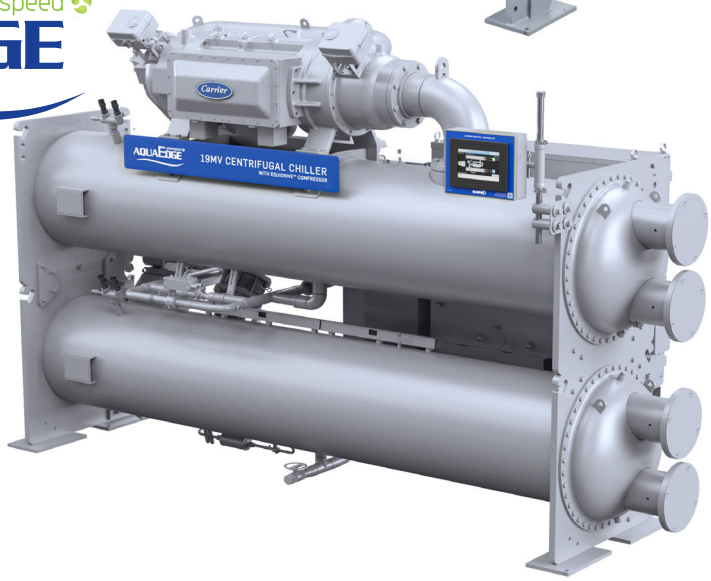
Product Data

AquaEdge® High-Efficiency Semi-Hermetic Centrifugal Liquid Chillers

150 to 700 Nominal Tons
(527 to 2,461 kW)



19MV 50/60 Hz
High-Efficiency Semi-Hermetic Centrifugal Liquid Chillers with Greenspeed® Intelligence, PIC6 Controls, and R-515B or R-513A Refrigerant

Features/Benefits

The 19MV AquaEdge® chillers offer:

- The use of non-ozone depleting refrigerant R-515B and R-513A
- Two-stage back-to-back EquiDrive™ semi-hermetic compressor 150 to 700 tons (527 to 2,461 kW)
- Dual EXV (19MV3 only), variable orifice metering device
- Air cooled variable speed drive
- Positive pressure design with compact footprint
- Modular construction
- Carrier offers a five-year refrigerant warranty (Domestic and Canada only)
- Magnetic and roller element bearing options (Roller element bearing available on 19MV3 only)

The AquaEdge chiller's high efficiencies are obtained in real-world operating conditions. Therefore, the effects of potential or indirect global warming are greatly diminished.

High efficiency

Today's owners of chilled water plants demand high efficiency from their chillers. As a result, the AquaEdge centrifugal chiller is offered as a variable-speed machine with a unit-mounted variable speed drive and permanent magnet motor to maximize part load efficiency.

Environmental leadership

Carrier has long been committed to the environment and its sustainability. AquaEdge chillers provide our customers with a high-efficiency, chlorine-free solution. Carrier's decision to utilize non-ozone depleting R-515B and R-513A refrigerant provides our customers with a safer and more environmentally balanced choice without compromising efficiency.

Reliability

The AquaEdge chiller's two-stage positive pressure EquiDrive back-to-back compressor, coupled with ASME (American Society of Mechanical Engineers) constructed heat exchangers, ensures high reliability and sustainability. Carrier's semi-hermetic motors operate in a clean, refrigerant cooled environment. The semi-hermetic design eliminates the potential shaft seal leaks and refrigerant loss. These are just some of the reasons why the AquaEdge family of chillers has one of the industry's lowest leak rates.

The AquaEdge chiller's two-stage positive pressure EquiDrive back-to-back compressor, coupled with ASME constructed heat exchangers, ensures high reliability.

Operating range

The 19MV chiller's EquiDrive two-stage back-to-back compressor provides MORe (More Operating Range) and high efficiency at design conditions, providing the flexibility to operate outside of design conditions to keep your building cool under pressure including operation down to 10% load without hot gas bypass (select models).

In addition the 19MV chiller's frequent start feature and dual EXVs sized to enable low lift operation at full load make the 19MV an ideal fit for chilled water systems with an integrated water side economizer.

Semi-hermetic compressor features

Magnetic bearings are integrated into the direct drive motor assembly. Motor is semi-hermetically sealed from the machine room; cooling is accomplished by spraying liquid refrigerant on the motor windings.

This highly efficient motor cooling method results in the use of smaller, cooler-running motors than could be realized with air-cooled designs of the same type.

In addition, Carrier's semi-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 startup and operation, when equipment temperature variations cause thermal expansion
- High noise levels that are common with air-cooled motors, which radiate noise to the mechanical room and adjacent areas
- Mechanical room cooling requirements associated with air-cooled motors, which dissipate heat to the mechanical room

Optional shipment with factory charge

The AquaEdge 19MV chiller can be shipped fully charged, minimizing start-up and maintenance time. Purge units are not required. The tight construction of the AquaEdge 19MV centrifugal chiller ensures that contaminants stay out and efficiency is maintained throughout the life of the chiller. The oil free design enables the AquaEdge 19MV chillers to be shipped with a full refrigerant charge without the need for isolation valves.

Positive pressure design

The AquaEdge 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.

Modular construction

The AquaEdge 19MV chiller is designed to fit through a 72 in. by 80 in. opening completely assembled (heat exchanger frame sizes 3 and 4, standard tier VFD). For smaller spaces, the evaporator, condenser, and compressor assemblies are completely bolted together, making the AquaEdge chillers ideally suited for replacement projects where ease of disassembly and reassembly at the jobsite are essential.

Table of contents

Features/Benefits (cont)

Marine container shipment (19MV, heat exchanger frame sizes 3 and 4 only, standard tier VFD)

The compact design allows for open-top container shipment to export destinations, ensuring product quality while reducing shipping cost.

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

Air-cooled VFD (variable frequency drive) is designed to be cooled without cooling water or refrigerant. Enclosure reduces the risk of exposure of electrical components to dirt, dust, moisture and splashing water. Using air instead of water also eliminates costly maintenance associated with the water cooling pump, heat exchanger, and rubber tubing used with water-cooled VFDs.

High-efficiency permanent magnet motor provides high efficiency at full and part loads.

Heat exchanger features

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. Optional 1 in. tubes provide optimized cost and less pressure drop than the standard 3/4 in. tubes. Tube expansion at center support sheets prevents unwanted tube movement and vibration, thereby reducing the possibility of premature tube failure. Double-grooved tube sheet holes reduce the possibility of leaks between the water and refrigerant system, increasing product reliability. Condenser baffle prevents direct impingement of high velocity compressor gas onto the condenser tubes. The baffle eliminates related vibration and wear of the tubes and distributes the refrigerant flow evenly over the length of the vessel for improved efficiency. Closely spaced intermediate support sheets prevent tube sagging and vibration, thereby increasing heat exchanger life.

Refrigerant filter drier isolation valves allow filter replacement without pumping down the chiller, which means less service time and less expense.

The Sensible Subcooler located in the bottom of the condenser increases the refrigeration effect by cooling condensed liquid refrigerant to a lower temperature, resulting in reduced compressor power consumption.

Dual Expansion Valves (EXV) (19MV3 only) provide precise refrigerant metering over a wide variety of operating conditions. As a result, optimal refrigerant levels can be maintained in the condenser and evaporator to achieve the greatest efficiency without unintentional hot gas bypass or flooding. The dual EXVs provide full capacity (up to 700 tons) at low lift conditions.

Microprocessor control features

The 10.4 in. native BACnet®[1] touchscreen direct digital Product Integrated Control (PIC6) provides unmatched flexibility, functionality, and seamless integration with the Carrier i-Vu® Building Automation and Control System supporting BACnet and Carrier Comfort Network® (CCN) communication protocols. The PIC6 control can be configured to display units in English or metric, and offers an "all-in-one" view of key chiller operational data, simplifying the interaction between the chiller and user.

Features include:

- Display of over 125 operating, status, and diagnostic messages for improved user experience
- Monitoring of over 100 functions and parameters 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
- Display mode uses English and Chinese.

1. Third-party trademarks and logos are property of their respective owners.

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

Chilled water reset can be accomplished manually or automatically from the building management system. Reset saves energy when warmer chilled water can be used. Demand limiting feature limits the power draw of the chiller during peak loading conditions. When incorporated into the Carrier Comfort Network building automation system, a red line command holds chillers at their present capacity and prevents any other chillers from starting. If a load shed signal is received, the compressors are unloaded to avoid high demand charges whenever possible.

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

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

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

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

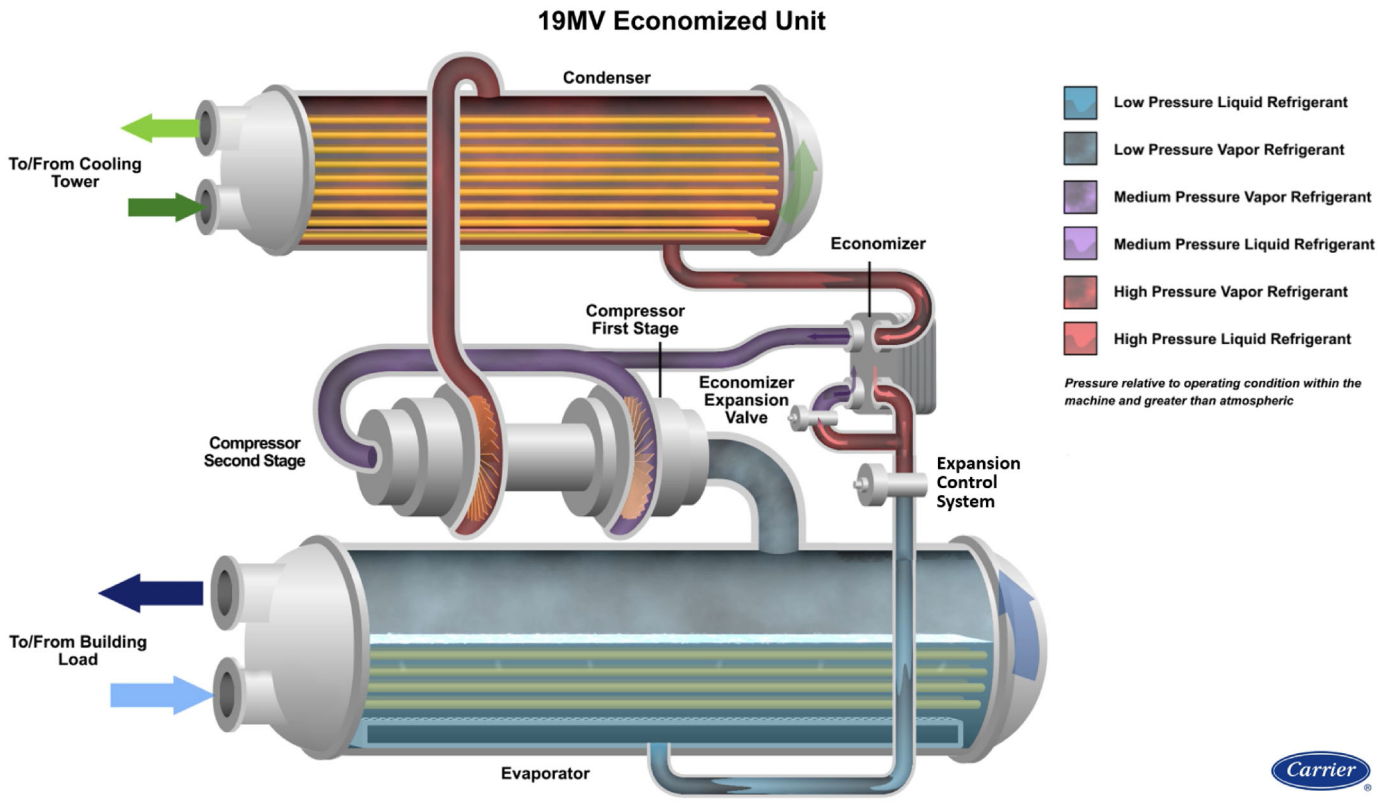
Extensive service menu features include password protection to prevent unauthorized access to the service menu. Built-in diagnostic capabilities assist in troubleshooting and recommend proper corrective action for pre-set alarms, resulting in greater operating time.

Alarm file maintains the last 25 time and date-stamped alarm and alert messages in memory; this function reduces troubleshooting time and cost. Configuration data backup in nonvolatile memory provides protection during power failures and eliminates time-consuming control reconfiguration.

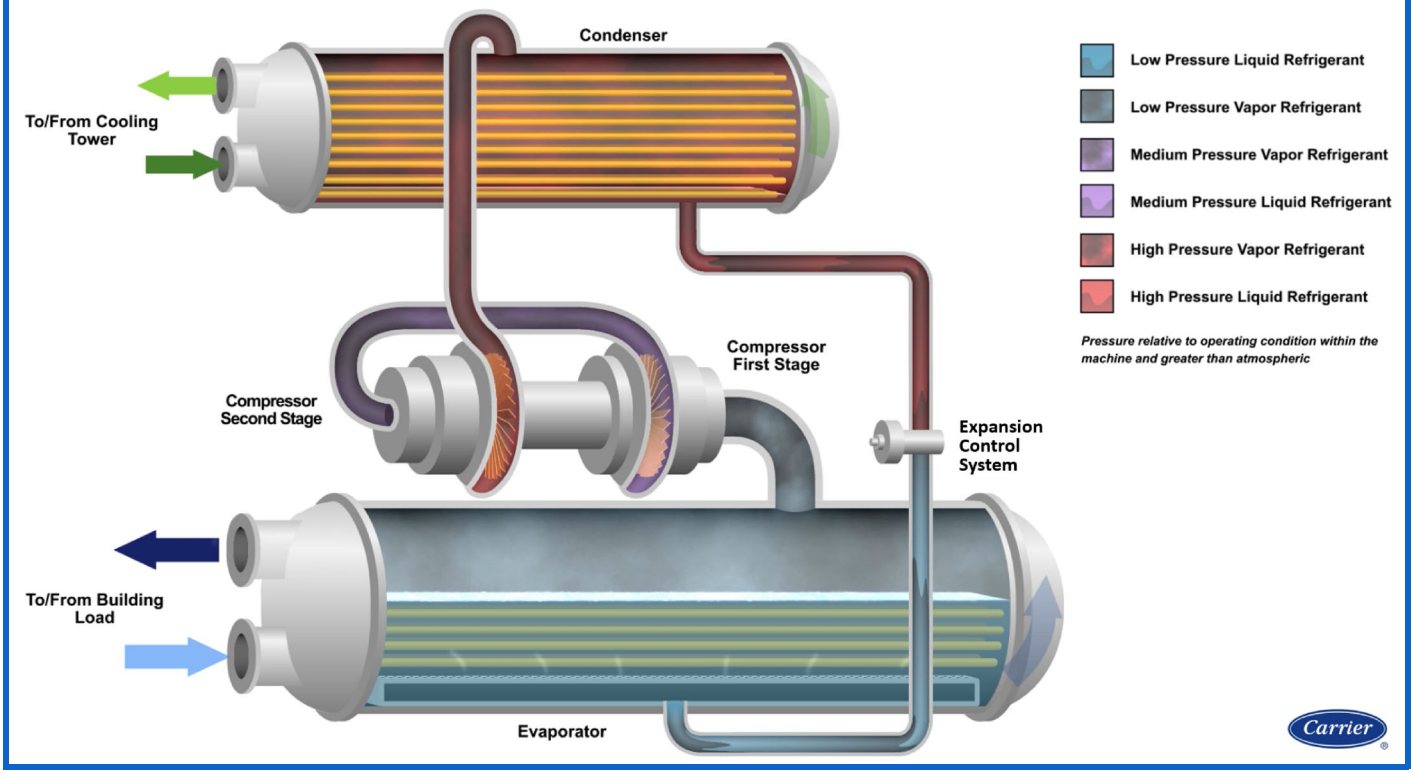
Features/Benefits (cont)

Refrigeration Cycle

19MV Refrigeration Cycle (Economized)



19MV Refrigeration Cycle (Non-Economized)



Model number nomenclature

19MV Two-Stage Compressor

19 MV – 4 1 N 4 1 N 3 6 9 E 7 5 –

Description
19 — High Efficiency Semi-Hermetic Centrifugal Liquid Chiller

MV — Model Designation

Bearing Option
– — Magnetic Bearing
R — Roller Element Bearing

Evaporator Frame Size
2 — Frame 2
3 — Frame 3
4 — Frame 4
5 — Frame 5

Evaporator Length
1 — 11 ft (3.4 m) Length
3 — 13 ft (4 m) Length

Evaporator Pass Arrangement and Tube Count
E — 3 pass, 3/4" tube, Lowest Tube Count
F — 3 pass, 3/4" tube, Medium Tube Count
G — 3 pass, 3/4" tube, Highest Tube Count
L — 1 or 2 pass, 3/4" tube, Lowest Tube Count
M — 1 or 2 pass, 3/4" tube, Medium Tube Count
N — 1 or 2 pass, 3/4" tube, Highest Tube Count

R — 3 pass, 1" tube, Lower-Medium Tube Count
S — 3 pass, 1" tube, Medium Tube Count
T — 3 pass, 1" tube, Medium-Higher Tube Count
X — 1 or 2 pass, 1" tube, Lowest Tube Count
Y — 1 or 2 pass, 1" tube, Medium Tube Count
Z — 1 or 2 pass, 1" tube, Highest Tube Count

