XRT

PRESSURES	SHELL SIDE (Refrigerant)		STANDARD TUBE SIDE (Water)	
	psi	kPa	psi	kPa
Leak Test at Design Pressure*	225	1551	150	1034
Hydrostatic Test	—	—	225	1551
Proof Test*	282	1944	—	—

*Nitrogen/Hellum

HEAT EXCHANGER MATERIAL SPECIFICATIONS

ITEM	MATERIAL	SPECIFICATION
Shell	HR Steel	ASME SA516 GR 70
Tube Sheet	HR Steel	ASME SA516 GR 70
Cooler Waterbox Cover	HR Steel	ASME SA516 GR 70
Cooler Waterbox Shell	HR Steel	ASME SA675 GR 60
Condenser Waterbox	HR Steel	ASME SA516 GR 70
Tubes	Finned Copper	ASME SB359
Discharge/Suction 19XR	Steel	ASME SA106 GRB
19XRT	Steel	ASME SA105

ASME — American Society of Mechanical Engineers

Insulation

MINIMUM FIELD-INSTALLED INSULATION REQUIREMENTS

CHILLER	HEAT EXCHANGER SIZE	INSULATION	
		ft ²	m ²
19XR	30-32	125	11.7
	35-37	135	12.6
	40-42	155	14.4
	45-47	170	15.8
	50-52	170	15.8
	55-57	185	17.2
	60-62	185	17.2
	65-67	205	19.1
19XRT	60-63	250	24.0

Factory insulation (optional) — The factory insulation option for the 19XR includes the following areas: cooler (not including waterbox); suction line up to the compressor suction housing; compressor motor and motor cooling return lines; several small oil cooling and oil return system lines. Optional factory insulation for the 19XRT is available for the evaporator shell and tube sheets, suction elbow, compressor motor, and motor refrigerant drain line(s). Insulation applied at the factory is 3/4 in. (19 mm) thick and has a thermal conductivity K value of (0.28 · Btu · in)/hr · ft² · °F [(0.0404 · W)/(m · °C)]. Insulation conforms with Underwriters' Laboratories (UL) Standard 94, Classification 94HBF

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.

If the machine is to be field insulated, obtain the approximate areas from the Insulation Requirements table.

Insulation of waterbox covers is made only in the field and this area is not included in Minimum Field-Installed Insulation Requirements table. When insulating the covers, allow for service access and removal of covers.

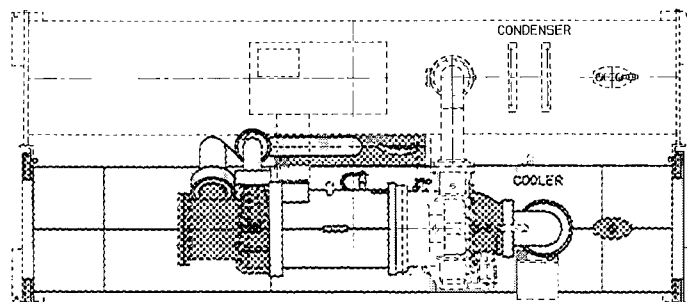
High humidity jobsite locations may require field supplied and installed insulation on the turbine casing, float chamber, suction housing, and the lower half of the condenser.

CONDENSATION VS RELATIVE HUMIDITY*

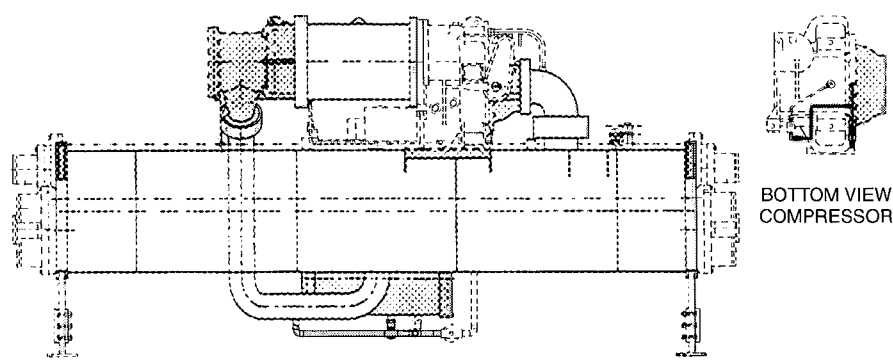
AMOUNT OF CONDENSATION	ROOM DRY-BULB TEMP		
	80 F (27 C)	90 F (32 C)	100 F (38 C)
	% Relative Humidity		
None	80	76	70
Slight	87	84	77
Extensive	94	91	84

*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.

