

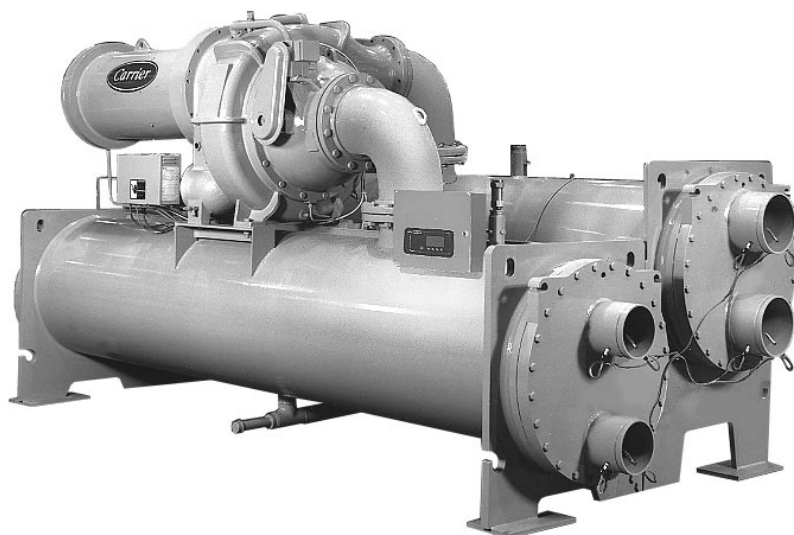


## Product Data

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

19XR — 200 to 1500 Nominal Tons (703 to 5275 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) using 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 by using 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, using 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 initial cost of the system.

**Mix-match capability** — The chillers provide a complete line of compressors and heat exchangers, ensuring the best combination of chiller 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, heat exchanger frame sizes 1 to 6 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 used for 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 Environmental Protection Agency's (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 chiller installation time and expense. (Available on heat exchanger frame sizes 1 to 6 only.)

### Hermetic compressor features:

**Single-stage design** — This design increases product reliability by eliminating the additional moving parts associated with multiple stage chillers, 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  $\pm .5$  F ( $.3$  C) of the desired set point without surge 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 use 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 uses 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.

**Tunnel diffuser** — The tunnel diffuser requires no moving or wearing parts, which increases product reliability. The tunnel design uses jet engine technology, increasing centrifugal compressor peak efficiency.

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

**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 lighter than comparable air-cooled motors.

## Table of contents

|                                 | Page  |
|---------------------------------|-------|
| Features/Benefits .....         | 1-6   |
| Model Number Nomenclature ..... | 4     |
| Chiller Components .....        | 7-9   |
| Options and Accessories .....   | 10    |
| Physical Data .....             | 11-17 |
| Dimensions .....                | 18-20 |
| Performance Data .....          | 21-23 |
| Electrical Data .....           | 23-30 |
| Controls .....                  | 31-33 |
| Typical Piping and Wiring ..... | 34,35 |
| Typical Field Wiring .....      | 36-42 |
| Control Wiring Schematic .....  | 43    |
| Application Data .....          | 44-54 |
| Guide Specifications .....      | 55-63 |

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** — The American Society of Mechanical Engineers (ASME) standard requires the use of an independent agency to certify the design, manufacture, and testing of all heat exchangers, ensuring the ultimate in heat exchanger safety, reliability, and long life.

**High performance tubing** — Tubing with internally and externally enhanced fins improves chiller 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™ system (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 II)** — Carrier's PIC II provides unmatched flexibility and functionality. Each unit integrates directly with the Carrier Comfort Network (CCN), providing a system solution to controls applications.

**Chiller Visual Control (CVC)** — The CVC, 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) backlit features 4 menu-specific softkeys. The default display offers all in one glance review of key chiller operation data, simplifying the interaction between chiller and user.

**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 used.

**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 holds

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 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 alert messages in memory; this function reduces troubleshooting time and cost.

**Configuration data backup** — Non-volatile memory provides protection during power failures and eliminates time consuming control reconfiguration.

**Circuit boards** — These circuit boards are designed, built, and tested in-house. Each board meets Carrier's stringent quality standards for superior reliability.

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 | DG | H | 64 | —                              |
|-------------------------------------------------------------------------|------|----|----|-----|----|---|----|--------------------------------|
| <b>Description</b>                                                      |      |    |    |     |    |   |    |                                |
| 19XR — High Efficiency Hermetic Centrifugal Liquid Chiller              |      |    |    |     |    |   |    |                                |
| 19XRT — Ultra High Efficiency Hermetic Centrifugal Liquid Chiller       |      |    |    |     |    |   |    |                                |
| <b>Cooler Size</b>                                                      |      |    |    |     |    |   |    |                                |
| 10-12 (Frame 1 XR)                                                      |      |    |    |     |    |   |    |                                |
| 15-17 (Frame 1 XR)                                                      |      |    |    |     |    |   |    |                                |
| 20-22 (Frame 2 XR)                                                      |      |    |    |     |    |   |    |                                |
| 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)                                                      |      |    |    |     |    |   |    |                                |
| 60-63 (Frame 6 XRT)                                                     |      |    |    |     |    |   |    |                                |
| 65-67 (Frame 6 XR)                                                      |      |    |    |     |    |   |    |                                |
| 70-72 (Frame 7 XR)                                                      |      |    |    |     |    |   |    |                                |
| 75-77 (Frame 7 XR)                                                      |      |    |    |     |    |   |    |                                |
| 80-82 (Frame 8 XR)                                                      |      |    |    |     |    |   |    |                                |
| 85-87 (Frame 8 XR)                                                      |      |    |    |     |    |   |    |                                |
| <b>Condenser Size</b>                                                   |      |    |    |     |    |   |    |                                |
| 10-12 (Frame 1 XR)                                                      |      |    |    |     |    |   |    |                                |
| 15-17 (Frame 1 XR)                                                      |      |    |    |     |    |   |    |                                |
| 20-22 (Frame 2 XR)                                                      |      |    |    |     |    |   |    |                                |
| 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)                                                      |      |    |    |     |    |   |    |                                |
| 60-63 (Frame 6 XRT)                                                     |      |    |    |     |    |   |    |                                |
| 65-67 (Frame 6 XR)                                                      |      |    |    |     |    |   |    |                                |
| 70-72 (Frame 7 XR)                                                      |      |    |    |     |    |   |    |                                |
| 75-77 (Frame 7 XR)                                                      |      |    |    |     |    |   |    |                                |
| 80-82 (Frame 8 XR)                                                      |      |    |    |     |    |   |    |                                |
| 85-87 (Frame 8 XR)                                                      |      |    |    |     |    |   |    |                                |
| <b>Compressor Code</b><br>(First Digit Indicates Compressor Frame Size) |      |    |    |     |    |   |    |                                |
|                                                                         |      |    |    |     |    |   |    | <b>Special Order Indicator</b> |
|                                                                         |      |    |    |     |    |   |    | — — Standard                   |
|                                                                         |      |    |    |     |    |   |    | S — Special Order              |
|                                                                         |      |    |    |     |    |   |    | <b>Motor Voltage Code</b>      |
|                                                                         |      |    |    |     |    |   |    | 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                 |
|                                                                         |      |    |    |     |    |   |    | <b>Motor Efficiency Code</b>   |
|                                                                         |      |    |    |     |    |   |    | H — High Efficiency            |
|                                                                         |      |    |    |     |    |   |    | S — Standard Efficiency        |
|                                                                         |      |    |    |     |    |   |    | <b>Motor Code</b>              |
|                                                                         |      |    |    |     |    |   |    | BD CD DB EH                    |
|                                                                         |      |    |    |     |    |   |    | BE CE DC EJ                    |
|                                                                         |      |    |    |     |    |   |    | BF CL DD EK                    |
|                                                                         |      |    |    |     |    |   |    | BG CM DE EL                    |
|                                                                         |      |    |    |     |    |   |    | BH CN DF EM                    |
|                                                                         |      |    |    |     |    |   |    | CP DG EN                       |
|                                                                         |      |    |    |     |    |   |    | CQ DH EP                       |
|                                                                         |      |    |    |     |    |   |    | DJ                             |



ASME  
'U' Stamp



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



ARI (Air Conditioning  
and Refrigeration  
Institute)  
Performance Certified



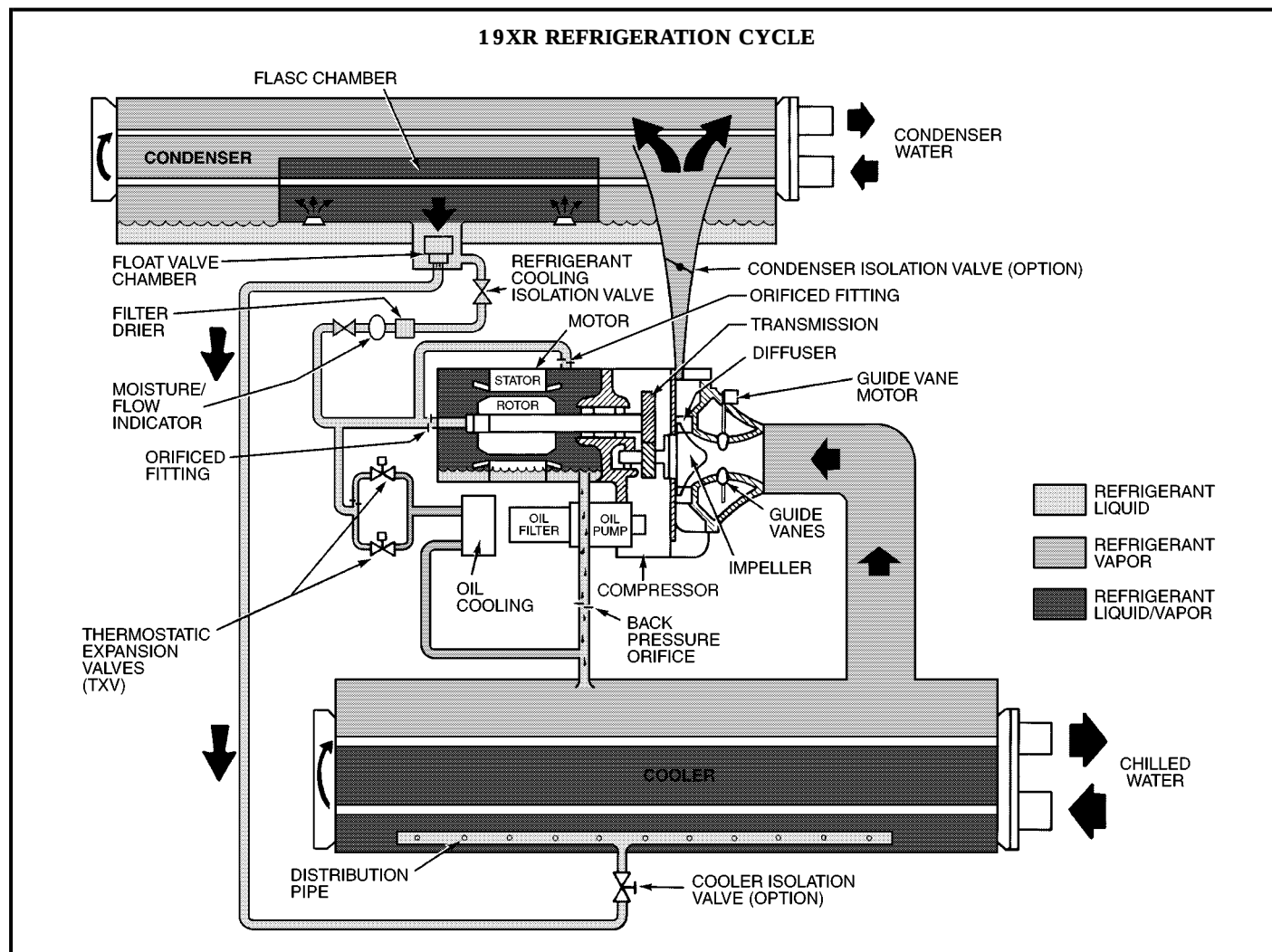
## 19XR Refrigeration Cycle

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 to use in an air-conditioning circuit or process liquid cooling.

After taking heat from the water, the refrigerant vapor is compressed. Compression adds still more heat energy and the refrigerant is quite warm (typically 98 to 102 F [37 to 40 C]) when it is discharged from the compressor into the condenser.

Relatively cool (typically 65 to 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.



## 19XRT Refrigeration Cycle

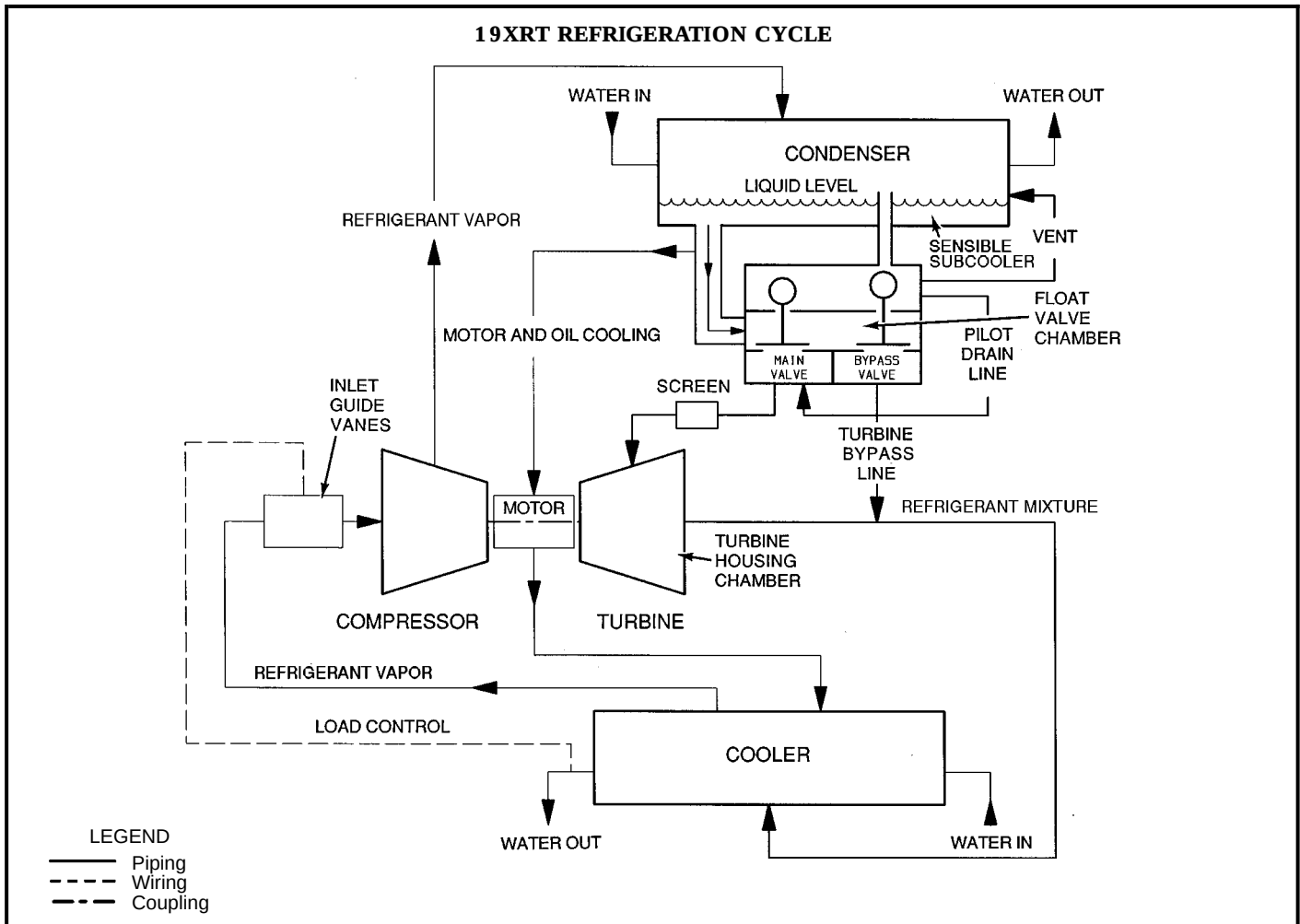
The compressor continuously draws refrigerant vapor from the cooler at a rate determined by the amount of guide vane opening. As the compressor suction reduces the pressure in the cooler, the remaining refrigerant boils at a low temperature (typically 38 to 42 F [3 to 6 C]). The energy required for boiling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

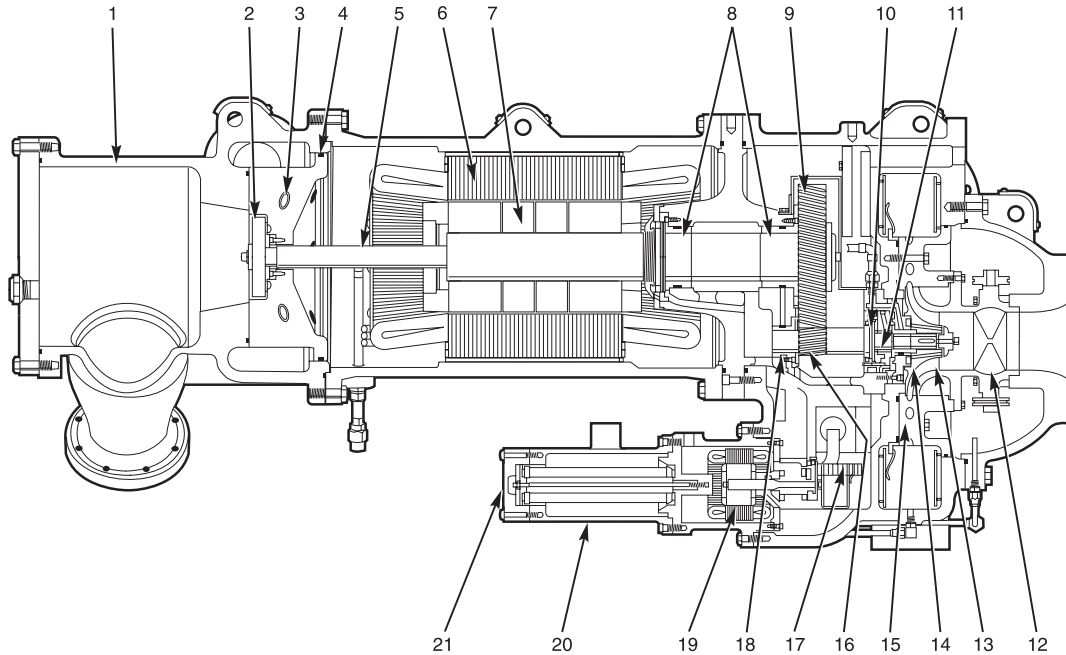
Relatively cool (typically 65 to 90 F [18 to 32 C]) water flowing through the condenser tubes removes heat from the refrigerant and the vapor condenses to a liquid. Further removal of heat from the refrigerant occurs in the lower chamber of the condenser, which is called the sensible

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. 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. A bypass float valve allows flow to bypass the turbine during start-ups and other transient situations when the turbine system capacity is too small.



## 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                 |

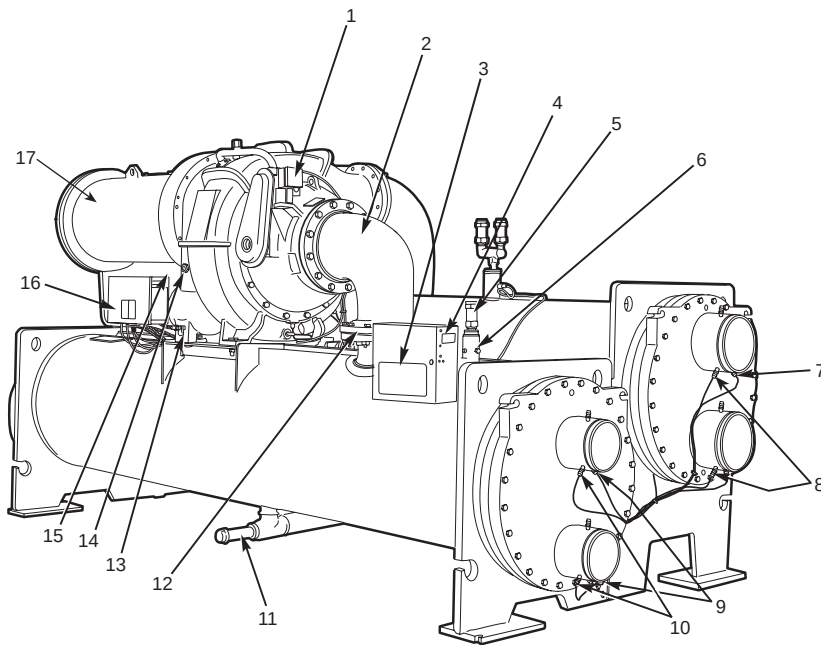
\*Items 1 to 5 apply to 19XRT only.

# Chiller components (cont)

19XR



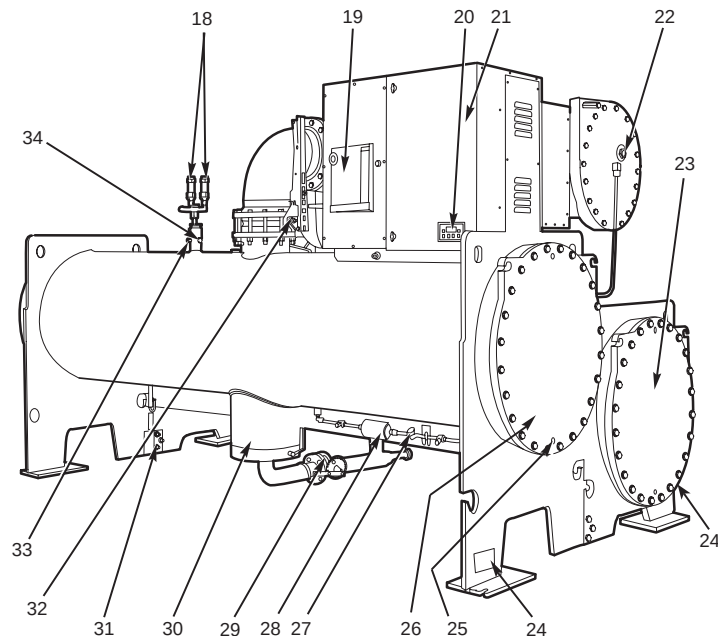
**FRONT VIEW**



**LEGEND**

- 1 — Guide Vane Actuator
- 2 — Suction Elbow
- 3 — Chiller Visual Control (CVC)
- 4 — Chiller Identification Nameplate
- 5 — Cooler, Auto Reset Relief Valves
- 6 — Cooler Pressure Transducer
- 7 — Condenser In/Out Temperature Thermistors
- 8 — Condenser Waterflow Device
- 9 — Cooler In/Out Temperature Thermistors
- 10 — Cooler Waterflow Device
- 11 — Refrigerant Charging Valve
- 12 — Typical Flange Connection
- 13 — Oil Drain Valve
- 14 — Oil Level Sight Glasses
- 15 — Refrigerant Oil Cooler (Hidden)
- 16 — Auxiliary Power Panel
- 17 — Motor Housing

**REAR VIEW**

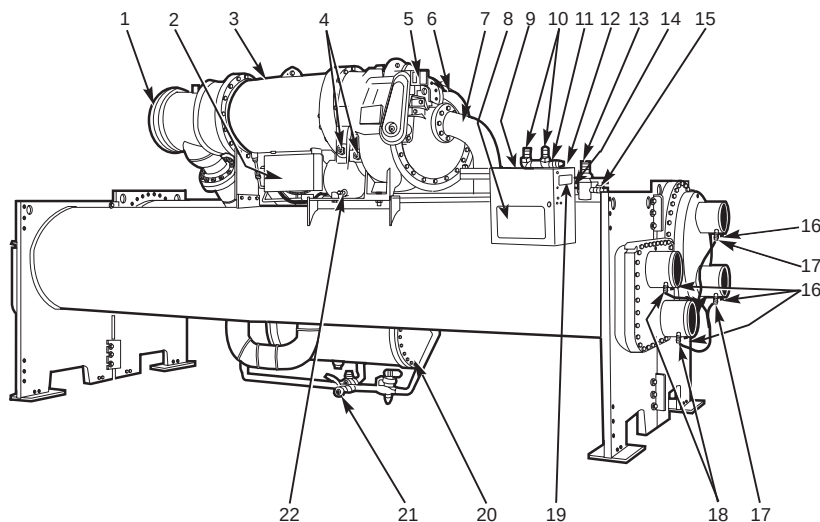


**LEGEND**

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

# 19XRT

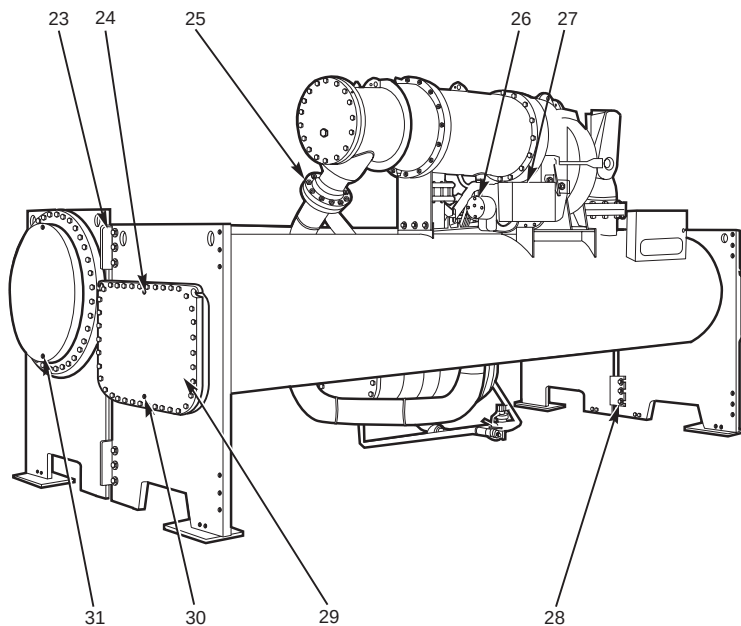
## RIGHT END VIEW



### 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 — Chiller Visual Control (CVC)
- 9 — Pumpdown Valve (Hidden)
- 10 — Condenser Relief Valves
- 11 — Relief Transfer Valve
- 12 — Condenser Pressure Transducer (Hidden)
- 13 — Cooler Relief Valve
- 14 — Cooler Pressure Transducer (Hidden)
- 15 — Pumpdown Valve
- 16 — Cooler/Condenser Waterflow Device
- 17 — Condenser In/Out Temperature Thermistors
- 18 — Cooler In/Out Temperature Thermistors
- 19 — Chiller Identification Nameplate
- 20 — Float Chamber
- 21 — Refrigerant Charging Valve
- 22 — Oil Drain Valve

## LEFT END VIEW



### LEGEND

- 23 — Take-Apart, Connector (Upper)
- 24 — Waterbox Vent Connection (Typical)
- 25 — Cooler Liquid Return Line
- 26 — Oil Filter Access Cover
- 27 — Refrigerant Oil Cooler
- 28 — Take-Apart, Rabbit-Fit Connector (Lower)
- 29 — Cooler Return-End Waterbox Cover
- 30 — Waterbox Drain Port (Typical)
- 31 — 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       |            |
| Steel Marine Bolt-On Waterboxes for condenser, 150 psig (1034 kPa) with Cupro-Nickel or Titanium-Clad Tubesheets (Available on Condenser Frame Sizes 2 to 8 Only)** | 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       |            |
| Unit Mounted Low-Voltage Wye-Delta or Solid-State Starters‡                                                                                                         | X       |            |
| Export Crating‡                                                                                                                                                     | X       |            |
| Customer Factory Performance Testing                                                                                                                                | X       |            |
| Extended Warranty (North American Operations [NAO] only)                                                                                                            | X       |            |
| Service Contract                                                                                                                                                    | 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          |
| Discharge Line Sound Reduction Kit                                                                                                                                  |         | X          |
| Acoustical Sound Insulation Kit                                                                                                                                     |         | X          |
| Spring Isolator Kit                                                                                                                                                 |         | X          |

\*Factory Installed.

†Field Installed.

\*\*Optional marine waterboxes available for 19XR heat exchanger frames 2 - 8 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.

‡Available on 19XR and 19XRT Heat Exchanger Frame sizes 1 to 6 only.