Condenser Frame Size
3 — Frame 3
4 — Frame 4
5 — Frame 5

Condenser Length
1 — 11 ft (3.4 m) Length
3 — 13 ft (4 m) Length

Condenser Pass Arrangement and Tube Count
C — 3 pass, 3/4" tube, Lowest Tube Count
D — 3 pass, 3/4" tube, 2nd Lowest Tube Count
F — 3 pass, 3/4" tube, 2nd Highest Tube Count
G — 3 pass, 3/4" tube, Highest Tube Count
K — 1 or 2 pass, 3/4" tube, Lowest Tube Count
L — 1 or 2 pass, 3/4" tube, 2nd Lowest Tube Count
M — 1 or 2 pass, 3/4" tube, 2nd Highest Tube Count
N — 1 or 2 pass, 3/4" tube, Highest Tube Count

Compressor Frame Size
2 — 200-350 Nominal Tons (703-1,230 kW)
3 — 300-700 Nominal Tons (1,055-2,462 kW)

Compressor Shroud Code
3
4
5
6
7 — Compressor frame 3 only
8 — Compressor frame 3 only

Compressor Impeller Diameter Code
9

Economizer Option
E — Economizer Included
N — No Economizer

Motor Code
3 — Smallest HP
5 — Medium HP
7 — Large HP

Voltage Code

Code	Volts-Phase-Hertz
3	380-3-60
4	416-3-60
5	460-3-60
9	400-3-50

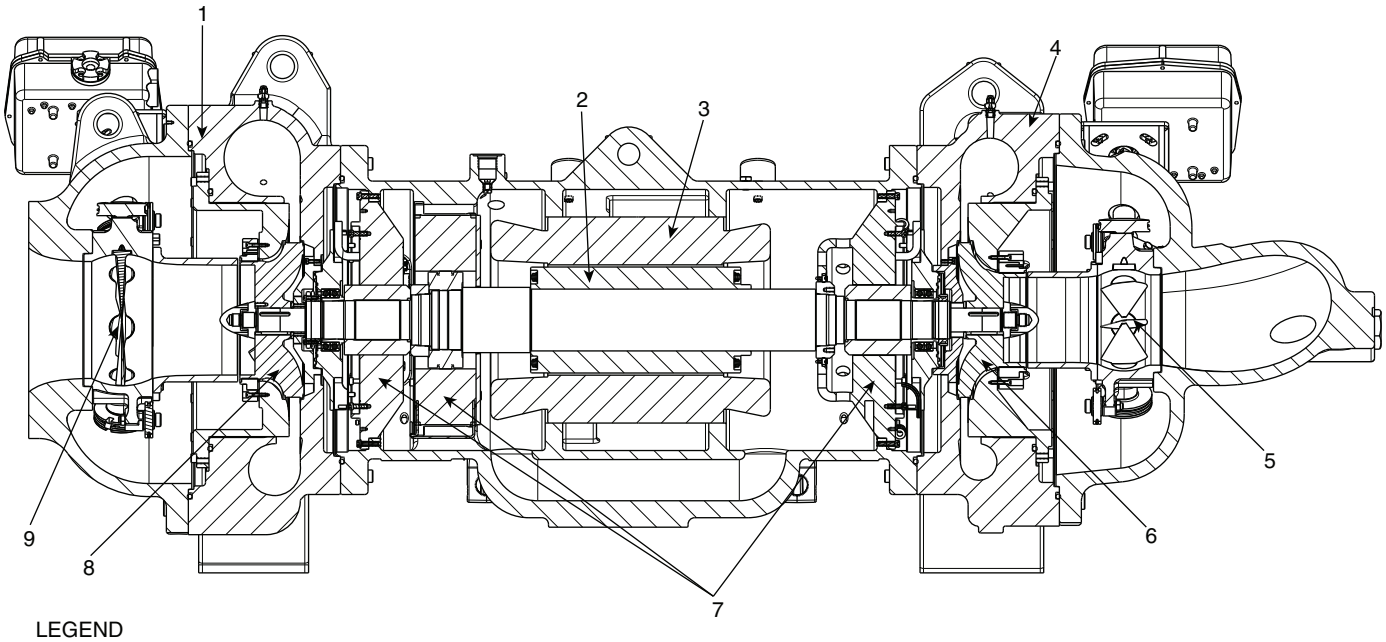
Special Code
– — Standard
S — Special

AHRI (Air-Conditioning, Heating, and Refrigeration Institute) Performance Certified

Quality Assurance
ISO 9001:2015-certified processes

Chiller components

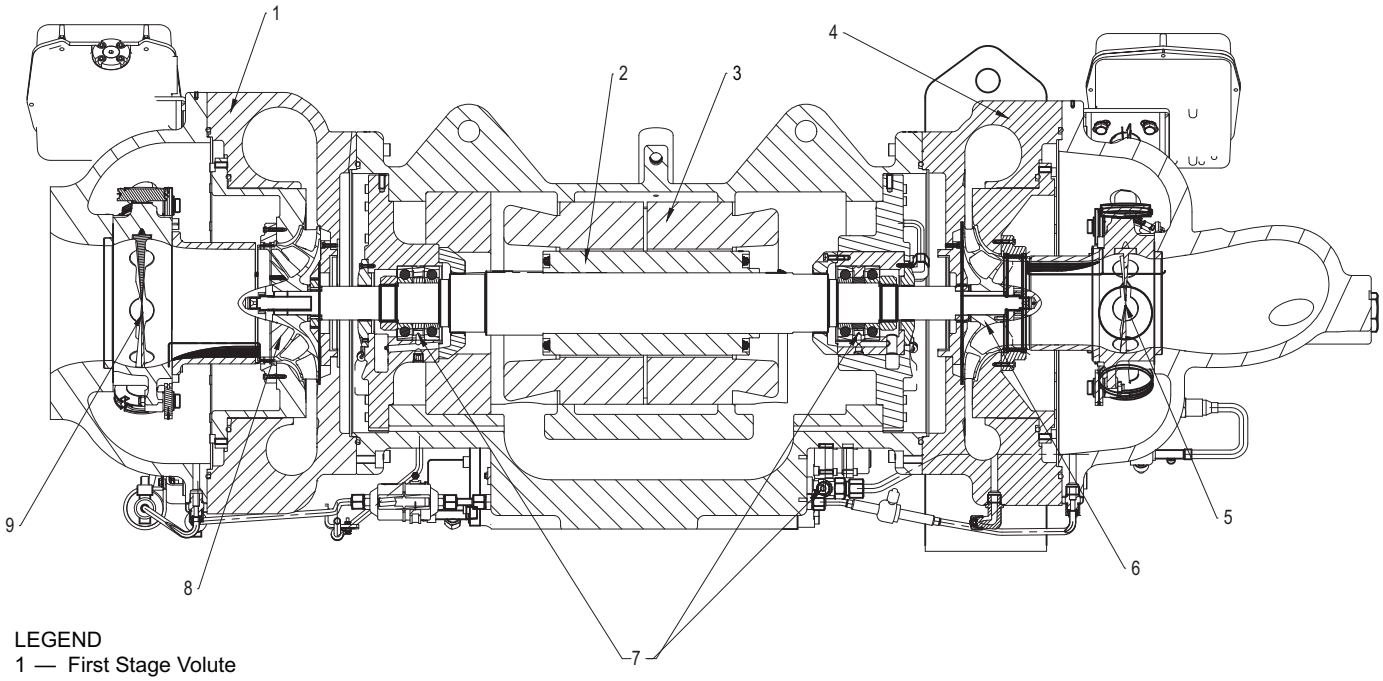
Compressor Components



LEGEND
1 — First Stage Volute
2 — Permanent Magnet Motor Rotor
3 — Motor Stator
4 — Second Stage Volute
5 — Second Stage Inlet Guide Vane
6 — Second Stage Impeller
7 — Magnetic Bearing System
8 — First Stage Impeller
9 — First Stage Inlet Guide Vane

Chiller components (cont)

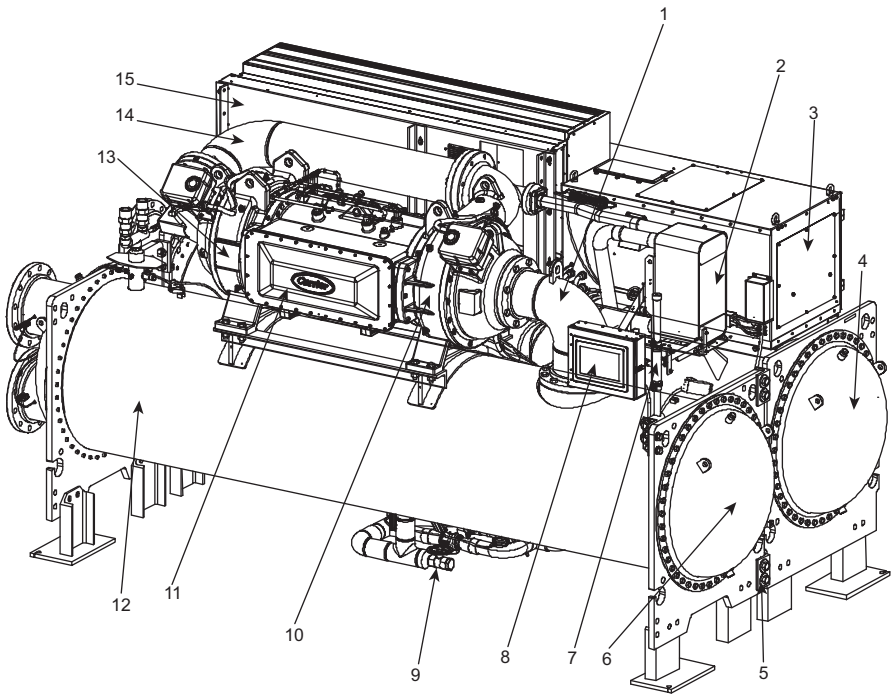
Compressor Components (cont)



LEGEND
1 — First Stage Volute
2 — Permanent Magnet Motor Rotor
3 — Motor Stator
4 — Second Stage Volute
5 — Second Stage Inlet Guide Vane
6 — Second Stage Impeller
7 — Oil Bearing System
8 — First Stage Impeller
9 — First Stage Inlet Guide Vane

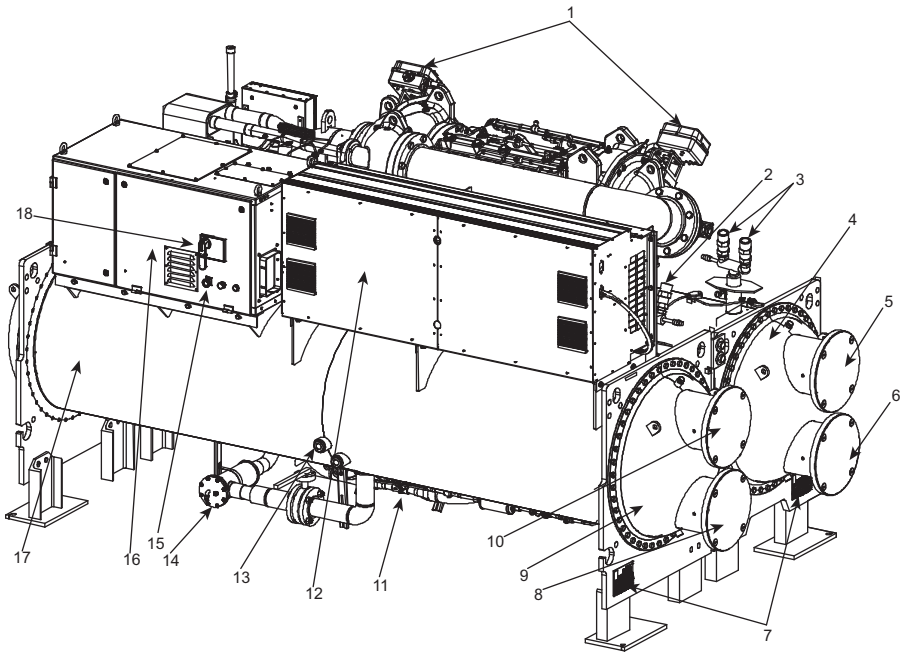
Chiller components (cont)

Chiller Components — 19MV Standard Tier Option



LEGEND
1 — Suction Elbow First Stage
2 — Refrigerant Economizer
3 — Integrated Power and Control Panel
4 — Condenser Waterbox Return End
5 — Bolt Together Plate
6 — Evaporator Waterbox Return End
7 — HMI Adjustment Arm
8 — 10.4 in. Color Touchscreen Display
9 — Refrigerant Charging Valve
10 — EquiDrive* Two-Stage Back-to-Back Centrifugal Compressor
11 — Permanent Magnet Motor (hidden)
12 — Evaporator
13 — Magnetic Bearing System
14 — Interstage Compressor Piping
15 — VFD (Variable Frequency Drive)

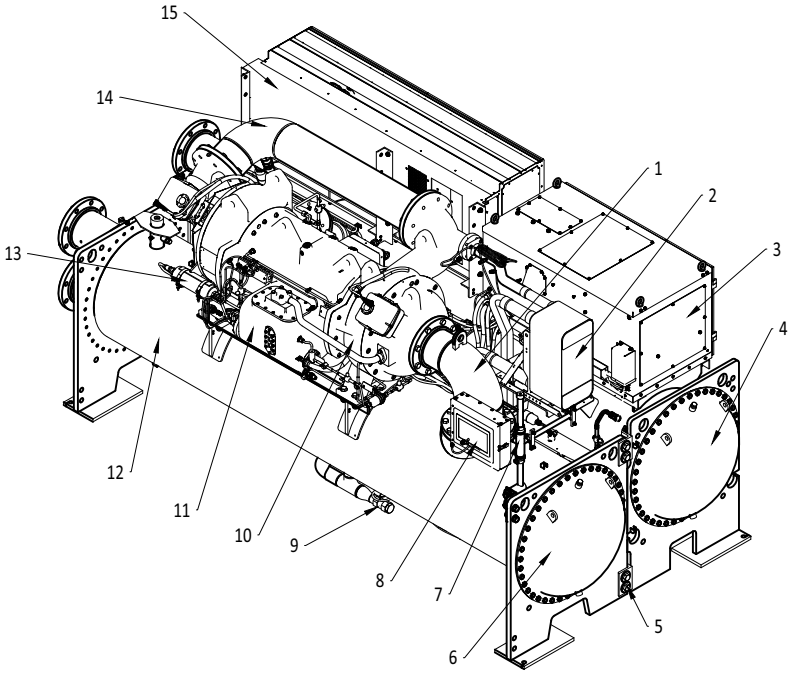
* Third-party trademarks and logos are property of their respective owners.



LEGEND
1 — Dual Inlet Guide Vane Actuators
2 — Condenser Dual Relief Valves
3 — Evaporator Dual Relief Valves
4 — Evaporator Waterbox
5 — Leaving Evaporator Nozzle
6 — Entering Evaporator Nozzle
7 — ASME Nameplates
8 — Entering Condenser Nozzle
9 — Condenser Waterbox
10 — Leaving Condenser Nozzle
11 — Dual Electronic Expansion Valves
12 — VFD (Variable Frequency Drive)
13 — Condenser Sight Glasses
14 — Strainer
15 — E-stop
16 — Integrated Power and Control Panel
17 — Condenser
18 — Main Circuit Breaker

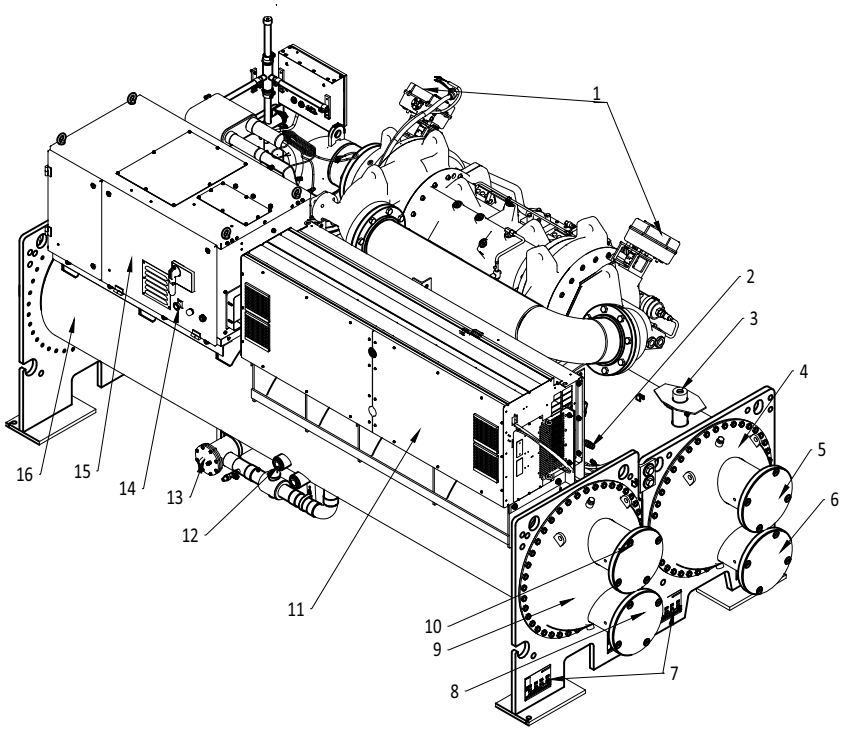
Chiller components (cont)

Chiller Components — 19MVR Standard Tier Option (19MV3 Only)



LEGEND
1 — Suction Elbow First Stage
2 — Refrigerant Economizer
3 — Integrated Power and Control Panel
4 — Condenser Waterbox Return End
5 — Bolt Together Plate
6 — Evaporator Waterbox Return End
7 — HMI Adjustment Arm
8 — 10.4 in. Color Touchscreen Display
9 — Refrigerant Charging Valve
10 — EquiDrive* Two-Stage Back-to-Back Centrifugal Compressor
11 — Permanent Magnet Motor (hidden)
12 — Evaporator
13 — Oil Bearing System
14 — Interstage Compressor Piping
15 — VFD (Variable Frequency Drive)

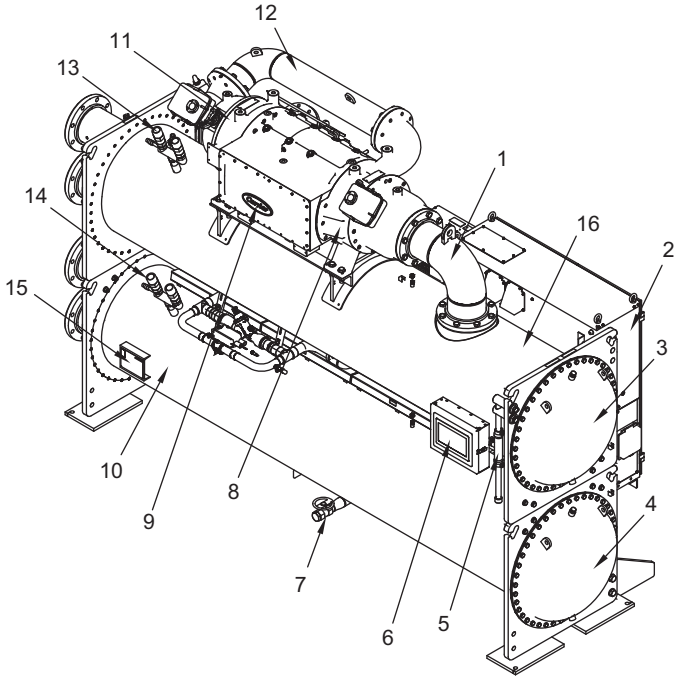
* Third-party trademarks and logos are property of their respective owners.



