AquaEdge®
19MV Two-Stage High-Efficiency Semi-Hermetic Centrifugal Liquid Chillers with Greenspeed® Intelligence, PIC6 Controls, and R-515B/R-513A/R-1234ze(E)

Installation Instructions

CONTENTS

SAFETY CONSIDERATIONS

Centrifugal liquid chillers are designed to provide safe and reliable service when operated within design specifications. When operating this equipment, use good judgment and safety precautions to avoid damage to equipment and property or injury to personnel.

Be sure you understand and follow the procedures and safety precautions contained in the machine instructions, as well as those listed in this guide.

⚠ DANGER

Failure to follow these procedures will result in severe personal injury or death.

DO NOT VENT refrigerant relief devices within a building. Outlet from relief valve or fusible plugs must be vented outdoors in accordance with the latest edition of ANSI/ASHRAE 15 (American National Standards Institute/American Society of Heating, Refrigerating and Air-Conditioning Engineers) (Safety Code for Mechanical Refrigeration). The accumulation of refrigerant in an enclosed space can displace oxygen and cause asphyxiation.

PROVIDE adequate ventilation in accordance with ANSI/ASHRAE 15, especially for enclosed and low overhead spaces. Inhalation of high concentrations of vapor is harmful and may cause heart irregularities, unconsciousness, or death. Intentional misuse can be fatal. Vapor is heavier than air and reduces the amount of oxygen available for breathing. Product causes eye and skin irritation. Decomposition products are hazardous.

DO NOT USE OXYGEN to purge lines or to pressurize a machine for any purpose. Oxygen gas reacts violently with oil, grease, and other common substances.

DO NOT USE air to leak test. Use only refrigerant or dry nitrogen.

NEVER EXCEED specified test pressures. VERIFY the allowable test pressure by checking the instruction literature and the design pressures on the equipment nameplate.

DO NOT VALVE OFF any safety device.

BE SURE that all pressure relief devices are properly installed and functioning before operating any machine.

RISK OF INJURY OR DEATH by electrocution. High voltage is present on motor leads even though the motor is not running. Open the power supply disconnect before touching motor leads or terminals and wait for capacitors to fully discharge.

IMPORTANT: The appliance is not to be used by person (including children) with reduced physical, sensory, or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instructions to do so.

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⚠ WARNING

Failure to follow these procedures may result in personal injury or death.

DO NOT USE TORCH to remove any component. System contains refrigerant which can be under pressure.

To remove a component, wear protective gloves and goggles and other necessary safety equipment, and proceed as follows.

a. Shut off electrical power to unit.
b. Recover refrigerant from system using both high-pressure and low-pressure ports.
c. Traces of vapor should be displaced with nitrogen and the work area should be well ventilated. Refrigerant in contact with an open flame produces toxic gases.
d. Cut component connection tubing with tubing cutter and remove component from unit.
e. Carefully unsweat remaining tubing stubs when necessary.

DO NOT USE eyebolts or eyebolt holes to rig machine sections or the entire assembly.

DO NOT work on high-voltage equipment unless you are a qualified electrician.

DO NOT WORK ON electrical components, including control panels, switches, variable frequency drives (VFDs), or compressors until you are sure ALL POWER IS OFF and no residual voltage can leak from capacitors or batteries. To turn power off to the chiller, the Main Circuit Breaker (MCB), Service Circuit Breaker (SCB), and Uninterruptible Power Supply (UPS) must be turned off.

LOCK OPEN AND TAG electrical circuits during servicing. IF WORK IS INTERRUPTED, confirm that all circuits are deenergized before resuming work.

AVOID SPILLING liquid refrigerant on skin or getting it into the eyes. USE SAFETY GOGGLES. Wash any spills from the skin with soap and water. If liquid refrigerant enters the eyes, IMMEDIATELY FLUSH EYES with water and consult a physician.

NEVER APPLY an open flame or live steam to a refrigerant cylinder. Dangerous over pressure can result. When it is necessary to heat refrigerant, use only warm (110°F [43°C]) water.

DO NOT REUSE disposable (nonreturnable) cylinders or attempt to refill them. It is DANGEROUS AND ILLEGAL. When cylinder is emptied, evacuate remaining gas pressure, loosen the collar, and unscrew and discard the valve stem. DO NOT INCINERATE.

CHECK THE REFRIGERANT TYPE before adding refrigerant to the machine. The introduction of the wrong refrigerant can cause machine damage or malfunction.

Operation of this equipment with refrigerants other than those cited herein should comply with ANSI/ASHRAE 15 (latest edition). Contact Carrier for further information on use of this machine with other refrigerants.

DO NOT ATTEMPT TO REMOVE fittings, covers, etc., with refrigerant in the machine or while machine is running. Be sure pressure is at 0 psig (0 kPa) before breaking any refrigerant connection. Note that at 65°F (18°C) the machine is at near 0 psig (0 kPa) so ensure to properly check for the existence of refrigerant in the machine.

CAREFULLY INSPECT all relief valves and other safety relief devices AT LEAST ONCE A YEAR. If machine operates in a corrosive atmosphere, inspect the devices at more frequent intervals.

⚠ WARNING

DO NOT ATTEMPT TO REPAIR OR RECONDITION any relief device when corrosion or build-up of foreign material (rust, dirt, scale, etc.) is found within the valve body or mechanism. Replace the valve or device.

DO NOT install relief devices in series or backwards.

USE CARE when working near or in line with a compressed spring. Sudden release of the spring can cause it and objects in its path to act as projectiles.