## UNIT-MOUNTED STARTER FEATURES AND OPTIONS

| ITEM                                                                        | WYE-DELTA | SOLID STATE |
|-----------------------------------------------------------------------------|-----------|-------------|
| ISM                                                                         | S         | S           |
| Branch Oil Pump Circuit Breaker                                             | S         | S           |
| 3 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         |
| Main Power Circuit Breaker with Shunt Trip (30,000 Amps Interrupt Capacity) | S         | S           |
| High Interrupt Capacity Main Circuit Breaker with Shunt Trip                | O         | O           |
| Phase Loss/Reversal Imbalance Protection                                    | S         | S           |
| Three Phase 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                                               | S         | S           |
| Three-Phase Analog Voltmeter with Switch                                    | O         | O           |
| Three-Phase Over/Under Voltage Protection                                   | S         | S           |
| Power Factor Digital Display                                                | S         | S           |
| Frequency Digital Display                                                   | S         | S           |
| Digital Watt Display                                                        | S         | S           |
| Digital Watt Hour Display                                                   | S         | S           |
| Digital Power Factor Display                                                | S         | S           |
| Demand Kilowatt Display                                                     | S         | S           |
| Lightning Arrestor and Surge Capacitor Package                              | O         | O           |
| Power Factor Correction Capacitors                                          | O         | O           |

### LEGEND

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

\*Low voltage; phase to phase and phase to ground.

Medium voltage; one phase to phase.

## 19XR COMPRESSOR AND MOTOR WEIGHTS\* — STANDARD AND HIGH EFFICIENCY MOTORS

### XR2† COMPRESSOR, LOW VOLTAGE MOTORS

| MOTOR<br>SIZE | ENGLISH                        |                         |       |                      |       |                           | SI                           |                       |       |                      |       |                           |
|---------------|--------------------------------|-------------------------|-------|----------------------|-------|---------------------------|------------------------------|-----------------------|-------|----------------------|-------|---------------------------|
|               | Compressor<br>Weight**<br>(lb) | Stator Weight††<br>(lb) |       | Rotor Weight<br>(lb) |       | End Bell<br>Cover<br>(lb) | Compressor<br>Weight<br>(kg) | Stator Weight<br>(kg) |       | Rotor Weight<br>(kg) |       | End Bell<br>Cover<br>(kg) |
|               |                                | 60 Hz                   | 50 Hz | 60 Hz                | 50 Hz |                           |                              | 60 Hz                 | 50 Hz | 60 Hz                | 50 Hz |                           |
| BD            | 2340                           | 1030                    | 1030  | 240                  | 240   | 185                       | 1061                         | 467                   | 467   | 109                  | 109   | 84                        |
| BE            | 2340                           | 1070                    | 1070  | 250                  | 250   | 185                       | 1061                         | 485                   | 485   | 113                  | 113   | 84                        |
| BF            | 2340                           | 1120                    | 1120  | 265                  | 265   | 185                       | 1061                         | 508                   | 508   | 120                  | 120   | 84                        |
| BG            | 2340                           | 1175                    | 1175  | 290                  | 290   | 185                       | 1061                         | 533                   | 533   | 132                  | 132   | 84                        |
| BH            | 2340                           | 1175                    | 1175  | 290                  | 290   | 185                       | 1061                         | 533                   | 533   | 132                  | 132   | 84                        |

### XR3† COMPRESSOR, LOW AND MEDIUM VOLTAGE MOTORS

| MOTOR<br>SIZE | ENGLISH                        |                         |       |                      |       |                           | SI                           |                       |       |                      |       |                           |
|---------------|--------------------------------|-------------------------|-------|----------------------|-------|---------------------------|------------------------------|-----------------------|-------|----------------------|-------|---------------------------|
|               | Compressor<br>Weight**<br>(lb) | Stator Weight††<br>(lb) |       | Rotor Weight<br>(lb) |       | End Bell<br>Cover<br>(lb) | Compressor<br>Weight<br>(kg) | Stator Weight<br>(kg) |       | Rotor Weight<br>(kg) |       | End Bell<br>Cover<br>(kg) |
|               |                                | 60 Hz                   | 50 Hz | 60 Hz                | 50 Hz |                           |                              | 60 Hz                 | 50 Hz | 60 Hz                | 50 Hz |                           |
| CD            | 2560                           | 1286                    | 1358  | 258                  | 273   | 274                       | 1160                         | 583                   | 616   | 117                  | 124   | 125                       |
| CE            | 2560                           | 1305                    | 1377  | 265                  | 281   | 274                       | 1160                         | 592                   | 624   | 120                  | 127   | 125                       |
| CL            | 2560                           | 1324                    | 1435  | 280                  | 296   | 274                       | 1160                         | 600                   | 651   | 127                  | 134   | 125                       |
| CM            | 2560                           | 1347                    | 1455  | 303                  | 303   | 274                       | 1160                         | 611                   | 660   | 137                  | 137   | 125                       |
| CN            | 2560                           | 1358                    | 1467  | 316                  | 316   | 274                       | 1160                         | 616                   | 665   | 143                  | 143   | 125                       |
| CP            | 2560                           | 1401                    | 1479  | 329                  | 316   | 274                       | 1160                         | 635                   | 671   | 149                  | 143   | 125                       |
| CQ            | 2560                           | 1455                    | 1479  | 329                  | 316   | 274                       | 1160                         | 660                   | 671   | 149                  | 152   | 125                       |

### XR4† COMPRESSOR, LOW AND MEDIUM VOLTAGE MOTORS||

| MOTOR<br>SIZE | ENGLISH                        |                         |       |                      |       |                           | SI                           |                       |       |                      |       |                           |
|---------------|--------------------------------|-------------------------|-------|----------------------|-------|---------------------------|------------------------------|-----------------------|-------|----------------------|-------|---------------------------|
|               | Compressor<br>Weight**<br>(lb) | Stator Weight††<br>(lb) |       | Rotor Weight<br>(lb) |       | End Bell<br>Cover<br>(lb) | Compressor<br>Weight<br>(kg) | Stator Weight<br>(kg) |       | Rotor Weight<br>(kg) |       | End Bell<br>Cover<br>(kg) |
|               |                                | 60 Hz                   | 50 Hz | 60 Hz                | 50 Hz |                           |                              | 60 Hz                 | 50 Hz | 60 Hz                | 50 Hz |                           |
| DB            | 3380                           | 1665                    | 1725  | 361                  | 391   | 236                       | 1532                         | 755                   | 782   | 164                  | 177   | 107                       |
| DC            | 3380                           | 1681                    | 1737  | 391                  | 404   | 236                       | 1532                         | 762                   | 788   | 177                  | 183   | 107                       |
| DD            | 3380                           | 1977                    | 2069  | 536                  | 596   | 318                       | 1532                         | 897                   | 938   | 243                  | 248   | 144                       |
| DE            | 3380                           | 2018                    | 2089  | 550                  | 550   | 318                       | 1532                         | 915                   | 948   | 249                  | 248   | 144                       |
| DF            | 3380                           | 2100                    | 2139  | 575                  | 567   | 318                       | 1532                         | 952                   | 970   | 261                  | 257   | 144                       |
| DG            | 3380                           | 2187                    | 2153  | 599                  | 599   | 318                       | 1532                         | 992                   | 977   | 272                  | 272   | 144                       |
| DH            | 3380                           | 2203                    | 2207  | 604                  | 604   | 318                       | 1532                         | 999                   | 1001  | 274                  | 274   | 144                       |
| DJ            | 3380                           | 2228                    | 2305  | 614                  | 614   | 318                       | 1532                         | 1011                  | 1046  | 279                  | 279   | 144                       |

\*Total compressor weight is the sum of the compressor aerodynamic components (compressor weight column), stator, rotor, and end bell cover weights.

†Compressor size number is the first digit of the compressor code. See Model Number Nomenclature on page 4.

\*\*Compressor aerodynamic component weight only. Does not include motor weight.

††Stator weight includes the stator and shell.

|| 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.

NOTE: Standard efficiency motor designations are followed by the letter S (e.g., BDS); high efficiency motor designations are followed by the letter H (e.g., BDH). See Model Number Nomenclature on page 4.

**19XR COMPRESSOR MOTOR WEIGHTS\* —  
STANDARD AND HIGH EFFICIENCY MOTORS (cont)**  
**XR5† COMPRESSOR, 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 |                     |
| EH         | 6700                     | 3060                | 3120  | 701               | 751   | 414                 | 3039                   | 1388               | 1415  | 318               | 341   | 188                 |
| EJ         | 6700                     | 3105                | 3250  | 716               | 751   | 414                 | 3039                   | 1408               | 1474  | 325               | 341   | 188                 |
| EK         | 6700                     | 3180                | 3250  | 716               | 768   | 414                 | 3039                   | 1442               | 1474  | 325               | 348   | 188                 |
| EL         | 6700                     | 3180                | 3370  | 737               | 801   | 414                 | 3039                   | 1442               | 1529  | 334               | 363   | 188                 |
| EM         | 6700                     | 3270                | 3370  | 737               | 801   | 414                 | 3039                   | 1483               | 1529  | 334               | 363   | 188                 |
| EN         | 6700                     | 3270                | 3520  | 801               | 851   | 414                 | 3039                   | 1483               | 1597  | 363               | 386   | 188                 |
| EP         | 6700                     | 3340                | 3520  | 830               | 851   | 414                 | 3039                   | 1515               | 1597  | 376               | 386   | 188                 |

\*Total compressor weight is the sum of the compressor aerodynamic components (compressor weight column), stator, rotor, and end bell cover weights.

†Compressor size number is the first digit of the compressor code. See Model Number Nomenclature on page 4.

\*\*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.

††Compressor aerodynamic component weight only. Does not include motor weight, does include turbine housing.

‡Stator weight includes the stator and shell.

**19XRT COMPRESSOR MOTOR WEIGHTS\* —  
HIGH EFFICIENCY MOTORS**  
**XRT3† COMPRESSOR, 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) |       | Compressor Weight (kg) | Stator Weight (kg) |
|            |                          | 60 Hz               | 50 Hz | 60 Hz             | 50 Hz |                        | 60 Hz              | 50 Hz | 60 Hz             | 50 Hz |                        |                    |
| CD         | 3710                     | 1402                | 1477  | 331               | 355   | 1682                   | 636                | 670   | 150               | 161   | 1682                   | 636                |
| CE         | 3710                     | 1427                | 1502  | 334               | 363   | 1682                   | 647                | 681   | 151               | 165   | 1682                   | 647                |
| CL         | 3710                     | 1452                | 1552  | 347               | 379   | 1682                   | 659                | 704   | 157               | 172   | 1682                   | 659                |
| CM         | 3710                     | 1465                | 1577  | 351               | 387   | 1682                   | 664                | 715   | 159               | 176   | 1682                   | 664                |
| CN         | 3710                     | 1477                | 1584  | 355               | 391   | 1682                   | 670                | 718   | 161               | 177   | 1682                   | 670                |
| CP         | 3710                     | 1527                | 1602  | 371               | 395   | 1682                   | 693                | 727   | 168               | 179   | 1682                   | 693                |
| CQ         | 3710                     | 1577                | 1602  | 387               | 395   | 1682                   | 715                | 727   | 176               | 179   | 1682                   | 715                |

\*Total compressor weight is the sum of the compressor aerodynamic components (compressor weight column), stator, rotor, and end bell cover weights.

†Compressor size number is the first digit of the compressor code. See Model Number Nomenclature on page 4.

\*\*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.

††Compressor aerodynamic component weight only. Does not include motor weight, does include turbine housing.

‡Stator weight includes the stator and shell.

NOTE: Standard efficiency motor designations are followed by the letter S (e.g., BDS); high efficiency motor designations are followed by the letter H (e.g., BDH). See Model Number Nomenclature on page 4.

**COMPONENT WEIGHTS**

| COMPONENT                       | FRAME 2 COMPRESSOR* |     | FRAME 3 COMPRESSOR* |     | FRAME 4 COMPRESSOR* |     | FRAME 5* COMPRESSOR |     |
|---------------------------------|---------------------|-----|---------------------|-----|---------------------|-----|---------------------|-----|
|                                 | lb                  | kg  | lb                  | kg  | lb                  | kg  | lb                  | kg  |
| Suction Elbow                   | 50                  | 23  | 54                  | 24  | 175                 | 79  | 400                 | 181 |
| Discharge Elbow                 | 60                  | 27  | 46                  | 21  | 157                 | 71  | 325                 | 147 |
| Control Cabinet†                | 30                  | 14  | 30                  | 14  | 30                  | 14  | 30                  | 14  |
| Optional Unit-Mounted Starter** | 500                 | 227 | 800                 | 227 | 800                 | 227 | N/A                 | N/A |
| Optional Isolation Valves       | 35                  | 16  | 115                 | 52  | 115                 | 52  | 200                 | 91  |

\*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 |
| 10   | 2,742                      | 2,704          | 290                | 200       | 283               | 348       | 1244                       | 1226           | 132                | 91        | 128               | 158       |
| 11   | 2,812                      | 2,772          | 310                | 200       | 309               | 374       | 1275                       | 1257           | 141                | 91        | 140               | 170       |
| 12   | 2,883                      | 2,857          | 330                | 200       | 335               | 407       | 1307                       | 1296           | 150                | 91        | 152               | 185       |
| 15   | 3,003                      | 2,984          | 320                | 250       | 327               | 402       | 1362                       | 1353           | 145                | 113       | 148               | 182       |
| 16   | 3,089                      | 3,068          | 340                | 250       | 359               | 435       | 1401                       | 1391           | 154                | 113       | 163               | 197       |
| 17   | 3,176                      | 3,173          | 370                | 250       | 391               | 475       | 1440                       | 1439           | 168                | 113       | 177               | 215       |
| 20   | 3,442                      | 3,523          | 345                | 225       | 402               | 398       | 1561                       | 1598           | 157                | 102       | 182               | 181       |
| 21   | 3,590                      | 3,690          | 385                | 225       | 456               | 462       | 1628                       | 1673           | 175                | 102       | 207               | 210       |
| 22   | 3,746                      | 3,854          | 435                | 225       | 514               | 526       | 1699                       | 1748           | 197                | 102       | 233               | 239       |
| 30   | 4,137                      | 3,694          | 350                | 260       | 464               | 464       | 1876                       | 1675           | 159                | 118       | 210               | 210       |
| 31   | 4,319                      | 3,899          | 420                | 260       | 531               | 543       | 1958                       | 1768           | 190                | 118       | 241               | 246       |
| 32   | 4,511                      | 4,100          | 490                | 260       | 601               | 621       | 2046                       | 1859           | 222                | 118       | 273               | 282       |
| 35   | 4,409                      | 4,606          | 400                | 310       | 511               | 513       | 2000                       | 2089           | 181                | 141       | 232               | 233       |
| 36   | 4,617                      | 4,840          | 480                | 310       | 587               | 603       | 2094                       | 2195           | 218                | 141       | 266               | 273       |
| 37   | 4,835                      | 5,069          | 550                | 310       | 667               | 692       | 2193                       | 2300           | 249                | 141       | 303               | 314       |
| 40   | 5,898                      | 6,054          | 560                | 280       | 746               | 798       | 2675                       | 2745           | 254                | 127       | 338               | 362       |
| 41   | 6,080                      | 6,259          | 630                | 280       | 812               | 877       | 2757                       | 2839           | 286                | 127       | 368               | 398       |
| 42   | 6,244                      | 6,465          | 690                | 280       | 873               | 957       | 2832                       | 2932           | 313                | 127       | 396               | 434       |
| 45   | 6,353                      | 6,617          | 640                | 330       | 821               | 880       | 2881                       | 3001           | 290                | 150       | 372               | 399       |
| 46   | 6,561                      | 6,851          | 720                | 330       | 897               | 971       | 2976                       | 3107           | 327                | 150       | 407               | 440       |
| 47   | 6,748                      | 7,085          | 790                | 330       | 966               | 1061      | 3060                       | 3213           | 358                | 150       | 438               | 481       |
| 50   | 7,015                      | 7,285          | 750                | 400       | 960               | 1063      | 3181                       | 3304           | 340                | 181       | 435               | 482       |
| 51   | 7,262                      | 7,490          | 840                | 400       | 1051              | 1142      | 3293                       | 3397           | 381                | 181       | 477               | 518       |
| 52   | 7,417                      | 7,683          | 900                | 400       | 1108              | 1217      | 3364                       | 3484           | 408                | 181       | 502               | 552       |
| 55   | 7,559                      | 7,980          | 870                | 490       | 1061              | 1177      | 3428                       | 3619           | 395                | 222       | 481               | 534       |
| 56   | 7,839                      | 8,214          | 940                | 490       | 1163              | 1267      | 3555                       | 3725           | 426                | 222       | 527               | 575       |
| 57   | 8,016                      | 8,434          | 980                | 490       | 1228              | 1352      | 3635                       | 3825           | 444                | 222       | 557               | 613       |
| 60   | 8,270                      | 8,286          | 940                | 420       | 1205              | 1325      | 3751                       | 3758           | 426                | 190       | 546               | 601       |
| 61   | 8,462                      | 8,483          | 980                | 420       | 1275              | 1402      | 3838                       | 3847           | 444                | 190       | 578               | 636       |
| 62   | 8,617                      | 8,676          | 1020               | 420       | 1332              | 1476      | 3908                       | 3935           | 462                | 190       | 604               | 669       |
| 65   | 8,943                      | 9,204          | 1020               | 510       | 1335              | 1472      | 4056                       | 4174           | 462                | 231       | 605               | 668       |
| 66   | 9,161                      | 9,428          | 1060               | 510       | 1414              | 1558      | 4155                       | 4276           | 481                | 231       | 641               | 707       |
| 67   | 9,338                      | 9,648          | 1090               | 510       | 1479              | 1643      | 4235                       | 4376           | 494                | 231       | 671               | 745       |
| 70   | 12,395                     | 13,139         | 1220               | 780       | 1866              | 1741      | 5621                       | 5959           | 553                | 354       | 846               | 790       |
| 71   | 12,821                     | 13,568         | 1340               | 780       | 2022              | 1908      | 5814                       | 6153           | 608                | 354       | 917               | 865       |
| 72   | 13,153                     | 13,969         | 1440               | 780       | 2144              | 2063      | 5965                       | 6335           | 653                | 354       | 972               | 936       |
| 75   | 13,293                     | 14,211         | 1365               | 925       | 2041              | 1947      | 6028                       | 6445           | 619                | 420       | 926               | 883       |
| 76   | 13,780                     | 14,702         | 1505               | 925       | 2220              | 2137      | 6259                       | 6667           | 683                | 420       | 1007              | 969       |
| 77   | 14,159                     | 15,160         | 1625               | 925       | 2359              | 2315      | 6421                       | 6875           | 737                | 420       | 1070              | 1050      |
| 80   | 16,156                     | 15,746         | 1500               | 720       | 2378              | 2200      | 7326                       | 7141           | 680                | 327       | 1078              | 998       |
| 81   | 16,530                     | 16,176         | 1620               | 720       | 2516              | 2366      | 7496                       | 7336           | 735                | 327       | 1141              | 1073      |
| 82   | 16,919                     | 16,606         | 1730               | 720       | 2658              | 2532      | 7673                       | 7531           | 785                | 327       | 1205              | 1148      |
| 85   | 17,296                     | 17,001         | 1690               | 860       | 2604              | 2461      | 7844                       | 7710           | 766                | 390       | 1181              | 1116      |
| 86   | 17,723                     | 17,492         | 1820               | 860       | 2761              | 2651      | 8037                       | 7933           | 825                | 390       | 1252              | 1202      |
| 87   | 18,169                     | 17,984         | 1940               | 860       | 2924              | 2841      | 8240                       | 8156           | 880                | 390       | 1326              | 1288      |

\*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 (CVC), 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       |

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

## ADDITIONAL WEIGHTS FOR 19XR MARINE WATERBOXES\*

### 150 psig (1034 kPa) MARINE WATERBOXES

| FRAME | NUMBER OF PASSES | ENGLISH (lb) |           |             |           | SI (kg)     |           |             |           |
|-------|------------------|--------------|-----------|-------------|-----------|-------------|-----------|-------------|-----------|
|       |                  | Cooler       |           | Condenser   |           | Cooler      |           | Condenser   |           |
|       |                  | Rigging Wgt  | Water Wgt | Rigging Wgt | Water Wgt | Rigging Wgt | Water Wgt | Rigging Wgt | Water Wgt |
| 1     | 1 & 3            | —            | —         | —           | —         | —           | —         | —           | —         |
|       | 2                | —            | —         | —           | —         | —           | —         | —           | —         |
| 2 & 3 | 1 & 3            | 730          | 700       | —           | —         | 331         | 318       | —           | —         |
|       | 2                | 365          | 350       | 365         | 350       | 166         | 159       | 166         | 159       |
| 4     | 1 & 3            | 1060         | 1025      | —           | —         | 481         | 465       | —           | —         |
|       | 2                | 530          | 510       | 530         | 510       | 240         | 231       | 240         | 231       |
| 5     | 1 & 3            | 1240         | 1160      | —           | —         | 562         | 526       | —           | —         |
|       | 2                | 620          | 580       | 620         | 580       | 281         | 263       | 281         | 263       |
| 6     | 1 & 3            | 1500         | 1350      | —           | —         | 680         | 612       | —           | —         |
|       | 2                | 750          | 675       | 750         | 675       | 340         | 306       | 340         | 306       |
| 7     | 1 & 3            | 2010         | 2720      | —           | —         | 912         | 1233      | —           | —         |
|       | 2                | 740          | 1360      | 600         | 1265      | 336         | 617       | 272         | 574       |
| 8     | 1 & 3            | 1855         | 3380      | —           | —         | 841         | 1533      | —           | —         |
|       | 2                | 585          | 1690      | 550         | 1560      | 265         | 766       | 249         | 707       |

### 300 psig (2068 kPa) MARINE WATERBOXES

| FRAME | NUMBER OF PASSES | ENGLISH (lb) |           |             |           | SI (kg)     |           |             |           |
|-------|------------------|--------------|-----------|-------------|-----------|-------------|-----------|-------------|-----------|
|       |                  | Cooler       |           | Condenser   |           | Cooler      |           | Condenser   |           |
|       |                  | Rigging Wgt  | Water Wgt | Rigging Wgt | Water Wgt | Rigging Wgt | Water Wgt | Rigging Wgt | Water Wgt |
| 1     | 1 & 3            | —            | —         | —           | —         | —           | —         | —           | —         |
|       | 2                | —            | —         | —           | —         | —           | —         | —           | —         |
| 2 & 3 | 1 & 3            | 860          | 700       | —           | —         | 390         | 318       | —           | —         |
|       | 2                | 430          | 350       | 430         | 350       | 195         | 159       | 195         | 159       |
| 4     | 1 & 3            | 1210         | 1025      | —           | —         | 549         | 465       | —           | —         |
|       | 2                | 600          | 510       | 600         | 510       | 272         | 231       | 272         | 231       |
| 5     | 1 & 3            | 1380         | 1160      | —           | —         | 626         | 526       | —           | —         |
|       | 2                | 690          | 580       | 690         | 580       | 313         | 263       | 313         | 253       |
| 6     | 1 & 3            | 1650         | 1350      | —           | —         | 748         | 612       | —           | —         |
|       | 2                | 825          | 675       | 825         | 675       | 374         | 306       | 374         | 306       |
| 7     | 1 & 3            | 3100         | 2720      | —           | —         | 1406        | 1234      | —           | —         |
|       | 2                | 1830         | 1360      | 2295        | 1265      | 830         | 618       | 1041        | 574       |
| 8     | 1 & 3            | 2745         | 3380      | —           | —         | 1245        | 1533      | —           | —         |
|       | 2                | 1475         | 1690      | 1630        | 1560      | 669         | 766       | 739         | 707       |

\*Add to cooler and condenser weights for total weights. Condenser weights may be found in the 19XR Heat Exchanger Weights table on page 13. The first digit of the heat exchanger code (first column) is the heat exchanger frame size.

# 19XR WATERBOX COVER WEIGHTS — ENGLISH (lb)

## FRAME 1

| WATERBOX<br>DESCRIPTION     | COOLER AND CONDENSER |         |
|-----------------------------|----------------------|---------|
|                             | Frame 1              |         |
|                             | Victaulic<br>Nozzles | Flanged |
| NIH, 1 Pass Cover, 150 psig | 177                  | 204     |
| NIH, 2 Pass Cover, 150 psig | 185                  | 218     |
| NIH, 3 Pass Cover, 150 psig | 180                  | 196     |
| NIH Plain End, 150 psig     | 136                  | 136     |
| NIH, 1 Pass Cover, 300 psig | 248                  | 301     |
| NIH, 2 Pass Cover, 300 psig | 255                  | 324     |
| NIH, 3 Pass Cover, 300 psig | 253                  | 288     |
| NIH Plain End, 300 psig     | 175                  | 175     |

## FRAMES 2, 3, 4, 5, AND 6

| WATERBOX<br>DESCRIPTION     | COOLER AND CONDENSER |         |                      |         |                      |         |                      |         |
|-----------------------------|----------------------|---------|----------------------|---------|----------------------|---------|----------------------|---------|
|                             | Frames 2 and 3       |         | Frame 4              |         | Frame 5              |         | Frame 6              |         |
|                             | Victaulic<br>Nozzles | Flanged | Victaulic<br>Nozzles | Flanged | Victaulic<br>Nozzles | Flanged | Victaulic<br>Nozzles | Flanged |
| 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 | 310                  | 340     | 504                  | 520     | 629                  | 655     | 817                  | 843     |
| NIH/MWB End Cover, 150 psig | 300                  | 300     | 379                  | 379     | 428                  | 428     | 583                  | 583     |
| NIH, 1 Pass Cover, 300 psig | 411                  | 486     | 593                  | 668     | 764                  | 839     | 880                  | 956     |
| NIH, 2 Pass Cover, 300 psig | 411                  | 518     | 594                  | 700     | 761                  | 878     | 844                  | 995     |
| NIH, 3 Pass Cover, 300 psig | 433                  | 468     | 621                  | 656     | 795                  | 838     | 901                  | 952     |
| NIH/MWB End Cover, 300 psig | 400                  | 400     | 569                  | 569     | 713                  | 713     | 833                  | 833     |

## FRAMES 7 AND 8

| WATERBOX<br>DESCRIPTION     | COOLER               |         |                      |         | CONDENSER            |         |                      |         |
|-----------------------------|----------------------|---------|----------------------|---------|----------------------|---------|----------------------|---------|
|                             | Frame 7              |         | Frame 8              |         | Frame 7              |         | Frame 8              |         |
|                             | Victaulic<br>Nozzles | Flanged | Victaulic<br>Nozzles | Flanged | Victaulic<br>Nozzles | Flanged | Victaulic<br>Nozzles | Flanged |
| NIH, 1 Pass Cover, 150 psig | 1392                 | 1469    | 1831                 | 1909    | 1205                 | 1282    | 1682                 | 1760    |
| NIH, 2 Pass Cover, 150 psig | 1345                 | 1461    | 1739                 | 1893    | 1163                 | 1279    | 1589                 | 1744    |
| NIH, 3 Pass Cover, 150 psig | 1434                 | 1471    | 1851                 | 1909    | 1222                 | 1280    | 1702                 | 1761    |
| NIH/MWB End Cover, 150 psig | 1022                 | 1022    | 1480                 | 1480    | 920                  | 920     | 1228                 | 1228    |
| NIH, 1 Pass Cover, 300 psig | 1985                 | 2150    | 2690                 | 2854    | 1690                 | 1851    | 2394                 | 2549    |
| NIH, 2 Pass Cover, 300 psig | 1934                 | 2174    | 2595                 | 2924    | 1628                 | 1862    | 2269                 | 2578    |
| NIH, 3 Pass Cover, 300 psig | 2009                 | 2090    | 2698                 | 2861    | 1714                 | 1831    | 2417                 | 2529    |
| NIH/MWB End Cover, 300 psig | 1567                 | 1567    | 1923                 | 1923    | 1440                 | 1440    | 1767                 | 1767    |

### LEGEND

NIH — Nozzle-in-Head  
MWB — Marine Waterbox

NOTE: Weight for NIH 2-pass cover, 150 psig (1034 kPa), is included in the heat exchanger weights shown on page 13.