LEGEND
1 — Dual Inlet Guide Vane Actuators
2 — Condenser Dual Relief Valves
3 — Evaporator Relief Valve
4 — Evaporator Waterbox
5 — Leaving Evaporator Nozzle
6 — Entering Evaporator Nozzle
7 — ASME Nameplates
8 — Entering Condenser Nozzle
9 — Condenser Waterbox
10 — Leaving Condenser Nozzle
11 — VFD (Variable Frequency Drive)
12 — Condenser Sight Glasses
13 — Strainer
14 — E-stop
15 — Integrated Power and Control Panel
16 — Condenser

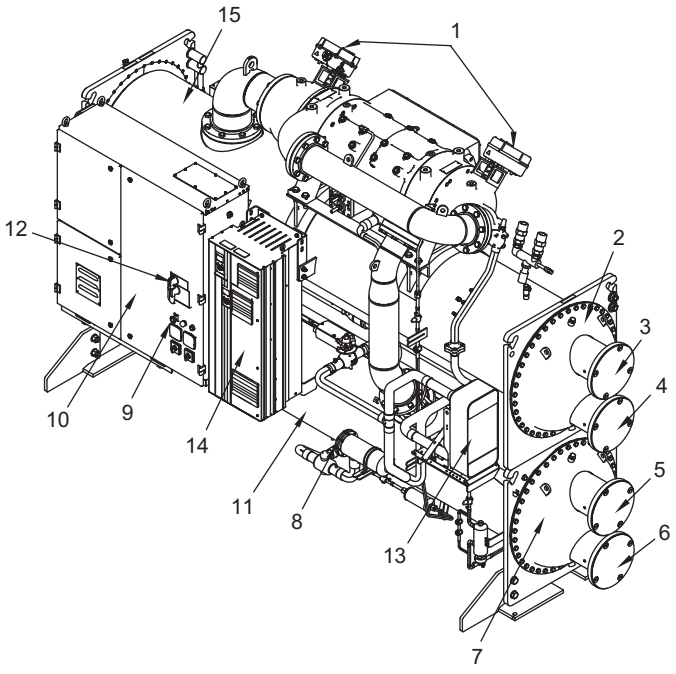
Chiller components (cont)

Chiller Components — 19MV2 Standard Tier Option



LEGEND

1 — Suction Elbow 1st Stage
2 — Integrated Power and Control Panel
3 — Condenser Waterbox Return End
4 — Evaporator Waterbox Return End
5 — HMI Adjustment Arm
6 — 10.4 in. Color Touchscreen Display
7 — Refrigerant Charging Valve
8 — EquiDrive Two-stage Back-to-Back Centrifugal Compressor
9 — Permanent Magnet Motor (hidden)
10 — Evaporator
11 — Magnetic Bearing System
12 — Interstage Compressor Piping
13 — Evaporator Dual Relief Valves
14 — Condenser Dual Relief Valves
15 — ASME Nameplate

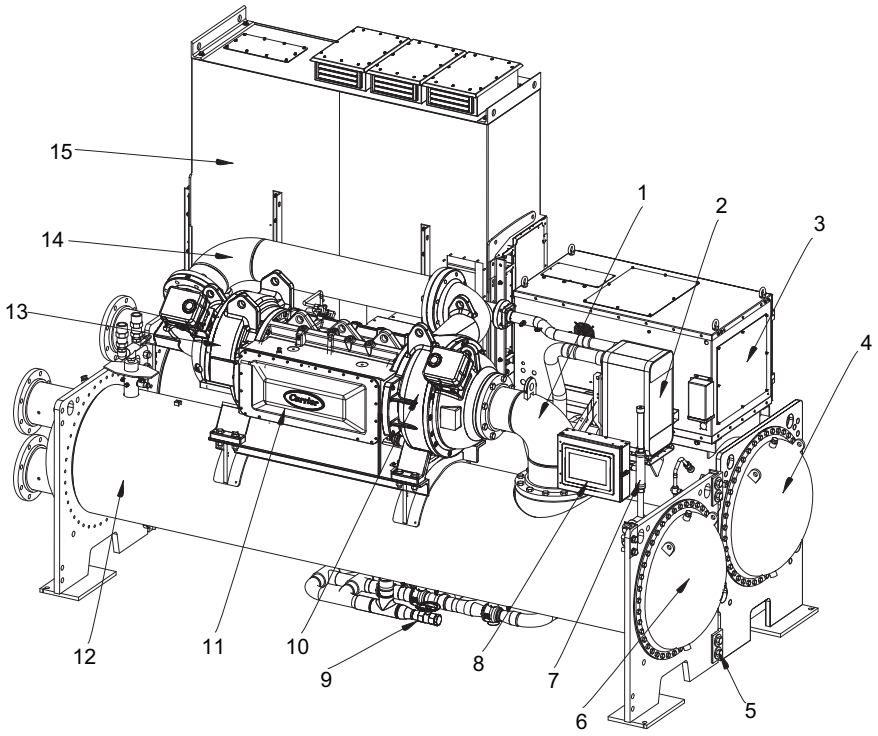


LEGEND

1 — Dual Inlet Guide Vane Actuators
2 — Evaporator Waterbox
3 — Leaving Evaporator Nozzle
4 — Entering Evaporator Nozzle
5 — Entering Condenser Nozzle
6 — Leaving Condenser Nozzle
7 — Condenser Waterbox
8 — Strainer
9 — E-stop
10 — Integrated Power and Control Panel
11 — Condenser
12 — Main Circuit Breaker
13 — Refrigerant Economizer
14 — VFD (Variable Frequency Drive)

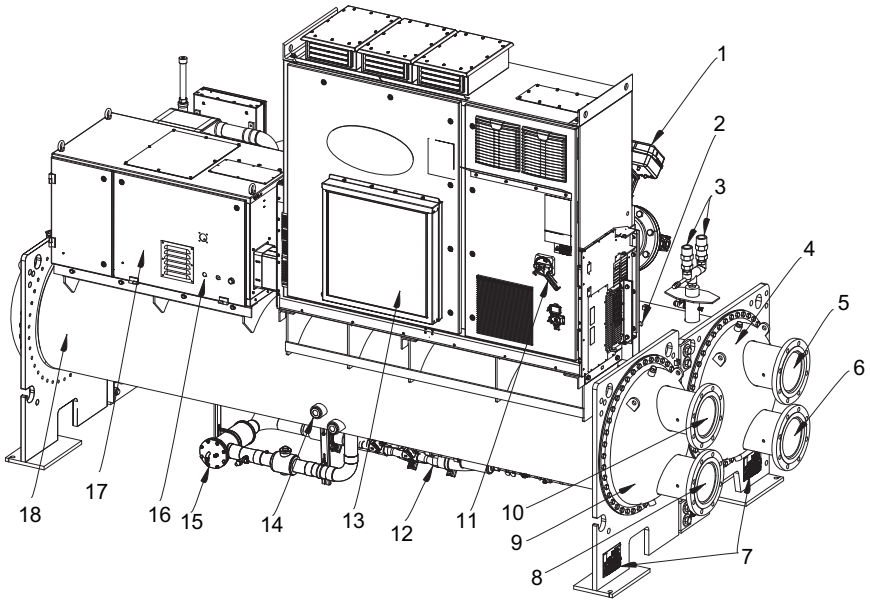
Chiller components (cont)

Chiller Components — High Tier Option (19MV-3 Only)



LEGEND
1 — Suction Elbow First Stage
2 — Refrigerant Economizer
3 — Integrated Power and Control Panel
4 — Condenser Waterbox Return End
5 — Bolt Together Plate
6 — Evaporator Waterbox Return End
7 — HMI Adjustment Arm
8 — 10.4 in. Color Touchscreen Display
9 — Refrigerant Charging Valve
10 — EquiDrive* Two-Stage Back-to-Back Centrifugal Compressor
11 — Permanent Magnet Motor (hidden)
12 — Evaporator
13 — Magnetic Bearing System
14 — Interstage Compressor Piping
15 — VFD (Variable Frequency Drive)

* Third-party trademarks and logos are property of their respective owners.



LEGEND
1 — Dual Inlet Guide Vane Actuators
2 — Condenser Dual Relief Valves
3 — Evaporator Dual Relief Valves
4 — Evaporator Waterbox
5 — Leaving Evaporator Nozzle
6 — Entering Evaporator Nozzle
7 — ASME Nameplates
8 — Entering Condenser Nozzle
9 — Condenser Waterbox
10 — Leaving Condenser Nozzle
11 — Main Circuit Breaker
12 — Dual Electronic Expansion Valves
13 — VFD (Variable Frequency Drive)
14 — Condenser Sight Glasses
15 — Strainer
16 — E-stop
17 — Integrated Power and Control Panel
18 — Condenser

Physical data

19MV chiller weight

The weight of a 19MV chiller is best obtained by running the chiller selection software. The 19MV has an extensive number of possible combinations of evaporators (including tubing type and length), condensers (including tubing type and length), waterbox types (taking into account heat exchanger passes), compressors, motors, and system accessories. The 19MV selection software will determine the rigging weight, operating weight, corner weight, and spring deflection (if applicable) of any configured unit. Due to rigging and installation considerations, there are times when it becomes necessary to determine the contribution of individual components that comprise the chiller. For these situations, a detailed component breakdown is provided in the 19MV Installation Instructions.

Options and accessories

ITEM	OPTION (FACTORY-INSTALLED)	ACCESSORY (FIELD-INSTALLED)
2 Pass Evaporator Water-Side Construction	X	
2 Pass Condenser Water-Side Construction	X	
Thermal Insulation (except Waterbox Covers)	X	
Marine Waterboxes 150 psig (1034 kPa)[a]	X	
Flanged Evaporator and/or Condenser Waterbox Nozzles[b]	X	
Economizer Assembly (refrigerant circuit)	X	
0.025, 0.028, 0.035 in. (0.635, 0.711 or 0.889 mm) Internally, Externally Enhanced Copper Tubing – Evaporator	X	
0.025, 0.028, 0.035 in. (0.635, 0.711 or 0.889 mm) Internally, Externally Enhanced Copper Tubing – Condenser	X	
Roller Element Bearing (19MV3 Only)	X	
High Tier VFD (for Harmonic Mitigation) (19MV3 Only)	X	
Customer Factory Performance Testing	X	
Extended Warranty (North America only)	X	
BluEdge Service Agreement		X
BluEdge Digital		X
Soleplate Package		X
Spring Isolator		X
Multiple Chiller System Remote Temperature Sensor		X
Freestanding Harmonic Filter		X

NOTE(S):

a. Optional marine waterboxes are available for 19MV, 2 pass only. Standard waterboxes for 19MV are nozzle-in-head type, 150 psig (1034 kPa).
b. Standard waterbox nozzles are Victaulic type. Flanged nozzles are available as an option with either nozzle-in-head type waterboxes or marine waterboxes.

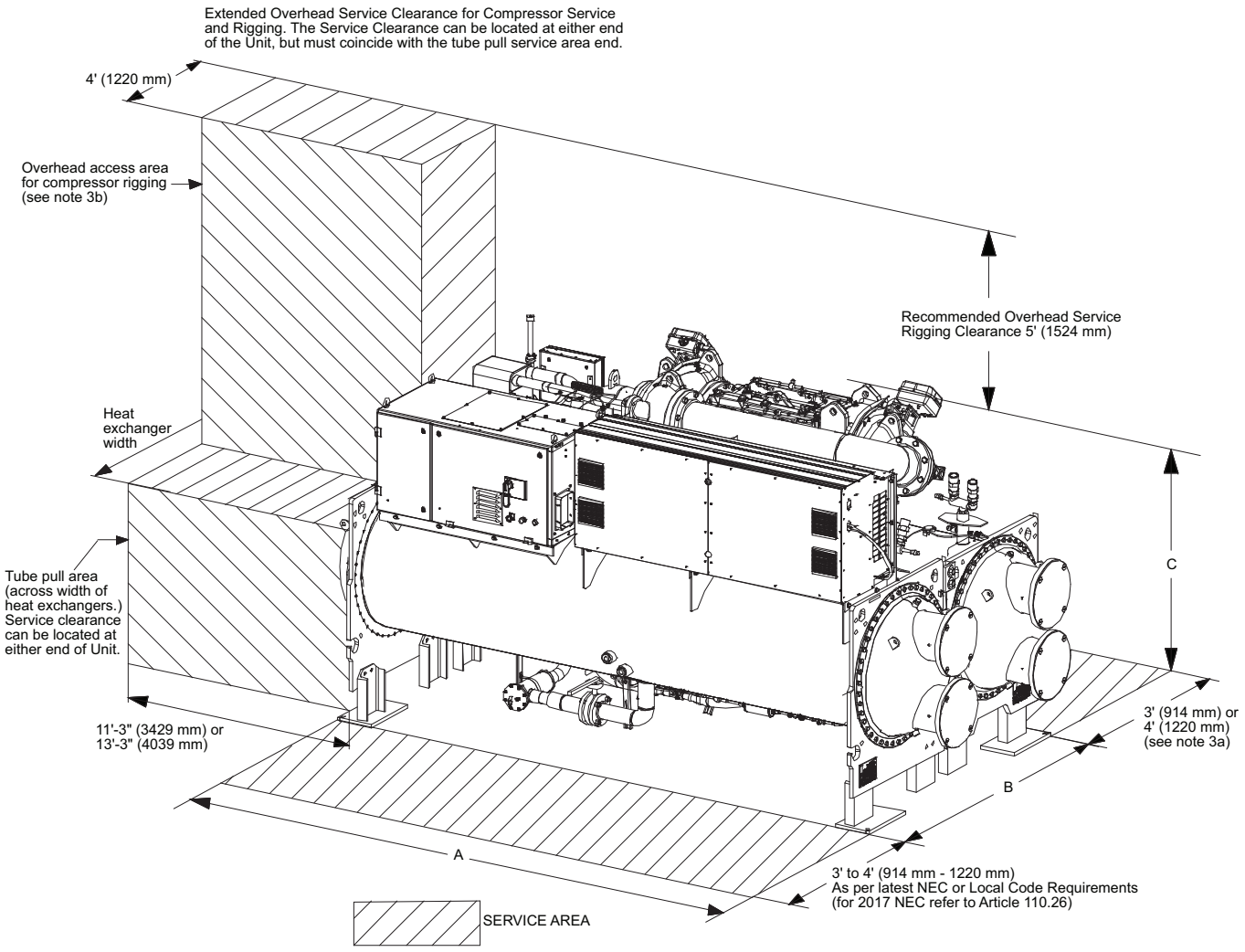
Unit-Mounted VFD Features and Options[a]

ITEM	STANDARD (S) / OPTIONAL (O)
Microprocessor Based Overload Trip Protection	S
Main Power Fuse	S: 100kA
Phase Loss/Reversal Imbalance Protection	S
Three-Phase Ground Fault Protection	S
Three-Phase Over/Under Voltage Protection	S
Lightning Surge Arrestor (MOV)	O
Harmonic Mitigation	O

NOTE(S):

a. Low voltage: phase to phase and phase to ground.