19XRT FACTORY-INSTALLED INSULATION AREA



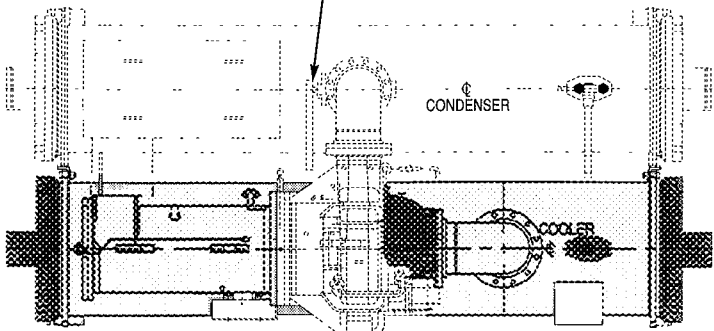
TOP VIEW



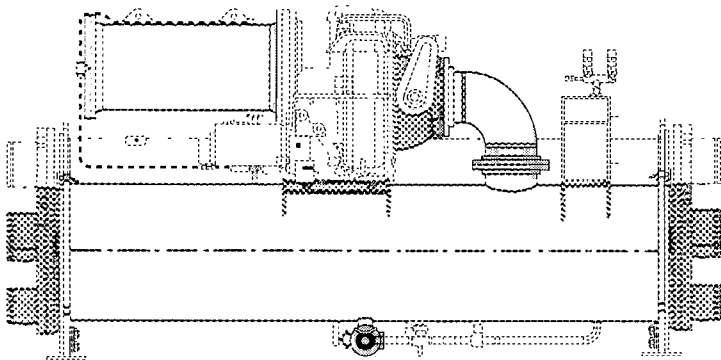
FACTORY-INSTALLED INSULATION
 FIELD-SUPPLIED AND INSTALLED INSULATION (IF REQUIRED)

19XR FACTORY-INSTALLED INSULATION AREA

WHEN DISCH ISOLATION VALVE IS USED
ORIENTATE HANDLE AS SHOWN



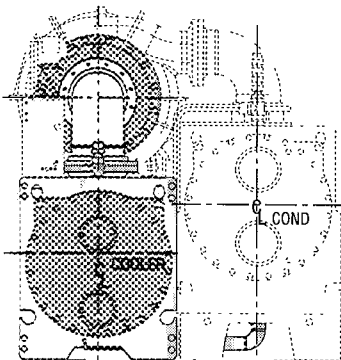
TOP VIEW



DRIVE END

FRONT VIEW

COMPRESSOR END



END VIEW

 FACTORY INSTALLED INSULATION  FIELD SUPPLIED AND INSTALLED INSULATION (IF REQUIRED)

Guide specifications



Packaged Hermetic Centrifugal Liquid Chiller

Size Range: **19XR — 350 to 800 Tons**

(1230 to 2813 kW)

19XRT — 350 to 525 Tons

(1230 to 1845 kW)

Carrier Model Number: **19XR, XRT**

Part 1 — General

1.01 SYSTEM DESCRIPTION

- A. Microprocessor-controlled liquid chiller shall utilize a single stage, semi-hermetic centrifugal compressor using refrigerant HFC-134a. Chillers using CFC refrigerants such as CFC-11, 12, or 500 shall not be acceptable.

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

1. A vapor activated alarm system consisting of all alarms, sensors, safeties, and ventilation equipment as required by ANSI/ASHRAE Standard 15 Safety Code for Mechanical Refrigeration (latest edition) with the quotation. 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. High efficiency purge unit.
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 550-92
- B. Equipment and installation shall be in compliance with ANSI/ASHRAE 15 (latest edition).
- C. Cooler and condenser shall include ASME "U" stamp and nameplate certifying compliance with ASME Section VIII, Division 1 code for unfired pressure vessels.

"A manufacturer's data report is required to verify pressure vessel construction adherence to ASME vessel construction requirements. Form U-1 or U-3 as required per ASME code rules is to be furnished to the owner. The U-Form must be signed by a qualified inspector, holding a National Board Commission, certifying that construction conforms to the latest ASME Code Section VIII, Div. 1 for pressure vessels. The ASME symbol "U" or "UM" must also be stamped on the heat exchanger. Vessels specifically exempted from the Scope of the Code must come with material, test, and construction methods certification and detailed documents similar to ASME U-1; further, these must be signed by an officer of the company."

- D. Chiller shall be manufactured in a facility which has been registered by Underwriters' Laboratories, Inc. (UL) to the International Organization for Standardization ISO 9000 Series Standards for quality.