# Physical data (cont)



## 19XR WATERBOX COVER WEIGHTS — SI (kg)

### FRAME 1

| WATERBOX<br>DESCRIPTION     | COOLER AND CONDENSER |         |
|-----------------------------|----------------------|---------|
|                             | Frame 1              |         |
|                             | Victaulic<br>Nozzles | Flanged |
| NIH, 1 Pass Cover, 1034 kPa | 80                   | 93      |
| NIH, 2 Pass Cover, 1034 kPa | 84                   | 99      |
| NIH, 3 Pass Cover, 1034 kPa | 82                   | 89      |
| NIH Plain End, 1034 kPa     | 62                   | 62      |
| NIH, 1 Pass Cover, 2068 kPa | 112                  | 137     |
| NIH, 2 Pass Cover, 2068 kPa | 116                  | 147     |
| NIH, 3 Pass Cover, 2068 kPa | 115                  | 131     |
| NIH Plain End, 2068 kPa     | 79                   | 79      |

### FRAMES 2, 3, 4, 5, AND 6

| WATERBOX<br>DESCRIPTION     | COOLER AND CONDENSER |         |                      |         |                      |         |                      |         |
|-----------------------------|----------------------|---------|----------------------|---------|----------------------|---------|----------------------|---------|
|                             | Frames 2 and 3       |         | Frame 4              |         | Frame 5              |         | Frame 6              |         |
|                             | Victaulic<br>Nozzles | Flanged | Victaulic<br>Nozzles | Flanged | Victaulic<br>Nozzles | Flanged | Victaulic<br>Nozzles | Flanged |
| NIH, 1 Pass Cover, 1034 kPa | 145                  | 159     | 220                  | 263     | 279                  | 296     | 364                  | 380     |
| NIH, 2 Pass Cover, 1034 kPa | 145                  | 159     | 221                  | 245     | 268                  | 301     | 349                  | 382     |
| NIH, 3 Pass Cover, 1034 kPa | 141                  | 154     | 229                  | 239     | 285                  | 297     | 371                  | 382     |
| NIH/MWB End Cover, 1034 kPa | 136                  | 136     | 172                  | 172     | 194                  | 194     | 264                  | 264     |
| NIH, 1 Pass Cover, 2068 kPa | 186                  | 220     | 269                  | 303     | 347                  | 381     | 399                  | 434     |
| NIH, 2 Pass Cover, 2068 kPa | 186                  | 235     | 269                  | 318     | 345                  | 398     | 383                  | 451     |
| NIH, 3 Pass Cover, 2068 kPa | 196                  | 212     | 282                  | 298     | 361                  | 380     | 409                  | 432     |
| NIH/MWB End Cover, 2068 kPa | 181                  | 181     | 258                  | 258     | 323                  | 323     | 378                  | 378     |

### FRAMES 7 AND 8

| WATERBOX<br>DESCRIPTION     | COOLER               |         |                      |         | CONDENSER            |         |                      |         |
|-----------------------------|----------------------|---------|----------------------|---------|----------------------|---------|----------------------|---------|
|                             | Frame 7              |         | Frame 8              |         | Frame 7              |         | Frame 8              |         |
|                             | Victaulic<br>Nozzles | Flanged | Victaulic<br>Nozzles | Flanged | Victaulic<br>Nozzles | Flanged | Victaulic<br>Nozzles | Flanged |
| NIH, 1 Pass Cover, 1034 kPa | 631                  | 666     | 830                  | 866     | 547                  | 581     | 763                  | 798     |
| NIH, 2 Pass Cover, 1034 kPa | 610                  | 663     | 789                  | 859     | 528                  | 580     | 721                  | 791     |
| NIH, 3 Pass Cover, 1034 kPa | 650                  | 667     | 840                  | 866     | 554                  | 580     | 772                  | 799     |
| NIH/MWB End Cover, 1034 kPa | 464                  | 464     | 671                  | 671     | 417                  | 417     | 557                  | 557     |
| NIH, 1 Pass Cover, 2068 kPa | 900                  | 975     | 1220                 | 1295    | 767                  | 839     | 1085                 | 1156    |
| NIH, 2 Pass Cover, 2068 kPa | 877                  | 986     | 1177                 | 1326    | 738                  | 845     | 1029                 | 1169    |
| NIH, 3 Pass Cover, 2068 kPa | 911                  | 948     | 1224                 | 1298    | 777                  | 831     | 1096                 | 1147    |
| NIH/MWB End Cover, 2068 kPa | 711                  | 711     | 872                  | 872     | 653                  | 653     | 801                  | 801     |

#### LEGEND

NIH — Nozzle-in-Head  
MWB — Marine Waterbox

NOTE: Weight for NIH 2-pass cover, 150 psig (1034 kPa), is included in the heat exchanger weights shown on page 13.

# 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      | —                | —        |

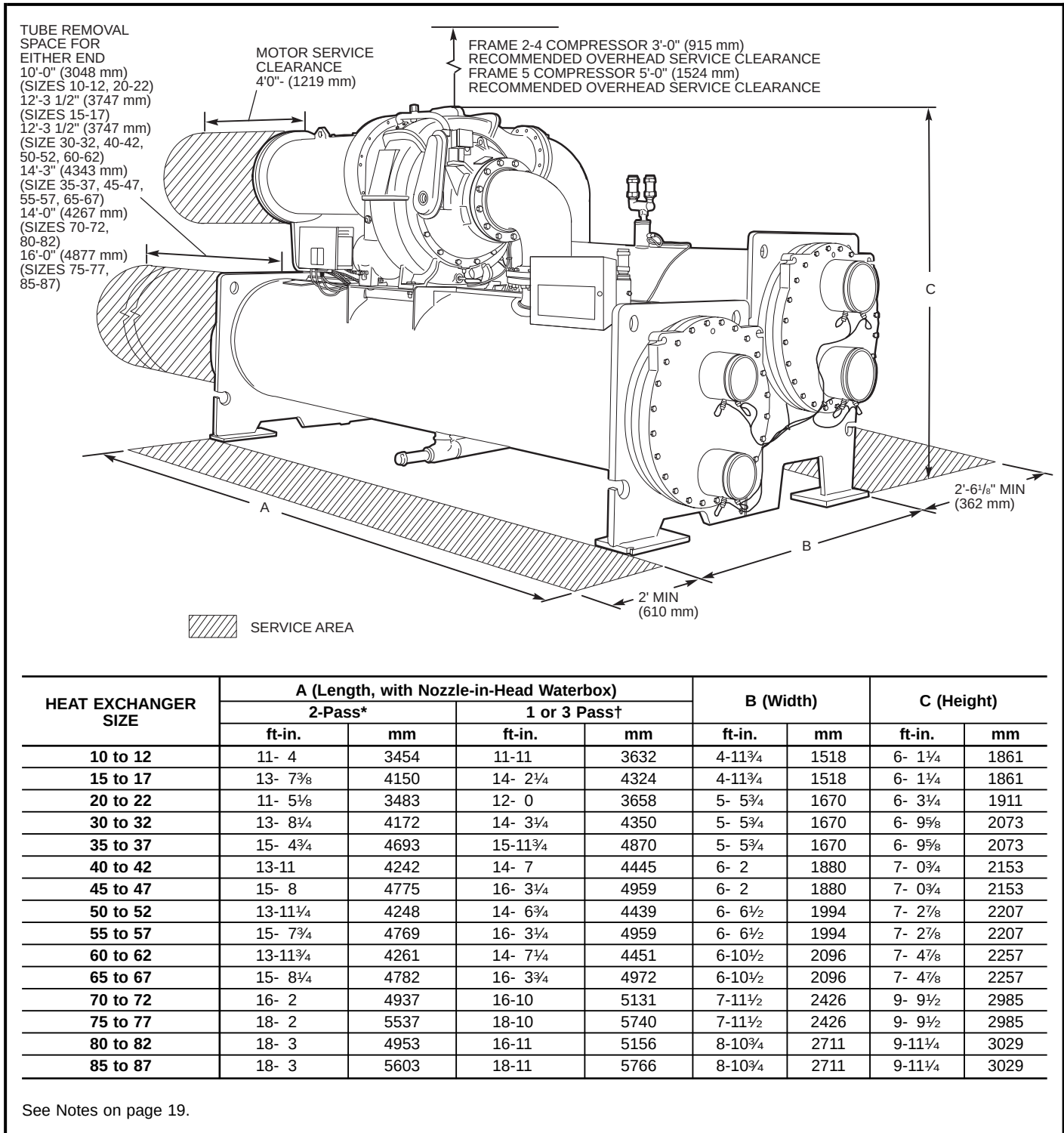
## LEGEND

**NIH** — Nozzle-In-Head

NOTE: Weight for NIH 2-pass cover, 150 psig, is included in 19XRT heater exchanger weights shown on page 14.

# Dimensions

19XR



## 19XR (cont)

| HEAT EXCHANGER<br>SIZE | A (Length, Marine Waterbox —<br>not shown) |      |                                   |      |
|------------------------|--------------------------------------------|------|-----------------------------------|------|
|                        | 2-Pass*                                    |      | 1 or 3 Pass†                      |      |
|                        | ft-in.                                     | mm   | ft-in.                            | mm   |
| 10 to 12               | NA                                         | NA   | NA                                | NA   |
| 15 to 17               | NA                                         | NA   | NA                                | NA   |
| 20 to 22               | 12-6 <sup>5</sup> / <sub>8</sub>           | 3826 | 14- 3                             | 4343 |
| 30 to 32               | 14-9                                       | 4496 | 16- 4 <sup>3</sup> / <sub>4</sub> | 4997 |
| 35 to 37               | 16-5 <sup>1</sup> / <sub>2</sub>           | 5017 | 18- 1 <sup>1</sup> / <sub>4</sub> | 5518 |
| 40 to 42               | 15-0 <sup>1</sup> / <sub>4</sub>           | 4591 | 16- 8 <sup>3</sup> / <sub>4</sub> | 5099 |
| 45 to 47               | 16-8 <sup>3</sup> / <sub>4</sub>           | 5099 | 18- 5 <sup>1</sup> / <sub>4</sub> | 5620 |
| 50 to 52               | 15-0 <sup>1</sup> / <sub>4</sub>           | 4591 | 16- 8 <sup>3</sup> / <sub>4</sub> | 5099 |
| 55 to 57               | 16-8 <sup>3</sup> / <sub>4</sub>           | 5099 | 18- 5 <sup>1</sup> / <sub>4</sub> | 5620 |
| 60 to 62               | 15-0 <sup>3</sup> / <sub>4</sub>           | 4591 | 16- 9 <sup>1</sup> / <sub>4</sub> | 5111 |
| 65 to 67               | 16-9 <sup>1</sup> / <sub>4</sub>           | 5112 | 18- 5 <sup>3</sup> / <sub>4</sub> | 5632 |
| 70 to 72               | 17-8                                       | 5385 | 19-10 <sup>1</sup> / <sub>2</sub> | 6058 |
| 75 to 77               | 19-8                                       | 5994 | 21-10 <sup>1</sup> / <sub>2</sub> | 6668 |
| 80 to 82               | 17-8 <sup>1</sup> / <sub>2</sub>           | 5398 | 20- 1                             | 6121 |
| 85 to 87               | 19-8 <sup>1</sup> / <sub>2</sub>           | 6007 | 22- 1                             | 6731 |

| FRAME<br>SIZE | NOZZLE SIZE (in.)<br>(Nominal Pipe Size) |        |        |           |        |        |
|---------------|------------------------------------------|--------|--------|-----------|--------|--------|
|               | Cooler                                   |        |        | Condenser |        |        |
|               | 1-Pass                                   | 2-Pass | 3-Pass | 1-Pass    | 2-Pass | 3-Pass |
| 1             | 8                                        | 6      | 6      | 8         | 6      | 6      |
| 2             | 10                                       | 8      | 6      | 10        | 8      | 6      |
| 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      |
| 7             | 14                                       | 12     | 10     | 14        | 12     | 12     |
| 8             | 14                                       | 14     | 12     | 14        | 14     | 12     |

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

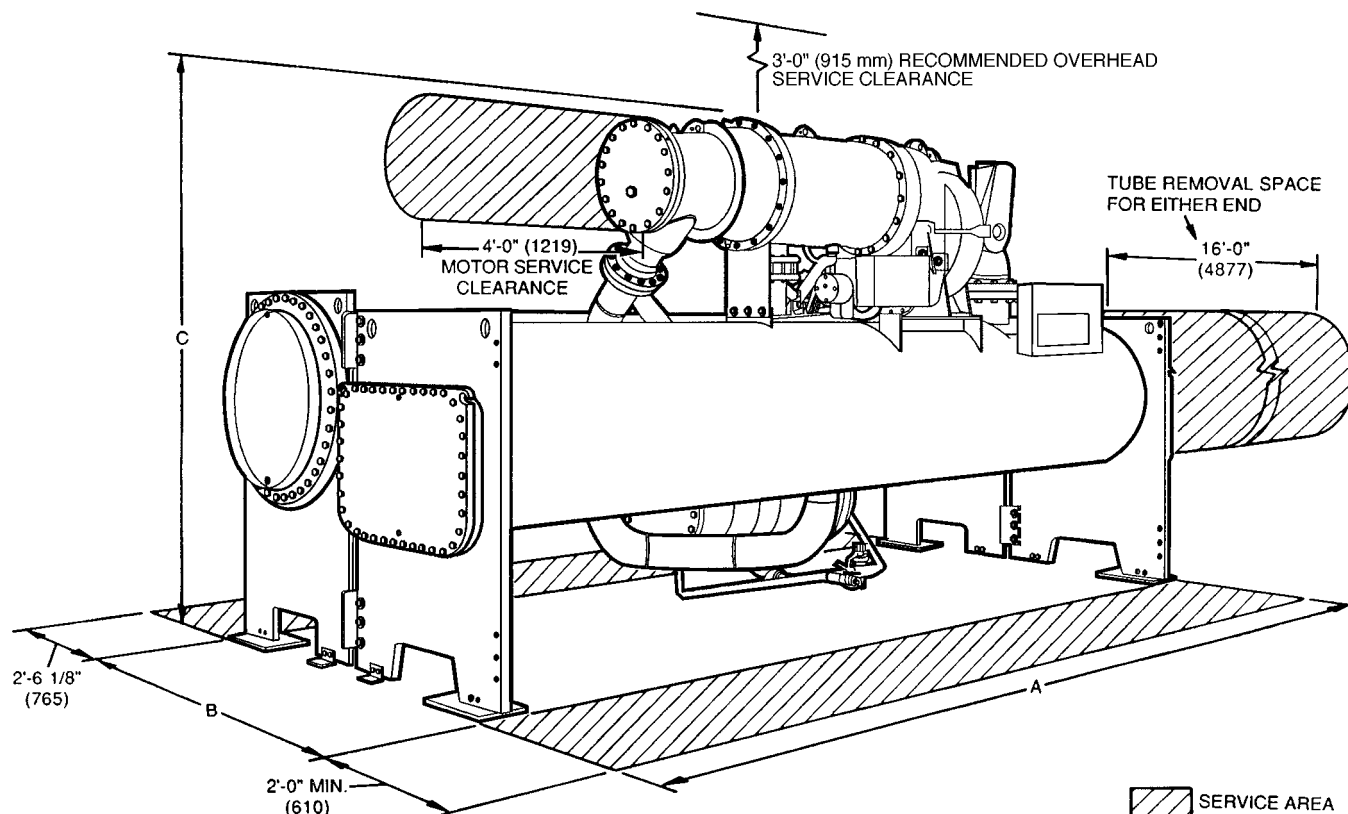
†1 or 3 pass length applies if either (or both) cooler or condenser is a 1 or 3 pass design.

### 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 for frame 2-4 compressor. Overhead clearance for service rigging frame 5 compressor should be 5 ft (1524 mm).
3. Certified drawings available upon request.
4. Marine waterboxes may add 6 in., to the width of the machine. See certified drawings for details.
5. 'A' length dimensions shown are for standard 150 psi design and victaulic connections. The 300 psi design and/or flanges will add length. See certified drawings.

# Dimensions (cont)

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 | 7-1       | 2159 | 8-7¼/16    | 2634 | 10                                    | 8      | 6      |
| 300 psig (2068 kPa) Std Nozzles     | 17-9                                     | 5410 | 18-5½        | 5626 | 7-1       | 2159 | 8-7¼/16    | 2634 | 10                                    | 8      | 6      |
| 150 psig (1034 kPa) Flanged Nozzles | 17-7⅞                                    | 5382 | 18-4¼        | 5594 | 7-1       | 2159 | 8-7¼/16    | 2634 | 10                                    | 8      | 6      |
| 300 psig (2068 kPa) Flanged Nozzles | 17-9⅞                                    | 5420 | 18-6¼        | 5645 | 7-1       | 2159 | 8-7¼/16    | 2634 | 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  |
| 1      | 10   | 428    | 1,711  | 214    | 855  | 143    | 570  |
|        | 11   | 489    | 1,955  | 244    | 978  | 163    | 652  |
|        | 12   | 550    | 2,200  | 275    | 1100 | 183    | 733  |
|        | 15   | 428    | 1,711  | 214    | 855  | 143    | 570  |
|        | 16   | 489    | 1,955  | 244    | 978  | 153    | 652  |
|        | 17   | 550    | 2,200  | 275    | 1100 | 183    | 733  |
| 2      | 20   | 611    | 2,444  | 305    | 1222 | 204    | 815  |
|        | 21   | 733    | 2,933  | 367    | 1466 | 244    | 978  |
|        | 22   | 861    | 3,446  | 431    | 1723 | 287    | 1149 |
| 3      | 30   | 611    | 2,444  | 305    | 1222 | 204    | 815  |
|        | 31   | 733    | 2,933  | 367    | 1466 | 244    | 978  |
|        | 32   | 855    | 3,422  | 428    | 1710 | 285    | 1141 |
|        | 35   | 611    | 2,444  | 305    | 1222 | 204    | 815  |
|        | 36   | 733    | 2,933  | 367    | 1466 | 244    | 978  |
|        | 37   | 855    | 3,422  | 428    | 1710 | 285    | 1141 |
| 4      | 40   | 989    | 3,959  | 495    | 1979 | 330    | 1320 |
|        | 41   | 1112   | 4,448  | 556    | 2224 | 371    | 1482 |
|        | 42   | 1222   | 4,888  | 611    | 2444 | 407    | 1775 |
|        | 45   | 989    | 3,959  | 495    | 1979 | 330    | 1320 |
|        | 46   | 1112   | 4,448  | 556    | 2224 | 371    | 1482 |
|        | 47   | 1222   | 4,888  | 611    | 2444 | 407    | 1775 |
| 5      | 50   | 1316   | 5,267  | 658    | 2634 | 439    | 1756 |
|        | 51   | 1482   | 5,927  | 741    | 2964 | 494    | 1976 |
|        | 52   | 1586   | 6,343  | 793    | 3171 | 529    | 2114 |
|        | 55   | 1316   | 5,267  | 658    | 2634 | 439    | 1756 |
|        | 56   | 1482   | 5,927  | 741    | 2964 | 494    | 1976 |
|        | 57   | 1586   | 6,343  | 793    | 3171 | 529    | 2114 |
| 6      | 60   | 1702   | 6,807  | 851    | 3404 | 567    | 2269 |
|        | 61   | 1830   | 7,320  | 915    | 3660 | 610    | 2440 |
|        | 62   | 1934   | 7,736  | 967    | 3868 | 645    | 2579 |
|        | 65   | 1702   | 6,807  | 851    | 3404 | 567    | 2269 |
|        | 66   | 1830   | 7,320  | 915    | 3660 | 610    | 2440 |
|        | 67   | 1934   | 7,736  | 967    | 3868 | 645    | 2579 |
| 7      | 70   | 1967   | 7,869  | 984    | 3935 | 656    | 2623 |
|        | 71   | 2218   | 8,871  | 1109   | 4436 | 739    | 2957 |
|        | 72   | 2413   | 9,653  | 1207   | 4827 | 804    | 3218 |
|        | 75   | 1967   | 7,869  | 984    | 3935 | 656    | 2623 |
|        | 76   | 2218   | 8,871  | 1109   | 4436 | 739    | 2957 |
|        | 77   | 2413   | 9,653  | 1207   | 4827 | 804    | 3218 |
| 8      | 80   | 2227   | 8,908  | 1114   | 4454 | 742    | 2969 |
|        | 81   | 2752   | 11,010 | 1376   | 5505 | 917    | 3670 |
|        | 82   | 2982   | 11,926 | 1491   | 5963 | 994    | 3975 |
|        | 85   | 2533   | 10,130 | 1266   | 5065 | 844    | 3377 |
|        | 86   | 2752   | 11,010 | 1376   | 5505 | 917    | 3670 |
|        | 87   | 2982   | 11,926 | 1491   | 5963 | 994    | 3975 |

| CONDENSER |      | 1 PASS |        | 2 PASS |      | 3 PASS |      |
|-----------|------|--------|--------|--------|------|--------|------|
| Frame     | Size | Min    | Max    | Min    | Max  | Min    | Max  |
| 1         | 10   | 533    | 2,132  | 267    | 1066 | 178    | 711  |
|           | 11   | 592    | 2,369  | 296    | 1185 | 197    | 790  |
|           | 12   | 666    | 2,665  | 333    | 1333 | 222    | 888  |
|           | 15   | 533    | 2,132  | 267    | 1066 | 178    | 711  |
|           | 16   | 592    | 2,369  | 296    | 1185 | 197    | 790  |
|           | 17   | 666    | 2,665  | 333    | 1333 | 222    | 888  |
| 2         | 20   | 646    | 2,582  | 323    | 1291 | 215    | 861  |
|           | 21   | 791    | 3,163  | 395    | 1581 | 264    | 1054 |
|           | 22   | 933    | 3,731  | 466    | 1866 | 311    | 1244 |
| 3         | 30   | 646    | 2,582  | 323    | 1291 | 215    | 861  |
|           | 31   | 791    | 3,162  | 395    | 1581 | 263    | 1054 |
|           | 32   | 932    | 3,731  | 466    | 1865 | 311    | 1244 |
|           | 35   | 646    | 2,582  | 323    | 1291 | 215    | 861  |
|           | 36   | 791    | 3,162  | 395    | 1581 | 263    | 1051 |
|           | 37   | 932    | 3,731  | 466    | 1865 | 311    | 1244 |
| 4         | 40   | 1096   | 4,383  | 548    | 2192 | 365    | 1461 |
|           | 41   | 1235   | 4,940  | 618    | 2470 | 412    | 1647 |
|           | 42   | 1371   | 5,485  | 686    | 2743 | 457    | 1828 |
|           | 45   | 1096   | 4,383  | 548    | 2192 | 365    | 1461 |
|           | 46   | 1235   | 4,940  | 618    | 2470 | 412    | 1647 |
|           | 47   | 1371   | 5,485  | 686    | 2743 | 457    | 1828 |
| 5         | 50   | 1507   | 6,029  | 754    | 3015 | 502    | 2010 |
|           | 51   | 1646   | 6,586  | 823    | 3293 | 549    | 2195 |
|           | 52   | 1783   | 7,131  | 891    | 3565 | 594    | 2377 |
|           | 55   | 1507   | 6,029  | 754    | 3015 | 502    | 2010 |
|           | 56   | 1646   | 6,586  | 823    | 3293 | 549    | 2195 |
|           | 57   | 1783   | 7,131  | 891    | 3565 | 594    | 2377 |
| 6         | 60   | 1919   | 7,676  | 959    | 3838 | 640    | 2559 |
|           | 61   | 2058   | 8,232  | 1029   | 4116 | 686    | 2744 |
|           | 62   | 2194   | 8,777  | 1097   | 4389 | 731    | 2926 |
|           | 65   | 1919   | 7,676  | 959    | 3838 | 640    | 2559 |
|           | 66   | 2058   | 8,232  | 1029   | 4116 | 686    | 2744 |
|           | 67   | 2194   | 8,777  | 1097   | 4389 | 731    | 2926 |
| 7         | 70   | 2310   | 9,240  | 1155   | 4620 | 770    | 3080 |
|           | 71   | 2576   | 10,306 | 1288   | 5153 | 859    | 3435 |
|           | 72   | 2825   | 11,301 | 1413   | 5650 | 942    | 3767 |
|           | 75   | 2310   | 9,240  | 1155   | 4620 | 770    | 3080 |
|           | 76   | 2576   | 10,306 | 1288   | 5153 | 859    | 3435 |
|           | 77   | 2825   | 11,301 | 1413   | 5650 | 942    | 3767 |
| 8         | 80   | 2932   | 11,727 | 1466   | 5864 | 977    | 3909 |
|           | 81   | 3198   | 12,793 | 1599   | 6397 | 1066   | 4264 |
|           | 82   | 3465   | 13,859 | 1732   | 6930 | 1155   | 4620 |
|           | 85   | 2932   | 11,727 | 1466   | 5864 | 977    | 3909 |
|           | 86   | 3198   | 12,793 | 1599   | 6397 | 1066   | 4264 |
|           | 87   | 3465   | 13,859 | 1732   | 6930 | 1155   | 4620 |

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

# Performance data (cont)



## 19XR HEAT EXCHANGER MIN/MAX FLOW RATES\*

SI (L/s)

| COOLER |      | 1 PASS |     | 2 PASS |     | 3 PASS |     |
|--------|------|--------|-----|--------|-----|--------|-----|
| Frame  | Size | Min    | Max | Min    | Max | Min    | Max |
| 1      | 10   | 27     | 108 | 13     | 54  | 9      | 36  |
|        | 11   | 31     | 123 | 15     | 62  | 10     | 41  |
|        | 12   | 35     | 139 | 17     | 69  | 12     | 46  |
|        | 15   | 27     | 108 | 13     | 54  | 9      | 36  |
|        | 16   | 31     | 123 | 15     | 62  | 10     | 41  |
|        | 17   | 35     | 139 | 17     | 69  | 12     | 46  |
| 2      | 20   | 39     | 154 | 19     | 77  | 13     | 51  |
|        | 21   | 46     | 185 | 23     | 93  | 15     | 62  |
|        | 22   | 54     | 217 | 27     | 109 | 18     | 72  |
| 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 |
| 7      | 70   | 124    | 496 | 62     | 248 | 41     | 165 |
|        | 71   | 140    | 560 | 70     | 280 | 47     | 187 |
|        | 72   | 152    | 609 | 76     | 305 | 51     | 203 |
|        | 75   | 124    | 596 | 62     | 248 | 41     | 165 |
|        | 76   | 140    | 560 | 70     | 280 | 47     | 187 |
|        | 77   | 152    | 609 | 76     | 305 | 51     | 203 |
| 8      | 80   | 140    | 562 | 70     | 281 | 47     | 187 |
|        | 81   | 174    | 695 | 87     | 347 | 58     | 232 |
|        | 82   | 188    | 752 | 94     | 376 | 63     | 251 |
|        | 85   | 160    | 639 | 80     | 320 | 53     | 213 |
|        | 86   | 174    | 695 | 87     | 347 | 58     | 232 |
|        | 87   | 188    | 752 | 94     | 376 | 63     | 251 |

| CONDENSER |      | 1 PASS |     | 2 PASS |     | 3 PASS |     |
|-----------|------|--------|-----|--------|-----|--------|-----|
| Frame     | Size | Min    | Max | Min    | Max | Min    | Max |
| 1         | 10   | 34     | 135 | 17     | 67  | 11     | 45  |
|           | 11   | 37     | 149 | 19     | 75  | 12     | 50  |
|           | 12   | 42     | 168 | 21     | 84  | 14     | 56  |
|           | 15   | 34     | 135 | 17     | 67  | 11     | 45  |
|           | 16   | 37     | 149 | 19     | 75  | 12     | 50  |
|           | 17   | 42     | 168 | 21     | 84  | 14     | 56  |
| 2         | 20   | 41     | 163 | 20     | 81  | 14     | 54  |
|           | 21   | 50     | 200 | 25     | 100 | 17     | 67  |
|           | 22   | 59     | 235 | 29     | 118 | 20     | 78  |
| 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 |
| 7         | 70   | 146    | 583 | 73     | 291 | 49     | 194 |
|           | 71   | 163    | 650 | 81     | 325 | 54     | 217 |
|           | 72   | 178    | 713 | 89     | 356 | 59     | 238 |
|           | 75   | 146    | 583 | 73     | 291 | 49     | 194 |
|           | 76   | 163    | 650 | 81     | 325 | 54     | 217 |
|           | 77   | 178    | 713 | 89     | 356 | 59     | 238 |
| 8         | 80   | 185    | 740 | 92     | 370 | 62     | 247 |
|           | 81   | 202    | 807 | 101    | 404 | 67     | 269 |
|           | 82   | 219    | 874 | 109    | 437 | 73     | 291 |
|           | 85   | 185    | 740 | 92     | 370 | 62     | 247 |
|           | 86   | 202    | 807 | 101    | 404 | 67     | 269 |
|           | 87   | 219    | 874 | 109    | 437 | 73     | 291 |

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

## 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-415 or consult Carrier regarding design information for the selection of starters.