19MV Recommended Clearances — Standard Tier Option



LEGEND

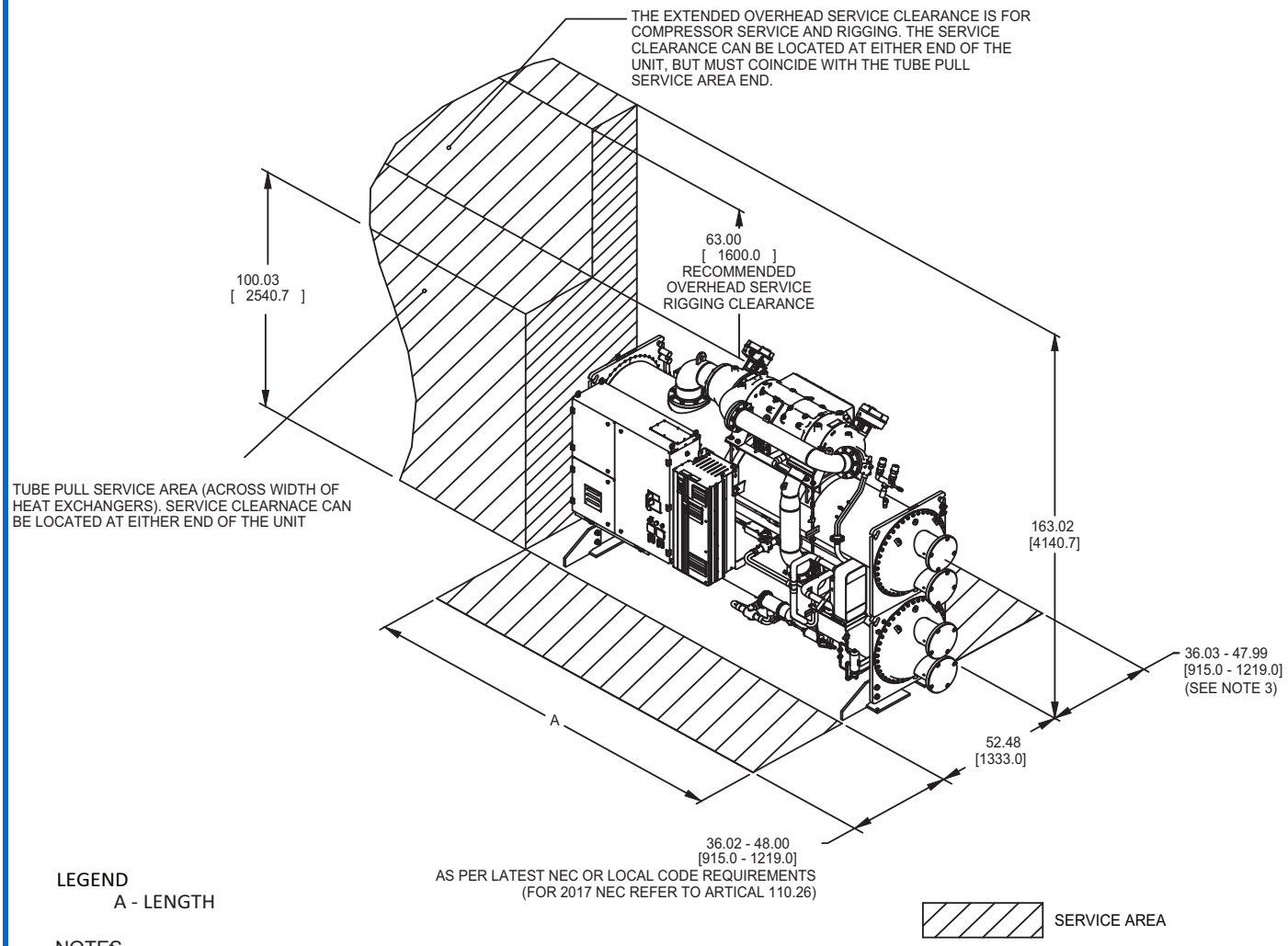
A — Length
B — Width
C — Height

NOTES:

1. Dished head (NIH) waterbox shown.
2. Service areas are minimum space required.
3. For compressor service either:
   a. Allow 4' (1220 mm) on the evaporator side of the chiller.
   b. Provide free space above the tube pull area equal to the height of chiller plus 5' (1524 mm). The overhead rigging space will allow the tube pull area to be utilized for service and must therefore coincide with the tube pull service area end.
4. For actual unit dimensions, contact your Carrier sales professional for certified drawings.

Dimensions (cont)

19MV2 Recommended Clearances — Standard Tier Option



LEGEND

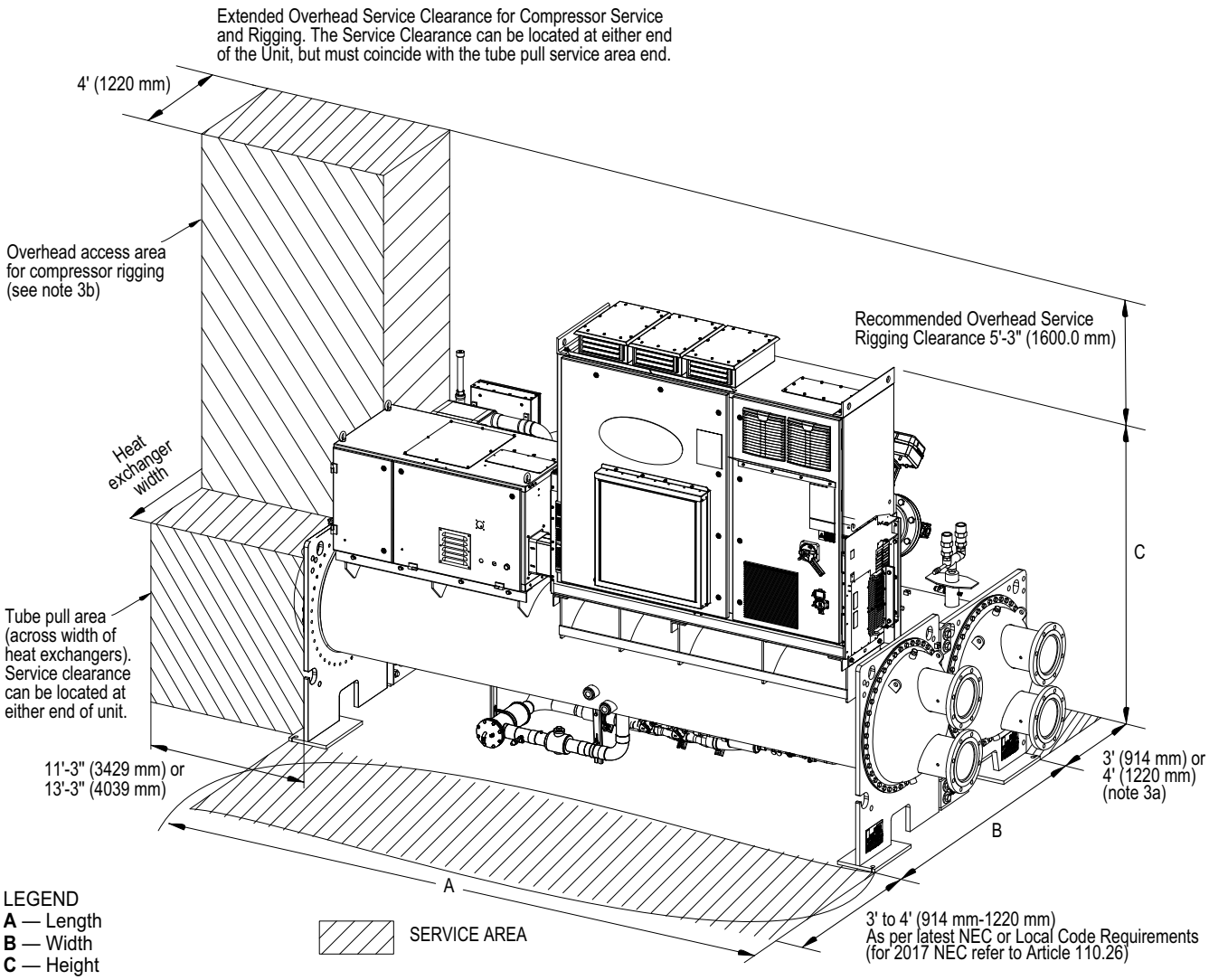
A - LENGTH

NOTES:

1. Dished head (NIH) waterbox shown.
2. Service areas are minimum space required.
3. Allow 48" [1219mm] on either side of the chiller.
4. Provide free space above the tube pull area equal to the height of the chiller plus 63" [1600mm] The overhead rigging spacewill allow the tube pull area to be utilized for service area.
5. For actual unit dimensions, contact your Carrier sales professional for certified drawings.

Dimensions (cont)

19MV Recommended Clearances — High Tier Option



LEGEND
A — Length
B — Width
C — Height

NOTES:
1. For reference, unit shown is HighTier VFD.
2. Dished head (NIH) waterbox shown.
3. Service areas are minimum space required.
4. For compressor service either:
   a. Allow 4' (1220 mm) on the evaporator side of the chiller.
   b. Provide free space above the tube pull area equal to the height of chiller plus 5' (1524 mm). The overhead rigging space will allow the tube pull area to be utilized for service and must therefore coincide with the tube pull service area end.
5. For actual unit dimensions, contact your Carrier sales professional for certified drawings.

Nozzle Size

FRAME SIZE	TYPE	DESIGN PRESSURE	PASSES	NOMINAL PIPE SIZE (in.)		ACTUAL PIPE ID (in.)	
				EVAPORATOR	CONDENSER	EVAPORATOR	CONDENSER
2	NIH	150	2	8	8	7.981	7.981
	MARINE	150	2	6	6	6.065	6.065
3	NIH	150	2	8	8	7.981	7.981
	MARINE	150	2	8	8	7.981	7.981
4	NIH	150	2	8	8	7.981	7.981
	MARINE	150	2	8	8	7.981	7.981
5	NIH	150	2	10	10	10.02	10.02
	MARINE	150	2	10	10	10.02	10.02

Selection procedure

The 19MV chiller can be tailored to the specific requirements of a given application. Please contact your local Carrier representative for a selection. The NG eCAT selection software analyzes many factors, including specific temperature, fluid type, and flow requirements to automatically configure the chiller's heat exchanger size, compressor aerodynamic model, and electrical sizing to deliver a chiller optimized to the job requirements.

Heat exchangers

Flow rate

If the evaporator flow is variable, the rate of change of flow should not exceed 30% per minute.

Water quality

Please consult your local Carrier representative and/or a local water quality expert.

Microprocessor controls

The microprocessor control system matches the capacity of the chiller to the cooling load while providing state-of-the-art chiller protection. The microprocessor-based control center protects the chiller by monitoring the digital and analog inputs and executing capacity overrides or safety shutdowns as necessary.

The system controls cooling load within the set point (plus or minus the dead band) by sensing the water or brine temperature and regulating the inlet guide vanes and regulating VFD speed.

Features

Control system

The control system on each 19MV centrifugal chiller is native BACnet, 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 seamlessly integrates with Carrier's i-Vu Building Automation Control System, supporting BACnet and Carrier Comfort Network (CCN) communication protocols. The PIC6 control system consists of one main control board and up to four IOBs (input/output board modules). All boards communicate via an internal LEN bus. The main control board is supplied from a 24 vac supply reference to earth ground. In the event of a power supply interrupt, the unit can restart automatically without the need for an external command. However, any faults active when the supply is interrupted are saved, and may in certain cases prevent a circuit or unit from restarting. IOBs are supplied from a 24 vac supply reference to earth ground. Always separate communication cables from other cables and always run wiring as directly as possible.

Sensors

Pressure transducers

Pressure transducers measure and control the pressures in the unit. These electronic sensors deliver 0 to 5 vdc. The transducers can be calibrated through the controller. The pressure transducers are connected to the IOBs. See the Pressure Transducers table.

Pressure Transducers

PRESSURE	TRANSDUCER PURPOSE
Evaporator	Measure Evaporator Pressure
Condenser	Measure Condenser Pressure
Economizer	Measure Economizer Pressure

Temperature sensors

The system uses electronic sensors to measure and control the temperatures in the unit. There are three types of temperature sensors: 5K thermistor, 10K thermistor, and RTD (resistance temperature detector), 100 ohm, 3-wire based on IOB channel configurations. The temperature sensor range is –40°F (–40°C) to 245°F (118°C). See the Temperature Sensors table.

Temperature Sensors

TEMPERATURE SENSOR	PURPOSE
Entering Chilled Water	Measure Entering Evaporator Water Temperature
Leaving Chilled Water	Measure Leaving Evaporator Water Temperature
Entering Condenser Water	Measure Entering Condenser Water Temperature
Leaving Condenser Water	Measure Leaving Condenser Water Temperature
Evaporator Refrigerant Liquid	Measure Evaporator Refrigerant Liquid Temperature
Compressor Discharge	Measure Compressor Discharge Temperature
Radial Bearing Temp Sensor	Measure Radial Bearing Temperature
Inboard Thrust Bearing Temp Sensor	Measure Inboard Thrust Bearing Temperature
Outboard Thrust Bearing Temp Sensor	Measure Outboard Thrust Bearing Temperature
Bearing Controller Temp Sensor	Measure Bearing Controller Temperature
Motor Winding Temperature Sensors	Measure Temperature Of Compressor Motor Windings
Oil Sump Temp Sensor[a]	Measure Oil Sump Temperature
Bearing oil supply temperature[a]	Measure Oil Sump Discharge Temperature

NOTE(S):

a. 19MVR option only.

Controls (cont)

Controls outputs

Evaporator/condenser water pump

The controller can stop and start an evaporator/condenser water pump.

Inlet guide vanes

The inlet guide vanes adjust the refrigerant vapor flow into the compressor to adapt to change in the operating conditions of the machine. To adjust the refrigerant flow, the guide vanes open or close to vary the cross-section of the refrigerant path. The high degree of accuracy with which the guide vanes are positioned ensures that the flow of refrigerant is precisely controlled.

Expansion control system valve

The expansion control system valve is set in conjunction with dual EXVs to ensure smooth, proper operation as the chiller unloads across its operating profile.

VFD

The VFD modifies motor voltage input and frequency to allow the chiller to react to changing lift conditions. Additionally, it allows compressor start-up and, along with inlet guide vanes, provides capacity control.

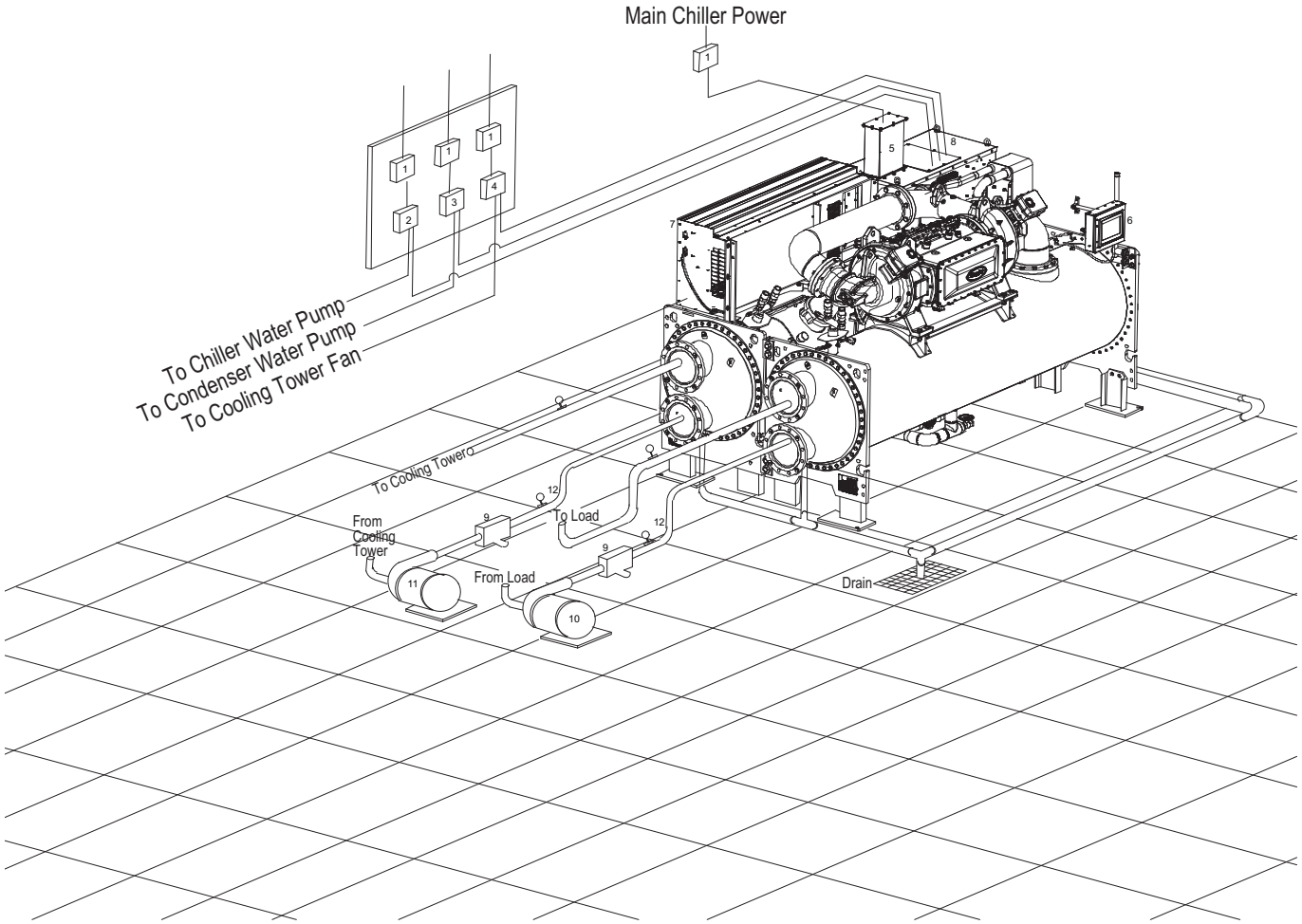
Safety cutouts

- Guide vane calibration not completed
- Guide vane fault
- High bearing temperature
- High motor temperature
- High discharge temperature
- Low refrigerant temperature
- High evaporator pressure
- Under voltage
- Over voltage
- Intermittent power loss
- VFD configuration conflict
- High pressure switch
- Low liquid level
- Compressor starter faults
- Compressor surge protection
- Evaporator freeze protection
- Ground fault

User interface and web connection

The PIC6 Human Machine Interface (HMI) is a color 10.4 in. touch screen. Navigation is either direct from the touch screen interface or by connecting to a web interface at the Ethernet IP port of the controller. The navigation menus are the same for both connection methods. To access the PIC6 user interface, enter the IP address of the unit in the address bar of your web browser. The IP address can be viewed or changed from the PIC6 interface.