- E. Chiller shall be designed and constructed to meet UL and UL of Canada requirements and have labels appropriately affixed

- F. 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 and oil pressures and temperatures are within acceptable limits

Each compressor assembly (19XR) shall be proof tested at a minimum 232 psig (1600 kPa) and leak tested at 185 psig (1276 kPa) with a nitrogen/helium gas mixture. For machine with turbine (19XRT), each compressor assembly shall be proof tested at a minimum 282 psig (1944 kPa) and leak tested at 225 psig (1551 kPa) with a nitrogen/helium gas mixture.

- G. Entire chiller assembly shall be proof tested at 232 psig (1600 kPa) and leak tested at 185 psig (1276 kPa) with a nitrogen/helium gas mixture on the refrigerant side. For machine with turbine (19XRT), entire chiller assembly shall be proof tested at 282 psig (1944 kPa) and leak tested with a nitrogen/helium gas mixture at 225 psig (1551 kPa) on the refrigerant side.

The water side of each heat exchanger shall be hydrostatically tested at 1.5 times rated working pressure.

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

- I. On chillers with unit mounted compressor motor starters, chiller and starter shall be factory wired and tested together to verify proper starter operation prior to shipment.

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 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. If the chiller is to be exported, the unit must be sufficiently protected against sea water corrosion to be suitable for shipment in a standard open top, ocean shipping container (19XR only).

1.04 WARRANTY

Warranty shall include parts and labor for one year after start-up or 18 months from shipment, whichever occurs first.

Guide specifications (cont)



Part 2 — Products

2.01 EQUIPMENT

A. General:

Factory assembled, single piece, liquid chiller shall consist of compressor, motor, lubrication system, cooler, condenser, initial oil and refrigerant operating charges, microprocessor control system, and documentation required prior to start-up. An optional compressor motor starter can be mounted on the chiller, wired, and tested by the chiller manufacturer.

B. Compressor:

1. One centrifugal compressor of the high performance, single-stage type. Connections to the compressor casing shall use O-rings instead of gaskets to reduce the occurrence of refrigerant leakage.
2. The open type impeller with machined shroud contours and impeller diameter optimize each compressor efficiency for each specified application
3. A tunnel diffuser shall provide a highly efficient controlled diffusion ratio by means of individually contoured, machined-in channels of circular cross section.
4. Compressor, motor, and transmission shall be hermetically sealed into a common assembly and arranged for easy field servicing. Internal compressor parts are accessible for servicing without removing the compressor base from the chiller. Connections to the compressor shall be flanged or bolted for easy disassembly.
5. The compressor shall incorporate a two-phase flow turbine expander energy reclaim system to recover energy otherwise lost in the expansion portion of the vapor compression cycle. The turbine wheel shall be attached to the motor shaft to supplement energy furnished by the motor (19XRT only).
6. Journal bearings shall be of the steel-backed, babbit lined type.
7. The high speed shaft thrust bearing shall be of the tilting pad, multi-shoe, Kingsbury type with individually replaceable shoes. The low speed shaft thrust bearing shall be of the tapered land type.
8. Transmission shall be single ratio, single helical, parallel shaft speed increaser. Gears shall conform to AGMA Standards.
9. The compressor design shall include a balancing piston to offset impeller thrust forces. The gear thrust load shall act opposite to impeller thrust loads.
10. The variable inlet guide vanes at the inlet to the impeller shall provide capacity modulation from 100% to 15% capacity, with 2.5 F (1.38 C) drop in entering condenser water temperature per 10% capacity reduction, while also providing pre-whirl of the refrigerant vapor entering the impeller for more efficient compression at all loads.

11. Compressor 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 motor-driven oil pump with factory installed motor contactor with overload protection.
- b. Refrigerant-cooled oil cooler.
- c. Oil pressure regulator.
- d. Twenty-micron oil filter with isolation valves to allow filter change without removal of refrigerant charge.
- e. Oil sump heater [115/230 v, 50 or 60 Hz] controlled from unit microprocessor.
- f. Oil reservoir temperature sensor with main control center digital readout.
- g. Oil pump and motor for 200-240, 380-480, or 507-619 v, 3 ph, 60 Hz power source, or 220-240, 346-440 v, 3 ph, 50 Hz power source.
- h. When factory mounted compressor motor starter is provided, all wiring to oil pump, oil heater, and controls shall be prewired in the factory and power shall be applied to check proper operation prior to shipment.

12. Compressor shall be fully field serviceable. Compressors which must be removed and returned to the factory for service shall be unacceptable.

13. Acoustical attenuation shall be provided as required, to achieve a maximum (full load or part load) sound level of [] dBA, measured per ARI Standard 575 (latest edition). Attenuation shall be designed to be easily removed and reinstalled.