Prior to installing or servicing this equipment ensure that personal protective equipment (PPE) is worn as required per OSHA or other local regulations.

For servicing or installing components where there is a risk of arc flash the technicians must wear personal protective equipment as identified in NFPA (National Fire Protection Association) 70E or other local country-specific requirements for arc flash protection.

⚠ WARNING

MAGNETIC FIELD HAZARD

Units equipped with the permanent magnet motor option contain rotors with powerful magnetic fields. Permanent magnet motor rotors, when removed from the stator, expose surrounding personnel and equipment to powerful magnetic fields which may cause serious health hazards to persons with pacemakers or defibrillators, hearing aids, metal implants, or other implanted electronic medical devices, and may impact other electronic devices such as mobile phones or smartwatches, watches, credit cards, etc. Persons in a risk group should consult a physician prior to compressor disassembly. Failure to follow these procedures may result in personal injury or death.

⚠ WARNING

The magnetic bearings have UPS power supply that provides control power. Before service or repair work starts disconnect the UPS and verify with voltage meter that there is no power present.

⚠ WARNING

Rotation of the shaft can generate voltage potential at the motor terminals. If the shaft is to be rotated the motor terminals should be grounded.

⚠ CAUTION

Dispose of refrigerant per local codes and regulations.

DO NOT introduce oil to the refrigerant circuit with refrigerant recovery containers, vacuum pump, or other means.

DO NOT leave refrigerant system open to air any longer than the actual time required to service the equipment. Seal circuits being serviced and charge with dry nitrogen to prevent contamination when timely repairs cannot be completed.

⚠ CAUTION

Install this equipment in a location which is not available for general public access. General installation altitude is to be 1000 m (3300 ft) or less unless special altitude height is defined at the time of unit selection.

Evaporator water temperature is 0°F (–17.8°C) to 150°F (65.6°C). Allowable water pressure is 0 psig (0 kPa) to 150 psig (1034 kPa) or as indicated on vessel nameplate.

⚠ CAUTION

Failure to follow these procedures may result in personal injury or damage to equipment.

DO NOT STEP on refrigerant lines. Broken lines can whip about and release refrigerant, causing personal injury.

DO NOT climb over a machine. Use platform, catwalk, or staging. Follow safe practices when using ladders.

USE MECHANICAL EQUIPMENT (crane, hoist, etc.) to lift or move inspection covers or other heavy components. Even if components are light, use mechanical equipment when there is a risk of slipping or losing your balance.

BE AWARE that certain automatic start arrangements CAN ENGAGE THE VFD, TOWER FAN, OR PUMPS. Open the disconnect *ahead of* the VFD, tower fan, and pumps. Shut off the machine or pump before servicing equipment.

USE only repaired or replacement parts that meet the code requirements of the original equipment.

DO NOT VENT OR DRAIN waterboxes containing industrial brines, liquid, gases, or semisolids without the permission of your process control group.

DO NOT LOOSEN waterbox cover bolts until the waterbox has been completely drained.

DOUBLE-CHECK that coupling nut wrenches, dial indicators, or other items have been removed before rotating any shafts.

DO NOT LOOSEN a packing gland nut before checking that the nut has a positive thread engagement.

PERIODICALLY INSPECT all valves, fittings, and piping for corrosion, rust, leaks, or damage.

PROVIDE A DRAIN connection in the vent line near each pressure relief device to prevent a build-up of condensate or rain water. Ensure to slope piping way from relief device.

INTRODUCTION

General

The 19MV unit is factory assembled, wired, and leak tested. Installation consists primarily of establishing water and electrical services to the machine. Rigging, installation, field wiring, field piping, and insulation of waterbox covers are the responsibility of the contractor and/or customer. Carrier has no installation responsibilities for the equipment. If unit is shipped without refrigerant, the refrigerant charge will be installed by the Carrier Start-up Technician during the start-up process.

Job Data

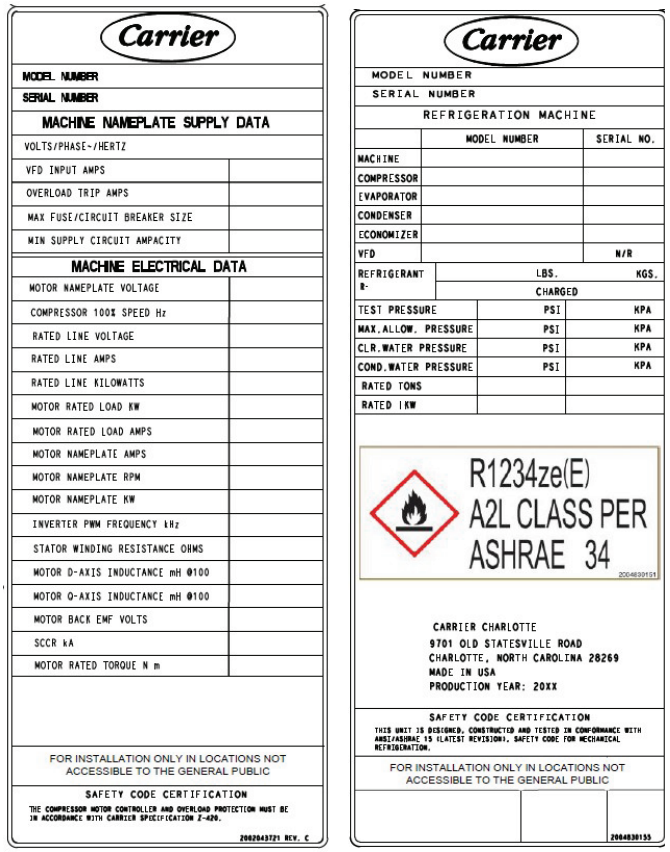
Necessary information consists of:

- job contract or specifications
- machine location prints
- rigging information
- piping prints and details
- field wiring drawings
- starter manufacturer's installation details
- Carrier certified print

CHILLER FAMILIARIZATION

Chiller Information Nameplate

The information nameplate is located on the left side of the chiller control panel. Refer to Fig. 1 for model number identification.