19MV Chiller with Unit-Mounted VFD Diagram — Standard Tier Option



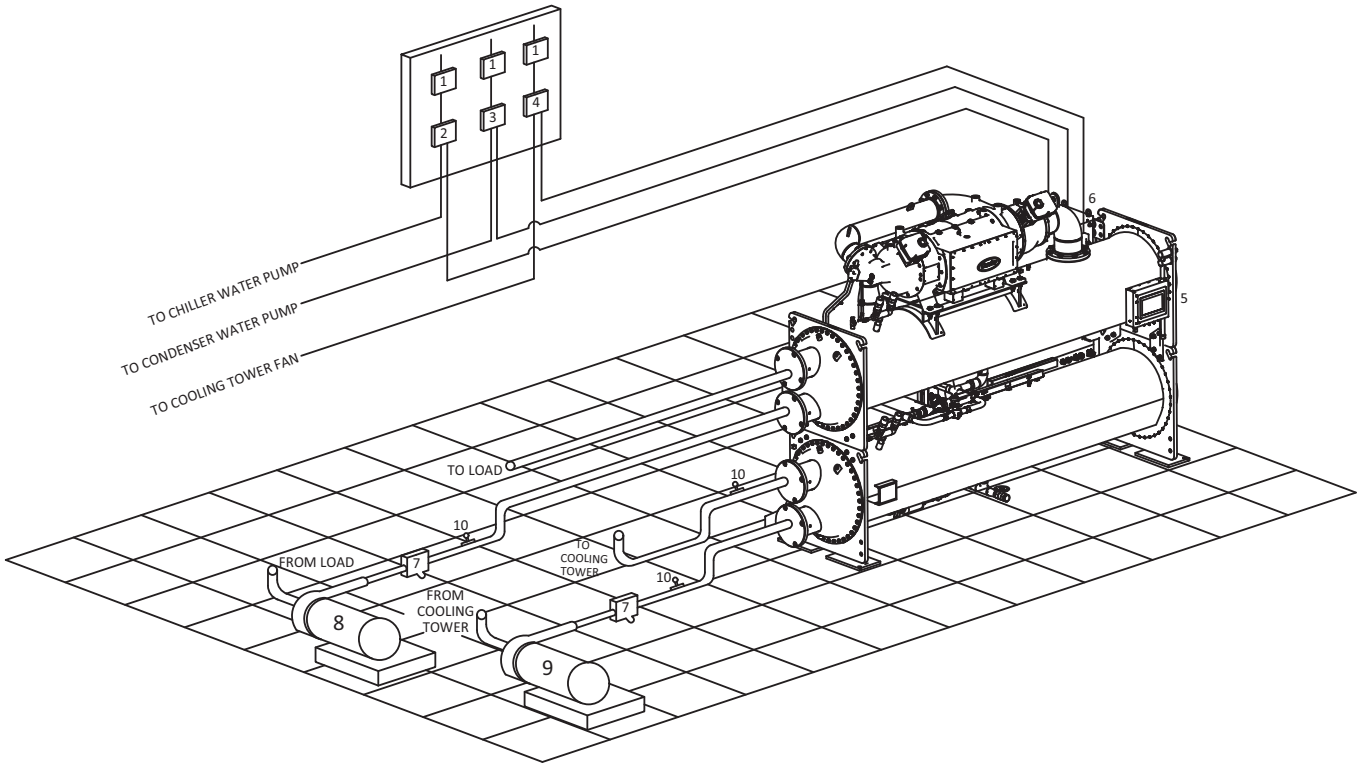
LEGEND

1	—	Disconnect
2	—	Chilled Water Pump Starter
3	—	Condenser Water Pump Starter
4	—	Cooling Tower Fan Starter (Low Fan, High Fan)
5	—	Tophat
6	—	HMI
7	—	Unit-Mounted VFD
8	—	Power Panel
9	—	Strainers
10	—	Chilled Water Pump
11	—	Condenser Water Pump
12	—	Pressure Gauges
13	—	Local Disconnect (hidden - in power panel)
		Piping

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. Wiring not shown for optional devices such as:
   - Remote Start/Stop
   - Remote Alarms
   - Optional Safety Device
   - 4 to 20 mA Resets
   - Optional Remote Sensors
4. IMPORTANT: Carrier suggests that a structural engineer be consulted if transmission of vibrations from mechanical equipment is of concern.
5. Isolation valves are recommended on the evaporator and condenser water piping to each chiller for service.
6. Operating environment — Chiller should be installed in an indoor environment where the ambient temperature is 40 to 104°F (4 to 40°C) with a relative humidity (non-condensing) of 95% or less. To ensure that electrical components operate properly, do not locate the chiller in an area exposed to dust, dirt, corrosive fumes, or excessive heat and humidity.
7. Disconnection must be incorporated in the fixed wiring in accordance with local country-specific requirements or NFPA (National Fire Protection Association).
8. Tophat is shipped loose and field assembled.
9. Strainers are typically located on the suction side of the water pumps. It is acceptable to install strainers on either side of the pump.
10. For R-1234ze(E) guidelines please refer to service and installation manuals.

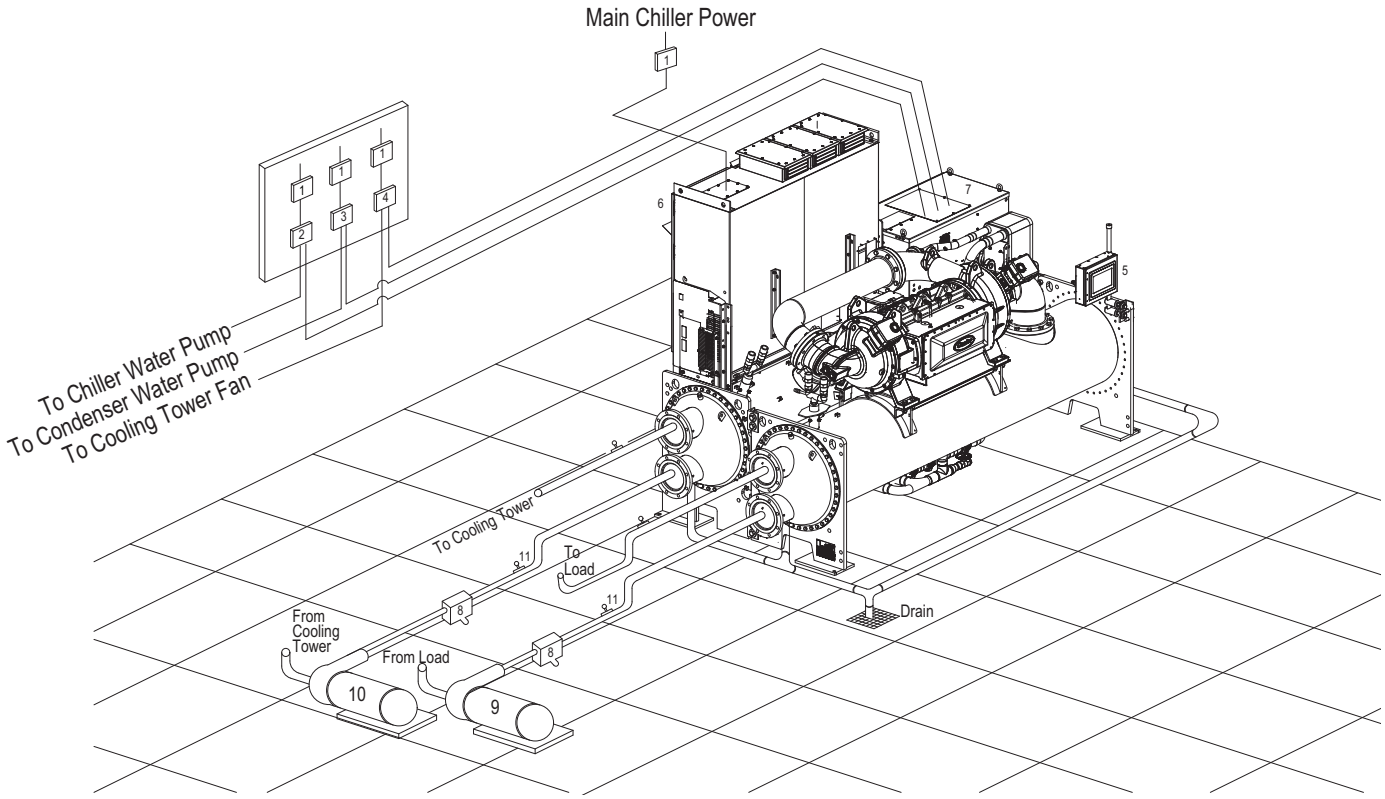
19MV2 Chiller with Unit-Mounted VFD Diagram — Standard Tier Option



LEGEND
1 — Disconnect
2 — Chilled Water Pump Starter
3 — Condenser Water Pump Starter
4 — Cooling Tower Fan Starter (Low Fan, High Fan)
5 — HMI
6 — Power Panel
7 — Strainer
8 — Chilled Water Pump
9 — Condenser Water Pump
10 — Pressure Gages
11 — Local Disconnect (hidden - in power panel)
Piping

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. Wiring not shown for optional devices such as:
   (a) Remote Start/Stop
   (b) Remote Alarms
   (c) Optional Safety Device
   (d) 4 to 20 mA Resets
   (e) Optional Remote Sensors
4. IMPORTANT: Carrier suggests that a structural engineer be consulted if transmission of vibrations from mechanical equipment is of concern.
5. Isolation valves are recommended on the evaporator and condenser water piping to each chiller for service.
6. Operating environment — Chiller should be installed in an indoor environment where the ambient temperature is 40 to 104°F (4 to 40°C) with a relative humidity (non-condensing) of 95% or less. To ensure that electrical components operate properly, do not locate the chiller in an area exposed to dust, dirt, corrosive fumes, or excessive heat and humidity.
7. Disconnection must be incorporated in the fixed wiring in accordance with the local country- specific requirements or NFPA (National Fire Protection Association).
8. Tophat is shipped loose and field assembled.
9. Strainers are typically located on the suction side of the water pumps. It is acceptable to install strainers on either side of the pump.

19MV Chiller with Unit-Mounted VFD Diagram — High Tier Option



LEGEND

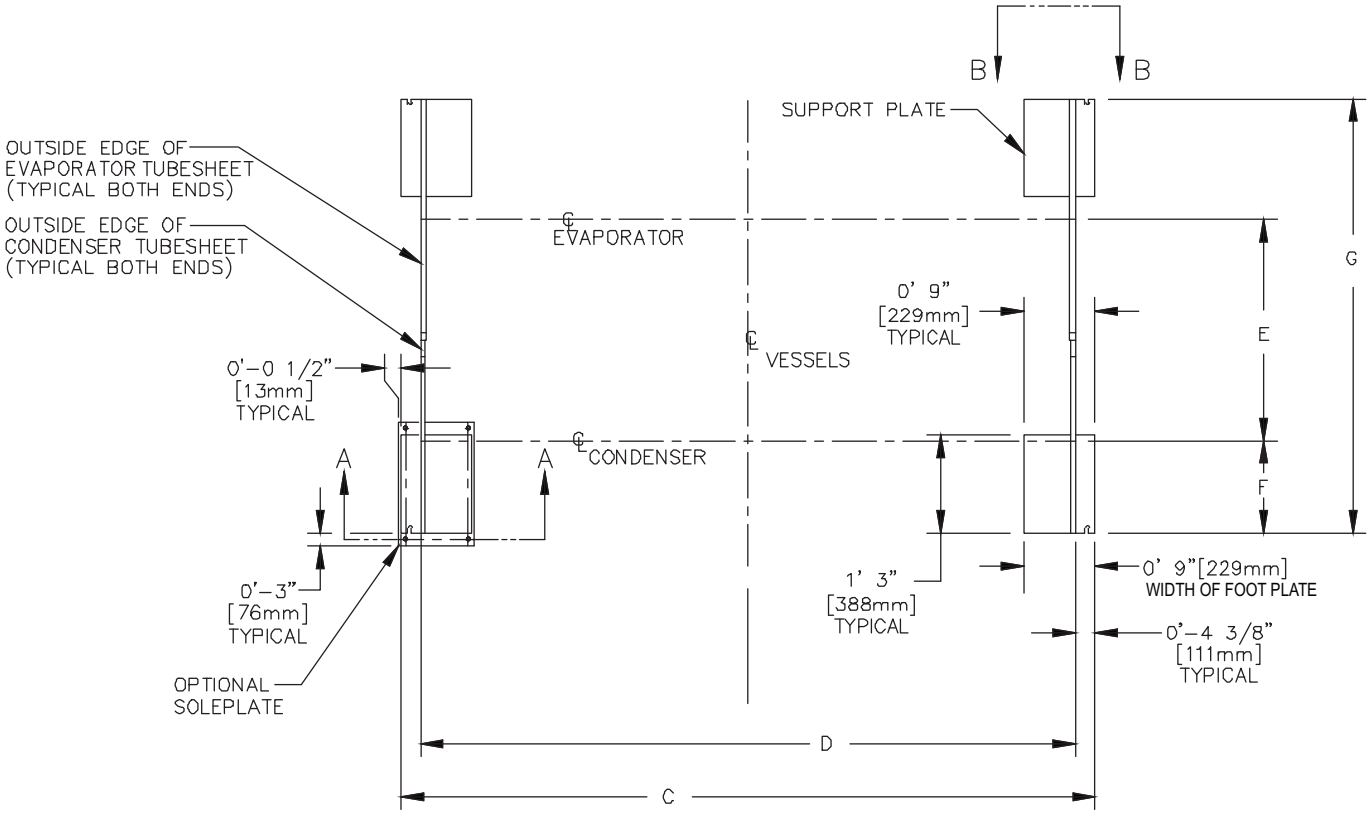
1	—	Disconnect
2	—	Chilled Water Pump Starter
3	—	Condenser Water Pump Starter
4	—	Cooling Tower Fan Starter (Low Fan, High Fan)
5	—	HMI
6	—	Unit-Mounted VFD
7	—	Control Panel
8	—	Strainers
9	—	Chilled Water Pump
10	—	Condenser Water Pump
11	—	Pressure Gauges
12	—	Local Disconnect (hidden - in power panel)
		Piping

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. Wiring not shown for optional devices such as:
   - Remote Start/Stop
   - Remote Alarms
   - Optional Safety Device
   - 4 to 20 mA Resets
   - Optional Remote Sensors
4. IMPORTANT: Carrier suggests that a structural engineer be consulted if transmission of vibrations from mechanical equipment is of concern.
5. Isolation valves are recommended on the evaporator and condenser water piping to each chiller for service.
6. Operating environment — Chiller should be installed in an indoor environment where the ambient temperature is 40 to 104°F (4 to 40°C) with a relative humidity (non-condensing) of 95% or less. To ensure that electrical components operate properly, do not locate the chiller in an area exposed to dust, dirt, corrosive fumes, or excessive heat and humidity.
7. Disconnection must be incorporated in the fixed wiring in accordance with local country-specific requirements or NFPA (National Fire Protection Association).
8. Tophat is shipped loose and field assembled.
9. Strainers are typically located on the suction side of the water pumps. It is acceptable to install strainers on either side of the pump.

Application data (cont)

19MV Two-Stage Compressor Machine Footprint



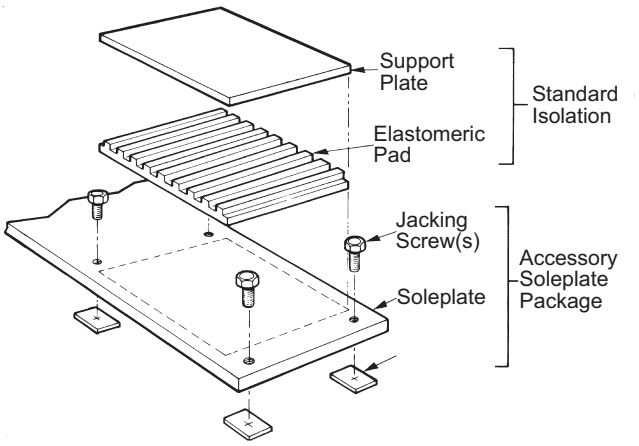
19MV HEAT EXCHANGER SIZE										
FRAME	DIMENSION C		DIMENSION D		DIMENSION E		DIMENSION F		DIMENSION G	
	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm
2	11' - 9-1/4"	3588	11' - 2"	3404	0	0	1' - 6-3/4"	475	3' - 1-3/8"	950
	13' - 9-1/4"	4198	13' - 2"	4013	0	0	1' - 6-3/4"	475	3' - 1-3/8"	950
3	11' - 9-1/4"	3588	11' - 2"	3404	2' - 11"	889	1' - 5-1/8"	435	5' - 10"	1778
	13' - 9-1/4"	4198	13' - 2"	4013	2' - 11"	889	1' - 5-1/8"	435	5' - 10"	1778
4	11' - 9-1/4"	3588	11' - 2"	3404	2' - 11"	889	1' - 4-3/4"	425	5' - 10"	1778
	13' - 9-1/4"	4198	13' - 2"	4013	2' - 11"	889	1' - 4-3/4"	425	5' - 10"	1778
5	11' - 9-1/4"	3588	11' - 2"	3404	3' - 3-1/4"	997	1' - 8"	997	7' - 6-1/2"	1994
	13' - 9-1/4"	4198	13' - 2"	4013	3' - 3-1/4"	997	1' - 8"	997	7' - 6-1/2"	1994

NOTES:

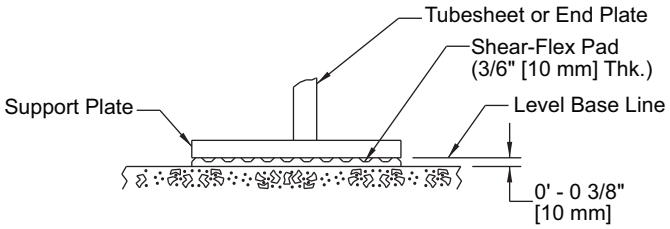
1. View A-A refers to accessory soleplate. See page 24.
2. View B-B refers to standard support plate. See page 24.
3. C dimension is measured from actual edge of footplate.
4. D dimension is measured from outside edge to outside edge of tubesheets.
5. E dimension is measured from center line to center line.
6. F dimension is measured from edge of tubesheets (extends past footplate). See certified drawings for actual maximum width.
7. G dimensions are from outermost edge of tubesheets (tubesheet extends slightly past footplate).