C. Motor:

1. Compressor motor shall be of the hermetic, liquid refrigerant cooled, squirrel cage, induction type suitable for voltage shown on the equipment schedule. If open motors are used in place of refrigerant cooled motors, the manufacturer shall supply a curve of motor heat loss as a function of load to allow calculation of the additional ventilation or air conditioning load generated from the motor heat rejection. In addition, a mechanical room safety alarm, wiring, and chiller emergency shut down shall be included to prevent chiller operation if machine room temperature exceeds 104 F (40 C).
2. Motor design speed shall be 3550 rpm (60 Hz) or 2950 rpm (50 Hz).
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 (with one spare) temperature sensor shall be provided.
7. Low voltage motors (600 v or less) shall be suitable for connection to wye-delta type reduced inrush starters or solid-state type reduced voltage starters.
8. Should the mechanical contractor choose to provide a chiller with an open motor instead of the specified semi-hermetic motor, the contractor shall either:

Supply additional ventilation to maintain a maximum mechanical room temperature of 104 F (40 C). Additional ventilation requirements shall be calculated as follows:

$$Cfm = \frac{(\text{Full load motor kW}) (0.05) (3413)}{(104 - 95) (1.08)}$$

$$Cfm = (\text{FLkW motor}) (17.6)$$

or, if the mechanical room is air conditioned, the mechanical contractor shall install additional cooling equipment to dissipate the motor heat as per the following formula:

$$Btuh = (\text{FLkW motor}) (0.05) (3413)$$

$$Btuh = (\text{FLkW motor}) (171)$$

and, alternately

$$\text{Tons} = \frac{Btuh}{12,000}$$

In either case, the additional piping, valves, air-handling equipment, insulation, wiring, switch-gear 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.

Also, if an open motor is provided, a mechanical room thermostat shall be installed 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 and condenser shall be of shell and tube type construction, each in separate shells. Units shall be fabricated with high-performance tubing, steel shell and tube sheets with fabricated steel waterboxes. Waterboxes shall be nozzle-in-head type with stubout nozzles having Victaulic grooves to allow for use of Victaulic couplings.

2. Tubing shall be copper, high-efficiency type, with integral internal and external enhancement. Tubes shall be nominal 3/4-in. OD with nominal wall thickness of 0.025 in. measured at the root of the fin. Tubes shall be rolled into tube sheets and shall be individually replaceable. Tube sheet holes shall be double grooved for joint structural integrity. Intermediate support sheet spacing shall not exceed 36 in. (914 mm).
3. Waterboxes and nozzle connections shall be designed for 150 psig (1034 kPa) minimum working pressure unless otherwise noted. Nozzles should have grooves to allow use of Victaulic couplings.
4. The tube sheets of the cooler and condenser shall be bolted together to allow for field disassembly and reassembly.
5. The vessel shall display an ASME nameplate which shows the pressure and temperature data and the "U" stamp for ASME Section VIII, Division 1. A pressure relief valve shall be installed on each heat exchanger.
6. 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.
7. 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.
8. Tubes shall be individually replaceable from either end of the heat exchanger without affecting the strength and durability of the tube sheet and without causing leakage in adjacent tubes.
9. The condenser shell shall include a sensible sub-cooler chamber which cools the condensed liquid refrigerant to a reduced temperature, thereby increasing the refrigeration cycle efficiency (19XRT only).
10. 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 (19XR only).

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. By maintaining a liquid seal at the flow valve, bypassed hot gas from the condenser to the cooler is eliminated. The float valve chamber shall have a bolted access cover to allow field inspection and the float valve shall be field serviceable. Fixed orifices shall be unacceptable.

Guide specifications (cont)



F. Controls, Safeties, and Diagnostics:

1. Controls:

- a. The chiller shall be provided with a factory installed and wired microprocessor control center with individually replaceable modular component construction. Components included shall be the main processor/input-output module, power supply, starter management module (located in the starter cabinet), relay board, and temperature and pressure (thermistor and transducer) sensors. An optional input module (8 input channels) can be factory or field installed. The control center includes 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 system shall have the ability to interface and communicate directly to the building control system without the use of additional field-installed hardware or software. Additional hardware will be necessary if the building control system is not Carrier Comfort Network (CCN).

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

- date and time of day
- 24 character primary system status message
- 24 character secondary status message
- chiller operating hours
- entering chilled water temperature
- leaving chilled water temperature
- evaporator refrigerant temperature
- entering condenser water temperature
- leaving condenser water temperature
- condenser refrigerant temperature
- oil supply pressure
- oil sump temperature
- percent motor Rated Load Amps (RLA)

The default screen shall be displayed if there is no manual activity at the control console for 15 minutes.

- c. The 4 function keys shall be software driven within the Status, Schedule, Set Point and Service menu structures (as described below).