## 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.

# Electrical data

## 60 Hz STANDARD EFFICIENCY MOTORS\*

### SIZE B MOTORS

| LOW VOLTAGE |                                  |        |       |       |       |       |       |       |
|-------------|----------------------------------|--------|-------|-------|-------|-------|-------|-------|
| Motor Size  | Motor Electrical Characteristics | Max kW | 200 v | 230 v | 380 v | 416 v | 460 v | 575 v |
| BDS         | RLA per 1kW                      | 100    | 3.27  | 2.83  | 1.71  | 1.59  | 1.41  | 1.14  |
|             | LRA Star                         |        | 619   | 492   | 294   | 322   | 245   | 225   |
|             | LRA Delta                        |        | 2158  | 1723  | 1026  | 1126  | 859   | 787   |
| BES         | RLA per 1kW                      | 136    | 3.22  | 2.79  | 1.70  | 1.55  | 1.40  | 1.12  |
|             | LRA Star                         |        | 717   | 650   | 421   | 362   | 324   | 276   |
|             | LRA Delta                        |        | 2505  | 2276  | 1471  | 1268  | 1138  | 962   |
| BFS         | RLA per 1kW                      | 171    | 3.19  | 2.77  | 1.67  | 1.54  | 1.39  | 1.11  |
|             | LRA Star                         |        | 975   | 886   | 475   | 521   | 443   | 327   |
|             | LRA Delta                        |        | 3402  | 3095  | 1667  | 1823  | 1548  | 1143  |
| BGS         | RLA per 1kW                      | 206    | 3.21  | 2.78  | 1.68  | 1.53  | 1.39  | 1.11  |
|             | LRA Star                         |        | 1289  | 929   | 612   | 547   | 465   | 421   |
|             | LRA Delta                        |        | 4495  | 3249  | 2138  | 1912  | 1624  | 1475  |
| BHS         | RLA per 1kW                      | 241    | 3.2   | 2.79  | 1.69  | 1.54  | 1.39  | 1.11  |
|             | LRA Star                         |        | 1219  | 999   | 578   | 633   | 515   | 421   |
|             | LRA Delta                        |        | 4274  | 3500  | 2034  | 2220  | 1809  | 1479  |

### SIZE C MOTORS

| LOW AND MEDIUM VOLTAGE |                                  |        |           |       |       |       |       |       |              |        |        |
|------------------------|----------------------------------|--------|-----------|-------|-------|-------|-------|-------|--------------|--------|--------|
| Motor Size             | Motor Electrical Characteristics | Max kW | Low Volts |       |       |       |       |       | Medium Volts |        |        |
|                        |                                  |        | 200 v     | 230 v | 380 v | 416 v | 460 v | 575 v | 2400 v       | 3300 v | 4160 v |
| CDS                    | RLA per 1kW                      | 200    | 3.28      | 2.85  | 1.83  | 1.57  | 1.43  | 1.14  | 0.274        | 0.199  | 0.158  |
|                        | LRA Star                         |        | 1135      | 1012  | 676   | 617   | 486   | 405   | —            | —      | —      |
|                        | LRA Delta                        |        | 3545      | 3163  | 2112  | 1929  | 1519  | 1265  | 255          | 199    | 147    |
| CES                    | RLA per 1kW                      | 219    | 3.28      | 2.85  | 1.73  | 1.57  | 1.43  | 1.14  | 0.272        | 0.196  | 0.155  |
|                        | LRA Star                         |        | 1395      | 1044  | 622   | 606   | 462   | 373   | —            | —      | —      |
|                        | LRA Delta                        |        | 4359      | 3263  | 1945  | 1893  | 1443  | 1165  | 284          | 210    | 164    |
| CLS                    | RLA per 1kW                      | 243    | 3.28      | 2.85  | 1.73  | 1.55  | 1.43  | 1.14  | 0.272        | 0.200  | 0.157  |
|                        | LRA Star                         |        | 1275      | 1173  | 749   | 708   | 546   | 398   | —            | —      | —      |
|                        | LRA Delta                        |        | 3984      | 3665  | 2340  | 2212  | 1707  | 1245  | 281          | 227    | 178    |
| CMS                    | RLA per 1kW                      | 267    | 3.32      | 2.89  | 1.74  | 1.56  | 1.44  | 1.15  | 0.272        | 0.199  | 0.159  |
|                        | LRA Star                         |        | 1349      | 1422  | 841   | 825   | 562   | 498   | —            | —      | —      |
|                        | LRA Delta                        |        | 4215      | 4443  | 2628  | 2577  | 1757  | 1556  | 313          | 261    | 198    |
| CNS                    | RLA per 1kW                      | 295    | 3.28      | 2.85  | 1.73  | 1.56  | 1.43  | 1.14  | 0.272        | 0.198  | 0.156  |
|                        | LRA Star                         |        | 1644      | 1333  | 865   | 874   | 663   | 610   | —            | —      | —      |
|                        | LRA Delta                        |        | 5138      | 4167  | 2704  | 2731  | 2071  | 1908  | 346          | 287    | 215    |
| CPS                    | RLA per 1kW                      | 323    | 3.24      | 2.82  | 1.71  | 1.56  | 1.41  | 1.13  | 0.274        | 0.200  | 0.160  |
|                        | LRA Star                         |        | 1607      | 1430  | 851   | 859   | 719   | 601   | —            | —      | —      |
|                        | LRA Delta                        |        | 5023      | 4468  | 2659  | 2684  | 2247  | 1878  | 378          | 320    | 237    |
| CQS                    | RLA per 1kW                      | 360    | 3.28      | 2.85  | 1.73  | 1.56  | 1.43  | 1.14  | 0.274        | 0.198  | 0.160  |
|                        | LRA Star                         |        | 1912      | 1639  | 948   | 1064  | 1000  | 672   | —            | —      | —      |
|                        | LRA Delta                        |        | 5976      | 5121  | 2963  | 3325  | 3125  | 2098  | 457          | 329    | 268    |

See Legend and Notes on page 24.

# Electrical data (cont)



## 60 Hz STANDARD EFFICIENCY MOTORS\* (cont)

### SIZE D MOTORS

| LOW, MEDIUM, AND HIGH VOLTAGE |                                  |           |       |       |       |       |       |              |        |        |        |            |      |
|-------------------------------|----------------------------------|-----------|-------|-------|-------|-------|-------|--------------|--------|--------|--------|------------|------|
| 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                       | 363       | 3.19  | 2.79  | 1.70  | 1.40  | 1.12  | 344          | 0.27   | 0.20   | 0.16   | 344        | —    |
|                               | LRA Star                         |           | 1791  | 1731  | 1118  | 866   | 750   |              | —      | —      | —      |            | —    |
|                               | LRA Delta                        |           | 5597  | 5410  | 3494  | 2705  | 2345  |              | 418    | 314    | 241    |            | —    |
| DCS                           | RLA per kW                       | 388       | 3.24  | 2.79  | 1.69  | 1.39  | 1.12  | 369          | 0.27   | 0.20   | 0.16   | 369        | —    |
|                               | LRA Star                         |           | 2325  | 1711  | 1104  | 855   | 741   |              | —      | —      | —      |            | —    |
|                               | LRA Delta                        |           | 7266  | 5347  | 3449  | 2673  | 2314  |              | 480    | 329    | 277    |            | —    |
| DDS                           | RLA per kW                       | 418       | 3.21  | 2.79  | 1.69  | 1.39  | 1.12  | 398          | 0.27   | 0.20   | 0.16   | 398        | 0.09 |
|                               | LRA Star                         |           | 2265  | 1868  | 1075  | 934   | 732   |              | —      | —      | —      |            | —    |
|                               | LRA Delta                        |           | 7078  | 5836  | 3361  | 2918  | 2286  |              | 515    | 367    | 297    |            | 237  |
| DES                           | RLA per kW                       | 443       | 3.24  | 2.83  | 1.70  | 1.42  | 1.12  | 421          | 0.27   | 0.19   | 0.15   | 421        | 0.09 |
|                               | LRA Star                         |           | 2352  | 2135  | 1117  | 1068  | 750   |              | —      | —      | —      |            | —    |
|                               | LRA Delta                        |           | 7350  | 6672  | 3491  | 3336  | 2343  |              | 555    | 377    | 320    |            | 234  |
| DFS                           | RLA per kW                       | 478       | 3.25  | 2.83  | 1.71  | 1.42  | 1.12  | 453          | 0.27   | 0.20   | 0.16   | 453        | 0.09 |
|                               | LRA Star                         |           | 2272  | 2112  | 1265  | 1056  | 838   |              | —      | —      | —      |            | —    |
|                               | LRA Delta                        |           | 7101  | 6599  | 3952  | 3300  | 2620  |              | 570    | 435    | 329    |            | 255  |
| DGS                           | RLA per kW                       | 523       | —     | —     | 1.67  | 1.38  | 1.11  | 497          | 0.27   | 0.20   | 0.16   | 497        | 0.09 |
|                               | LRA Star                         |           | —     | —     | 1237  | 1179  | 946   |              | —      | —      | —      |            | —    |
|                               | LRA Delta                        |           | —     | —     | 3867  | 3684  | 2956  |              | 636    | 440    | 367    |            | 270  |
| DHS                           | RLA per kW                       | 561       | —     | —     | 1.68  | 1.38  | 1.10  | 533          | 0.28   | 0.20   | 0.16   | 533        | 0.09 |
|                               | LRA Star                         |           | —     | —     | 1583  | 1131  | 1008  |              | —      | —      | —      |            | —    |
|                               | LRA Delta                        |           | —     | —     | 4945  | 3533  | 3151  |              | 704    | 496    | 406    |            | 302  |
| DJS                           | RLA per kW                       | 597       | —     | —     | 1.68  | 1.38  | 1.12  | 568          | 0.27   | 0.20   | 0.16   | 568        | 0.09 |
|                               | LRA Star                         |           | —     | —     | 1593  | 1181  | 944   |              | —      | —      | —      |            | —    |
|                               | LRA Delta                        |           | —     | —     | 4977  | 3690  | 2951  |              | 719    | 522    | 415    |            | 323  |

### SIZE E MOTORS

| LOW AND MEDIUM VOLTAGE |                                  |        |           |       |       |       |              |        |        |
|------------------------|----------------------------------|--------|-----------|-------|-------|-------|--------------|--------|--------|
| Motor Size             | Motor Electrical Characteristics | Max kW | Low Volts |       |       |       | Medium Volts |        |        |
|                        |                                  |        | 380 v     | 416 v | 460 v | 575 v | 2400 v       | 3300 v | 4160 v |
| EHS                    | RLA per kW                       | 604    | 1.67      | 1.52  | 1.37  | 1.10  | 0.264        | 0.193  | 0.152  |
|                        | LRA Star                         |        | 2425      | 2158  | 1901  | 1520  | —            | —      | —      |
|                        | LRA Delta                        |        | 8128      | 7240  | 6366  | 5100  | 894          | 637    | 517    |
| EJS                    | RLA per kW                       | 648    | 1.67      | 1.52  | 1.37  | 1.10  | 0.264        | 0.194  | 0.153  |
|                        | LRA Star                         |        | 2431      | 2162  | 1904  | 1526  | —            | —      | —      |
|                        | LRA Delta                        |        | 8146      | 7264  | 6394  | 5119  | 1061         | 866    | 612    |
| EKS                    | RLA per kW                       | 695    | 1.66      | 1.52  | 1.37  | 1.10  | 0.266        | 0.194  | 0.153  |
|                        | LRA Star                         |        | 2434      | 2166  | 1905  | 1524  | —            | —      | —      |
|                        | LRA Delta                        |        | 8184      | 7287  | 6410  | 5137  | 1067         | 869    | 613    |
| ELS                    | RLA per kW                       | 755    | 1.66      | 1.51  | 1.37  | 1.10  | 0.265        | 0.192  | 0.154  |
|                        | LRA Star                         |        | 2438      | 2169  | 1907  | 1528  | —            | —      | —      |
|                        | LRA Delta                        |        | 8213      | 7320  | 6436  | 5154  | 1250         | 851    | 720    |
| EMS                    | RLA per kW                       | 814    | 1.65      | 1.51  | 1.37  | 1.09  | 0.264        | 0.190  | 0.153  |
|                        | LRA Star                         |        | 2913      | 2726  | 2626  | 1855  | —            | —      | —      |
|                        | LRA Delta                        |        | 9769      | 9131  | 8807  | 6243  | 1255         | 970    | 728    |
| ENS                    | RLA per kW                       | 886    | 1.64      | 1.50  | 1.36  | 1.08  | 0.263        | 0.191  | 0.151  |
|                        | LRA Star                         |        | 2919      | 2729  | 2632  | 1855  | —            | —      | —      |
|                        | LRA Delta                        |        | 9799      | 9177  | 8840  | 6259  | 1450         | 1056   | 838    |
| EPS                    | RLA per kW                       | 943    | 1.64      | 1.50  | 1.36  | 1.08  | 0.262        | 0.191  | 0.152  |
|                        | LRA Star                         |        | 2922      | 2734  | 2634  | 1858  | —            | —      | —      |
|                        | LRA Delta                        |        | 9830      | 9199  | 8870  | 6273  | 1455         | 1060   | 844    |

#### 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:

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

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

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

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

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

## 60 Hz HIGH EFFICIENCY MOTORS

### SIZE B MOTORS\*

| LOW VOLTAGE |                                     |        |                      |                      |                     |                     |                     |                      |
|-------------|-------------------------------------|--------|----------------------|----------------------|---------------------|---------------------|---------------------|----------------------|
| Motor Size  | Motor Electrical Characteristics    | Max kW | 200 v                | 230 v                | 380 v               | 416 v               | 460 v               | 575 v                |
| BDH         | RLA per kW<br>LRA Star<br>LRA Delta | 100    | 3.13<br>772<br>2679  | 2.76<br>797<br>2763  | 1.65<br>430<br>1488 | 1.54<br>469<br>1628 | 1.38<br>397<br>1381 | 1.100<br>293<br>1018 |
| BEH         | RLA per kW<br>LRA Star<br>LRA Delta | 135    | 3.16<br>1154<br>4000 | 2.72<br>832<br>2891  | 1.64<br>549<br>1900 | 1.53<br>601<br>2078 | 1.37<br>486<br>1693 | 1.096<br>398<br>1382 |
| BFH         | RLA per kW<br>LRA Star<br>LRA Delta | 171    | 3.10<br>1189<br>4145 | 2.73<br>1232<br>4273 | 1.64<br>734<br>2543 | 1.54<br>801<br>2772 | 1.36<br>616<br>2139 | 1.111<br>566<br>1959 |
| BGH         | RLA per kW<br>LRA Star<br>LRA Delta | 206    | 3.09<br>1414<br>4911 | 2.68<br>1225<br>4269 | 1.63<br>731<br>2546 | 1.49<br>719<br>2503 | 1.36<br>796<br>2751 | 1.073<br>505<br>1761 |
| BHH         | RLA per kW<br>LRA Star<br>LRA Delta | 240    | 1.20<br>2164<br>7194 | 2.69<br>1224<br>4283 | 1.63<br>728<br>2552 | 1.49<br>798<br>2786 | 1.37<br>886<br>3068 | 1.075<br>505<br>1769 |

### SIZE C MOTORS

| LOW VOLTAGE |                                     |        |                      |                      |                      |                      |                      |                       |
|-------------|-------------------------------------|--------|----------------------|----------------------|----------------------|----------------------|----------------------|-----------------------|
| Motor Size  | Motor Electrical Characteristics    | Max kW | 200 v                | 230 v                | 380 v                | 416 v                | 460 v                | 575 v                 |
| CDH         | RLA per kW<br>LRA Star<br>LRA Delta | 200    | 3.22<br>1518<br>5264 | 2.87<br>1580<br>5392 | 1.80<br>1039<br>3568 | 1.68<br>1016<br>3495 | 1.44<br>782<br>2696  | 1.167<br>618<br>2134  |
| CEH         | RLA per kW<br>LRA Star<br>LRA Delta | 219    | 3.22<br>1680<br>5814 | 2.87<br>1694<br>5836 | 1.81<br>1146<br>3938 | 1.67<br>1100<br>3787 | 1.43<br>847<br>2923  | 1.174<br>699<br>2412  |
| CLH         | RLA per kW<br>LRA Star<br>LRA Delta | 243    | 3.31<br>2232<br>7670 | 2.86<br>1874<br>6457 | 1.85<br>1366<br>4698 | 1.62<br>1071<br>3694 | 1.43<br>926<br>3228  | 1.167<br>759<br>2620  |
| CMH         | RLA per kW<br>LRA Star<br>LRA Delta | 267    | 3.43<br>2825<br>9704 | 2.88<br>2143<br>7375 | 1.80<br>1348<br>4649 | 1.59<br>1058<br>3853 | 1.44<br>1046<br>3606 | 1.195<br>912<br>3149  |
| CNH         | RLA per kW<br>LRA Star<br>LRA Delta | 295    | 3.34<br>2896<br>9613 | 2.84<br>2116<br>7295 | 1.76<br>1332<br>4604 | 1.69<br>1456<br>5012 | 1.42<br>1031<br>3572 | 1.167<br>901<br>3110  |
| CPH         | RLA per kW<br>LRA Star<br>LRA Delta | 323    | 3.25<br>2650<br>9158 | 2.83<br>2358<br>8118 | 1.74<br>1408<br>4867 | 1.61<br>1381<br>4766 | 1.40<br>1090<br>3777 | 1.154<br>951<br>3292  |
| CQH         | RLA per kW<br>LRA Star<br>LRA Delta | 360    | 3.19<br>2518<br>8728 | 2.88<br>2889<br>9955 | 1.73<br>1527<br>5277 | 1.59<br>1463<br>5051 | 1.44<br>1447<br>4998 | 1.177<br>1169<br>4035 |

See Legend and Notes on page 26.

# Electrical data (cont)



## 60 Hz HIGH EFFICIENCY MOTORS (cont)

### SIZE D MOTORS\*

| LOW, MEDIUM, AND HIGH VOLTAGE |                                     |        |                        |                       |                       |                       |                       |                       |                    |                   |                   |                   |
|-------------------------------|-------------------------------------|--------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|--------------------|-------------------|-------------------|-------------------|
| Motor Size                    | Motor Electrical Characteristics    | Max kW | Low Volts              |                       |                       |                       |                       |                       | Medium Volts       |                   |                   | High Volts        |
|                               |                                     |        | 200 v                  | 230 v                 | 380 v                 | 416 v                 | 460 v                 | 575 v                 | 2400 v             | 3300 v            | 4160 v            | 6900              |
| DBH                           | RLA per kW<br>LRA Star<br>LRA Delta | 356    | 0.449<br>2649<br>9164  | 0.117<br>2787<br>9597 | 1.700<br>1260<br>4385 | 1.569<br>1263<br>4381 | 1.390<br>1091<br>3787 | 1.142<br>945<br>3280  | 0.275<br>634<br>—  | 0.200<br>473<br>— | 0.159<br>369<br>— | —<br>—<br>—       |
| DCH                           | RLA per kW<br>LRA Star<br>LRA Delta | 379    | 0.623<br>2840<br>9814  | 0.224<br>2684<br>9266 | 1.696<br>1351<br>4694 | 1.563<br>1327<br>4604 | 1.436<br>1346<br>4658 | 1.149<br>1074<br>3715 | 0.275<br>694<br>—  | 0.201<br>523<br>— | 0.159<br>403<br>— | —<br>—<br>—       |
| DDH                           | RLA per kW<br>LRA Star<br>LRA Delta | 409    | 0.784<br>2807<br>9723  | 0.424<br>2893<br>9985 | 1.705<br>1518<br>5269 | 1.570<br>1461<br>5061 | 1.441<br>1449<br>5025 | 1.154<br>1159<br>4001 | 0.273<br>710<br>—  | 0.197<br>490<br>— | 0.157<br>409<br>— | 0.096<br>298<br>— |
| DEH                           | RLA per kW<br>LRA Star<br>LRA Delta | 434    | 0.969<br>2615<br>9151  | 0.601<br>2648<br>9236 | 1.761<br>1583<br>5525 | 1.588<br>1363<br>4754 | 1.431<br>1180<br>4129 | 1.145<br>936<br>3279  | 0.271<br>704<br>—  | 0.199<br>541<br>— | 0.157<br>410<br>— | 0.096<br>319<br>— |
| DFH                           | RLA per kW<br>LRA Star<br>LRA Delta | 469    | 1.190<br>3351<br>11638 | 0.752<br>2846<br>9916 | 1.731<br>1612<br>5633 | 1.602<br>1611<br>5617 | 1.437<br>1396<br>4871 | 1.176<br>1251<br>4357 | 0.271<br>772<br>—  | 0.199<br>595<br>— | 0.157<br>447<br>— | 0.098<br>354<br>— |
| DGH                           | RLA per kW<br>LRA Star<br>LRA Delta | 509    | —<br>—<br>—            | —<br>—<br>—           | 1.713<br>1695<br>5921 | 1.581<br>1661<br>5798 | 1.456<br>1681<br>5860 | 1.157<br>1287<br>4498 | 0.269<br>787<br>—  | 0.197<br>627<br>— | 0.155<br>458<br>— | 0.096<br>393<br>— |
| DHH                           | RLA per kW<br>LRA Star<br>LRA Delta | 546    | —<br>—<br>—            | —<br>—<br>—           | 1.732<br>1932<br>6738 | 1.572<br>1659<br>5810 | 1.444<br>1682<br>5864 | 1.148<br>1290<br>4507 | 0.271<br>932<br>—  | 0.199<br>702<br>— | 0.156<br>536<br>— | 0.095<br>392<br>— |
| DJH                           | RLA per kW<br>LRA Star<br>LRA Delta | 559    | —<br>—<br>—            | —<br>—<br>—           | —<br>—<br>—           | —<br>—<br>—           | —<br>—<br>—           | —<br>—<br>—           | 0.271<br>1001<br>— | 0.198<br>751<br>— | 0.156<br>581<br>— | 0.095<br>425<br>— |

### SIZE E MOTORS\*

| LOW, MEDIUM, AND HIGH VOLTAGE |                                     |        |             |             |                      |                      |                      |                      |                    |                    |                   |                   |
|-------------------------------|-------------------------------------|--------|-------------|-------------|----------------------|----------------------|----------------------|----------------------|--------------------|--------------------|-------------------|-------------------|
| Motor Size                    | Motor Electrical Characteristics    | Max kW | Low Volts   |             |                      |                      |                      |                      | Medium Volts       |                    |                   | High Volts        |
|                               |                                     |        | 200 v       | 230 v       | 380 v                | 416 v                | 460 v                | 575 v                | 2400 v             | 3300 v             | 4160 v            | 6900              |
| EHH                           | RLA per kW<br>LRA Star<br>LRA Delta | 600    | —<br>—<br>— | —<br>—<br>— | 1.67<br>2087<br>7049 | 1.52<br>1941<br>6541 | 1.38<br>1834<br>6170 | 1.10<br>1465<br>4944 | 0.267<br>—<br>1102 | 0.193<br>—<br>793  | 0.153<br>—<br>635 | 0.093<br>—<br>380 |
| EJH                           | RLA per kW<br>LRA Star<br>LRA Delta | 644    | —<br>—<br>— | —<br>—<br>— | 1.66<br>2091<br>7070 | 1.51<br>1943<br>6552 | 1.37<br>1836<br>6190 | 1.10<br>1469<br>4949 | 0.264<br>—<br>1142 | 0.193<br>—<br>872  | 0.152<br>—<br>660 | 0.093<br>—<br>380 |
| EKH                           | RLA per kW<br>LRA Star<br>LRA Delta | 691    | —<br>—<br>— | —<br>—<br>— | 1.66<br>2346<br>7912 | 1.53<br>2285<br>7702 | 1.37<br>1837<br>6212 | 1.10<br>1468<br>4966 | 0.266<br>—<br>1281 | 0.192<br>—<br>870  | 0.153<br>—<br>743 | 0.093<br>—<br>417 |
| ELH                           | RLA per kW<br>LRA Star<br>LRA Delta | 750    | —<br>—<br>— | —<br>—<br>— | 1.65<br>2350<br>7941 | 1.52<br>2289<br>7731 | 1.37<br>1837<br>6230 | 1.10<br>1471<br>4981 | 0.264<br>—<br>1398 | 0.192<br>—<br>942  | 0.152<br>—<br>806 | 0.092<br>—<br>450 |
| EMH                           | RLA per kW<br>LRA Star<br>LRA Delta | 806    | —<br>—<br>— | —<br>—<br>— | 1.66<br>2787<br>9391 | 1.51<br>2611<br>8801 | 1.36<br>2257<br>7623 | 1.09<br>1784<br>6021 | 0.266<br>—<br>1400 | 0.194<br>—<br>1076 | 0.153<br>—<br>806 | 0.093<br>—<br>515 |
| ENH                           | RLA per kW<br>LRA Star<br>LRA Delta | 876    | —<br>—<br>— | —<br>—<br>— | 1.66<br>2791<br>9425 | 1.51<br>2614<br>8831 | 1.37<br>2257<br>7642 | 1.09<br>1784<br>6042 | 0.264<br>—<br>1668 | 0.192<br>—<br>1163 | 0.152<br>—<br>962 | 0.092<br>—<br>565 |
| EPH                           | RLA per kW<br>LRA Star<br>LRA Delta | 931    | —<br>—<br>— | —<br>—<br>— | 1.66<br>2792<br>9446 | 1.51<br>2617<br>8850 | 1.37<br>2527<br>8536 | 1.09<br>1786<br>6061 | 0.263<br>—<br>1664 | 0.191<br>—<br>1157 | 0.153<br>—<br>959 | 0.092<br>—<br>562 |

#### 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\***  
**SIZE B MOTORS**

| LOW VOLTAGE |                                     |        |                      |                     |                     |
|-------------|-------------------------------------|--------|----------------------|---------------------|---------------------|
| Motor Size  | Motor Electrical Characteristics    | Max kW | 230 v                | 346 v               | 400 v               |
| BDS         | RLA per kW<br>LRA Star<br>LRA Delta | 100    | 2.83<br>533<br>1569  | 1.88<br>356<br>1235 | 1.63<br>292<br>1020 |
| BES         | RLA per kW<br>LRA Star<br>LRA Delta | 138    | 2.73<br>669<br>2337  | 1.83<br>513<br>1787 | 1.58<br>368<br>1284 |
| BFS         | RLA per kW<br>LRA Star<br>LRA Delta | 175    | 2.73<br>800<br>2777  | 1.81<br>538<br>1877 | 1.56<br>477<br>1660 |
| BGS         | RLA per kW<br>LRA Star<br>LRA Delta | 210    | 2.72<br>978<br>3403  | 1.80<br>585<br>2050 | 1.56<br>554<br>1932 |
| BHS         | RLA per kW<br>LRA Star<br>LRA Delta | 247    | 2.72<br>1192<br>4133 | 1.79<br>784<br>2729 | 1.55<br>627<br>2191 |

**SIZE C MOTORS**

| LOW AND MEDIUM VOLTAGE |                                     |        |                      |                      |                     |                   |                   |
|------------------------|-------------------------------------|--------|----------------------|----------------------|---------------------|-------------------|-------------------|
| Motor Size             | Motor Electrical Characteristics    | Max kW | Low Volts            |                      |                     | Medium Volts      |                   |
|                        |                                     |        | 230 v                | 346 v                | 400 v               | 3000 v            | 3300 v            |
| CDS                    | RLA per kW<br>LRA Star<br>LRA Delta | 196    | 2.82<br>924<br>2887  | 1.87<br>673<br>2102  | 1.62<br>563<br>1761 | 0.212<br>—<br>194 | 0.199<br>—<br>194 |
| CES                    | RLA per kW<br>LRA Star<br>LRA Delta | 214    | 2.85<br>1165<br>3640 | 1.90<br>780<br>2436  | 1.64<br>665<br>2078 | 0.219<br>—<br>214 | 0.197<br>—<br>212 |
| CLS                    | RLA per kW<br>LRA Star<br>LRA Delta | 239    | 2.82<br>1197<br>3740 | 1.87<br>812<br>2536  | 1.62<br>721<br>2252 | 0.212<br>—<br>241 | 0.196<br>—<br>236 |
| CMS                    | RLA per kW<br>LRA Star<br>LRA Delta | 263    | 2.79<br>1542<br>4819 | 1.85<br>833<br>2603  | 1.60<br>730<br>2280 | 0.220<br>—<br>258 | 0.200<br>—<br>254 |
| CNS                    | RLA per kW<br>LRA Star<br>LRA Delta | 290    | 2.79<br>1446<br>4518 | 1.85<br>854<br>2670  | 1.70<br>896<br>2800 | 0.216<br>—<br>291 | 0.194<br>—<br>285 |
| CPS                    | RLA per kW<br>LRA Star<br>LRA Delta | 318    | 2.82<br>1534<br>4794 | 1.87<br>1020<br>3187 | 1.62<br>951<br>2973 | 0.215<br>—<br>325 | 0.197<br>—<br>292 |
| CQS                    | RLA per kW<br>LRA Star<br>LRA Delta | 355    | 2.79<br>1542<br>4819 | 1.96<br>1303<br>4071 | 1.60<br>951<br>2973 | 0.213<br>—<br>346 | 0.194<br>—<br>343 |

See Legend and Notes on page 28.