19MV Isolation with Accessory Soleplate Package

TYPICAL ISOLATION



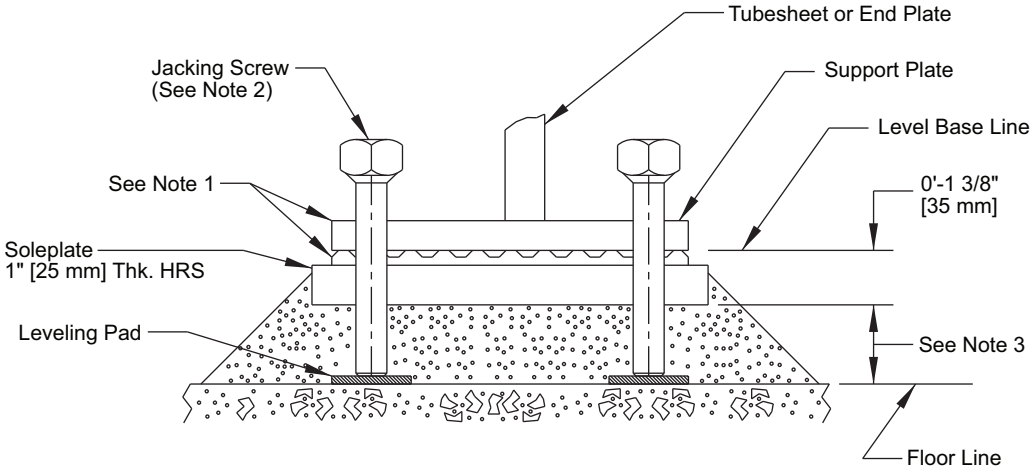
STANDARD ISOLATION



VIEW B-B

ISOLATION WITH STANDARD PACKAGE ONLY

NOTE: Isolation package includes 4 Shear-Flex isolation pads.



VIEW A-A

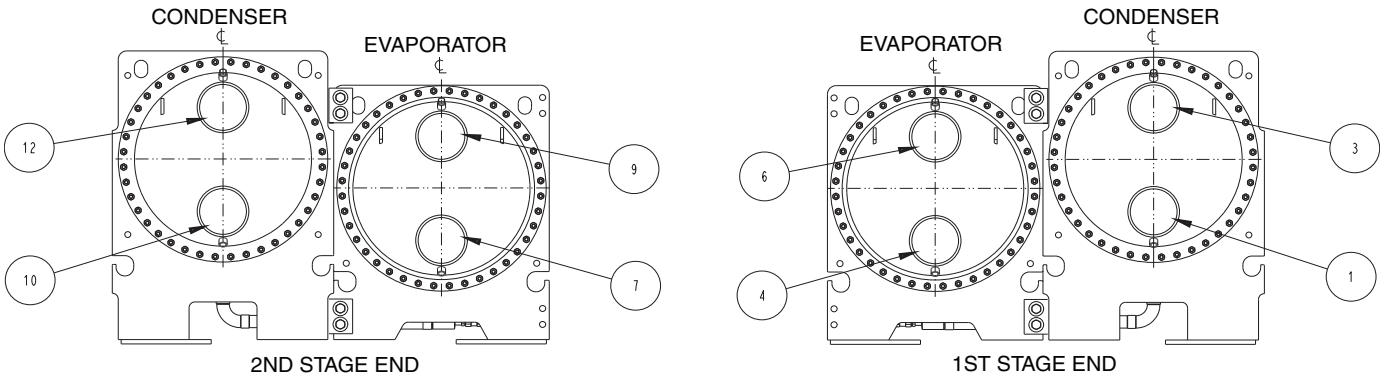
NOTES:

1. Optional soleplate package includes 4 soleplates, 16 jacking screws, and 16 leveling pads. Isolation package is also required.
2. Jacking screws to be removed after grout has set.
3. Thickness of grout will vary, depending on the amount necessary to level chiller. Use Ceilcote®[1] 748 OR MasterFlow™[1] 885, 1-1/2 in. (38.1 mm) to 2-1/4 in. (57 mm) thick. Both grouts have minimum shrinkage. MasterFLow is premixed.
4. For R-1234ze(E) guidelines please refer to service and installation manuals.

1. Third-party trademarks and logos are property of their respective owners.

Application data (cont)

19MV Nozzle Arrangements Nozzle-in-Head Waterboxes



NOZZLE ARRANGEMENT CODES FOR NOZZLE-IN-HEAD WATERBOXES

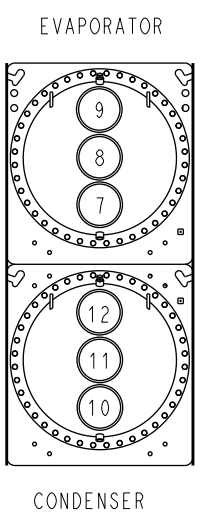
EVAPORATOR WATERBOXES[a]			
PASS	In	Out	Arrangement Code[b]
2	7	9	C
	4	6	D

CONDENSER WATERBOXES[a]			
PASS	In	Out	Arrangement Code[b]
2	10	12	R
	1	3	S

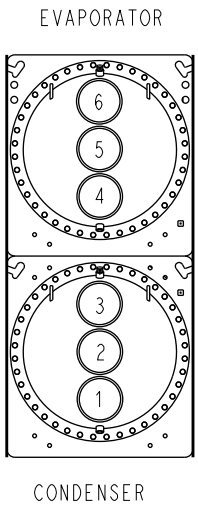
NOTE(S):

a. Vents and drains are 3/4 in., FPT, located on waterbox head.
b. Refer to certified drawings.

19MV2 Nozzle Arrangements Nozzle-in-Head Waterboxes



2nd Stage End



1st Stage End

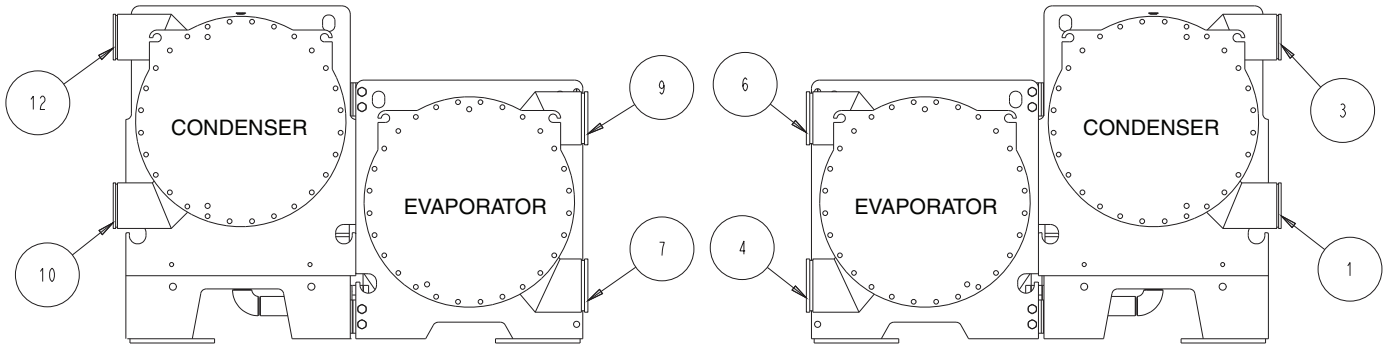
NOZZLE ARRANGEMENT CODES FOR NOZZLE-IN-HEAD WATERBOXES

EVAPORATOR WATERBOXES			
PASS	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

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

Application data (cont)

19MV Nozzle Arrangements Marine Waterboxes



2ND STAGE END

1ST STAGE END

NOZZLE ARRANGEMENT CODES FOR MARINE WATERBOXES

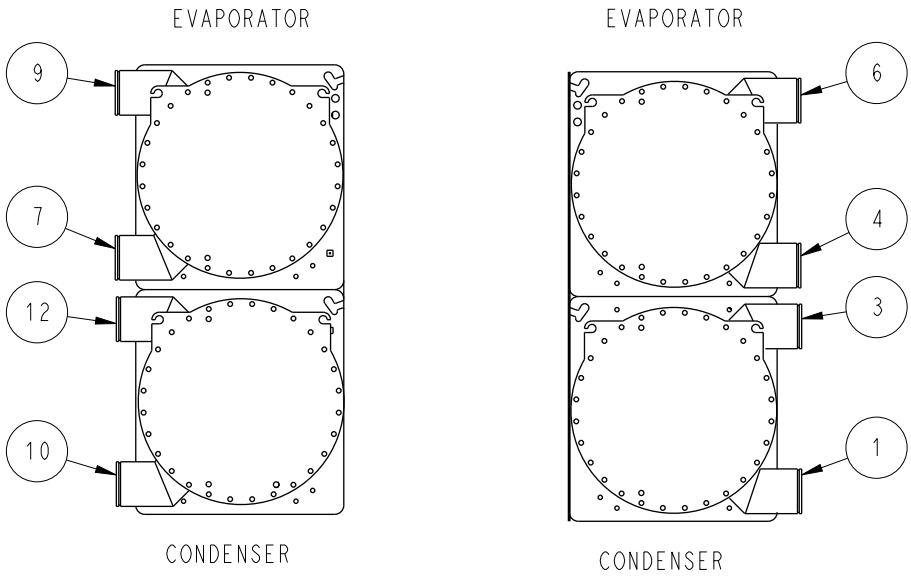
EVAPORATOR WATERBOXES[a]			
PASS	In	Out	Arrangement Code[b]
2	7	9	C
	4	6	D

CONDENSER WATERBOXES[a]			
PASS	In	Out	Arrangement Code[b]
2	10	12	R
	1	3	S

NOTE(S):

a. Vents and drains are 3/4 in., FPT, located on waterbox head.
b. Refer to certified drawings.

19MV2 Nozzle Arrangements Marine Waterboxes



2nd Stage End

1st Stage End

NOZZLE ARRANGEMENT CODES FOR MARINE WATERBOXES

EVAPORATOR WATERBOXES[a]			
PASS	In	Out	Arrangement Code[b]
1	9	6	A
	6	9	B
2	7	9	C
	4	6	D
3	7	6	E
	4	9	F

CONDENSER WATERBOXES[a]			
PASS	In	Out	Arrangement Code[b]
1	12	3	P
	3	12	Q
2	10	12	R
	1	3	S

NOTE(S):

a. Vents and drains are 3/4 in., FPT, located on waterbox head.
b. Refer to certified drawings.

Application data (cont)

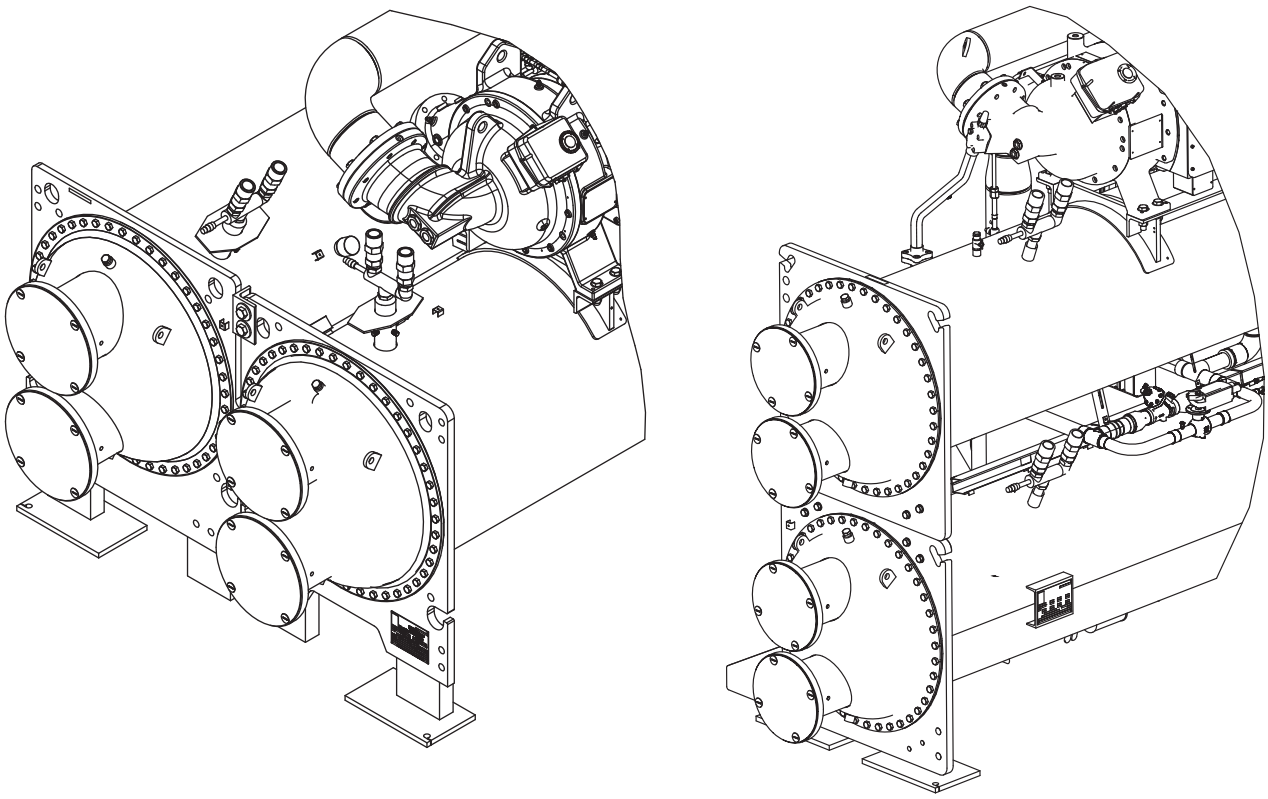
Relief Valve Locations[a]

LOCATION	FRAME SIZE	PRESSURE RELIEF DEVICE OUTLET SIZE
EVAPORATOR	2, 3, 4, 5	2 x 1-1/4 in. NPT Female Connector (installed with transfer valve)
CONDENSER		2 x 1-1/4 in. NPT Female Connector (installed with transfer valve)

NOTE(S):

a. All valves relieve at 185 psig (1275 kPa).

Relief Device Arrangements



Application data (cont)

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 gauges be provided at points of entering and leaving water to measure pressure drop through the heat exchanger. Gauges may be installed as shown in Pressure Gauge Location table. Pressure gauges installed at the vent and drain connections do not include nozzle pressure losses.

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

Pressure Gauge Location

NUMBER OF PASSES	GAUGE LOCATION (EVAPORATOR OR CONDENSER)
2	Two gauges in waterbox with nozzles

ASME stamping

All 19MV heat exchangers are constructed in accordance with ASHRAE (American Society of Heating, Refrigerating, 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 vessel is constructed and certified in accordance with ASME Section 8, Division 1.

Relief valve discharge pipe sizing

See page 27 for number of relief valves and locations.

Relief valve discharge piping size should be calculated per ASHRAE 15, latest edition, using the tabulated C factors for each vessel shown in the Rupture Disc Discharge Pipe Sizing table.

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.

Relief Valve Discharge Pipe Sizing

HEAT EXCHANGER	FRAME SIZE	REQUIRED C FACTOR R-134a [LBM AIR / MIN]	REQUIRED C FACTOR R-513A R-515B R1234ZE(E) [LBM AIR / MIN]	RATED C FACTOR [LBM AIR / MIN]	FIELD CONNECTION SIZE in. [FPT]
EVAPORATOR	21E to 21N	39.6	36.1	70.8	1-1/4
	23E to 23N	46.7	42.6	70.8	1-1/4
	31B to 31N	39.5	36.0	70.8	1-1/4
	33B to 33N	46.5	42.4	70.8	1-1/4
	41B to 41N	45.8	41.8	70.8	1-1/4
	43B to 43N	54.0	49.3	70.8	1-1/4
	51B to 51N	48.8	44.5	70.8	1-1/4
	53B to 53N	57.5	52.5	70.8	1-1/4
	31O to 31Z	39.5	36.0	70.8	1-1/4
	33O to 33Z	46.5	42.4	70.8	1-1/4
	41O to 41Z	45.8	41.8	70.8	1-1/4
	43O to 43Z	54.0	49.3	70.8	1-1/4
	51O to 51Z	48.8	44.5	70.8	1-1/4
	53O to 53Z	57.5	52.5	70.8	1-1/4
CONDENSER	21K to 21P	37.8	34.5	70.8	1-1/4
	23K to 23P	44.6	40.7	70.8	1-1/4
	31B to 31N	37.6	34.3	70.8	1-1/4
	33B to 33N	44.3	40.4	70.8	1-1/4
	41B to 41N	42.8	39.1	70.8	1-1/4
	43B to 43N	50.5	46.1	70.8	1-1/4
	51B to 51N	46.5	42.4	70.8	1-1/4
	53B to 53N	54.9	50.1	70.8	1-1/4

Application data (cont)

Design pressures

Design and test pressures for heat exchangers are listed below.