1) Status Function:

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

- evaporator pressure
- condenser pressure
- bearing oil supply temperature
- compressor discharge temperature
- motor winding temperature
- number of compressor starts
- control point settings

- discrete output status of various devices
- compressor motor starter status
- optional spare input channels (16 maximum)

2) 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 a minimum of two 365-day occupancy schedules. Each schedule shall allow a minimum of 8 separate occupied/unoccupied periods, any or all of which can be scheduled by individual day for any or all days of the week, with a separate schedule for holidays. Schedules shall allow specification of Daylight savings start/end and up to 18 user-defined holidays up to one year in advance (month, day, and duration in days). Display of the occupancy schedules shall be viewable on the LCD screen. Each schedule shall provide a means of configuring an occupancy timed override to permit a "one time extension" of an occupied period on the configured day. The controls shall also provide for chiller start-up and shutdown via remote contact closure from a customer supplied device or from a building management system software command.

3) Set Point Function:

The controls shall provide the capability to view and change the leaving chilled water set point, entering chilled water set point, and demand limit set point at any time during chiller operating or shutdown periods. The controls shall allow for the specification of capacity control by either leaving chilled water or entering chilled water.

4) 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
- Execute a chiller controls test function for quick identification of malfunctioning components
- View/modify chiller configuration
- View/modify chiller occupancy periods
- View/modify schedule holiday periods
- View/modify schedule override periods
- View/modify system time and date

d. Network Window Function

Each Chiller LID (Local Interface Device) shall be capable of viewing multiple point values and statuses from other like controllers 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 LID shall also have access to the alarm history file of all like controllers connected on the network.

- e. Capacity control shall be by means of a variable inlet guide vanes located at the impeller inlet. Load modulation shall be from 100% to 15% of compressor full load under normal ARI conditions without the use of hot gas bypass. The guide vanes are precisely positioned by a PID (proportional-integral-derivative) control algorithm to ensure precise control ($\pm 0.5^\circ\text{F}$ [$\pm 0.3^\circ\text{C}$]) of desired chilled water temperature without hunting or overshooting the set point.
- f. The microprocessor control system shall include a programmed sequence to meet pre-lube needs prior to machine start-up and during coast down after machine stop. The microprocessor shall automatically activate and interlock the chilled water pump, condenser water pump, and cooling tower fans upon chiller activation.
- g. Upon request to start the compressor, the control system shall start the chilled water pump, condenser water pumps and tower fans and verify that flows have been established. The controller shall then compare the entering/leaving chilled water temperature with the chilled water set point. If the chilled water temperature is less than the chilled water set point, the control system shall shut down the condenser water pump and wait for the cooling load to be established.
- h. A user-configurable ramp loading rate, effective during the chilled water temperature pull-down 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 pull-down 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.
- i. The control system shall include 2 compressor cycle timers to protect the motor from

rapid cycling, a 15 minute minimum start-to-start timer, and a 1 minute minimum stop-to-start timer. In addition the compressor shall be inhibited from restarting if more than 8 manual starts within a 12 hour period have occurred

- j. The control system shall automatically cycle the compressor off to minimize energy usage whenever the leaving chilled water temperature is 5°F (3°C) below the desired chilled water set point. The chilled water pump shall remain on and when the leaving chilled water temperature rises above the set point by a user-configured amount, the compressor shall automatically restart. During the shut-down period, a message shall be displayed informing the operator a recycle restart is pending.
- k. The control system shall monitor line voltage and if loss of voltage, high or low line voltage, or single cycle dropout is sensed, the chiller shall shut down. Upon restoration of line voltage, if the auto-restart after power failure algorithm is enabled, the chiller shall automatically resume the mode of operation functioning prior to shutdown.
- l. The control center shall allow reset of the chilled water temperature set point based on any one of the following criteria:
 - Chilled water reset based on an external 4 to 20 mA signal
 - Chilled water reset based on a remote temperature sensor (such as outdoor air).
 - Chilled water reset based on water temperature rise across the evaporator.

When reset is active, a message shall be displayed indicating the type reset in effect.

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

When demand limit is active a message shall be displayed indicating the source of the demand signal.

- n. 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 LCD screen, informing the operator of the shutdown cause.)
 - motor overcurrent
 - over voltage*
 - under voltage*
 - single cycle dropout*
 - bearing oil high temperature
 - low evaporator refrigerant temperature
 - high condenser pressure
 - high motor temperature
 - high compressor discharge temperature
 - low oil pressure
 - prolonged surge
 - loss of cooler water flow
 - loss of condenser water flow
 - 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 which 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:
 - high condenser pressure
 - high motor temperature
 - low evaporator refrigerant temperature
 - high motor amps

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 shut down and alarm

3. Diagnostics and Service:

- a. The control system shall execute a series of prestart checks whenever a start command is received to determine if pressures, temperatures, and timers are within pre-start limits, thereby allowing start-up to proceed. If any of the limits are exceeded, a text alert message will be displayed informing the operator of the cause of the pre-start alert
- b. 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 pump test shall automatically energize the chilled water pump, condenser water pump, and oil pump. The control system shall confirm that water flow and oil pressure have been established and require operator confirmation before proceeding to the next test. A guide vane actuator test shall open and close the guide vanes to check for proper operation prior to proceeding to the next test. The operator manually acknowledges proper guide vane operation prior to proceeding to the next test.