NOTE: Nameplate on the right to be used only with units containing A2L refrigerant.. The equivalent non-A2L nameplate is to be used on other units.

Fig. 1 — 19MV Refrigeration Machine Nameplate

System Components

The main components include the evaporator and condenser heat exchangers in separate vessels, compressor, PIC6 Touch Screen, power panel, economizer (option), VFD, and magnetic bearing or roller element bearing system.

EVAPORATOR

This heat exchanger is located underneath the compressor. The evaporator is maintained at lower refrigerant temperature/pressure so evaporating refrigerant can remove heat from water flowing through its internal tubes.

CONDENSER

This heat exchanger operates at a higher refrigerant temperature/pressure than the evaporator and has water flowing through its internal tubes in order to remove heat from the refrigerant.

COMPRESSOR

This component maintains system temperature and pressure differences and moves the heat carrying refrigerant from the evaporator to the condenser. The 19MV unit has a back to back two-stage, direct drive, and economized compressor.

PIC6 Touch Screen Panel

This panel is the user interface for controlling the chiller and has the following functions:

- Chiller operation
- Chiller diagnostic
- Chiller status display
- Chiller parameter configuration
- Open protocol interface to outside building management system (BMS)

Power Panel

This power panel is divided into a high voltage section and a low voltage section. It includes the input and output boards (IOB), control transformers, relays, contactors, and circuit breakers. It provides the power distribution and protection to the electrical component installed on chiller, and has the following functions:

- Communication with PIC6 touch screen
- Communication with VFD
- Communication with magnetic bearing controller (MBC)
- VFD Main Circuit Breaker
- Sensor input and outputs
- Actuators control
- UPS power supply for the magnetic bearing controller (MBC)

Economizer (Option)

The economizer reduces the refrigerant temperature to an intermediate level between the evaporator and condenser vessels. In the economizer, vapor is led to the inlet of the second stage of the compressor, and the liquid to the evaporator. The energy removed from the vaporized refrigerant in the economizer allows the liquid refrigerant in the evaporator to absorb more heat when it evaporates and benefits the overall cooling efficiency cycle.

VFD

The VFD provides a pulse width modulated signal that results in variable frequency and voltage to the permanent magnet compressor motor. It is controlled and monitored from the PIC6 control system.

Magnetic Bearing System

The magnetic bearing system consists of a controller (MBC) which through electromagnetic actuators (active magnetic bearings) controls the levitation of the shaft while the compressor is rotating. Various sensors provide the MBC with information to make corrections to the bearings to keep the shaft at its desired location by adjusting the individual bearings electromagnetic flux. The magnetic bearing system communicates with the PIC6 control system.

INSTALLATION

Step 1 — Receive the Machine

INSPECT SHIPMENT

⚠ CAUTION

Do not open any valves or loosen any connections. The 19MV machine may be shipped with a refrigerant or nitrogen holding charge. Damage to machine may result.

1. Inspect for shipping damage while machine is still on shipping conveyance. If machine appears to be damaged or has been torn loose from its anchorage, have it examined by transportation inspectors before removal. Forward claim papers directly to transportation company. *Manufacturer is not responsible for any damage incurred in transit.*
2. Check all items against shipping list. Immediately notify the nearest Carrier representative if any item is missing.
3. To prevent loss or damage, leave all parts in original packages until installation. All openings are closed with covers or plugs to prevent dirt and debris from entering machine components during shipping.

IDENTIFY MACHINE

The machine model number, serial number, rated voltage, and heat exchanger sizes are shown on machine identification nameplate (Fig. 1-2). Check this information against shipping papers and job data.

INSTALLATION REQUIREMENTS

Prior to starting chiller electrical installation, certain requirements should be checked. Input power wire sizes, branch circuit protection, and control wiring are all areas that need to be evaluated. See Fig. 3-6 for typical compressor chiller components.

Determine Wire Size Requirements

Wire size should be determined based on the size of the conduit openings, and applicable local, national, and international codes (e.g., NEC [National Electric Code]/CEC regulations). General recommendations are included in the Carrier field wiring drawings. Consult drawing for termination lug sizes.

Conduit Entry Size

It is important to determine the size of the conduit openings in the enclosure power entry plate so that the wire planned for a specific entry point will fit through the opening. Do NOT punch holes or drill into the top surface of any panels. Knockouts are provided on the enclosure. The plate provided to cover the power panel for shipment is to be reused for the tophat conduit entry. The power entry plate is designed to be removed before any holes are made to prevent particulate from entering the cabinet.

Recommended Control and Signal Wire Sizes

The recommended minimum size wire to connect I/O signals to the control terminal blocks is 18 AWG (American Wire Gauge). Recommended terminal tightening torque is 7 to 9 in.-lb (0.79 to 1.02 N-m).

Required Airflow Clearances

Be sure there is adequate clearance for air circulation around the enclosure. Danfoss VFD fans required a minimum clearance of 9 in. (228.6 mm); all other fans require a minimum clearance of 6 in. (152.4 mm) wherever vents are located in an enclosure.