Design and Test Pressures for Heat Exchangers

VESSEL PRESSURES		SHELL SIDE (REFRIGERANT)		STANDARD TUBE SIDE (WATER)		OPTIONAL TUBE SIDE (WATER)	
		psig	kPa	psig	kPa	psig	kPa
EVAPORATOR	Design	185	1276	150	1034	300	2068
	Leak Test (min)	185	1276	150	1034	300	2068
	Hydrostatic Test	—	—	195	1344	390	2690
	Proof Test (min Pneumatic)	204	1407	—	—	—	—
CONDENSER	Design	185	1276	150	1034	300	2068
	Leak Test (min)	185	1276	150	1034	300	2068
	Hydrostatic Test	—	—	195	1344	390	2690
	Proof Test (min Pneumatic)	204	1407	—	—	—	—
ECONOMIZER	Design	185	1276	—	—	—	—
	Leak Test (min)	185	1276	—	—	—	—
	Hydrostatic Test	—	—	—	—	—	—
	Proof Test (min Pneumatic)	204	1407	—	—	—	—

Heat Exchanger Material Specifications

ITEM	MATERIAL	SPECIFICATION
SHELL	HR Steel	ASME SA516 GR .70
TUBE SHEET	HR Steel	ASME SA516 GR .70
FLAT COVERS	HR Steel	ASME/ASTM A516 GR.70
PIPE	Steel	ASME SA106 GRB/SA53 E/B
FLANGES	Steel	ASME B16.5
TUBES	Per Job Requirement	ASME SB359
DISHED COVER	HR Steel	ASTM A516 GR.70/GB713 Q345R
MARINE WATER BOX SHELL	HR Steel	ASME/ASTM A516 GR.70

Insulation

Factory insulation (optional)

The factory insulation option for the 19MV chillers include the following areas: evaporator (not including waterbox); suction line up to the compressor suction housing; compressor motor and motor cooling return lines; motor MBC cover; the liquid line, economizer, and economizer piping.

Insulation applied at the factory is 3/4 in. (19 mm) thick and has a thermal conductivity K value of 0.28 (Btu in.)/hr ft^2 °F [(0.0404 • W)/(m • °C)]. Insulation conforms with Underwriters Laboratories (UL) Standard 94, Classification 94HBF.

Insulation at jobsite

As indicated in the Condensation vs. Relative Humidity table, the factory insulation provides excellent protection against condensation under most operating conditions. If temperatures in the equipment area exceed the maximum design conditions, extra insulation is recommended. If the machine is to be field insulated, obtain the approximate areas from the Minimum Field-Installed 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 suction housing and lower half of the condenser.

Minimum Field-Installed Insulation Requirements[a,b]

FRAME SIZE	LENGTH (in.)	INSULATION AREA (sq ft)
Frame 2	134	125
	158	135
Frame 3	134	125
	158	135
Frame 4	134	155
	158	170
Frame 5	134	170
	158	185

NOTE(S):

a. Factory installed as shown on page 30.
b. Insulation amount includes only the amount of insulation required to insulate the sections of the chiller that would be included in the factory-installed insulation option.

Condensation vs. Relative Humidity[a]

AMOUNT OF CONDENSATION	ROOM DRY-BULB TEMP		
	80°F (27°C)	90°F (32°C)	100°F (38°C)
	% RELATIVE HUMIDITY		
NONE	80	76	70
SLIGHT	87	84	77
EXTENSIVE	94	91	84

NOTE(S):

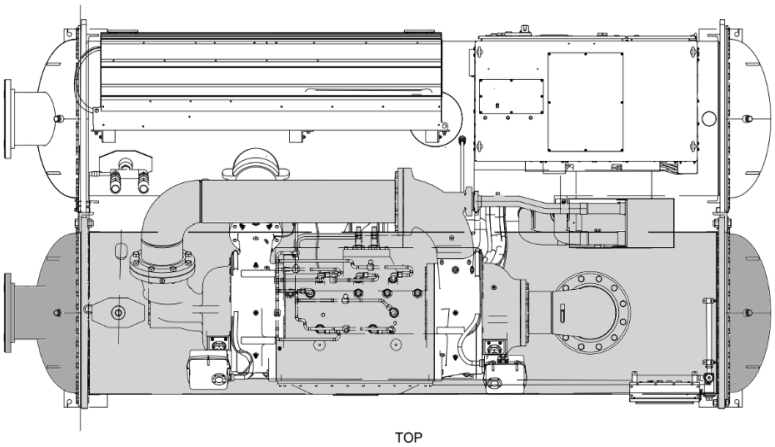
a. These approximate figures are based on 35°F (1.7°C) saturated suction temperature. A 2°F (1.1°C) change in saturated suction temperature changes the relative humidity values by 1% in the same direction.

Unit location

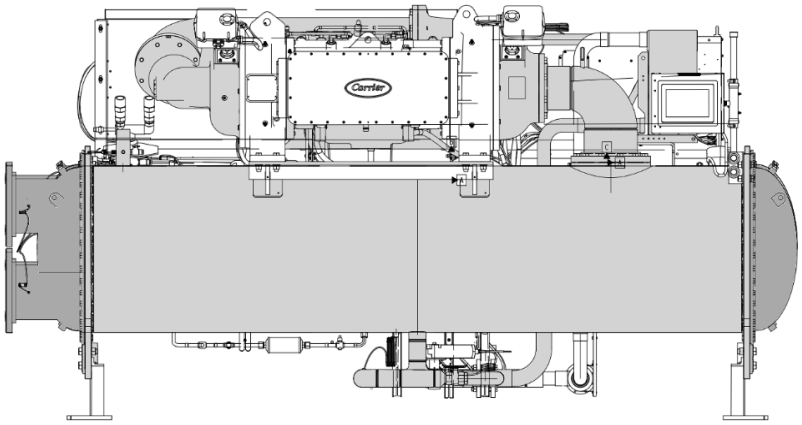
The chiller should be installed in an indoor environment where the ambient temperature is 40 to 104°F (4 to 40°C) with a relative humidity (non-condensing) of 95% or less. To ensure that electrical components operate properly, do not locate the chiller in an area exposed to dust, dirt, corrosive fumes, or excessive heat and humidity.

Application data (cont)

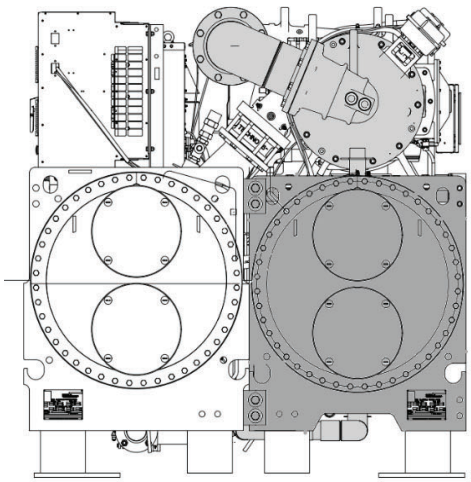
19MV Standard Insulation Area



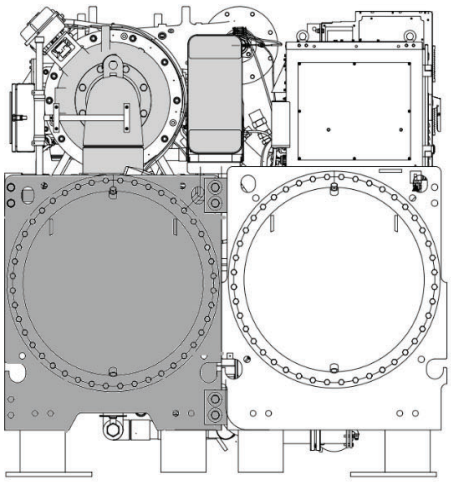
TOP



2ND STAGE FRONT 1ST STAGE



2ND STAGE END



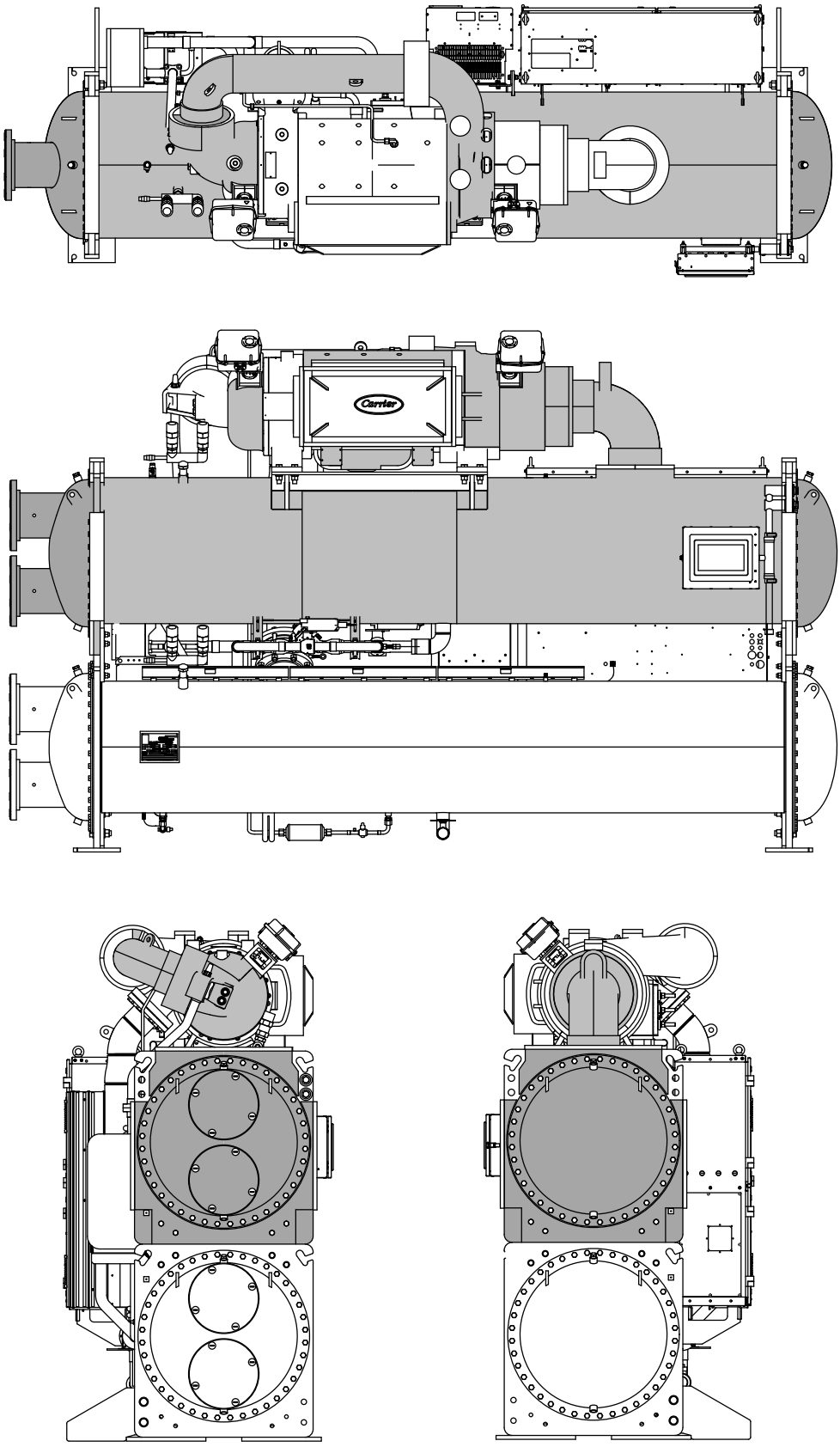
1ST STAGE END

FACTORY INSTALLED FIELD SUPPLIED AND INSTALLED

NOTE: Economized configuration optional, and shown here as reference.

Application data (cont)

19MV2 Standard Insulation Area



NOTE: Economized configuration optional, and shown here as reference.

Note about this specification:
This specification is in the "Masterformat" as published by the Construction Specification Institute. Please feel free to copy this specification directly into your building spec.

Packaged Semi-Hermetic Centrifugal Liquid Chiller

HVAC Guide Specifications — 19MV

Size Range: **19MV to 150 to 700 Nominal Tons (527 to 2,461 kW)**

Carrier Model Number: **19MV**

Part 1 — General

1.01 SYSTEM DESCRIPTION

A. Microprocessor-controlled liquid chiller shall use a semi-hermetic centrifugal compressor using refrigerant R-515B or R-513A.

B. If a manufacturer proposes a liquid chiller using R-123 or R-514A refrigerant, then the manufacturer shall include in the chiller price:

1. A vapor activated alarm system capable of responding to R-123 or R-514A levels of 10 ppm Allowable Exposure Limit (AEL).
2. External refrigerant storage tank and pumpout unit.
3. Zero emission purge unit capable of operating even when the chiller is not operating.
4. Back-up relief valve to rupture disk.
5. Chiller pressurizing system to prevent leakage of noncondensables into chiller during shutdown periods.
6. Plant room ventilation.

1.02 QUALITY ASSURANCE

A. Chiller performance shall be rated in accordance with AHRI (Air-Conditioning, Heating and Refrigeration Institute) Standard 550/590, latest edition. The chiller manufacturer, model number and refrigerant shall be listed on the AHRI.org website (www.ahridirectory.org).

B. Equipment and installation shall be in compliance with ANSI/ASHRAE (American National Standards Institute/American Society of Heating, Refrigerating and Air-Conditioning Engineers) 15 (latest edition).

C. Evaporator and condenser refrigerant side shall include ASME "U" stamp and nameplate certifying compliance with ASME Section VIII, Division 1 code for unfired pressure vessels.

D. Chiller shall be designed and constructed to meet UL (Underwriters Laboratories) and UL, Canada requirements and have labels appropriately affixed.

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

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

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

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

I. The unit-mounted VFD (variable frequency drive) shall be factory wired and tested to verify proper operation prior to shipment.

J. The management system governing the manufacture of this chiller shall be ISO 9001:2015 certified.

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 full charge of refrigerant R-515B or R-513A 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 shall be sufficiently protected from the factory against sea water corrosion to be suitable for shipment in a standard open top, ocean shipping container (19MV heat exchanger frame sizes 3 and 4 only, standard tier VFD).

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, variable frequency drive, lubrication system, evaporator, condenser, initial oil and refrigerant operating charges, microprocessor control system, and documentation required prior to start-up.

B. Compressor:

1. One high performance centrifugal compressor.
2. Compressor, motor, and transmission shall be semi-hermetically sealed into a common assembly and arranged for easy field servicing.
3. Connections to the compressor casing shall use gaskets to reduce the occurrence of refrigerant leakage. Connections to the compressor shall be flanged or bolted for easy disassembly.

4. All pressure transducers 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. Pressure transducers and temperature sensors shall be serviceable without the need for refrigerant charge removal or isolation. The high pressure switch requires pulling of the refrigerant charge before changing.
5. The 19MV– unit has magnetic bearings and backup angular contact roller element bearings. The 19MVR unit has angular contact ball bearings which control the radial and axial movement of the shaft.
6. Centrifugal compressors shall use variable inlet guide vanes to provide capacity modulation while also providing pre-whirl of the refrigerant vapor entering the impeller for more efficient compression at all loads.
7. In the 19MVR unit, centrifugal compressors shall be provided with a factory-installed lubrication system to deliver oil under pressure to bearings and transmission. Included in the system shall be:
   a. Hermetic driven oil pump with factory-installed motor contactor with overload protection.
   b. Oil pressure regulator (19MVR rolling element bearing units).
   c. Oil filter with isolation valves to allow filter change without removal of refrigerant charge (19MVR rolling element bearing units).
   d. Oil sump heater controlled from unit microprocessor (19MVR rolling element bearing units).
   e. Oil reservoir temperature sensor with main control center digital readout (19MVR rolling element bearing units).
   f. When factory-mounted compressor motor starter or VFD is provided, all wiring to oil pump, oil heater, and controls shall be prewired in the factory.
   g. Compressor shall be fully field serviceable. Compressors which must be removed and returned to the factory for service shall be unacceptable.

C. Motor:
1. Compressor motor shall be of the semi-hermetic, liquid refrigerant cooled, permanent magnet type suitable for voltage shown on the equipment schedule.
   a. On 19MVR rolling element bearing units, an oil reservoir shall collect oil and refrigerant that leaks past the seal.
   b. A float device shall be provided to open when the reservoir is full, directing the refrigerant/oil mixture back into the compressor housing.
   c. A refrigerant sensor shall be located next to the open drive seal to detect leaks.
2. Motors shall be suitable for operation in a refrigerant atmosphere and shall be cooled by atomized refrigerant in contact with the motor windings.
3. Motor stator shall be arranged for service or removal with only minor compressor disassembly and without removing main refrigerant piping connections.
4. Full load operation of the motor shall not exceed nameplate rating.
5. At least one motor winding temperature sensor (and one spare) shall be provided.
6. Should the mechanical contractor choose to provide a chiller with an open motor instead of the specified semi-hermetic motor, the contractor shall install additional cooling equipment to dissipate the motor heat as per the following formula:

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

   Btuh = (FLkW motor) (171)

   and, alternately,

   Tons = Btuh / 12,000

   The additional piping, valves, air-handling equipment, insulation, wiring, switchgear changes, ductwork, and coordination with other trades shall be the responsibility of the mechanical contractor. Shop drawings reflecting any changes to the design shall be included in the submittal, and incorporated into the final as built drawings for the project.
7. Also, if an open motor is provided, a mechanical room thermostat shall be provided and set at 104°F (40°C). If this temperature is exceeded, the chillers shall shut down and an alarm signal shall be generated to the Central Energy Management System (EMS) display module prompting the service personnel to diagnose and repair the cause of the overtemperature 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 mechanical room conditions stated above shall be considered in the determination of conformance to the scheduled chiller energy efficiency requirement.