# Electrical data (cont)



## 50 Hz STANDARD EFFICIENCY MOTORS\* (cont)

### SIZE D MOTORS

| LOW, MEDIUM, AND HIGH VOLTAGE |                                     |           |                      |                      |                      |              |                  |                  |            |                  |
|-------------------------------|-------------------------------------|-----------|----------------------|----------------------|----------------------|--------------|------------------|------------------|------------|------------------|
| 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<br>LRA Star<br>LRA Delta | 341       | 2.85<br>1730<br>5407 | 1.91<br>1240<br>3875 | 1.64<br>998<br>3118  | 344          | 0.22<br>—<br>331 | 0.20<br>—<br>324 | 344        | —<br>—<br>—      |
| DCS                           | RLA per kW<br>LRA Star<br>LRA Delta | 366       | 2.83<br>1708<br>5337 | 1.90<br>1224<br>3825 | 1.64<br>985<br>3079  | 369          | 0.22<br>—<br>382 | 0.20<br>—<br>346 | 369        | —<br>—<br>—      |
| DDS                           | RLA per kW<br>LRA Star<br>LRA Delta | 394       | 2.79<br>1554<br>4857 | 1.86<br>1149<br>3591 | 1.62<br>1048<br>3274 | 398          | 0.22<br>—<br>414 | 0.20<br>—<br>380 | 398        | 0.10<br>—<br>230 |
| DES                           | RLA per kW<br>LRA Star<br>LRA Delta | 417       | 2.80<br>1798<br>5618 | 1.86<br>1136<br>3551 | 1.62<br>1076<br>3362 | 421          | 0.22<br>—<br>412 | 0.20<br>—<br>424 | 421        | 0.10<br>—<br>256 |
| DFS                           | RLA per kW<br>LRA Star<br>LRA Delta | 449       | 2.75<br>1973<br>6165 | 1.83<br>1251<br>3910 | 1.58<br>1146<br>3581 | 453          | 0.22<br>—<br>273 | 0.20<br>—<br>269 | 453        | 0.10<br>—<br>281 |
| DGS                           | RLA per kW<br>LRA Star<br>LRA Delta | 493       | 2.76<br>2496<br>7799 | 1.83<br>1355<br>4235 | 1.58<br>1212<br>3787 | 498          | 0.21<br>—<br>493 | 0.19<br>—<br>477 | 498        | 0.10<br>—<br>294 |
| DHS                           | RLA per kW<br>LRA Star<br>LRA Delta | 528       | 2.74<br>2397<br>7490 | 1.82<br>1517<br>4741 | 1.58<br>1318<br>4118 | 533          | 0.21<br>—<br>517 | 0.19<br>—<br>511 | 533        | 0.10<br>—<br>322 |
| DJS                           | RLA per kW<br>LRA Star<br>LRA Delta | 563       | —<br>—<br>—          | 1.85<br>1538<br>4806 | 1.60<br>1552<br>4850 | 569          | 0.2<br>—<br>570  | 0.19<br>—<br>551 | 569        | 0.10<br>—<br>348 |

### SIZE E MOTORS

| LOW AND MEDIUM VOLTAGE |                                     |        |                      |                    |                   |
|------------------------|-------------------------------------|--------|----------------------|--------------------|-------------------|
| Motor Size             | Motor Electrical Characteristics    | Max kW | Low Volts            | Medium Volts       |                   |
|                        |                                     |        | 400 v                | 3000 v             | 3300 v            |
| EHS                    | RLA per kW<br>LRA Star<br>LRA Delta | 608    | 1.58<br>1953<br>6543 | 0.212<br>—<br>721  | 0.192<br>—<br>653 |
| EJS                    | RLA per kW<br>LRA Star<br>LRA Delta | 652    | 1.57<br>1955<br>6566 | 0.210<br>—<br>767  | 0.190<br>—<br>749 |
| EKS                    | RLA per kW<br>LRA Star<br>LRA Delta | 701    | 1.57<br>1957<br>6585 | 0.211<br>—<br>767  | 0.191<br>—<br>749 |
| ELS                    | RLA per kW<br>LRA Star<br>LRA Delta | 754    | 1.57<br>2411<br>8099 | 0.211<br>—<br>940  | 0.191<br>—<br>838 |
| EMS                    | RLA per kW<br>LRA Star<br>LRA Delta | 815    | 1.57<br>2414<br>8122 | 0.211<br>—<br>937  | 0.191<br>—<br>841 |
| ENS                    | RLA per kW<br>LRA Star<br>LRA Delta | 887    | 1.57<br>2417<br>8151 | 0.210<br>—<br>1058 | 0.191<br>—<br>963 |
| EPS                    | RLA per kW<br>LRA Star<br>LRA Delta | 944    | 1.57<br>2417<br>8175 | 0.210<br>—<br>1061 | 0.191<br>—<br>965 |

#### LEGEND

**ikW** — 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 HIGH EFFICIENCY MOTORS

### SIZE B MOTORS\*

| LOW VOLTAGE |                                     |        |                      |                     |                      |
|-------------|-------------------------------------|--------|----------------------|---------------------|----------------------|
| Motor Size  | Motor Electrical Characteristics    | Max kW | 230 v                | 346 v               | 400 v                |
| BDH         | RLA per kW<br>LRA Star<br>LRA Delta | 100    | 2.75<br>673<br>2332  | 1.83<br>462<br>1607 | 1.600<br>423<br>1466 |
| BEH         | RLA per kW<br>LRA Star<br>LRA Delta | 135    | 2.76<br>988<br>3405  | 1.82<br>591<br>2051 | 1.565<br>521<br>1808 |
| BFH         | RLA per kW<br>LRA Star<br>LRA Delta | 172    | 2.71<br>1040<br>3598 | 1.81<br>791<br>2739 | 1.575<br>656<br>2282 |
| BGH         | RLA per kW<br>LRA Star<br>LRA Delta | 206    | 2.74<br>1455<br>5023 | 1.80<br>787<br>2742 | 1.567<br>821<br>2842 |
| BHH         | RLA per kW<br>LRA Star<br>LRA Delta | 241    | 2.73<br>1453<br>5047 | 1.81<br>786<br>2745 | 1.568<br>819<br>2846 |

### SIZE C MOTORS

| LOW VOLTAGE |                                     |        |                       |                       |                       |
|-------------|-------------------------------------|--------|-----------------------|-----------------------|-----------------------|
| Motor Size  | Motor Electrical Characteristics    | Max kW | 230 v                 | 346 v                 | 400 v                 |
| CDH         | RLA per kW<br>LRA Star<br>LRA Delta | 196    | 2.938<br>1477<br>5115 | 2.032<br>1145<br>3952 | 1.727<br>929<br>3210  |
| CEH         | RLA per kW<br>LRA Star<br>LRA Delta | 214    | 2.934<br>1601<br>6645 | 1.964<br>1111<br>3843 | 1.721<br>1003<br>3459 |
| CLH         | RLA per kW<br>LRA Star<br>LRA Delta | 239    | 2.900<br>1730<br>5994 | 1.927<br>1154<br>4006 | 1.655<br>954<br>3311  |
| CMH         | RLA per kW<br>LRA Star<br>LRA Delta | 263    | 2.915<br>1959<br>6765 | 1.929<br>1253<br>4343 | 1.627<br>928<br>3227  |
| CNH         | RLA per kW<br>LRA Star<br>LRA Delta | 290    | 2.865<br>1922<br>6663 | 1.898<br>1233<br>4278 | 1.702<br>1278<br>4417 |
| CPH         | RLA per kW<br>LRA Star<br>LRA Delta | 318    | 2.828<br>1897<br>6592 | 1.912<br>1385<br>4801 | 1.671<br>1263<br>4370 |
| CQH         | RLA per kW<br>LRA Star<br>LRA Delta | 355    | 2.873<br>2243<br>7751 | 1.889<br>1384<br>4812 | 1.651<br>1263<br>4389 |

### SIZE D MOTORS\*

| LOW, MEDIUM, AND HIGH VOLTAGE |                                     |        |                        |                       |                       |                   |                   |                   |
|-------------------------------|-------------------------------------|--------|------------------------|-----------------------|-----------------------|-------------------|-------------------|-------------------|
| Motor Size                    | Motor Electrical Characteristics    | Max kW | Low Volts              |                       |                       | Medium Volts      |                   | High Volts        |
|                               |                                     |        | 230 v                  | 346 v                 | 400 v                 | 3000 v            | 3300 v            | 6300              |
| DBH                           | RLA per kW<br>LRA Star<br>LRA Delta | 334    | 0.480<br>1950<br>6766  | 1.909<br>1248<br>4345 | 1.673<br>1184<br>4120 | 0.217<br>440<br>— | 0.198<br>395<br>— | —<br>—<br>—       |
| DCH                           | RLA per kW<br>LRA Star<br>LRA Delta | 366    | 0.078<br>0.897<br>6600 | 1.921<br>1388<br>4789 | 1.651<br>1157<br>4031 | 0.216<br>468<br>— | 0.196<br>423<br>— | —<br>—<br>—       |
| DDH                           | RLA per kW<br>LRA Star<br>LRA Delta | 392    | 0.313<br>2213<br>7674  | 1.903<br>1370<br>4762 | 1.657<br>1247<br>4352 | 0.217<br>506<br>— | 0.196<br>450<br>— | 0.103<br>278<br>— |
| DEH                           | RLA per kW<br>LRA Star<br>LRA Delta | 415    | 0.447<br>2449<br>8499  | 1.927<br>1568<br>5445 | 1.646<br>1232<br>4301 | 0.216<br>546<br>— | 0.197<br>523<br>— | 0.104<br>304<br>— |
| DFH                           | RLA per kW<br>LRA Star<br>LRA Delta | 446    | 0.617<br>2474<br>8636  | 1.934<br>1658<br>5780 | 1.649<br>1318<br>4605 | 0.215<br>580<br>— | 0.195<br>510<br>— | 0.103<br>302<br>— |
| DGH                           | RLA per kW<br>LRA Star<br>LRA Delta | 491    | —<br>—<br>—            | 1.933<br>1780<br>6213 | 1.656<br>1473<br>5141 | 0.215<br>624<br>— | 0.197<br>615<br>— | 0.102<br>321<br>— |
| DHH                           | RLA per kW<br>LRA Star<br>LRA Delta | 524    | —<br>—<br>—            | 1.901<br>1830<br>6393 | 1.665<br>1733<br>6041 | 0.213<br>561<br>— | 0.193<br>832<br>— | 0.103<br>634<br>— |
| DJH                           | RLA per kW<br>LRA Star<br>LRA Delta | 551    | —<br>—<br>—            | 0.076<br>1830<br>6408 | 1.655<br>1733<br>6052 | 0.210<br>851<br>— | 0.194<br>928<br>— | 0.103<br>403<br>— |

See Legend and Notes on page 30.

# Electrical data (cont)



## 50 Hz HIGH EFFICIENCY MOTORS (cont)

### SIZE E MOTORS\*

| LOW, MEDIUM, AND HIGH VOLTAGE |                                  |        |           |              |        |            |
|-------------------------------|----------------------------------|--------|-----------|--------------|--------|------------|
| Motor Size                    | Motor Electrical Characteristics | Max kW | Low Volts | Medium Volts |        | High Volts |
|                               |                                  |        | 400 v     | 3000 v       | 3300 v | 6300 v     |
| EHH                           | RLA per kW                       | 603    | 1.58      | 0.209        | 0.189  | 0.101      |
|                               | LRA Star                         |        | 1651      | —            | —      | —          |
|                               | LRA Delta                        |        | 5586      | 803          | 695    | 384        |
| EJH                           | RLA per kW                       | 646    | 1.58      | 0.211        | 0.190  | 0.102      |
|                               | LRA Star                         |        | 1890      | —            | —      | —          |
|                               | LRA Delta                        |        | 6375      | 874          | 824    | 383        |
| EKH                           | RLA per kW                       | 695    | 1.58      | 0.210        | 0.191  | 0.101      |
|                               | LRA Star                         |        | 1891      | —            | —      | —          |
|                               | LRA Delta                        |        | 6401      | 872          | 827    | 426        |
| ELH                           | RLA per kW                       | 749    | 1.57      | 0.211        | 0.191  | 0.101      |
|                               | LRA Star                         |        | 2321      | —            | —      | —          |
|                               | LRA Delta                        |        | 7834      | 1055         | 901    | 467        |
| EMH                           | RLA per kW                       | 809    | 1.57      | 0.210        | 0.192  | 0.101      |
|                               | LRA Star                         |        | 2323      | —            | —      | —          |
|                               | LRA Delta                        |        | 7855      | 1047         | 901    | 465        |
| ENH                           | RLA per kW                       | 880    | 1.57      | 0.209        | 0.191  | 0.104      |
|                               | LRA Star                         |        | 2325      | —            | —      | —          |
|                               | LRA Delta                        |        | 7875      | 1154         | 1137   | 586        |
| EPH                           | RLA per kW                       | 936    | 1.57      | 0.210        | 0.190  | 0.101      |
|                               | LRA Star                         |        | 2324      | —            | —      | —          |
|                               | LRA Delta                        |        | 7891      | 1151         | 1130   | 586        |

#### 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.

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

### 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       |
|          |            | 430-3-60                      | 380/480               | 9.09       | 1.60       |
|          |            | 563-3-60                      | 507/619               | 24.38      | 2.08       |
|          | 1.50       | 230-3-50                      | 220/240               | 11.15      | 1.93       |
|          |            | 393-3-50                      | 346/440               | 8.30       | 1.76       |

NOTE: FLA (Full Load Amps) = Sealed kva • 1000/√3 • volts

LRA (Locked Rotor Amps) = Inrush kva • 1000/√3 • volts

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

| ITEM            | POWER           | SEALED kva | AVERAGE WATTS                  |
|-----------------|-----------------|------------|--------------------------------|
| CONTROLS        | 24 VAC          | 0.12       | 120                            |
| OIL SUMP HEATER | 115-230/1/50-60 | —          | 1500<br>(Frame 2 Compressor)   |
|                 |                 |            | 1800<br>(Frame 3,4 Compressor) |
|                 |                 |            | 2200<br>(Frame 5 Compressor)   |
|                 |                 |            |                                |

#### 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 chiller and provides a communication link to the Carrier Comfort Network (CCN).

### Features

#### Control system

- Sixteen-Line by 40-Character Backlit Display
- Component Test and Diagnostic Check
- Programmable Recycle Allows Chiller to Recycle at Optimum Loads for Decreased Operating Costs
- Menu-Driven Keypad Interface for Status Display, Set Point Control, and System Configuration
- CCN Compatible
- Primary and Secondary Status Messages
- Individual Start/Stop Schedules for Local and CCN Operation Modes
- Recall of Up to 25 Alarm/Alert Messages with Diagnostic Help
- Two Chiller Lead/Lag with Third Chiller Standby is Standard in the PIC II 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\*
- Low Level Ground Fault
  - Low Voltage — phase to phase and phase to ground
  - Medium Voltage — phase to ground

## Capacity control

- Leaving Chilled Water Control
- Entering Chilled Water Control
- Ice Build 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
- Pre-Start Check of Safeties and Alerts
- Low Chilled Water (Load) Recycle
- Monitor/Number Compressor Starts and Run Hours
- Manual Reset of Safeties

### Indications

- Chiller Operating Status Message
- Power-On
- Pre-Start Diagnostic Check
- Compressor Motor Amps
- Pre-Alarm Alert††
- Alarm
- Contact for Remote Alarm
- Safety Shutdown Messages
- Elapsed Time (Hours of Operation)
- Chiller Input kW

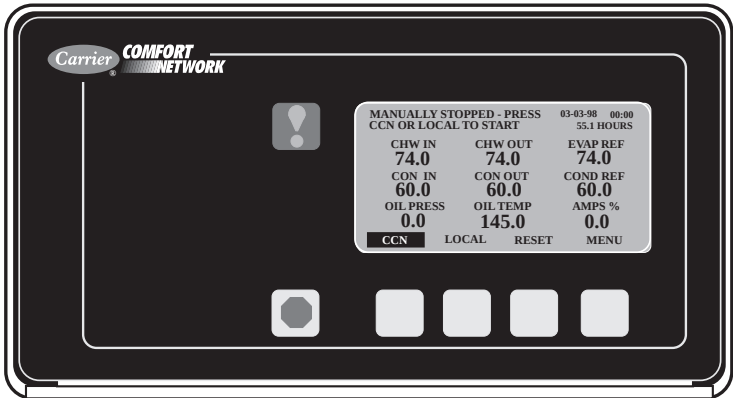
\*These can be configured by user to provide alert indication at user-defined limit.

†Override protection: Causes compressor to first unload and then, if necessary, shut down.

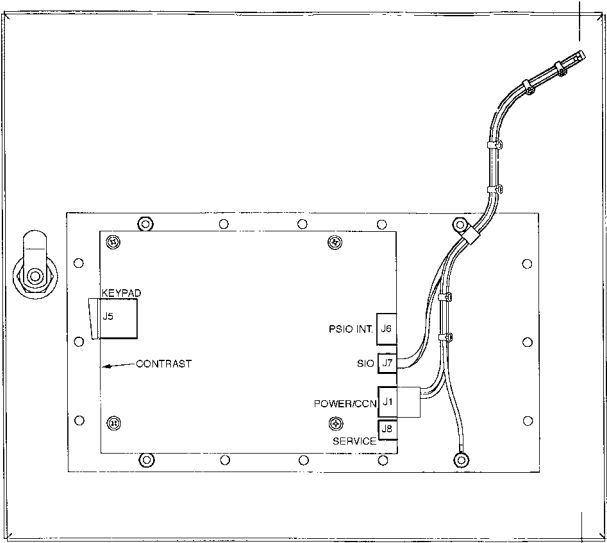
\*\*Will not require manual reset or cause an alarm if auto-restart after power failure is enabled.

††By display code only.

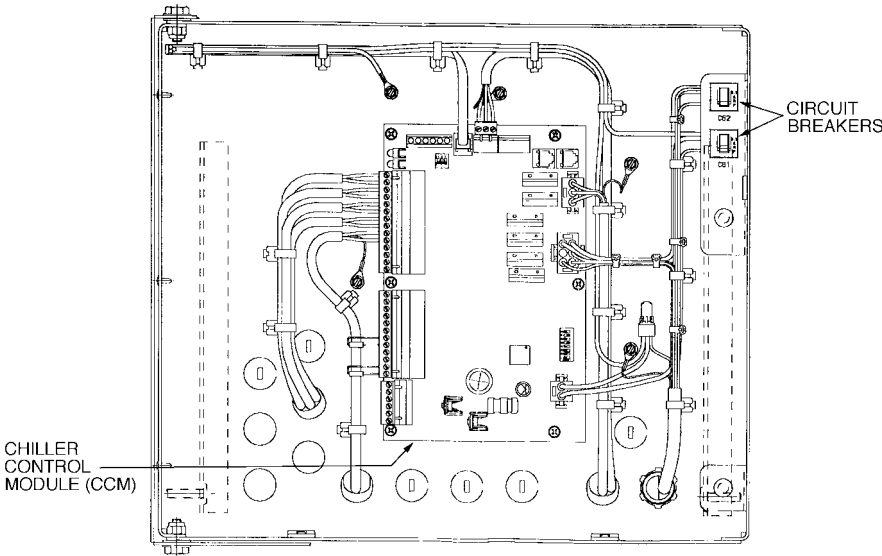
CONTROL PANEL DISPLAY (FRONT VIEW)

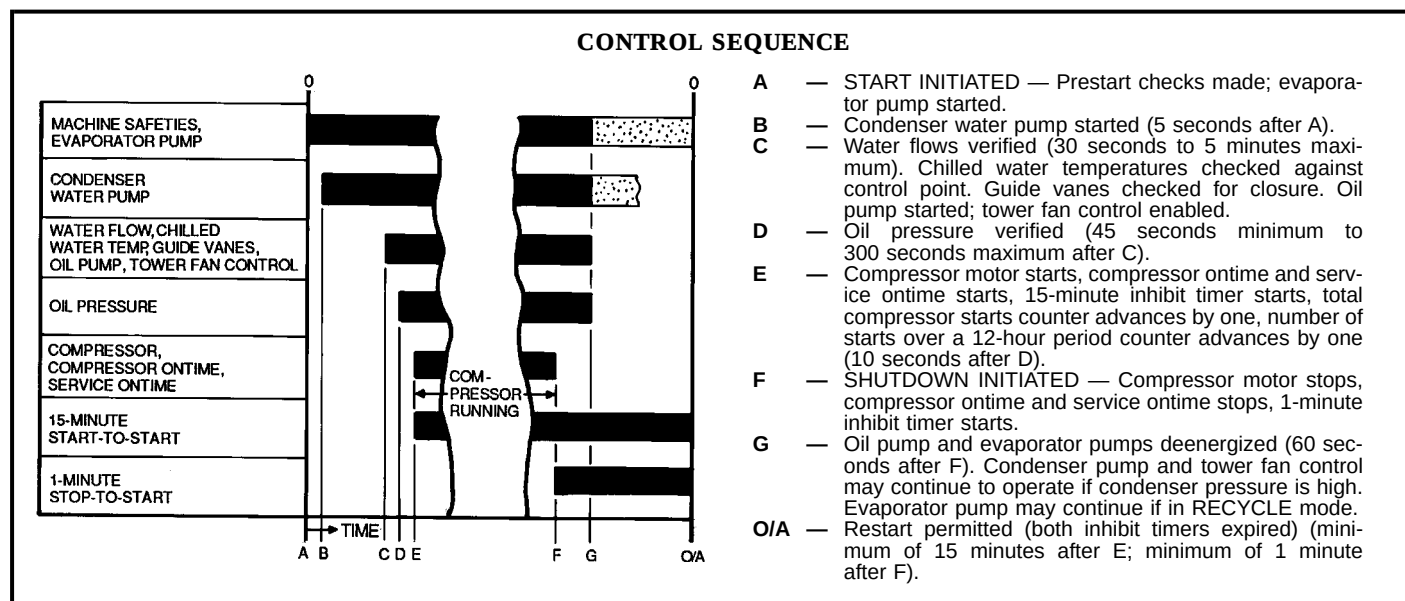


CONTROL PANEL (BACK VIEW)



CONTROL PANEL (INTERNAL VIEW)





## Control sequence

**To start** — Local start-up (manual start-up) is initiated by pressing the LOCAL menu softkey which is indicated on the default chiller visual control (CVC) 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 displays and the start will be delayed or is aborted). The signal is sent to start the cooler 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 continues to monitor flows up to the configured flow verify time. 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 turns off and the chiller goes 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 4% open, start-up waits until the vanes are less than 4% open. If the vanes are less than 4% open and the oil pump pressure is less than 4 psi (28 kPa), the oil pump energizes. The controls wait 45 seconds for the oil pressure to reach a maximum of 18 psi (124 kPa). After oil pressure is verified, the controls wait 40 seconds. At that point, the compressor start relay is energized to start the compressor and the following start/timing functions are initiated:

- The “start-to-stop timer” is activated
- The “compressor ontime” and “service ontime” timers are activated
- The “starts over a 12-hour period counter” advances by one
- The “total compressor starts counter” advances by one

**Once started** — The controls enter the ramp loading mode to slowly open the guide vanes to prevent a rapid increase in compressor power consumption. Once ramp loading is completed the controls enter the capacity control mode. Any failure, after the compressor is energized, that results in a safety shutdown energizes the alarm light and displays the applicable shutdown status on the liquid-crystal display (LCD) screen.

**Shutdown sequence** — The chiller can shut down if:

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

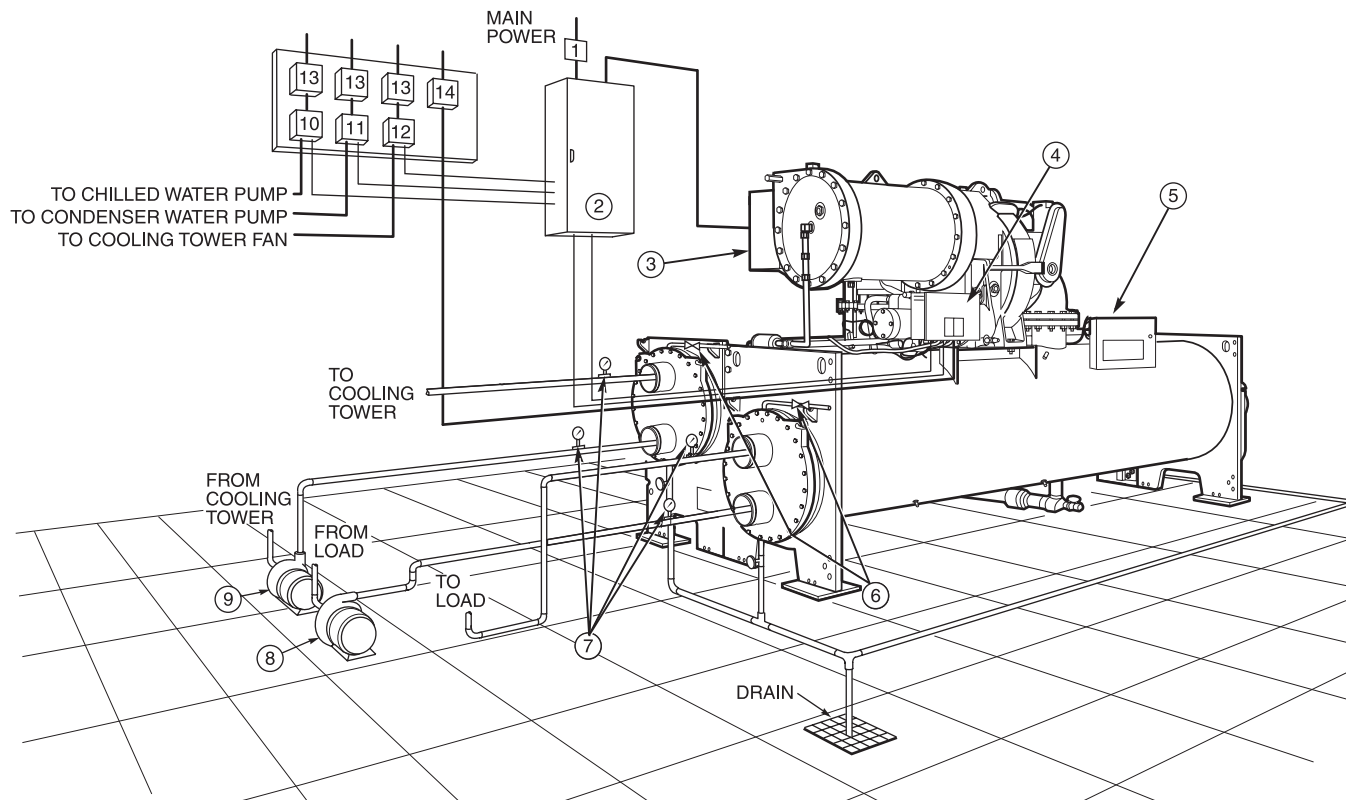
Once the controls are placed in shutdown mode, the shutdown sequence first stops the compressor by deactivating the start relay. Compressor ontime and service ontime stop and the guide vanes are then brought to the closed position. The oil pump relay and chilled water/brine pump are shut down 60 seconds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

If optional soft stop unloading is activated once the Stop button is pressed or the remote contacts open, the guide vanes close, the motor unloads to a configured amperage level, and the chiller shuts down. The display indicates “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 before to restarting the chiller.