Service Clearances

Verify that service clearances are adequate as identified in Fig. 7 or 8.

Match Power Module Input and Supply Power Ratings

It is important to verify that building power will meet the input power requirements of the Machine Electrical Data nameplate input power rating. Be sure the input power to the chiller corresponds to the chiller's nameplate voltage, current, and frequency and to the design data sheet provided by the equipment salesman. Verify all electrical inputs against design data sheets. The electrical data nameplate is located on the right side of the power panel enclosure.

PROVIDE MACHINE PROTECTION

Store machine indoors, protected from construction dirt and moisture as identified in the long term storage requirements in a document available from your equipment sales engineer. Inspect under shipping tarps, bags, or crates to be sure that water has not collected during transit. Keep protective shipping covers in place until machine is ready for installation.

⚠ CAUTION

Freezing water can damage equipment. If machine can be or possibly has been exposed to freezing temperatures after water circuits have been installed, open waterbox drains and remove all water from evaporator and condenser. Leave drains open until system is ready to be filled.

It is important to properly plan before installing a 19MV unit to ensure that the environmental and operating conditions are satisfactory and the machine is protected. The installation must comply with all requirements in this document and in the certified prints.

Operating Environment

Chiller should be installed in an indoor environment where the ambient temperature is between 40 and 104°F (4 and 40°C) with a relative humidity of 95% or less, non-condensing. 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. The mechanical room should have four walls and a ceiling.

NOTE: NEMA Type 1 power panels are constructed for indoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment and to provide a degree of protection against falling dirt. This type of power panel does not protect against water, dust, moisture, or airborne contaminants.

Step 2 — Rig the Machine

The 19MV machine can be rigged as an entire assembly. It also has connections that allow the compressor, evaporator, and condenser sections to be separated and rigged individually.

RIG MACHINE ASSEMBLY

See rigging instructions on label attached to machine. Refer to rigging guide (Fig. 9 or 10), dimensions in Fig. 7, and physical data in Tables 1-9. *Lift machine only from the points indicated in rigging guide.*

IMPORTANT: Verify with company performing the rigging that they have access to required spreader beam for 4 point lift. Carrier is not responsible for rigging damage.

Each lifting cable or chain must be capable of supporting the entire weight of the machine.

Contractors are not authorized to disassemble any part of the chiller without Carrier's supervision. Any request otherwise must be approved in writing by the Carrier Technical Service Manager. Non-conformance to this requirement may result in loss of product warranty.

⚠ WARNING

Lifting chiller or components from points other than those specified may result in serious damage to the machine or personal injury. Rigging equipment and procedures must be adequate for maximum chiller weight. See Fig. 9 or 10 and Table 4 for maximum chiller and component weights.