D. Evaporator and Condenser:
1. Evaporator shall be of shell and tube type construction, each in separate shells. Units shall be fabricated with high-performance tubing, minimum 1/4 in. (6 mm) steel shell and tube sheets with fabricated steel waterboxes.
   a. Waterbox shall be nozzle-in-head waterbox (150 psig [1034 kPa]).

b. Waterbox shall have standard Victaulic grooves. Victaulic AGS grooves shall be provided for nominal 14 in. pipe and larger.

2. Condenser shall be of shell and tube type construction, each in separate shells. Units shall be fabricated with high-performance tubing, minimum 1/4 in. (6 mm) steel shell and tube sheets with fabricated steel waterboxes.
   a. Waterbox shall be nozzle-in-head (150 psig [1034 kPa]).
   b. Waterbox shall have standard Victaulic grooves. Victaulic AGS grooves shall be provided for nominal 14 in. pipe and larger.
3. Waterboxes shall have vents, drains, and covers to permit tube cleaning within the space shown on the drawings. A thermistor-type temperature sensor with quick connects shall be factory installed in each water nozzle.
4. 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.
5. Tubing shall be copper, high-efficiency type, with integral internal and external enhancement unless otherwise noted. Tubes shall be nominal 3/4 in. or 1 in. OD with nominal wall thickness of 0.025 in. measured at the root of the fin at the enhanced areas and nominal wall thickness of 0.049 in. where the tubes are in contact with the end tube sheets unless otherwise noted. Tubes shall be rolled into tube sheets and shall be individually replaceable. Tube sheet holes shall be double grooved for joint structural integrity.
6. Evaporator shall be designed to prevent liquid refrigerant from entering the compressor.
7. The condenser shell shall cool the condensed liquid refrigerant to a reduced temperature, thereby increasing the refrigeration cycle efficiency.
8. A reseating-type pressure relief valve shall be installed on each heat exchanger. If a non-reseating type is used, a backup reseating type shall be installed in series.

E. Refrigerant Flow Control:
   1. 19MV3 Only —To maintain optimal part load efficiency at high or low lift, the chiller shall utilize (2) Electronic Expansion Valves (EXVs) in the liquid line between the condenser and the evaporator. When equipped, the economizer shall use a variable metering valve. To ensure good operating performance, the valve design will prevent refrigerant gas from the condenser from passing to the evaporator or economizer at full or part load.
   2. By maintaining a liquid seal at the flow valve, bypassed hot gas from the condenser to the evaporator is eliminated. The float valve chamber shall have a bolted access cover to allow field inspection and the float valve shall be field serviceable.

F. Controls, Safeties, and Diagnostics:
   1. Controls:
      a. The chiller shall be provided with a factory-installed and wired microprocessor control center. The microprocessor can be configured for either English or SI units.
      b. All chiller and starter monitoring shall be displayed at the chiller control panel.
      c. The controls shall make use of non-volatile memory.
      d. The chiller control system shall have the ability to interface and communicate directly to the building control system.
      e. The default standard display screen shall simultaneously indicate the following minimum information:
         1) Date and time of day
         2) 24-character primary system status message
         3) 24-character secondary status message
         4) Chiller operating hours
         5) Entering chilled water temperature
         6) Leaving chilled water temperature
         7) Evaporator refrigerant temperature
         8) Entering condenser water temperature
         9) Leaving condenser water temperature
         10) Condenser refrigerant temperature
         11) Percent motor rated load amps (RLA).
      f. In addition to the default screen, status screens shall be accessible to view the status of every point monitored by the control center including:
         1) Evaporator pressure
         2) Condenser pressure
         3) Oil supply pressure (19MVR rolling element bearing units)
         4) Oil sump temperature (19MVR rolling element bearing units)
         5) Bearing oil supply temperature (19MVR rolling element bearing units)
         6) Compressor discharge temperature
         7) Motor winding temperature
         8) Number of compressor starts
         9) Control point settings
         10) Discrete output status of various devices
         11) Compressor motor starter status
         12) Optional spare input channels
         13) Current and voltage for each phase
         14) Frequency.

g. Schedule Function:

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

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

h. Service Function:

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

i. Network Window Function:

Each chiller control panel 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 control panel shall also have access to the alarm history file of all like controllers connected on the network.

j. Pump Control:

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

k. Ramp Loading:

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

l. Chilled Water Reset:

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

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

m. Demand Limit:

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

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

n. Controlled Compressor Shutdown:

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

2. Safeties:

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

1) Motor overcurrent
2) Over voltage[1]
3) Under voltage[1]
4) Single cycle dropout[1]
5) Bearing oil high temperature (19MVR rolling element bearing units)
6) Low evaporator refrigerant temperature
7) High condenser pressure
8) High motor temperature
9) High compressor discharge temperature
10) Prolonged surge
11) Loss of evaporator water flow
12) Loss of condenser water flow
13) Starter fault.

b. The control system shall detect conditions that approach protective limits and take self

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

corrective action prior to an alarm occurring. The system shall automatically reduce chiller capacity when any of the following parameters are outside their normal operating range:

1) High condenser pressure
2) High motor temperature
3) Low evaporator refrigerant temperature
4) Surge prevention control
5) High motor amps.

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

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

3. Diagnostics and Service:

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

b. 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 and an actual reading shall be performed for each transducer and each thermistor installed on the chiller. All out-of-range sensors shall be identified.

4. 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 allow a staggered restart of the chillers after a power failure.

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.

H. Piping Requirements — Instrumentation and Safeties:

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

b. Gauges shall be installed in the entering and leaving water lines of the evaporator and condenser.

I. Isolator Pads:

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. Manufacturer shall supply the following literature:

a. Start-up, operation, and maintenance instructions.

b. Installation instructions.

c. Field wiring diagrams.

d. One complete set of certified drawings.

K. Special Features:

1. Soleplate Package Accessory:

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

2. Spring Isolators Accessory:

   Field furnished and selected for the desired degree of isolation.

3. Spare Sensors with Leads Accessory:

   Unit manufacturer shall furnish additional temperature sensors and leads.

4. Stand-Alone Pumpout Unit Accessory:

   A free-standing pumpout shall be provided. The pumpout unit shall use a scroll compressor with water-cooled condenser. Condenser water piping and 3-phase motor power shall be installed at the jobsite by the installing contractor.

5. Separate Storage Tank and Pumpout Unit Accessory:

   A free-standing refrigerant storage tank and pumpout unit shall be provided. The storage vessels shall be designed per ASME Section VIII Division 1 code with 185 psig (1276 kPa) design pressure. Double relief valves per ANSI/ASHRAE 15, latest edition, shall be provided. The tank shall include a liquid level gauge and pressure gauge. The pumpout unit shall use a scroll compressor with water cooled condenser. Condenser water piping and 3-phase motor power shall be installed at the jobsite by the installing contractor.

6. Refrigerant Charge:

   The chiller shall ship from the factory fully charged with R-515B or R-513A refrigerant.

7. Thermal Insulation:

   Unit manufacturer shall insulate the evaporator shell, economizer, low side compressor suction elbow, motor shell, and motor cooling lines. Insulation shall be 3/4 in. (19 mm) thick with a thermal conductivity not exceeding 0.28 (Btu in.)/hr ft^2 F [(0.0404 • W)/(m • °C)] and shall conform to UL standard 94, classification 94 HBF.

8. Evaporator and Condenser Tubes:

   Contact local Carrier representative for other tube offerings.

9. Evaporator and Condenser Passes:

   Unit manufacturer shall provide the evaporator with 2 pass configuration on the water side.

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

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

11. Flanged Waterbox Nozzles:

    Unit manufacturer shall furnish standard flanged piping connections on the evaporator and/or condenser.

12. Hinges:

    Unit manufacturer shall furnish hinges on waterboxes to facilitate tube cleaning.

13. Unit-Mounted Variable Frequency Drive (VFD) without Built-In Harmonic Filter (available for low voltage only, 19MV3 only):

    a. Design:

       1) VFD shall be air cooled, microprocessor based, pulse width modulated (PWM) design. Water cooled designs are not acceptable.

       2) Output power devices shall be insulated gate bipolar transistors (IGBTs).

       3) Converter section with full-wave fixed diode bridge rectifier shall convert incoming fixed voltage/frequency to fixed DC voltage.

       4) DC link shall filter and smooth the converted DC voltage.

       5) Transistorized inverter and control regulator shall convert fixed DC voltage to a sinusoidal PWM waveform.

       6) Integrated controls shall coordinate motor speed and guide vane position to optimize chiller performance over a wide variety of operating conditions.

       7) Surge prevention and surge protection algorithms shall take action to prevent surge and move chiller operation away from surge.

    b. Enclosure:

       1) Pre-painted, unit-mounted cabinet protected against limited ingress of dust and water splashing shall include hinged doors and removable lifting lugs.

       2) Electrical system shall have a short circuit interrupt and withstand rating of at least 100,000 amps.

       3) Provisions to padlock main disconnect handle in the "Off" position shall be provided. Mechanical interlock to prevent opening cabinet door with disconnect in the "On" position or moving disconnect to the "ON" position while the door is open shall be provided.

       4) Provisions shall be made for top entry of incoming line power cables.

14. Heat Sink:

    The heat sink shall be air cooled.

    a. VFD Rating:

       1) Drive shall be suitable for nameplate voltage ±10%.

       2) Drive shall be suitable for continuous operation at 100% of nameplate amps and 150% of nameplate amps for 3 seconds.

       3) Drive shall comply with applicable UL, CE, and NEMA standards.

4) Drive shall be suitable for operation in ambient temperatures between 40 and 104°F (4.4 and 40°C), 95% humidity (non-condensing) for altitudes up to 8250 ft (2500 m) above sea level; altitude derating applies after 1000 m. Specific drive performance at jobsite ambient temperature and elevation shall be provided by manufacturer in the bid.

b. User Interface:

Displays shall provide interface for programming and display of VFD and chiller parameters. Viewable parameters include:

1) Operating, configuration, and fault messages.
2) Frequency in hertz.

c. VFD Performance:

1) VFD full load efficiency shall meet or exceed 97% at 100% VFD Rated ampacity.
2) Displacement Input Power Factor shall meet or exceed 94% soft start, linear acceleration, coast to stop.
3) Base motor frequency shall be up to 480 Hz; adjustable frequency range from 0 to 480 Hz.

d. Chiller Electrical Service (single point power):

1) Chiller shall have input circuit breaker with minimum 100,000 amp interrupt capacity.
2) Chiller shall have standard 15 amp branch oil pump circuit breaker to provide power for chiller oil pump.
3) Chiller shall have standard 3 kva control power transformer with circuit breaker to provide power for oil heater, VFD controls and chiller controls.
4) The branch oil pump circuit breaker and control power transformer shall be factory wired.
5) Input power shall be 380/480 vac, ±10 percent, 3 phase, 50/60 Hz, ±3 Hz.

e. Discrete Outputs:

115-v discrete contact outputs shall be provided for:

1) Circuit breaker shunt trip
2) Chilled water pump
3) Condenser water pump
4) Alarm status.

f. Analog Output:

An analog (4 to 20 mA) output for head pressure reference shall be provided. This signal shall be suitable to control a 2-way or 3-way water regulating valve in the condenser piping.

g. Protection — the following shall be supplied:

1) Under-voltage
2) Over voltage
3) Phase loss
4) Phase reversal
5) Ground fault
6) Phase unbalance protection
7) Single cycle voltage loss protection
8) Programmable auto restart after loss of power
9) Motor overload protection (NEMA Class 10)
10) Motor overtemperature protection.

h. VFD Testing:

VFD shall be factory mounted, wired and tested on the chiller prior to shipment.

15. Unit-Mounted Variable Frequency Drive (VFD), Active Front-End, Low Harmonic VFD (PowerFlex 755TL)

a. Design:

1) VFD is air-cooled, microprocessor-based, pulse width modulated (PWM) design.
2) Input and output power devices shall be insulated gate bipolar transistors (IGBTs).
3) Active rectifier shall convert incoming voltage / frequency to DC voltage. Input current and voltage shall be regulated.
4) Transistorized inverter and control regulator shall convert DC voltage to a sinusoidal PWM waveform.
5) Integrated chiller controls shall coordinate motor speed and guide vane position to optimize chiller performance over all chiller operating conditions.
6) Surge prevention and surge protection algorithms shall take action to prevent surge and move chiller operation away from surge.

b. Enclosure:

1) Pre-painted unit mounted, NEMA 1 (IP20) or NEMA 12 (IP54) cabinet shall include hinged, lockable doors and removable lifting lugs.
2) VFD power modules shall have a short circuit interrupt and withstand rating of 100,000 amps (35,000 amps for 575-v units).
3) Provisions to padlock main disconnect handle in the "Off" positions shall be provided. Mechanical interlock to prevent opening cabinet door with discon-

nect in the "On" position or moving disconnect to the "On" position while the door is open shall be provided.

4) Provisions shall be made for top entry of incoming line power cables.

c. Heat Sink:

The heat sink shall be air cooled.

d. VFD Rating:

1) Drive shall be suitable for continuous operation at nameplate voltage ±10%.

2) Drive shall be suitable for continuous operation at 100% of nameplate amps and 150% of nameplate amps for 3 sec.

3) Drive shall comply with applicable ANSI, NEMA, UL, CE Standards.

4) Drive shall be suitable for operation in ambient temperatures between 40 and 104°F (4.4 and 40°C), 95% humidity (non-condensing) for altitudes up to 6000 ft (1829 m) above sea level. Derating required above 3300 ft (1000 m). Specific drive performance at jobsite ambient temperature and elevation shall be provided by manufacturer in the bid.

e. User Interface:

A single display shall provide interface for programming and display of VFD and chiller parameters. Viewable parameters include:

1) Operating, configuration, and fault messages

2) Frequency in Hz

3) Load and line side voltage and current (at the VFD)

4) kW (line and load side)

5) IGBT temperatures

f. VFD Performance:

1) VFD voltage total harmonic distortion (THD) and harmonic current total demand distortion (TDD) shall not exceed IEEE-519 requirements using the VFD circuit breaker input terminals as the point of common coupling (PCC). Product will meet IEEE-519 requirements at input CB terminals.

2) VFD full load efficiency shall meet or exceed 96% at 100% VFD rated ampacity.

a) Active rectifier shall regulate unity displacement power factor to 0.99 or higher at full load.

b) Soft start, linear acceleration, coast to stop.

c) Base motor frequency shall be up to 480 Hz. Adjustable frequency range from 0 to 480 Hz.

g. VFD Electrical Service (single point power):

1) VFD shall have input circuit breaker with minimum 65,000 amp interrupt capacity, 100,000 amp interrupt available.

2) VFD shall have standard 15 amp branch circuit breaker to provide power for chiller oil pump.

3) VFD shall have standard control power transformer with circuit breaker to provide power for oil heater, VFD controls and chiller controls.

4) The branch oil pump circuit breaker and control power transformer shall be factory wired.

5) Nameplate voltage shall range between 380 and 460 ±10%, 3 phase, 50/60 Hz ±2% Hz.

h. Discrete Outputs:

115-v discrete contact outputs shall be provided for field wired:

1) Chilled water pump

2) Condenser water pump

3) Alarm status

4) Tower fan low

5) Tower fan high

i. Analog Output:

An analog (4 to 20 mA) output for head pressure reference shall be provided. This signal shall be suitable to control a 2-way or 3-way water regulating valve in the condenser piping.

j. Protection (the following shall be supplied):

1) Under-voltage

2) Over voltage

3) Phase loss

4) Phase reversal

5) Ground fault

6) Phase unbalance protection

7) Single cycle voltage loss protection

8) Programmable auto restart after loss of power

9) Motor overload protection

k. VFD Testing:

VFD shall be factory mounted, wired and tested on the chiller prior to shipment.

l. VFD Certifications and Standards:

1) CE Standard including:

a) Low Voltage Directive

b) EMC Directive

c) Machinery Directive

d) Standards applied; EN 61800-3/ EN 61800-5-1

Guide specifications (cont)

e) EMC Directive (2014/30/EU)
f) Low Voltage Directive (2014/35/EU)
g) RoHS Directive (2011/65/EU)

2) UL 61800-5-1 and 61800-5-2
3) cUL
4) UKCA (EMC, LVD, MD, RHoS).
5) TÜV and Rheinland Standards (with Safe I/O) applied:
   a) IEC 61508 PARTS 1…7
   b) EN 61800-3 EN 61800-5-1
   c) IEC 61800-5-2 EN
   d) ISO 13849-1
   e) IEC 62061
   f) ISO 60204-1
   g) Machinery Directive (2006/42/EC)

Pg 40 Catalog No. 04-52190037-01 Printed in U.S.A. Form 19MV-CLT-5PD
Replaces: 19MV-CLT-3PD