## 19XR CHILLER WITH FREE-STANDING STARTER



### LEGEND

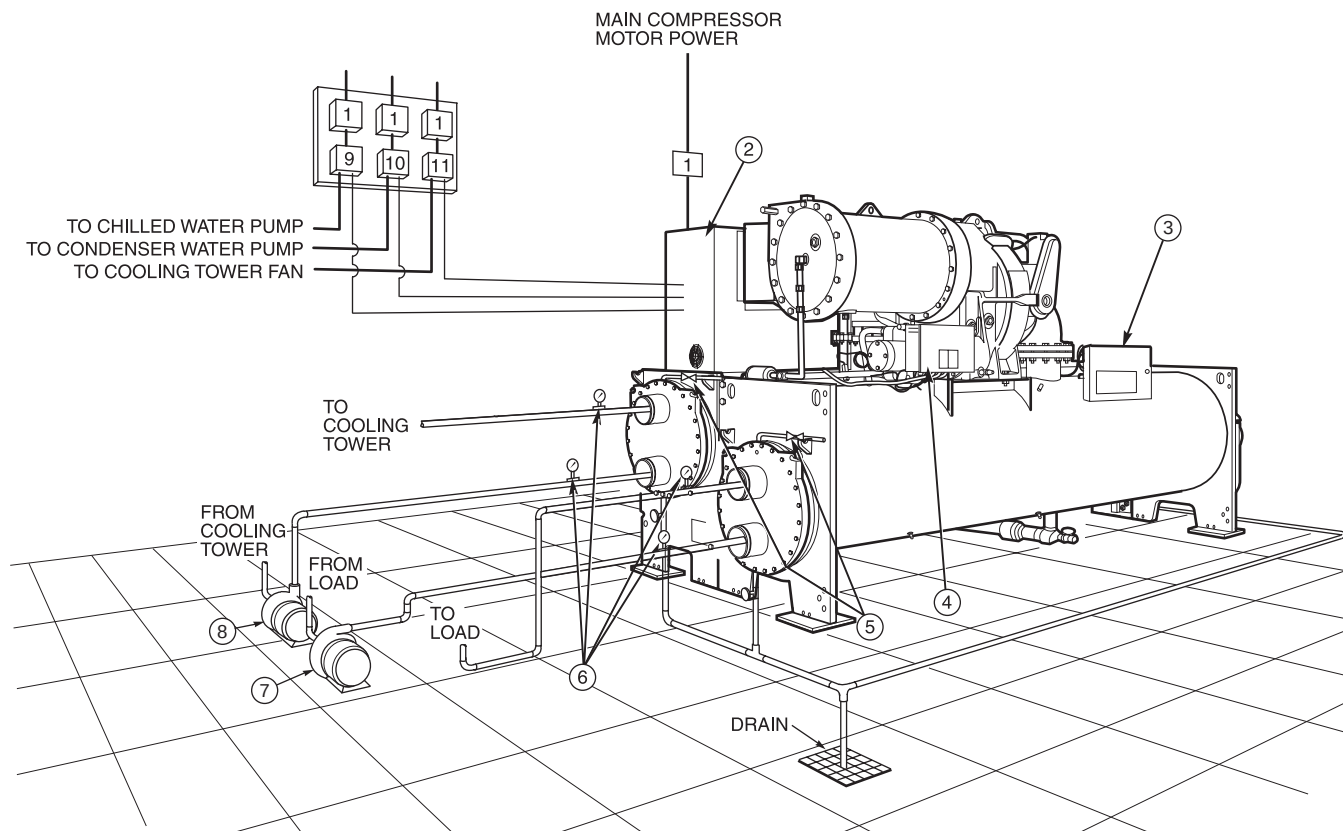
- 1 — Disconnect
- 2 — Freestanding Compressor Motor Starter
- 3 — Compressor Motor Terminal Box
- 4 — Chiller Power Panel
- 5 — Control Panel
- 6 — Vents
- 7 — Pressure Gages
- 8 — Chilled Water Pump
- 9 — Condenser Water Pump
- 10 — Chilled Water Pump Starter
- 11 — Condensing Water Pump Starter
- 12 — Cooling Tower Fan Starter (Low Fan, High Fan)
- 13 — Disconnect
- 14 — Oil Pump Disconnect (see Note 5)

- 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
5. Oil pump disconnect may be located within the enclosure of Item 2 — Freestanding Compressor Motor Starter.

## 19XR CHILLER WITH OPTIONAL UNIT-MOUNTED STARTER



### LEGEND

- 1 — Disconnect
  - 2 — Unit-Mounted Starter
  - 3 — Control Panel
  - 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 (Low Fan, High Fan)
-  Piping  
 Control Wiring  
 Power Wiring

### NOTES:

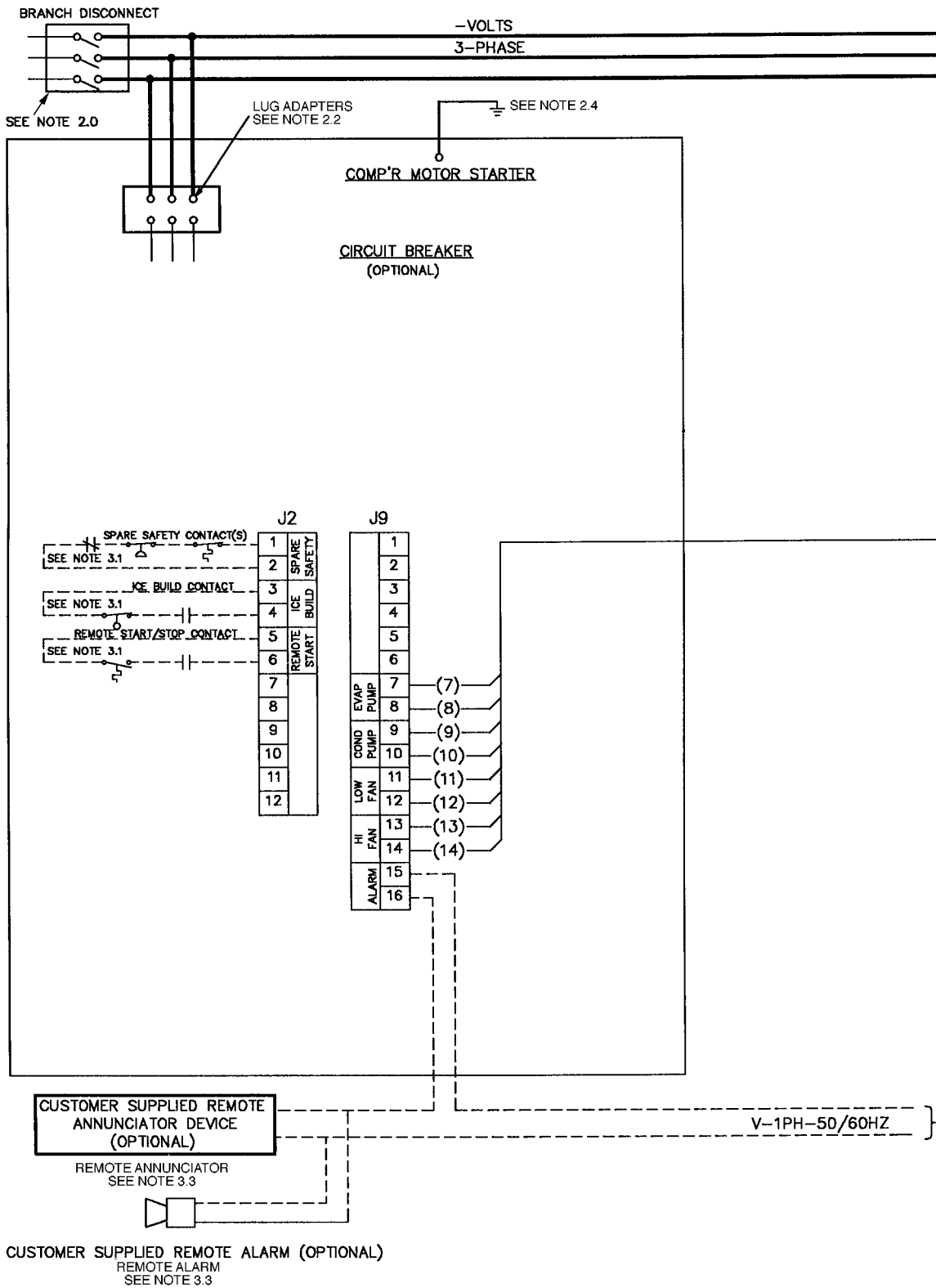
1. Wiring and piping shown are for general point-of-connection only and are not intended to show details for a specific installation. Certified field wiring and dimensional diagrams are available on request.
2. All wiring must comply with applicable codes.
3. Refer to Carrier System Design Manual for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



19XR, 19XRT TYPICAL FIELD WIRING WITH OPTIONAL UNIT MOUNTED STARTER (LOW VOLTAGE)

COMPRESSOR MOTOR TERMINAL BOX  
19-9/16" SQ. X 22-1/8" DEEP  
(APPROX. INSIDE DIMENSIONS)

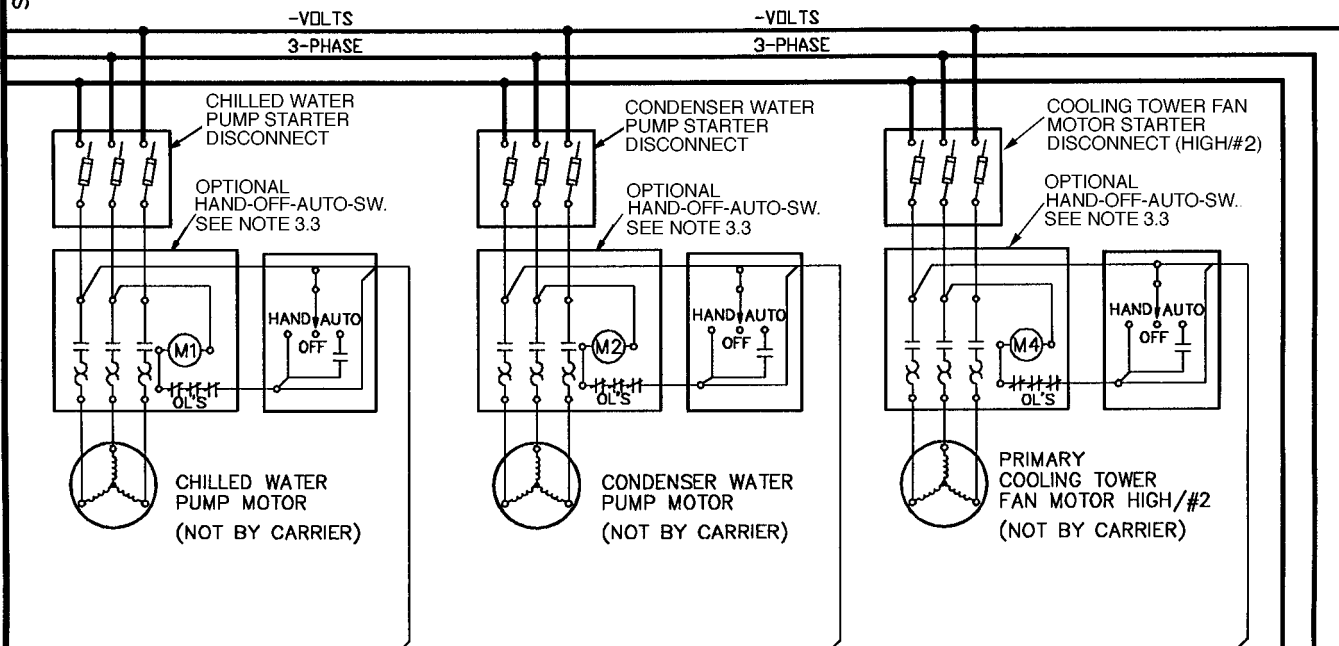
SHT 3 OF 4  
SHT 4 OF 4



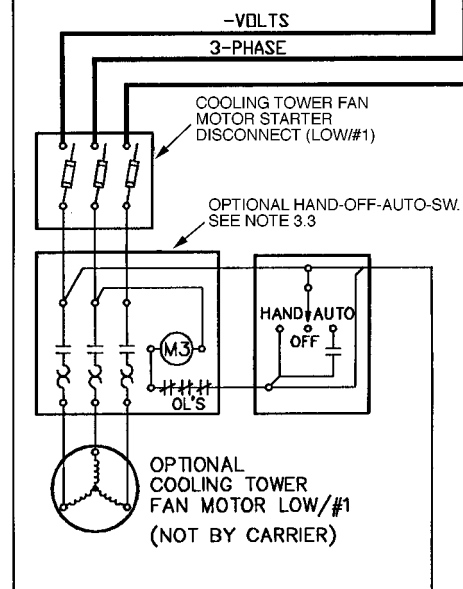
MATCH LINE  
MATCH LINE

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

SHT 3 OF 4  
SHT 4 OF 4



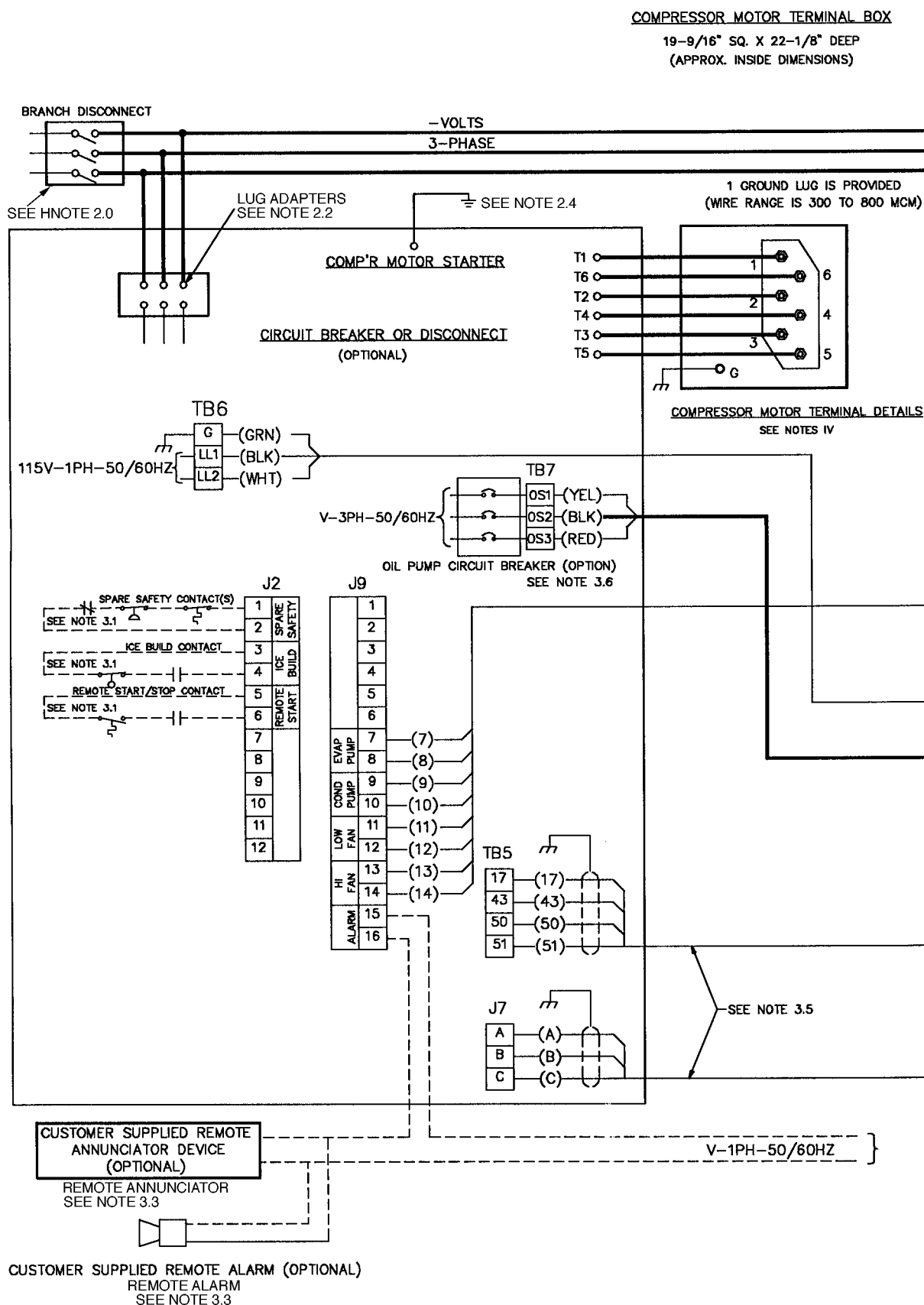
- LEGEND
- COND — Condenser
  - EVAP — Evaporator
  - OL — Compressor Overload
  - Required Power Wiring
  - Required Control Wiring
  - - - Options Wiring



MATCH LINE  
MATCH LINE

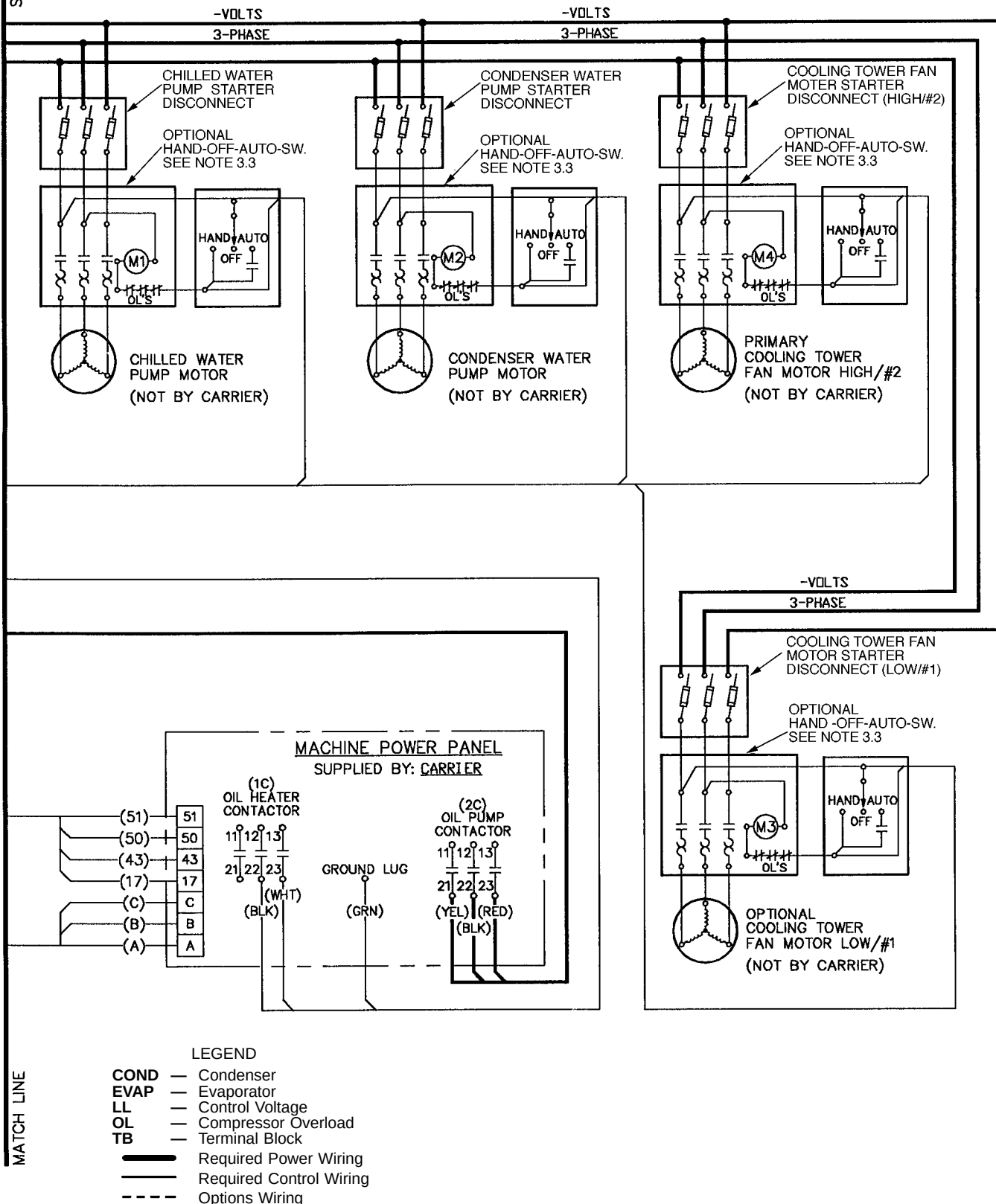
## 19XR, 19XRT TYPICAL FIELD WIRING WITH FREE-STANDING STARTER (LOW VOLTAGE)

SHT 3 OF 4  
SHT 4 OF 4

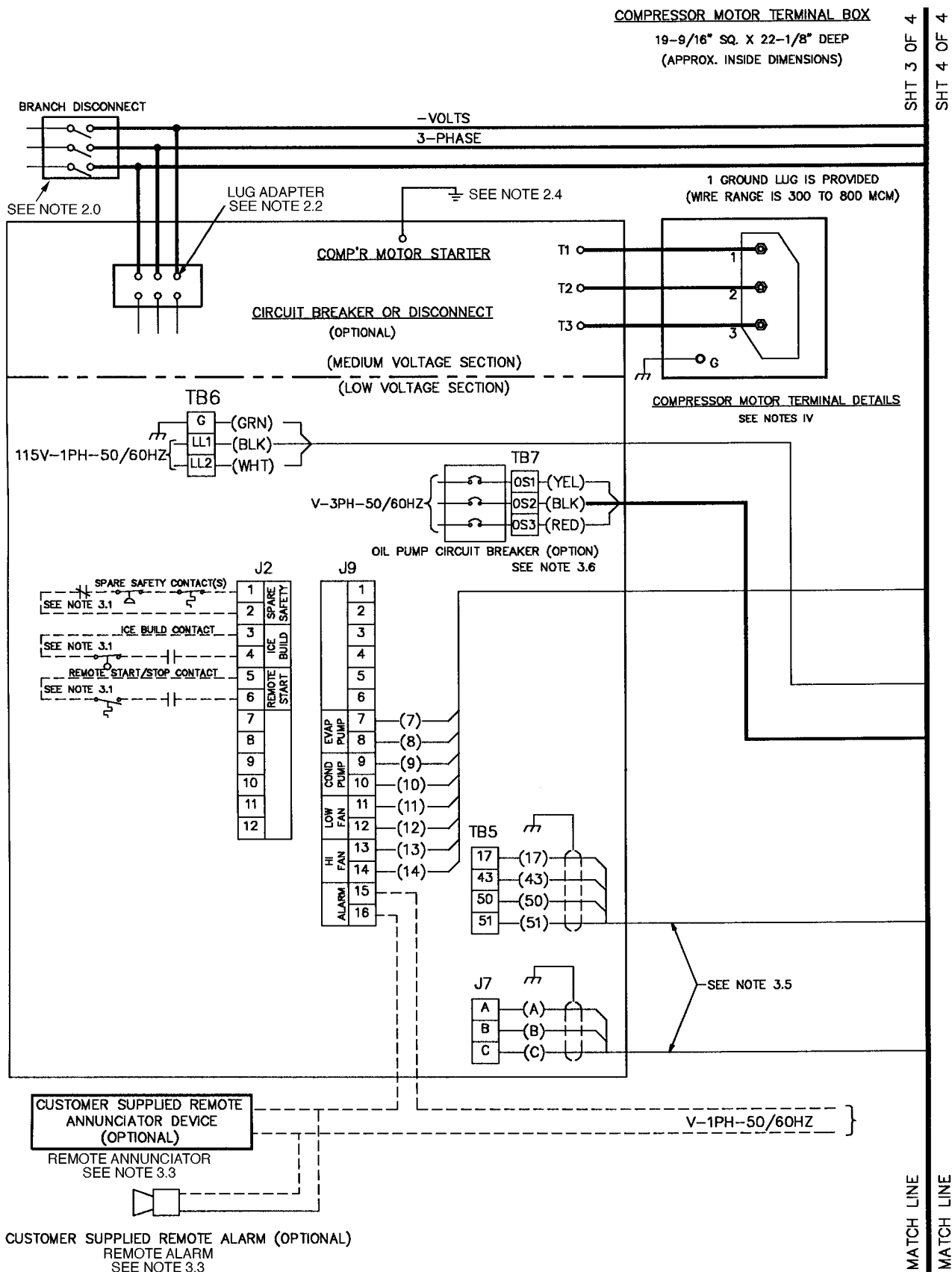


19XR, 19XRT TYPICAL FIELD WIRING WITH FREE-STANDING STARTER (LOW VOLTAGE) (cont)

SHT 3 OF 4  
SHT 4 OF 4

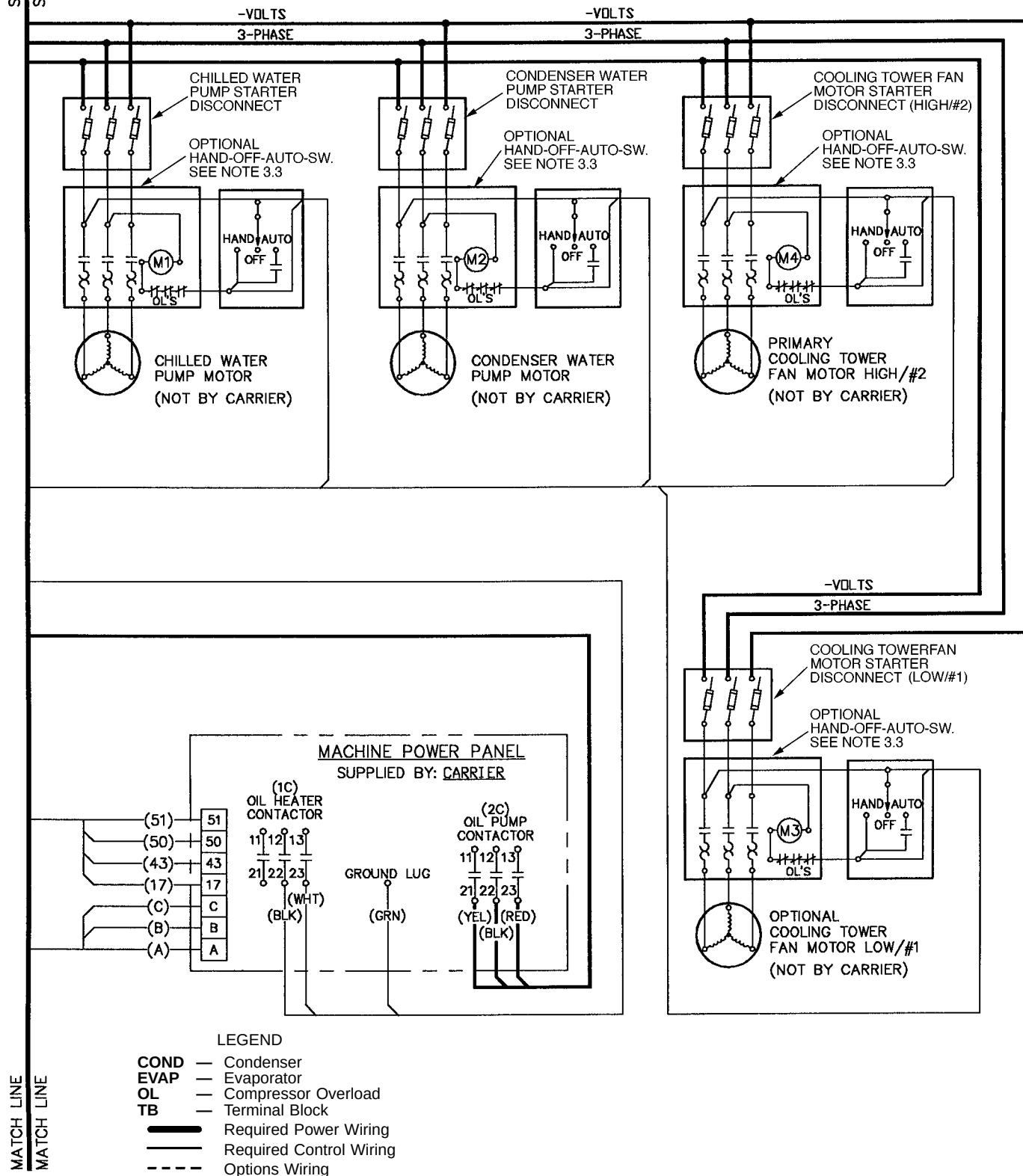


## 19XR, 19XRT TYPICAL FIELD WIRING WITH FREE-STANDING STARTER (MEDIUM VOLTAGE)



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

SHT 3 OF 4  
SHT 4 OF 4



# Typical field wiring (cont)



## NOTES FOR TYPICAL FIELD WIRING SCHEMATICS (PAGES 36 - 41)

### NOTES:

#### I. GENERAL

- 1.0 Starters shall be designed and manufactured in accordance with Carrier Engineering Requirement Z-415.
- 1.1 All field-supplied conductors, devices, and the field-installation wiring, 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 Provide a means of disconnecting power to starter.
- 2.1 For unit mounted starter, power conductor rating must meet minimum unit nameplate voltage and compressor motor RLA (minimum circuit ampacity).
- 2.2 Lug adapters may be required if installation conditions dictate that conductors be sized beyond the minimum ampacity required. For low and medium voltage free-standing starters contact starter supplier for lug information. For unit-mounted starters, breaker lugs will accommodate the quantity (#) and size (MCM) cables (per phase) as follows:

| BENSHAW<br>(SOLID STATE) |                             |                    | CUTLER HAMMER<br>(WYE DELTA) |                             |                    |
|--------------------------|-----------------------------|--------------------|------------------------------|-----------------------------|--------------------|
| Starter<br>RLA           | Lug Capacity<br>(Per Phase) |                    | Starter<br>RLA               | Lug Capacity<br>(Per Phase) |                    |
|                          | #<br>Conductors             | Conductor<br>Range |                              | #<br>Conductors             | Conductor<br>Range |
| 0-200A                   | 1                           | #4 —<br>350MCM     | 186-207A                     | 1                           | #3 —<br>350MCM     |
| 201-300A                 | 2                           | #1 —<br>250MCM     | 208-298A                     | 2                           | 2/0 —<br>250MCM    |
| 301-480A                 | 2                           | 3/0 —<br>500MCM    | 297-444A                     | 2                           | 250 —<br>350MCM    |
| 481-740A                 | 3                           | 3/0 —<br>500MCM    | 445-606A                     | 2                           | 1 —<br>500MCM      |
| 741-1250A                | 4                           | 350 —<br>750MCM    | 607-888A                     | 4                           | 4/0 —<br>500MCM    |
|                          |                             |                    | 889-1316A                    | 4                           | 500 —<br>1000MCM   |

- 2.3 Power conductors to starter must enter through top of enclosure. Flexible conduit should be used for the last few feet to the enclosure to provide unit vibration isolation.
- 2.4 Compressor motor and controls must be grounded by using equipment grounding lugs provided inside unit mounted starter enclosure.
- 2.5 Unit-mounted starters with "Rated Load Amps" (RLA) greater than 700 RLA (Benshaw) or 935 RLA (Cutler Hammer) require the assembly and the installation of a "Top Hat" (located inside enclosure) to provide the required wire bending space for incoming power leads.