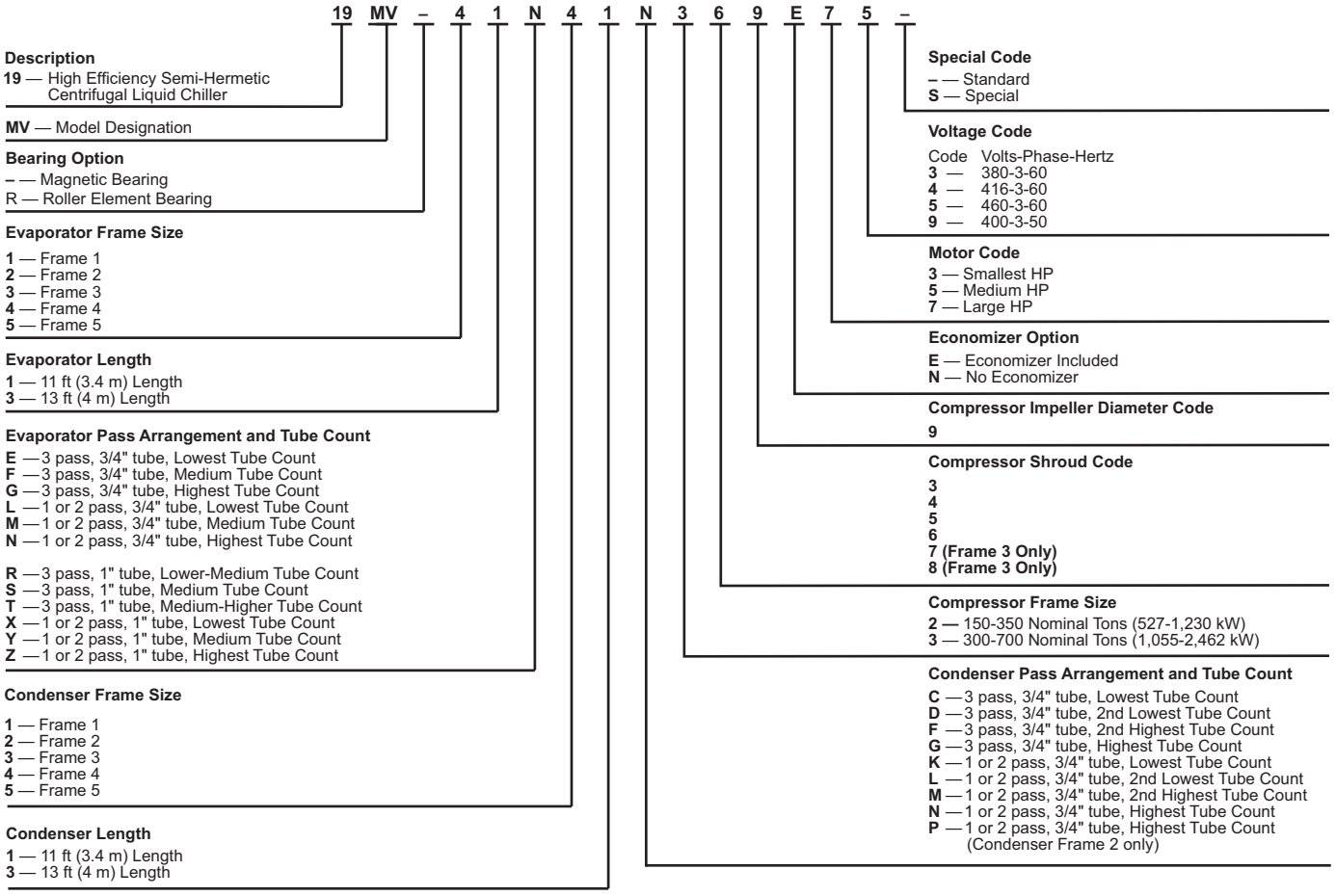
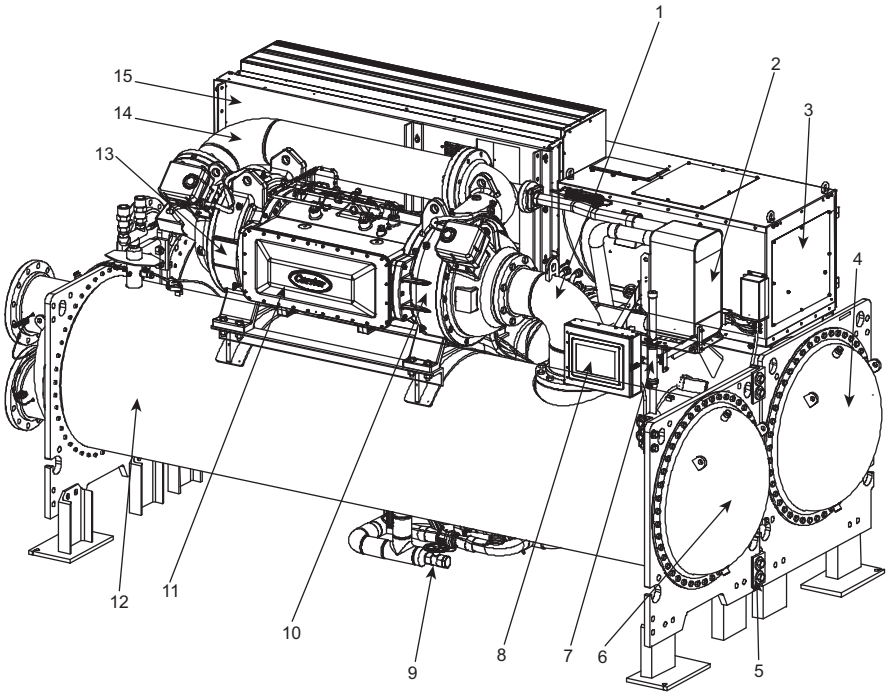


Fig. 2 — 19MV Chiller Model Number Identification



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)

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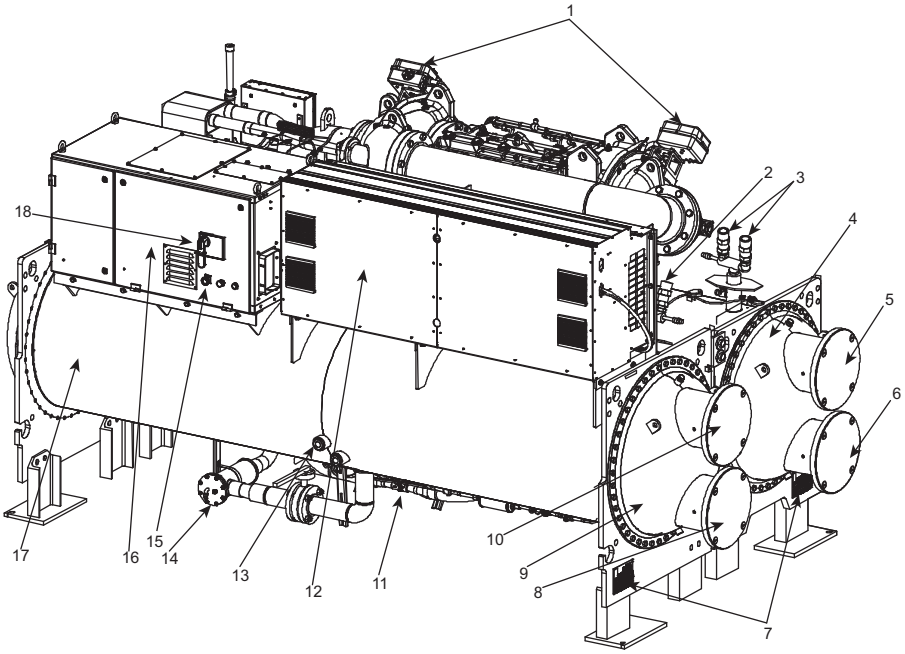
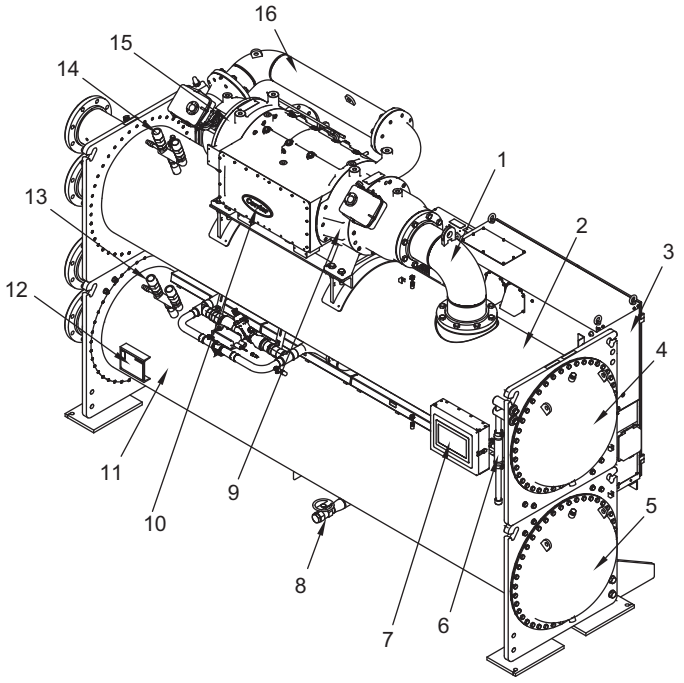