- c. 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 LCD screen the actual reading of each transducer and each thermistor installed on the chiller.
- d. All sensors shall have quick disconnects to allow replacement of the sensor without replacement of the entire sensor wire. 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.

4. Building Control System Interface:

The chiller control system shall have the ability to interface and communicate directly to the building control system without the use of additional field installed hardware and software. The building control system and the centrifugal chiller must be supplied by the same manufacturer. If different building control and chiller suppliers are chosen the chiller shall be supplied with a Dataport module which shall translate the information in the chiller microprocessor to an ASCII stream of data which can be read by any manufacturer's building management control system.

5. Multiple Chiller Control

The chiller controls shall be supplied as standard with a two chiller lead/lag and a third chiller standby system. The control system shall automatically start and stop a lag or second chiller on a two chiller system. If one of the two chillers on line goes into a fault mode, the third standby chiller shall be automatically started. The two chiller lead/lag system shall allow manual rotation of the lead chiller, include load balancing if configured, and a staggered restart of the chillers after a power failure.

For systems with more than two operational chillers, a Chillervisor System Manager (CSM) module shall be field installed in the control center of one of the chillers. This control system can automatically control up to 8 chillers in the same plant room. If desired, other components of the chilled water plant, such as cooling towers, pumps, and valves can be controlled by additional hardware and software supplied by the chiller manufacturer.

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 the water flow switches to the chiller control circuit to ensure that chiller will not operate until flows are established and maintained.
3. Electrical contractor shall wire the chilled water pump, condenser water pump, and tower fan control circuit to the chiller control circuit.
4. Electrical contractor shall supply and install electrical wiring and devices required to interface the chiller controls with the building control system if applicable.
5. 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. Gages shall be Marsh Master or equal with 4½ in. nominal diameter face. 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.

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. After the above services have been performed, the same factory-trained representative shall be available for a period of classroom instruction not to exceed 8 hours to instruct the owner's personnel in the proper operation and maintenance of the chiller.
3. 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. Field-Installed Accessories:

The following standard accessories are available for field installation:

1. Soleplate Package:

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

2. Spring Isolators:

Field furnished and selected for the desired degree of isolation

3. Spare Sensors with Leads:

Unit manufacturer shall furnish additional temperature sensors and leads to be used in conjunction with the control options module upgrade kit.

4. Control Options Module Upgrade Kit:

Unit manufacturer shall furnish an 8-input control module required to provide chilled water reset from 4-20 mA signal or remote temperature sensor, auto demand limit from 4-20 mA signal, or monitoring common supply and return chilled water temperature for multiple chiller control. Accessory includes options transformer for installation in power panel. The 8-input module shall be capable of generating a 20 mA current supply for modulation by others or accepting a 4-20 mA input from others

5. Sound Insulation Kit

Unit manufacturer shall furnish a sound insulation kit that covers the compressor housing, motor housing, compressor discharge pipe, condenser shell, and suction line.

- a. Inner and outer jacket construction shall be 17 oz/sq yd PTFE Teflon impregnated fiberglass cloth.
- b. Insulation material shall be 11 lb/cu ft fiberglass needled material with Barium Sulfate loaded vinyl acoustic barrier
- c. Blanket construction shall be double sewn and lock stitched with minimum of 7 stitches per inch using Teflon-coated, fiberglass thread. All raw jacket edges shall have a tri-fold Teflon cloth binding. No raw cut edges shall be exposed.
- d. Insulation design shall accommodate temperature and pressure probes, gages, tubing, piping, and brackets
- e. To avoid penetrating noise at mating seams, blanket pieces shall include an extended 2-in wide vinyl flap. This flap shall cover all exposed seams, thereby minimizing any potential noise leaks.
- f. An aluminum nameplate shall be riveted to each blanket piece. Each tag shall be embossed or etched with lettering indicating piece location, description, size, and tag number sequence.

Guide specifications (cont)



- g. To enhance blanket quality and maintain uniform thickness, stainless steel quilting pins shall be placed at random locations no greater than 18 in. apart to prevent shifting of the insulation filler.