#### III. CONTROL WIRING

- 3.0 Field supplied control conductors to be at least 18 AWG or larger.
- 3.1 Optional ice build start/terminate device contacts, optional remote start/stop device contacts and optional spare safety device contacts, must have 24 VAC 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 J2-1 and J2-2 before connecting auxiliary safeties between these terminals.

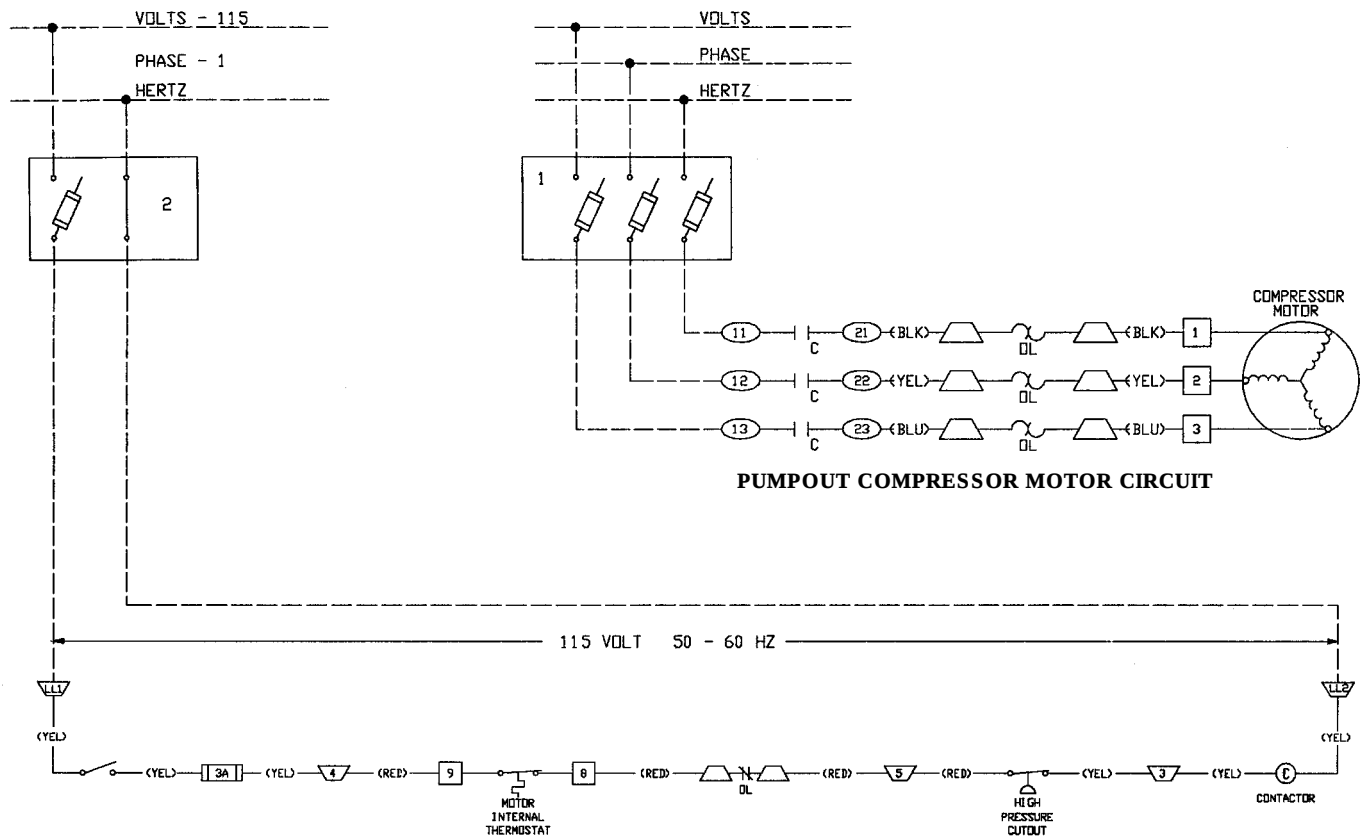
- 3.3 ISM contact outputs can control cooler and condenser pump and tower fan motor contactor coil loads (VA) rated 5 amps at 115 VAC up to 3 amps at 277 VAC. Control wiring required for Carrier to start pumps and tower fan motors must be provided to assure machine protection. If primary pump and tower fan motor control is by other means, also provide a parallel means for control by Carrier. Do not use starter control transformer as the power source for contactor coil 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 Control wiring between starter and power panel must be separate shielded cables with minimum rating of 600 v, 80° C. Ground shield at starter.
- 3.6 If optional oil pump circuit breaker is not supplied within the starter enclosure as shown, it must be located within sight of the chiller 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) 5/8" terminal studs (lead connectors not supplied by Carrier). Either 3 or 6 conductors must be run between compressor motor and starter, depending on the size of the conductors or the type of motor starter employed. If only 3 leads are utilized, jumper motor terminals as follows : 1 to 6, 2 to 4, 3 to 5. Center to center distance between terminals is 3-5/32". Compressor motor starter must have nameplate stamped as to conforming with Carrier Engineering requirement "Z-415".
- 4.1 Medium voltage [over 600 volts] compressor motors have (3) terminals. Connections are 9/16 threaded stud. A compression lug with a single 9/16 DIA hole can be connected directly to the stud or 3 adapters are supplied for connecting a NEMA lug. Use suitable connectors and insulation for high voltage alternating current cable terminations (these items are not supplied by Carrier). Compressor motor starter must have nameplate stamped as to conforming with Carrier Engineering requirement "Z-415".
- 4.2 Power conductor rating must meet minimum unit nameplate voltage and compressor motor RLA. (Conductor as defined below may be a single lead or multiple smaller ampacity leads in parallel for the purpose of carrying the equivalent or higher current of a single larger lead.)  
When (3) conductors are used:  
Minimum ampacity per conductor = 1.25 x compressor RLA  
When (6) conductors are used:  
minimum ampacity per conductor = 0.721 x compressor RLA
- 4.3 When more than one conduit is used to run conductors from starter to compressor motor terminal box, an equal number of leads from each phase (conductor) 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).
- 4.4 Compressor motor power conductors may enter terminal box through top, left side or bottom left 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. For the medium voltage free standing starter, use of stress cones may require an oversize (special) motor terminal box (not supplied by Carrier). For low voltage free-standing starter 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.
- 4.5 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 #4 AWG-500 MCM pressure connector, supplied and located in the lower left side corner of the compressor motor terminal box.
- 4.6 Do not allow motor terminals to support weight of wire cables. Use cable supports and strain reliefs as required.
- 4.7 For low voltage free-standing starter use backup wrench when tightening lead connectors to motor terminal studs. Torque to 45 lb-ft max.

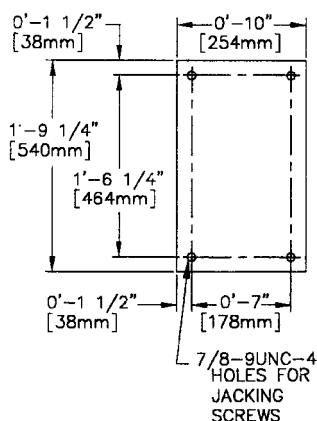
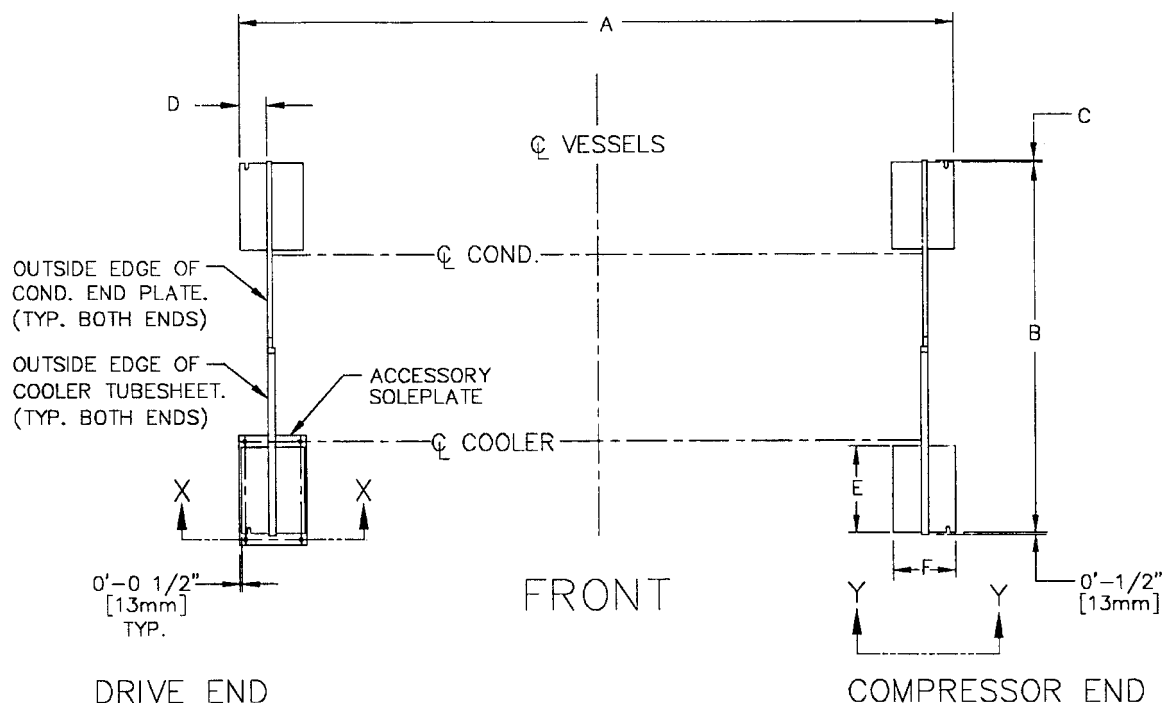
## PUMPOUT UNIT WIRING SCHEMATIC



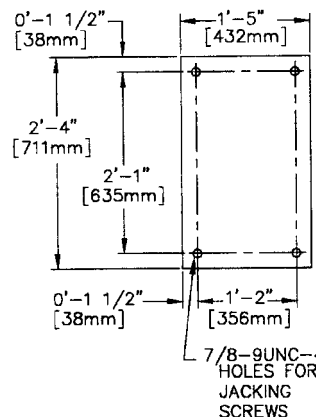
## TYPICAL UNIT-MOUNTED PUMPOUT CONTROL CIRCUIT

| PUMPOUT COMPRESSOR MOTOR |    |       |         |
|--------------------------|----|-------|---------|
| Hz                       | Ph | Volts | Max RLA |
| 50                       | 3  | 400   | 4.7     |
|                          |    | 208   | 10.9    |
| 60                       | 3  | 230   | 9.5     |
|                          |    | 460   | 4.7     |
|                          |    | 575   | 3.8     |

## 19XR/19XRT ISOLATION WITH ACCESSORY SOLEPLATE PACKAGE



SOLEPLATE DETAIL FOR  
19XR1 THROUGH 19XR6  
AND 19XRT6

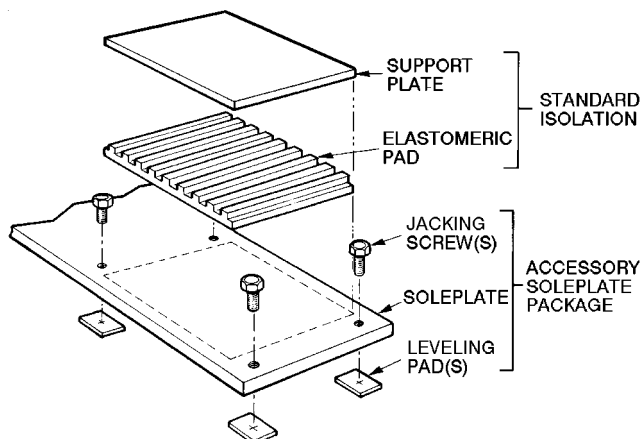


SOLEPLATE DETAIL FOR  
19XR7 AND 19XR8

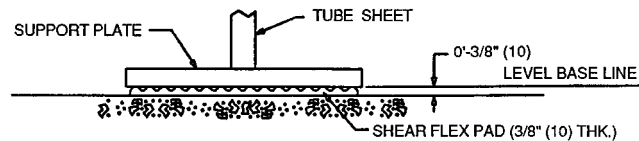
| UNIT  | HEAT EXCHANGER SIZE | DIMENSIONS (ft-in.) |                    |                   |                    |                    |                    |
|-------|---------------------|---------------------|--------------------|-------------------|--------------------|--------------------|--------------------|
|       |                     | A                   | B                  | C                 | D                  | E                  | F                  |
| 19XR  | 10-12               | 10- 8 $\frac{3}{4}$ | 4-10 $\frac{1}{4}$ | —                 | 0-4 $\frac{3}{8}$  | 1- 0               | 0-10 $\frac{1}{2}$ |
|       | 15-17               | 13- 0 $\frac{1}{4}$ | 4-10 $\frac{1}{4}$ | —                 | 0-4 $\frac{3}{8}$  | 1- 0               | 0-10 $\frac{1}{2}$ |
|       | 20-22               | 10- 8 $\frac{3}{4}$ | 5- 4 $\frac{3}{4}$ | —                 | 0-4 $\frac{3}{8}$  | 1- 0               | 0-10 $\frac{1}{2}$ |
|       | 30-32               | 13- 0 $\frac{1}{4}$ | 5- 4 $\frac{3}{4}$ | —                 | 0-4 $\frac{3}{8}$  | 1- 0               | 0-10 $\frac{1}{2}$ |
|       | 35-37               | 14- 8 $\frac{3}{4}$ | 5- 4 $\frac{3}{4}$ | —                 | 0-4 $\frac{3}{8}$  | 1- 0               | 0-10 $\frac{1}{2}$ |
|       | 40-42               | 12-10 $\frac{3}{4}$ | 6- 0               | 0-2               | 0-3 $\frac{5}{8}$  | 1- 3 $\frac{3}{4}$ | 0- 9               |
|       | 45-57               | 14- 7 $\frac{1}{4}$ | 6- 0               | 0-2               | 0-3 $\frac{5}{8}$  | 1- 3 $\frac{3}{4}$ | 0- 9               |
|       | 50-52               | 12-10 $\frac{3}{4}$ | 6- 5 $\frac{1}{2}$ | 0-0 $\frac{1}{2}$ | 0-3 $\frac{5}{8}$  | 1- 3 $\frac{3}{4}$ | 0- 9               |
|       | 55-57               | 14- 7 $\frac{1}{4}$ | 6- 5 $\frac{1}{2}$ | 0-1               | 0-3 $\frac{5}{8}$  | 1- 3 $\frac{3}{4}$ | 0- 9               |
|       | 60-62               | 12-10 $\frac{3}{4}$ | 6- 9 $\frac{1}{2}$ | 0-1               | 0-3 $\frac{5}{8}$  | 1- 3 $\frac{3}{4}$ | 0- 9               |
|       | 65-67               | 14- 7 $\frac{1}{4}$ | 6- 9 $\frac{1}{2}$ | 0-1               | 0-3 $\frac{5}{8}$  | 1- 3 $\frac{3}{4}$ | 0- 9               |
|       | 70-72               | 15- 1 $\frac{7}{8}$ | 7-10 $\frac{1}{2}$ | 0-1               | 0-6 $\frac{5}{16}$ | 1-10               | 1- 4               |
|       | 75-77               | 17- 1 $\frac{7}{8}$ | 7-10 $\frac{1}{2}$ | 0-1               | 0-6 $\frac{5}{16}$ | 1-10               | 1- 4               |
|       | 80-82               | 15- 1 $\frac{7}{8}$ | 8- 9 $\frac{3}{4}$ | 0-1               | 0-6 $\frac{5}{16}$ | 1-10               | 1- 4               |
|       | 85-87               | 17- 1 $\frac{7}{8}$ | 8- 9 $\frac{3}{4}$ | 0-1               | 0-6 $\frac{5}{16}$ | 1-10               | 1- 4               |
| 19XRT | 60-63               | 16- 7 $\frac{1}{4}$ | 7- 0               | 0-0 $\frac{1}{2}$ | 0-3 $\frac{5}{8}$  | 1- 3 $\frac{3}{4}$ | 0- 9               |

## 19XR/XRT ISOLATION WITH ACCESSORY SOLEPLATE PACKAGE (cont)

### TYPICAL ISOLATION



### STANDARD ISOLATION

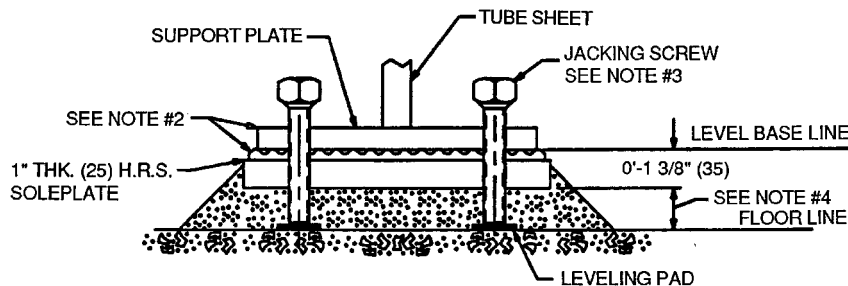


VIEW Y-Y

ISOLATION WITH ISOLATION PACKAGE ONLY  
(STANDARD)

NOTE: Isolation package includes 4 shear flex pads.

### ACCESSORY SOLEPLATE DETAIL

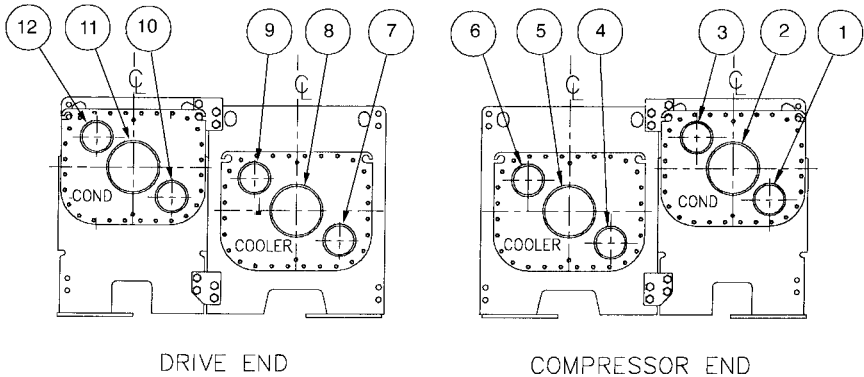


VIEW X-X

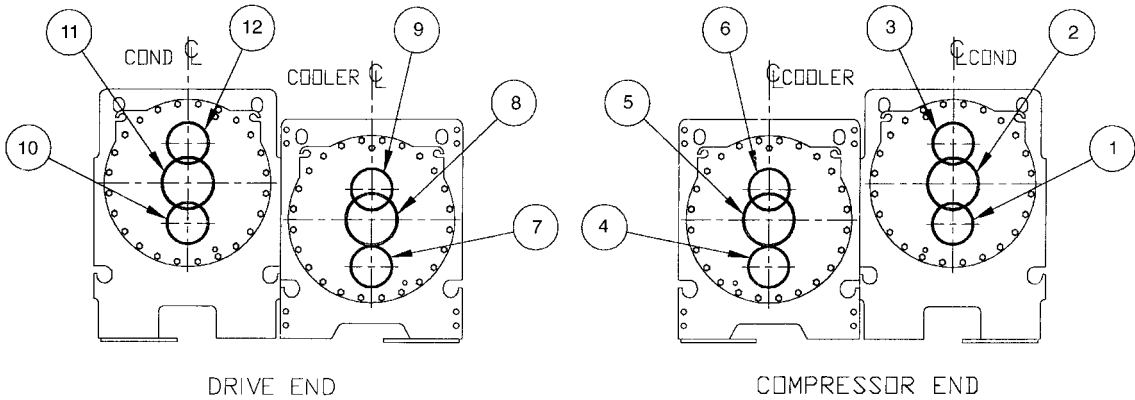
#### NOTES:

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, Ceilcote 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



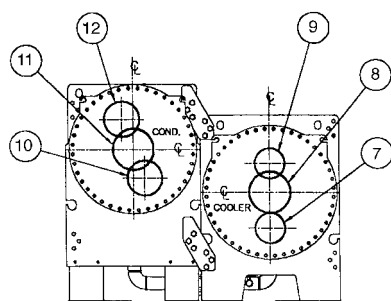
FRAMES 1, 2, AND 3



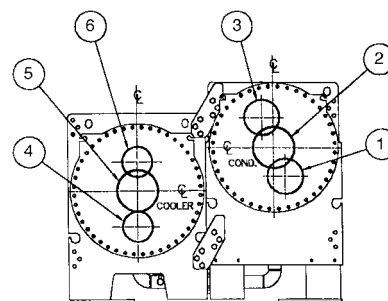
FRAMES 4, 5, AND 6

## 19XR NOZZLE ARRANGEMENTS (cont)

### NOZZLE-IN-HEAD WATERBOXES (cont)



DRIVE END



COMPRESSOR END

### FRAMES 7 AND 8

### NOZZLE ARRANGEMENT CODES FOR ALL 19XR NOZZLE-IN-HEAD WATERBOXES

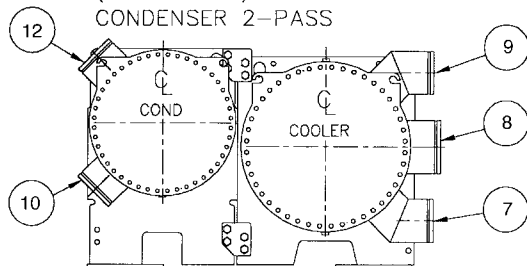
| PASS | COOLER WATERBOXES |     |                   |
|------|-------------------|-----|-------------------|
|      | In                | Out | Arrangement Code* |
| 1    | 8                 | 5   | A                 |
|      | 5                 | 8   | B                 |
| 2    | 7                 | 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.

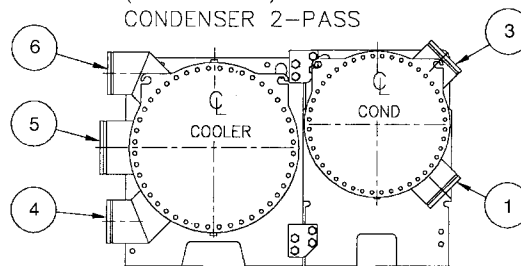
### MARINE WATERBOXES

NOTE :  
COOLER 3-PASS NOZZLE @ 45°  
(NOT SHOWN) SIMILIAR TO  
CONDENSER 2-PASS



DRIVE END

NOTE :  
COOLER 3-PASS NOZZLE @ 45°  
(NOT SHOWN) SIMILIAR TO  
CONDENSER 2-PASS



COMPRESSOR END

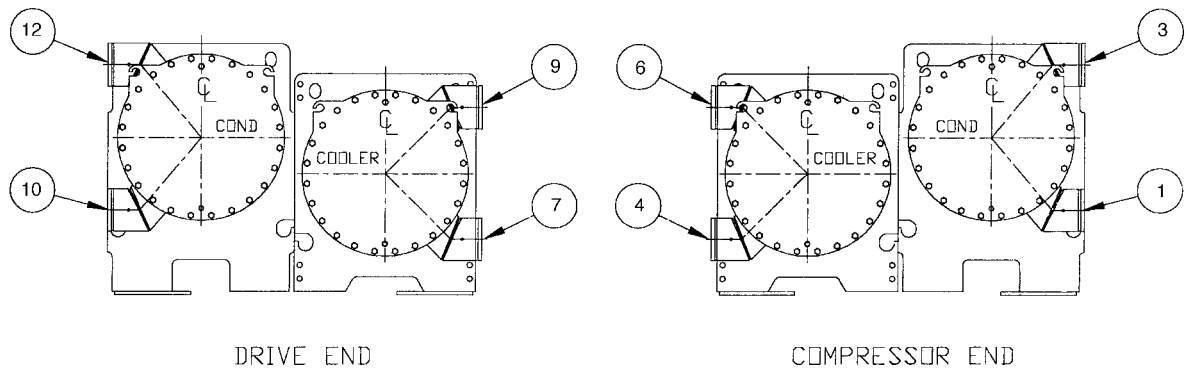
### FRAMES 2 AND 3†

†There is no Frame 1 marine waterbox.