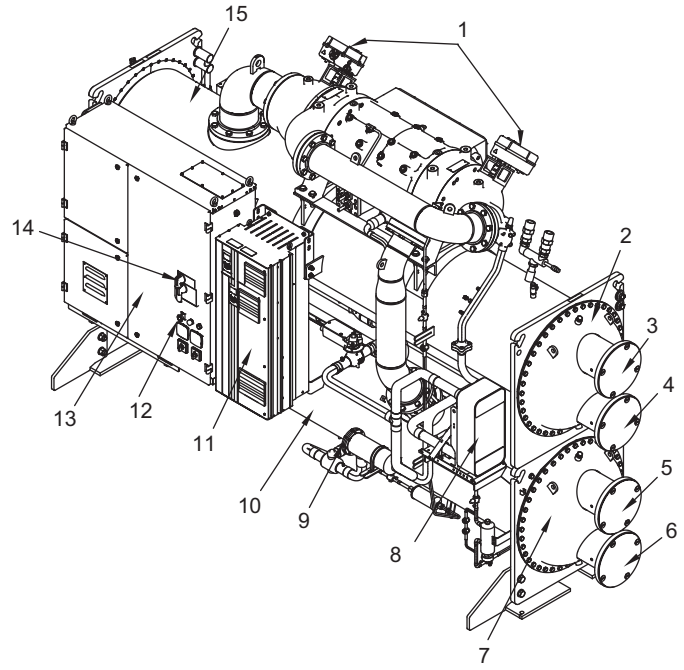
LEGEND
1 — Dual Inlet Guide Vane Actuators
2 — Condenser Dual Relief Valves
3 — Evaporator Dual Relief Valves
4 — Evaporator Waterbox
5 — Leaving Evaporator Nozzle
6 — Entering Evaporator Nozzle
7 — ASME Nameplates
8 — Entering Condenser Nozzle
9 — Condenser Waterbox
10 — Leaving Condenser Nozzle
11 — 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

Fig. 3 — Typical 19MV3 Compressor Chiller Components, Standard Tier, Magnetic Bearing Option



LEGEND

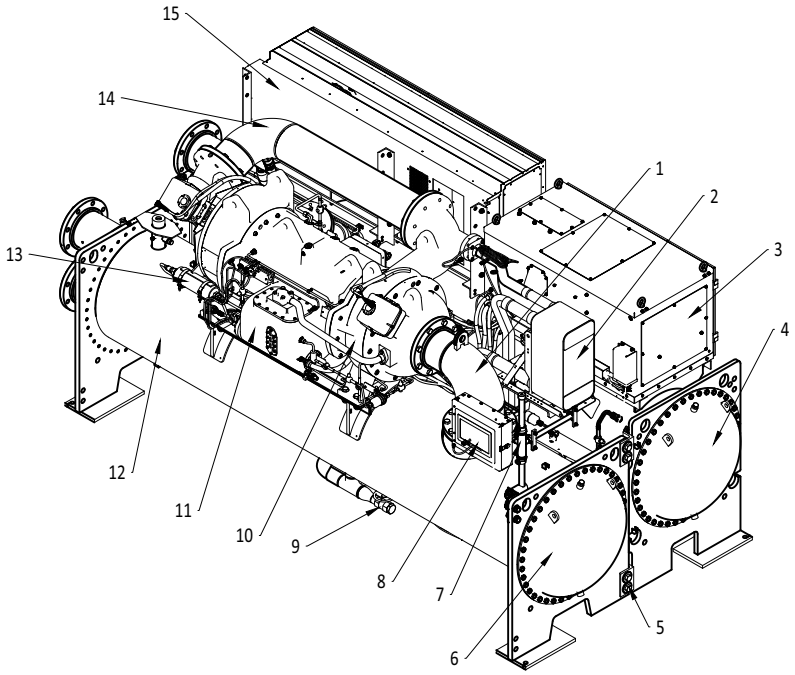
1 — Suction Elbow First Stage
2 — Evaporator
3 — Integrated Power and Control Panel
4 — Condenser Waterbox Return End
5 — Evaporator Waterbox Return End
6 — HMI Adjustment Arm
7 — 10.4 in. Color Touchscreen Display
8 — Refrigerant Charging Valve
9 — EquiDrive Two-stage Back-to-Back Centrifugal Compressor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