6. Stand-alone Pumpout Unit:

A freestanding pumpout unit shall be provided. The pumpout unit shall utilize a semi-hermetic reciprocating compressor with water cooled condenser. Condenser water piping, 3 phase motor power, and 115-volt control power shall be installed at the jobsite by the installing contractor.

7. Separate Storage Tank and Pumpout Unit:

A freestanding refrigerant storage tank and pumpout unit shall be provided. The storage vessels shall be designed per ASME Section VIII Division 1 code with 300 psig (2068 kPa) design pressure. Double relief valves per ANSI/ASHRAE 15, latest edition, shall be provided. The tank shall include a liquid level gage and pressure gage. The pumpout unit shall utilize a semi-hermetic reciprocating compressor with water cooled condenser. Condenser water piping, 3 phase motor power, and 115-volt control power shall be installed at the jobsite by the installing contractor.

- 8. Mechanical contractor shall supply and install flow detection devices (United Electric 24-013H2012R or equal) in chilled water and condenser water piping. Switches shall make contact when flow is established. Flow switches shall be installed in horizontal runs at least 5 pipe diameters downstream from any bend or tee.

L. Factory-Installed Options:

The following standard options, if selected, are factory installed. Certain options will supersede the standard features listed previously, and are indicated by an (*).

* 1 Thermal Insulation:

Unit manufacturer shall insulate the cooler shell, economizer low side compressor suction elbow, motor shell and motor cooling lines. Insulation shall be 3/4 in. (19 mm) thick with a thermal conductivity not exceeding

$$0.28 \frac{\text{Btu} \cdot \text{in.}}{\text{hr} \cdot \text{ft}^2 \cdot ^\circ\text{F}} \quad (0.0404 \frac{\text{W}}{\text{m} \cdot ^\circ\text{C}})$$

and shall conform to UL Standard 94, classification 94 HBF.

* 2. Automatic Hot Gas Bypass:

Hot gas bypass valve and piping, designed to artificially load the evaporator, shall be factory furnished to permit chiller operation down to 15% of full load capacity for extended periods of time.

3. Control Options Module:

Unit manufacturer shall install an 8-input control module required to provide chilled water reset from 4-20 mA signal or remote temperature sensor, auto demand limit from 4-20 mA signal or monitoring common supply and return chilled water temperature for multiple chiller control. Option includes transformer in power panel.

* 4. Cooler and Condenser Tubes:

- a. Unit manufacturer shall provide 3/4-in. outside diameter copper tubes in the cooler and/or condenser that are internally/externally enhanced and have 0.028 in. (0.711 mm) wall thickness.
- b. Unit manufacturer shall provide 3/4-in. outside diameter copper tubes in the cooler and/or condenser that are internally/externally enhanced and have 0.035 in. (0.889 mm) wall thickness.
- c. Unit manufacturer shall provide 3/4-in. outside diameter copper tubes in the cooler and/or condenser that are smooth bore/externally enhanced and have 0.028 in. (0.711 mm) wall thickness.
- d. Unit manufacturer shall provide 3/4-in. outside diameter copper tubes in the cooler and/or condenser that are smooth bore/externally enhanced and have 0.035 in. (0.889 mm) wall thickness.
- e. Unit manufacturer shall provide 3/4-in. outside diameter 90/10 CuNi tubes in the condenser that are smooth bore/externally enhanced and have 0.028 in. (0.711 mm) wall thickness.
- f. Unit manufacturer shall provide 3/4-in. outside diameter 90/10 CuNi tubes in the condenser that are smooth bore/externally enhanced and have 0.035 in. (0.889 mm) wall thickness.
- g. Unit manufacturer shall provide 3/4-in. outside diameter 90/10 CuNi tubes in the condenser that are internally/externally enhanced and have 0.028 in. (0.711 mm) wall thickness.
- h. Unit manufacturer shall provide 3/4-in. outside diameter 90/10 CuNi tubes in the condenser that are internally/externally enhanced and have 0.035 in. (0.889 mm) wall thickness.
- i. Unit manufacturer shall provide 3/4-in. outside diameter titanium tubes in the condenser that are smooth bore and have 0.023 in. (0.584 mm) wall thickness.
- j. Unit manufacturer shall provide 3/4-in. outside diameter titanium tubes in the condenser that are smooth bore and have 0.028 in. (0.711 mm) wall thickness.
- k. Unit manufacturer shall provide 3/4-in. outside diameter titanium tubes in the condenser that are internally enhanced and have 0.025 in. (0.635 mm) wall thickness.
- l. Unit manufacturer shall provide 3/4-in. outside diameter titanium tubes in the condenser that are internally enhanced and have 0.028 in. (0.711 mm) wall thickness.