### 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                | —                    | —   | —                |

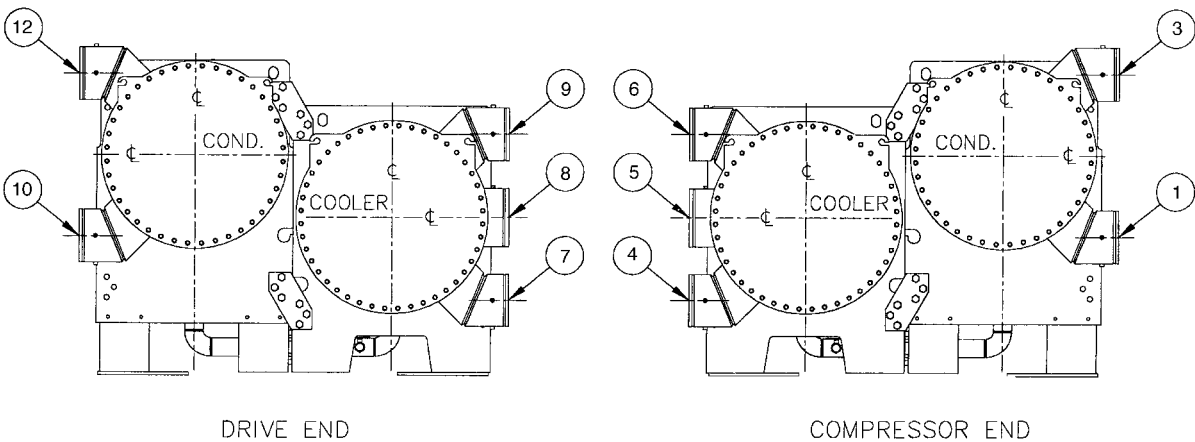
19XR NOZZLE ARRANGEMENTS (cont)  
MARINE WATERBOXES (cont)



FRAMES 4, 5, AND 6

NOZZLE ARRANGEMENT CODES

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



FRAMES 7 AND 8

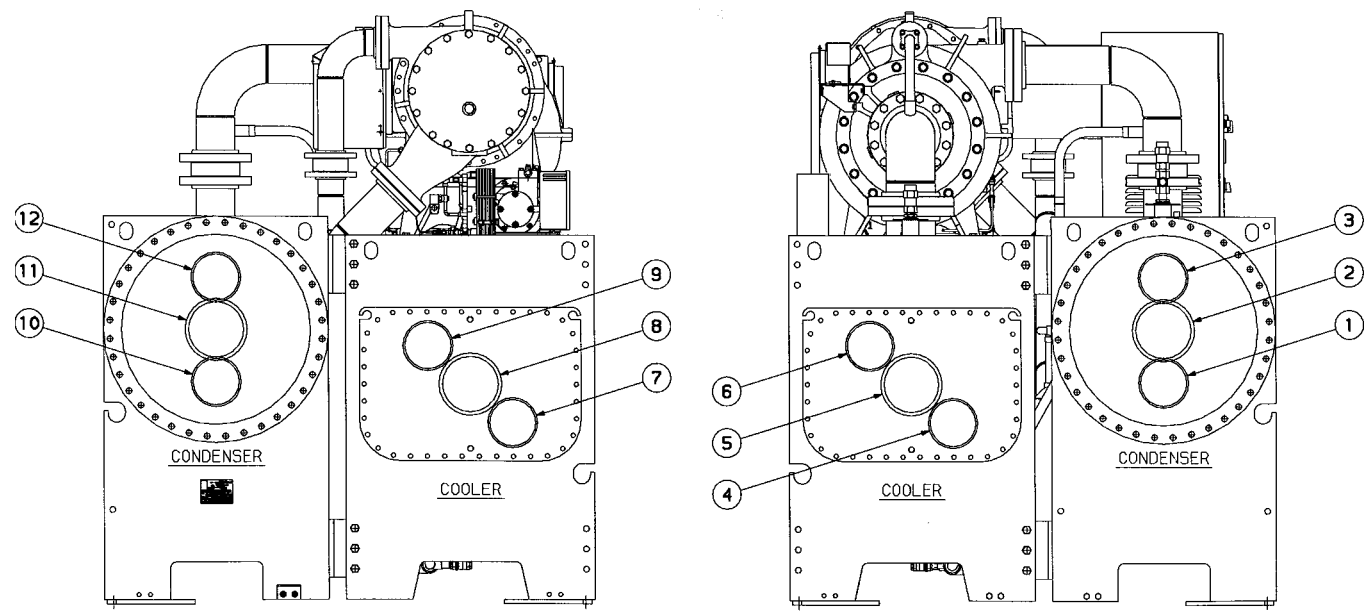
NOZZLE ARRANGEMENT CODES

| 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                | —                    | —   | —                |

# 19XR WATERBOX NOZZLE SIZES (Nozzle-In-Head and Marine Waterboxes)

| FRAME<br>SIZE | PRESSURE<br>psig (kPa) | PASS | NOMINAL PIPE SIZE (in.) |           | ACTUAL PIPE ID (in.) |           |
|---------------|------------------------|------|-------------------------|-----------|----------------------|-----------|
|               |                        |      | Cooler                  | Condenser | Cooler               | Condenser |
| 1             | 150/300<br>(1034/2068) | 1    | 8                       | 8         | 7.981                | 7.981     |
|               |                        | 2    | 6                       | 6         | 6.065                | 6.065     |
|               |                        | 3    | 6                       | 6         | 6.065                | 6.065     |
| 2             | 150/300<br>(1034/2068) | 1    | 10                      | 10        | 10.020               | 10.020    |
|               |                        | 2    | 8                       | 8         | 7.981                | 7.981     |
|               |                        | 3    | 6                       | 6         | 6.065                | 6.065     |
| 3             | 150/300<br>(1034/2068) | 1    | 10                      | 10        | 10.020               | 10.020    |
|               |                        | 2    | 8                       | 8         | 7.981                | 7.981     |
|               |                        | 3    | 6                       | 6         | 6.065                | 6.065     |
| 4             | 150/300<br>(1034/2068) | 1    | 10                      | 10        | 10.020               | 10.020    |
|               |                        | 2    | 8                       | 8         | 7.981                | 7.981     |
|               |                        | 3    | 6                       | 6         | 6.065                | 6.065     |
| 5             | 150/300<br>(1034/2068) | 1    | 10                      | 10        | 10.020               | 10.020    |
|               |                        | 2    | 8                       | 10        | 7.981                | 10.020    |
|               |                        | 3    | 6                       | 8         | 6.065                | 7.981     |
| 6             | 150/300<br>(1034/2068) | 1    | 10                      | 10        | 10.020               | 10.020    |
|               |                        | 2    | 10                      | 10        | 10.020               | 10.020    |
|               |                        | 3    | 8                       | 8         | 7.981                | 7.981     |
| 7             | 150<br>(1034)          | 1    | 14                      | 14        | 13.250               | 13.250    |
|               |                        | 2    | 12                      | 12        | 12.000               | 12.000    |
|               |                        | 3    | 10                      | 12        | 10.020               | 12.000    |
|               | 300<br>(2068)          | 1    | 14                      | 14        | 12.500               | 12.500    |
|               |                        | 2    | 12                      | 12        | 11.376               | 11.750    |
|               |                        | 3    | 10                      | 12        | 9.750                | 11.750    |
| 8             | 150<br>(1034)          | 1    | 14                      | 14        | 13.250               | 13.250    |
|               |                        | 2    | 14                      | 14        | 13.250               | 13.250    |
|               |                        | 3    | 12                      | 12        | 12.000               | 12.000    |
|               | 300<br>(2068)          | 1    | 14                      | 14        | 12.500               | 12.500    |
|               |                        | 2    | 14                      | 14        | 12.500               | 12.500    |
|               |                        | 3    | 12                      | 12        | 11.376               | 11.376    |

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     |

## Vent and drain connections

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

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

It is recommended that pressure gages be provided at points of entering and leaving water to measure pressure drop through the heat exchanger. Gages may be installed 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 of the required pressure range do not have the accuracy to 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

Frames 1 - 6 19XR heat exchangers and the 19XRT chillers are equipped with 4 relief valves: 2 relief valves are mounted on the 3-way service valve on the condenser and 2 relief valves are mounted on the 3-way service valve of the cooler. Frame 7 and Frame 8 19XR heat exchangers are equipped with 8 relief valves: 4 relief valves are on the condenser (2 on each of the two 3-way transfer valves) and 4 relief valves on the cooler (2 on each of the two 3-way service valves). The relief pressure for all 19XR/XRT chillers is 185 psi (1275 kPa).

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 the tables below.

**19XR**

| HEAT EXCHANGER | FRAME SIZE | VESSEL REQUIRED C FACTOR (lb air/Min) | RELIEF VALVE RATED C FACTOR (lb air/Min) | FIELD CONNECTION SIZE (FPT) |
|----------------|------------|---------------------------------------|------------------------------------------|-----------------------------|
| COOLER         | 10 to 12   | 30.0                                  | 37.6                                     | 1"                          |
|                | 15 to 17   | 36.0                                  | 37.6                                     | 1"                          |
|                | 20 to 22   | 35.7                                  | 37.6                                     | 1"                          |
|                | 30 to 32   | 43.8                                  | 70.8                                     | 1¼"                         |
|                | 35 to 37   | 49.9                                  | 70.8                                     | 1¼"                         |
|                | 40 to 42   | 50.4                                  | 70.8                                     | 1¼"                         |
|                | 45 to 47   | 57.4                                  | 70.8                                     | 1¼"                         |
|                | 50 to 52   | 53.7                                  | 70.8                                     | 1¼"                         |
|                | 55 to 57   | 61.1                                  | 70.8                                     | 1¼"                         |
|                | 60 to 62   | 57.0                                  | 70.8                                     | 1¼"                         |
|                | 65 to 67   | 64.9                                  | 70.8                                     | 1¼"                         |
|                | 70 to 72   | 77.0                                  | 141.6                                    | 1¼"                         |
|                | 75 to 77   | 88.0                                  | 141.6                                    | 1¼"                         |
|                | 80 to 82   | 87.7                                  | 141.6                                    | 1¼"                         |
|                | 85 to 87   | 100.3                                 | 141.6                                    | 1¼"                         |
| CONDENSER      | 10 to 12   | 31.7                                  | 40.4                                     | 1"                          |
|                | 15 to 17   | 38.0                                  | 40.4                                     | 1"                          |
|                | 20 to 22   | 34.0                                  | 37.6                                     | 1"                          |
|                | 30 to 32   | 41.8                                  | 70.8                                     | 1¼"                         |
|                | 35 to 37   | 47.6                                  | 70.8                                     | 1¼"                         |
|                | 40 to 42   | 47.1                                  | 70.8                                     | 1¼"                         |
|                | 45 to 47   | 53.7                                  | 70.8                                     | 1¼"                         |
|                | 50 to 52   | 51.2                                  | 70.8                                     | 1¼"                         |
|                | 55 to 57   | 58.3                                  | 70.8                                     | 1¼"                         |
|                | 60 to 62   | 55.3                                  | 70.8                                     | 1¼"                         |
|                | 65 to 67   | 63.0                                  | 70.8                                     | 1¼"                         |
|                | 70 to 72   | 72.3                                  | 141.6                                    | 1¼"                         |
|                | 75 to 77   | 82.7                                  | 141.6                                    | 1¼"                         |
|                | 80 to 82   | 80.7                                  | 141.6                                    | 1¼"                         |
|                | 85 to 87   | 92.3                                  | 141.6                                    | 1¼"                         |

**19XRT**

| HEAT EXCHANGER | FRAME SIZE | VESSEL REQUIRED C FACTOR (lb air/Min) | RELIEF VALVE RATED C FACTOR (lb air/Min) | FIELD CONNECTION SIZE (FPT) |
|----------------|------------|---------------------------------------|------------------------------------------|-----------------------------|
| COOLER         | 60-63      | 74.7                                  | 87.4                                     | 1½"                         |
| CONDENSER      | 60-63      | 69.9                                  | 70.8                                     | 1¼"                         |

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<br>(Refrigerant) |      | STANDARD TUBE SIDE<br>(Water) |      | OPTIONAL TUBE SIDE<br>(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<br>(Refrigerant) |      | STANDARD TUBE SIDE<br>(Water) |      |
|-------------------------------|-----------------------------|------|-------------------------------|------|
|                               | psi                         | kPa  | psi                           | kPa  |
| Leak Test at Design Pressure* | 225                         | 1551 | 150                           | 1034 |
| Hydrostatic Test              | —                           | —    | 225                           | 1551 |
| Proof Test*                   | 282                         | 1944 | —                             | —    |

\*Nitrogen/Helium.

### HEAT EXCHANGER MATERIAL SPECIFICATIONS

| ITEM                            | MATERIAL       | SPECIFICATION                                  |
|---------------------------------|----------------|------------------------------------------------|
| Shell                           | HR Steel       | ASME SA516 GR .70                              |
| Tube Sheet                      | HR Steel       | ASME SA516 GR .70                              |
| Condenser/Cooler Waterbox Cover | HR Steel       | ASME SA516 GR .70, SA-36, or SA-285 GRL        |
| Condenser/Cooler Waterbox Shell | HR Steel       | ASME SA675 GR .60, SA-516 GR70, or SA-181 CL70 |
| Tubes                           | Finned Copper  | ASME SB359                                     |
| Discharge/Suction               | Steel<br>Steel | ASME SA106 GRB<br>ASME SA105                   |
| Pipe                            |                |                                                |
| Flanges                         |                |                                                |

ASME — American Society of Mechanical Engineers

HR — Hot Rolled

## Insulation

### MINIMUM FIELD-INSTALLED INSULATION REQUIREMENTS

| CHILLER | HEAT EXCHANGER<br>SIZE | INSULATION*     |                |
|---------|------------------------|-----------------|----------------|
|         |                        | ft <sup>2</sup> | m <sup>2</sup> |
| 19XR    | 10-12                  | 75              | 6.9            |
|         | 15-17                  | 85              | 7.9            |
|         | 20-22                  | 100             | 9.3            |
|         | 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           |
|         | 70-72                  | 260             | 24.2           |
|         | 75-77                  | 295             | 27.4           |
|         | 80-82                  | 310             | 28.8           |
|         | 85-87                  | 355             | 32.9           |
| 19XRT   | 60-63                  | 250             | 24.0           |

\*Factory installed as shown on page 53 and 54.

**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, the liquid line, and the float chamber. 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  $(0.28 \cdot \text{Btu} \cdot \text{in}) / \text{hr} \cdot \text{ft}^2 \cdot ^\circ\text{F}$  [ $(0.0404 \cdot \text{W}) / (\text{m} \cdot ^\circ\text{C})$ ]. 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 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. To estimate waterbox cover areas refer to certified drawings.

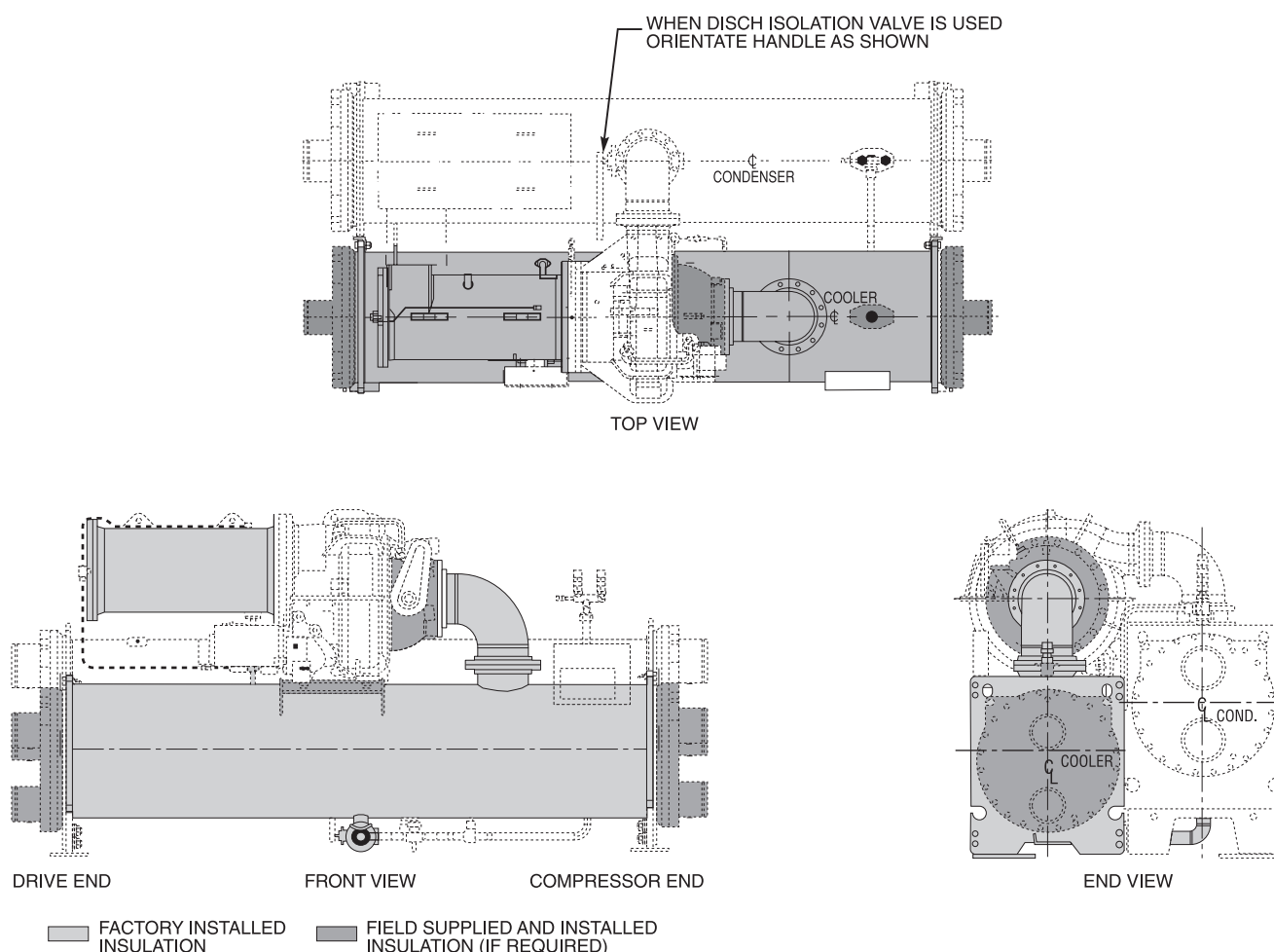
High humidity jobsite locations may require field supplied and installed insulation on the float chamber, suction housing, and the lower half of the condenser.

#### CONDENSATION VS RELATIVE HUMIDITY\*

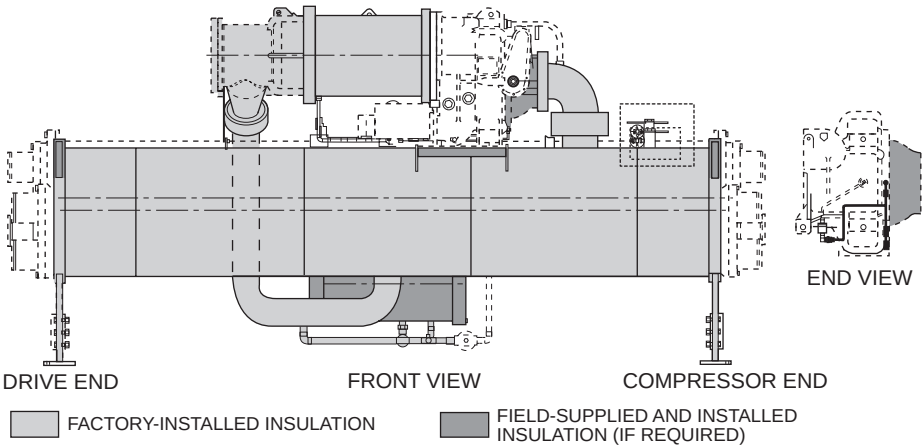
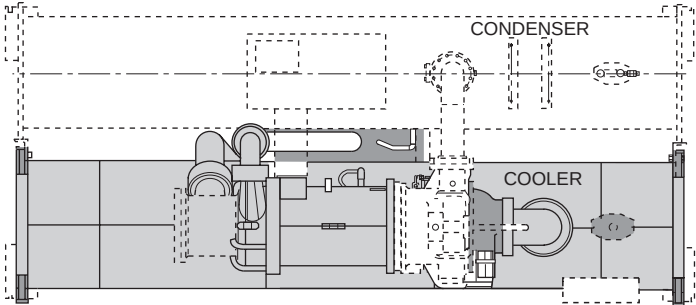
| AMOUNT OF<br>CONDENSATION | ROOM DRY-BULB TEMP  |             |              |
|---------------------------|---------------------|-------------|--------------|
|                           | 80 F (27 C)         | 90 F (32 C) | 100 F (38 C) |
|                           | % Relative Humidity |             |              |
| 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.

#### 19XR FACTORY-INSTALLED INSULATION AREA



19XRT FACTORY-INSTALLED INSULATION AREA



## Packaged Hermetic Centrifugal Liquid Chiller

Size Range: **19XR — 200 to 1500 Tons**  
**(703 to 5275 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 use 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 using 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 that vibration levels, oil pressures, and temperatures are within acceptable limits.

Each compressor assembly shall be proof tested at a minimum 232 psig (1600 kPa) and leak tested at 185 psig (1276 kPa) with a tracer gas mixture. The leak test shall not allow any leaks greater than 0.5 oz/year of refrigerant.

- G. Entire chiller assembly shall be proof tested at 232 psig (1600 kPa) and leak tested at 185 psig (1276 kPa) with a tracer gas mixture on the refrigerant side. The leak test shall not allow any leaks greater than 0.5 oz/year of refrigerant.

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 heat exchangers, Frames 1 through 6 only).

#### 1.04 WARRANTY

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

### 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.
2. The open type impeller with machined shroud contours and impeller diameter optimize each compressor's 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 casing shall use O-rings instead of gaskets to reduce the occurrence of refrigerant leakage. Connections to the compressor shall be flanged or bolted for easy disassembly.
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, Quality II.
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. 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 in-rush 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:

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

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

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:

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

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

and, alternately

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

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.

## 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 Chiller Visual Control (CVC), Chiller Control Module (CCM) power supply, Integrated Starter Module (ISM) (located in the starter cabinet), and temperature and pressure (thermistor and transducer) sensors. The control center shall include a 16 line by 40 character liquid crystal display, 4 function keys, stop button, and alarm light. The microprocessor shall 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. Chiller microprocessor shall include the capability to be wired into a chiller system manager control system. When connected to this system it shall provide data required for integrated chiller plant control.

- 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 unless another specific screen is requested. If, after viewing another screen and if there is no soft-key activity at the control console for 15 minutes, the display shall automatically revert to the default screen, and backlight will go off.

- 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

#### 2) Schedule Function:

The chiller controls shall be configurable for manual or automatic start-up and shut-down. 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 CVC 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 anytime 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 CVC 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 CVC 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 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 pulldown or percent motor amps/minute. During the ramp loading period, a message shall be displayed informing the operator that the chiller is operating in ramp loading mode.
- 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 unless manually reset to override the starts count.

- j. The control system shall automatically cycle the compressor off to minimize energy usage whenever the leaving chilled water temperature is the number of configured degrees below the desired chilled water set point (5 F [3 C] default). 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 shutdown 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, ground fault 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. No additional wiring shall be required.
  - 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.
- If a chiller system manager control system is provided, reset function shall apply to the entire chiller plant manager control system. 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.
  - 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 CVC 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 that approach protective limits and take self-corrective action prior to an alarm occurring. The system shall automatically reduce chiller capacity when any of the following parameters are outside their normal operating range:
  - 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 shall 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. 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 CVC screen the actual reading of each transducer and each thermistor installed on the chiller. All out-of-range sensors shall be identified.
- 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 or other chiller plant control requirements, a Chillervisor System Manager (CSM) with inherent input/output capability shall be installed. Chiller System Manager control system shall be complete with required input/output to control up to eight (8) chillers on a common loop, condenser water system and secondary loop pumps. The liquid crystal display specified for the chiller microprocessor shall be the only operator interface

required to program, modify, change, enable, or disable the Chiller System Manager. The Chiller System Manager shall provide:

- Automatic lead/lag control of chillers based on system load
- Lead/lag switching based on runtime, fixed rotation, calendar date, and/or outside air temperature.
- Capability to customize sequence for unequal sized chillers
- Capability to designate a chiller to perform “feathering functions”
- Capability to start next available chiller in event of chiller alarm
- Capability to perform chilled water system reset based on outdoor-air temperature chilled water system differential temperature or return chilled water temperature
- Control of pumps, towers, valves and variable frequency drives via input/output modules
- Interface to building demand meter for demand limiting via the optional Loadshed Module
- Data logging for chiller operating parameters via the optional Data Collection Module

The chiller microprocessor and Chiller System Manager shall be capable of interfacing with a PC operator workstation supplied with chiller manufacturer software. The PC interface software shall include the ability to annunciate alarms, display dynamic graphics of the chiller plant, and display chiller plant reports. The chiller microprocessor shall be capable of communicating with other vendor supplied control devices as required for data logging, demand limiting, air side interface, and other control functions.

Chiller system manager control system shall be capable of interfacing with other building automation and control systems via a hardwire or serial interface. If a building automation and control system is supplied by other than the chiller manufacturer the supply of additional communications interface hardware and software shall be the responsibility of the building automation and control system supplier.

#### 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 chilled water pump, condenser water pump, and tower fan control circuit to the chiller control circuit.
3. Electrical contractor shall supply and install electrical wiring and devices required to interface the chiller controls with the building control system if applicable.
4. Electrical power shall be supplied to the unit at the voltage, phase, and frequency listed in the equipment schedule. Contractor shall provide separate 460-v power supply and disconnect for oil pump

and optional pumpout unit when 416-v main motor power is specified.

#### 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.

##### 4. 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.

- a. Insulation material shall be 11 lb/cu ft fiberglass needled material with Barium Sulfate loaded vinyl acoustic barrier.
- b. 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.
- c. Insulation design shall accommodate temperature and pressure probes, gages, tubing, piping, and brackets.
- d. 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.
- e. 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.
- f. 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.

### 3. Discharge Line Sound Reduction Kit:

Unit manufacturer shall furnish a discharge line sound reduction kit that completely covers the compressor discharge pipe and reduces compressor noise. See Item 4a through 4g (Sound Insulation Kit) for detailed materials and construction specifications for the discharge line sound reduction kit.

### 4. Stand-Alone Pumpout Unit:

A freestanding pumpout unit shall be provided. The pumpout unit shall use 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.

### 5. 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 use 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.

### 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 ¾ in. (19 mm) thick with a thermal conductivity not exceeding

$$0.28 \frac{\text{Btu} \cdot \text{in.}}{\text{hr} \cdot \text{ft}^2 \cdot ^\circ\text{F}} \left( 0.0404 \frac{\text{W}}{\text{m} \cdot ^\circ\text{C}} \right) \text{ and shall conform to UL Standard 94, classification 94 HBF.}$$

### \* 2. Automatic Hot Gas Bypass:

Hot gas bypass valve and piping shall be factory furnished to permit chiller operation for extended periods of time.

### \* 3. Cooler and Condenser Tubes:

- a. Unit manufacturer shall provide ¾-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 ¾-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 ¾-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 ¾-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 ¾-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 ¾-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 ¾-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 ¾-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 ¾-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 ¾-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.
- \* 4. 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.
- \* 5. Nozzle-In-Head, 300 psig (2068 kPa):  
Unit manufacturer shall furnish nozzle-in-head style waterboxes on the cooler and/or condenser rated at 300 psig (2068 kPa).
- \* 6. 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).
- \* 7. 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).
- \* 8. Flanged Water Nozzles:  
Unit manufacturer shall furnish standard flanged piping connections on the cooler and/or condenser.
9. 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.
10. 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.
11. Optional Compressor Discharge Isolation Valve and Liquid Line Ball:  
These items shall be factory installed to allow isolation of the refrigerant charge in the condenser for servicing the compressor.
12. Optional Low-Voltage Unit-Mounted Starter (Not available on chiller heat exchanger sizes 7 and 8):  
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 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. ISM 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 single cycle dropout protection.
  - d. 3 kva control/oil heater transformer.
  - e. Branch circuit breaker for oil pump.
  - f. Branch circuit breaker for control power and oil heater.
  - g. Optional solid-state starter shall provide stepless compressor motor acceleration and limit motor inrush current to 150 to 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.  
Solid-state starter shall also include a diagnostic LCD (liquid crystal display) display shall be provided to indicate:
    - Starter on
    - Run (up to voltage)
    - Phase correct
    - Overtemperature fault
    - SCR gates energized
    - Ground fault
    - Current imbalance fault
    - Shorted SCR
  - h. Both the optional and solid-state and wye-delta starters shall include the following standard motor protection features:
    - Phase loss
    - Phase reversal
    - Phase imbalance
    - 3-phase ground fault
    - Low Voltage — phase to phase and phase to ground
    - Medium Voltage — phase to ground
    - Current overload
    - Current flow while stopped
    - 3-phase under/over voltage
    - 3-phase digital ammeter/voltmeter
    - Microprocessor based overload trip protection
    - Watts
    - Power factor
    - Frequency
    - Watt demand
    - Watt hour