LEGEND

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

Fig. 4 — Typical 19MV2 Compressor Chiller Components, Standard Tier, Magnetic Bearing 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 — Oil Bearing System
14 — Interstage Compressor Piping
15 — VFD (Variable Frequency Drive)

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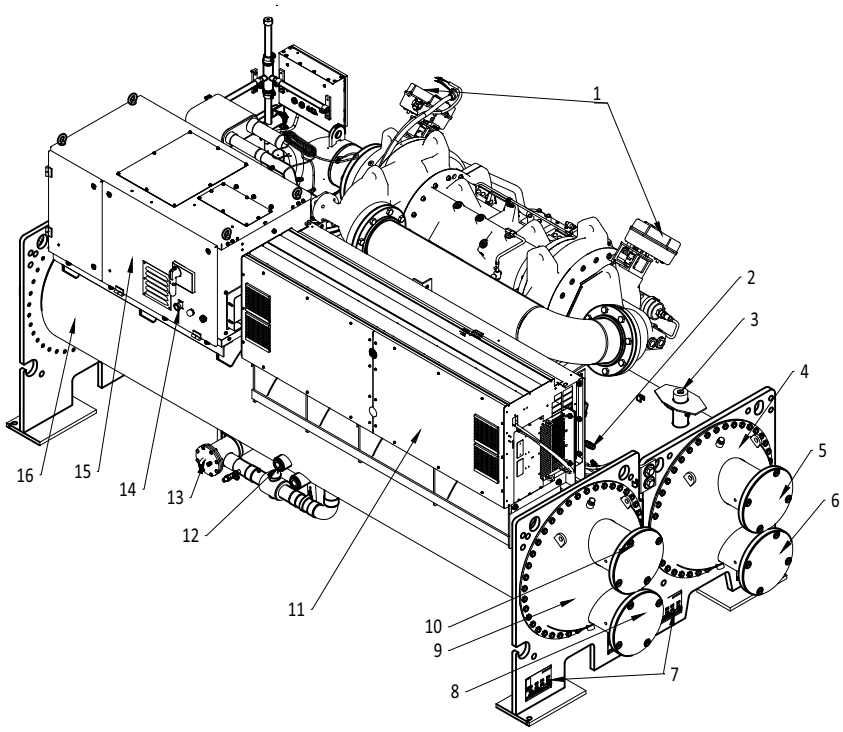
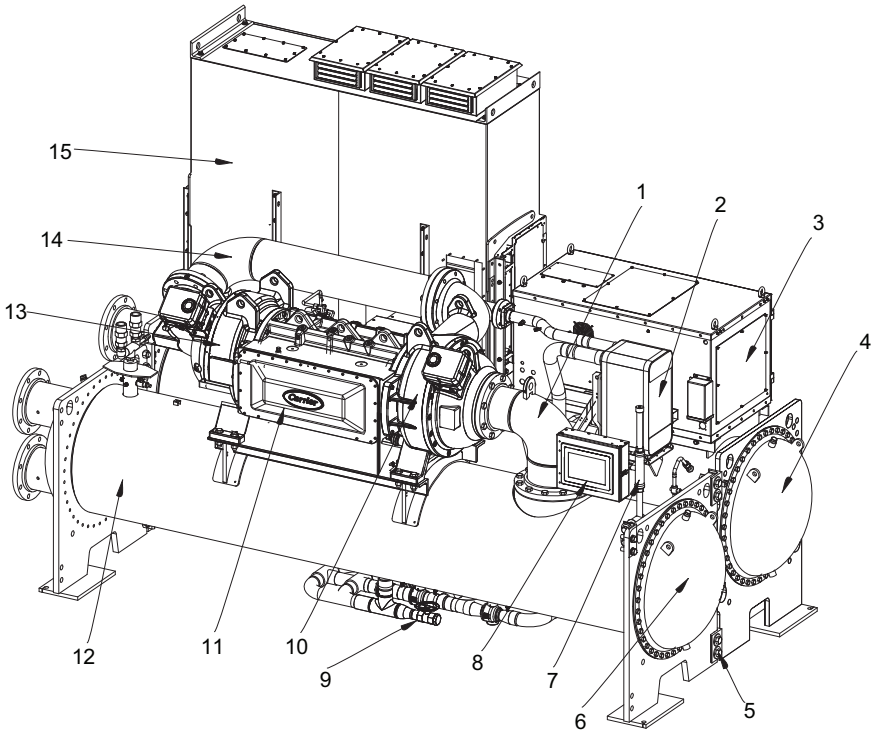


LEGEND
1 — Dual Inlet Guide Vane Actuators
2 — Condenser Dual Relief Valves
3 — Evaporator Relief Valve
4 — Evaporator Waterbox
5 — Leaving Evaporator Nozzle
6 — Entering Evaporator Nozzle
7 — ASME Nameplates
8 — Entering Condenser Nozzle
9 — Condenser Waterbox
10 — Leaving Condenser Nozzle
11 — VFD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

Fig. 5 — Typical 19MV3 Compressor Chiller Components, Standard Tier, Oil Bearing 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)