- * 5. Cooler and Condenser Passes:
 - a. Unit manufacturer shall provide the cooler and/or condenser with 1 pass configuration on the water side.
 - b. Unit manufacturer shall provide the cooler and/or condenser with 2-pass configuration on the water side.
 - c. Unit manufacturer shall provide the cooler and/or condenser with 3 pass configuration on the water side.
- * 6. Nozzle-In-Head, 300 psig (2068 kPa) (19XRT only):

Unit manufacturer shall furnish nozzle-in-head style waterboxes on the cooler and/or condenser rated at 300 psig (2068 kPa).
- * 7 Marine Waterboxes, 150 psig (1034 kPa) (19XR only):

Unit manufacturer shall furnish marine style waterboxes on the cooler and/or condenser rated at 150 psig (1034 kPa).
- * 8. Marine Waterboxes, 300 psig (2068 kPa) (19XR only):

Unit manufacturer shall furnish marine style waterboxes on the cooler and/or condenser rated at 300 psig (2068 kPa).
- * 9. Flanged Water Nozzles:

Unit manufacturer shall furnish standard flanged piping connections on the cooler and/or condenser
- 10. Factory Performance Test:

Unit manufacturer shall provide a certified (non-witnessed) or witnessed single point performance test per the latest version of ARI-550 test procedures. Additional points shall be available as an option.
- 11. Pumpout Unit:

A refrigerant pumpout system shall be installed on the chiller. The pumpout system shall include a 2-hp compressor and drive, piping, wiring, and motor. The storage vessel shall be integral to the machine, external to the unit cooler or condenser shells and shall be large enough to hold the entire refrigerant charge. Isolation of the refrigerant in the cooler or condenser during servicing shall be unacceptable.
- 12. NEMA 12 Machine (19XR only):

Machine shall be manufactured to meet NEMA 12 requirements including power panel and control panel.
- 13. Optional compressor discharge isolation valve and liquid line ball shall be factory installed to allow isolation of the refrigerant charge in the condenser for servicing the compressor.
- 14. Optional Low Voltage Unit Mounted Starter:

An optional reduced voltage wye-delta or solid-state starter shall be supplied. The compressor motor starter shall be factory mounted, wired and tested prior to shipment by the chiller manufacturer. Customer electrical connection for compressor motor power shall be limited to main power leads to the starter, wiring of the cooler and condenser flow switches to the chiller control circuit, and wiring water pumps and tower fans to the chiller control circuit. Included in the UL and CSA approved starters are:

 - a. NEMA 1 enclosure with integral fan cooling and lockable hinged doors.
 - b. Main power disconnect (non-fused type).
 - c. Starter Management Module (SMM) which communicates with the chiller control system to perform starting and stopping of the chiller, water pumps, and tower fans, as well as monitoring starter operation. Included in this module is a single cycle dropout protection.
 - d. Microprocessor based, 3-phase, overload relay with manual reset.
 - e. 2 kva control/oil heater transformer.
 - f. Branch circuit breaker for oil pump.
 - g. Branch circuit breaker for control power and oil heater.
 - h. 5 pilot relays for control of chilled water pump, condenser water pump, tower fan, customer remote alarm, and main power disconnect shunt trip

Guide specifications (cont)



- i. Optional solid-state starter shall provide step-less compressor motor acceleration and limit motor inrush current to 150-300% of compressor motor rated load amps. The starter shall include 6 Silicon Control Rectifiers (SCR) with integrally mounted bypass contactors to provide SCR bypass once the motor has achieved full voltage and speed. The starter shall also include automatic acceleration kick circuitry which monitors motor current to sense when the inrush current subsides and automatically ramps voltage up at a quicker rate to eliminate the instability which occurs at the break-away torque point.

Solid-state starter shall also include the following standard features:

- 1) Current imbalance detector which monitors 3-phase motor current to provide the following protection:
- Phase loss
 - Phase reversal
 - Phase imbalance
 - Ground fault
 - Shorted SCR
 - Current flow while stopped protection
 - 3-phase under/over voltage protection

- 2) Diagnostic LED's shall be provided to indicate:

- Starter on
- Run (up to voltage)
- Phase correct
- Over-temperature fault
- SCR gates energized
- Ground fault
- Current imbalance fault
- Shorted SCR

- j. Optional wye-delta starter shall include as standard the IQ 1000 II motor protection system. System shall provide:

- Phase loss
- Phase reversal
- Phase imbalance
- 3-phase digital ammeter
- Ground fault protection
- Microprocessor based overload trip protection

Optional wye-delta starter shall provide as an option an IQ Data Plus II system. This system shall provide:

- 3-phase amp/voltmeter (digital)
- Watts
- Power factor
- Frequency
- Watt demand
- Watt hour
- 3-phase under/over voltage protection