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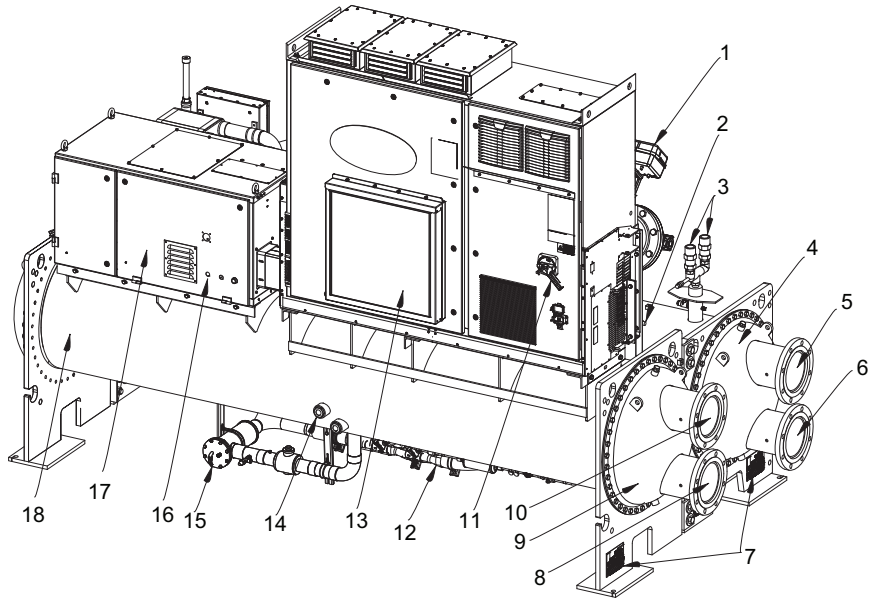

LEGEND
1 — Dual Inlet Guide Vane Actuators
2 — Condenser Dual Relief Valves
3 — Evaporator Dual Relief Valves
4 — Evaporator Waterbox
5 — Leaving Evaporator Nozzle
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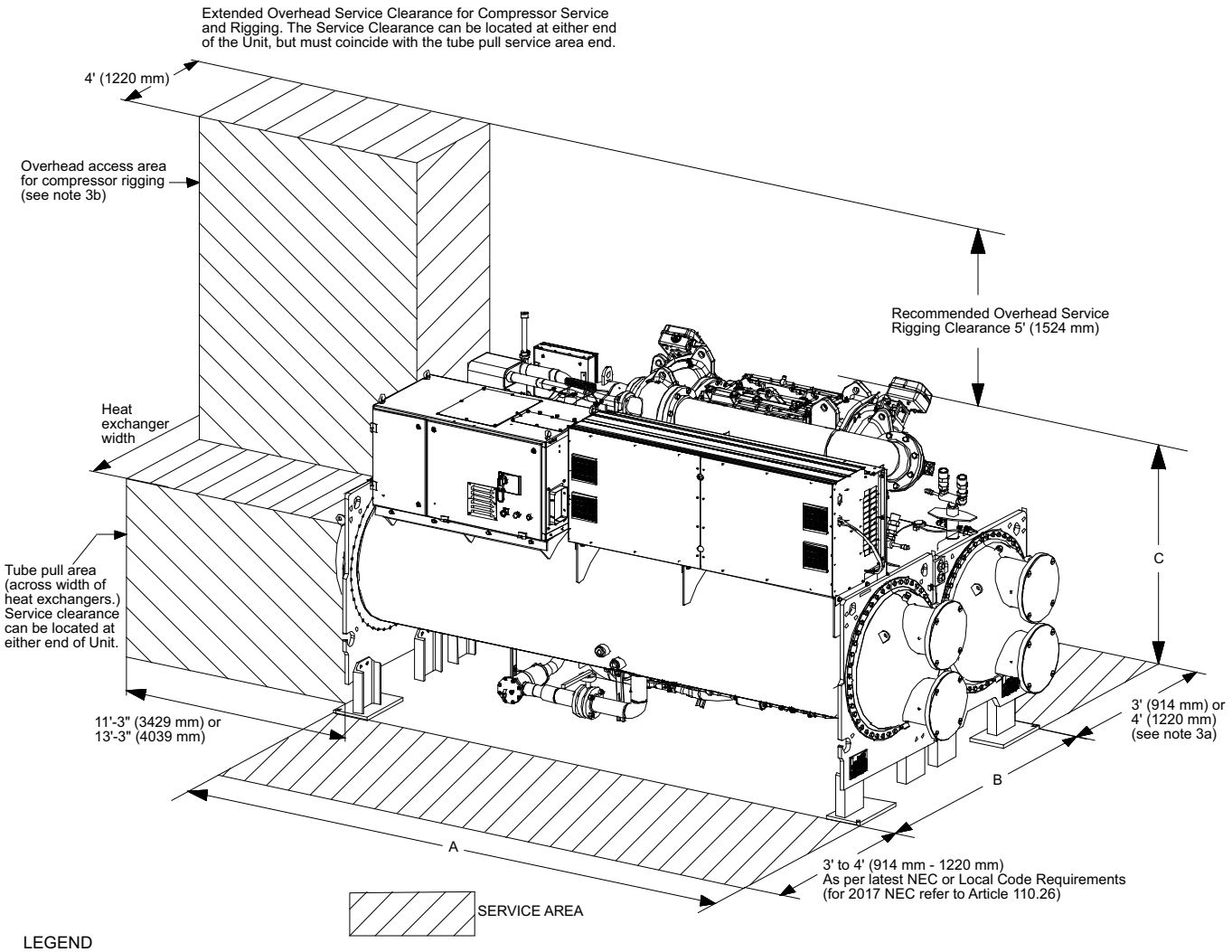
12 — Dual Electronic Expansion Valves
13 — VFD (Variable Frequency Drive)
14 — Condenser Sight Glasses
15 — Strainer
16 — E-stop
17 — Integrated Power and Control Panel
18 — Condenser

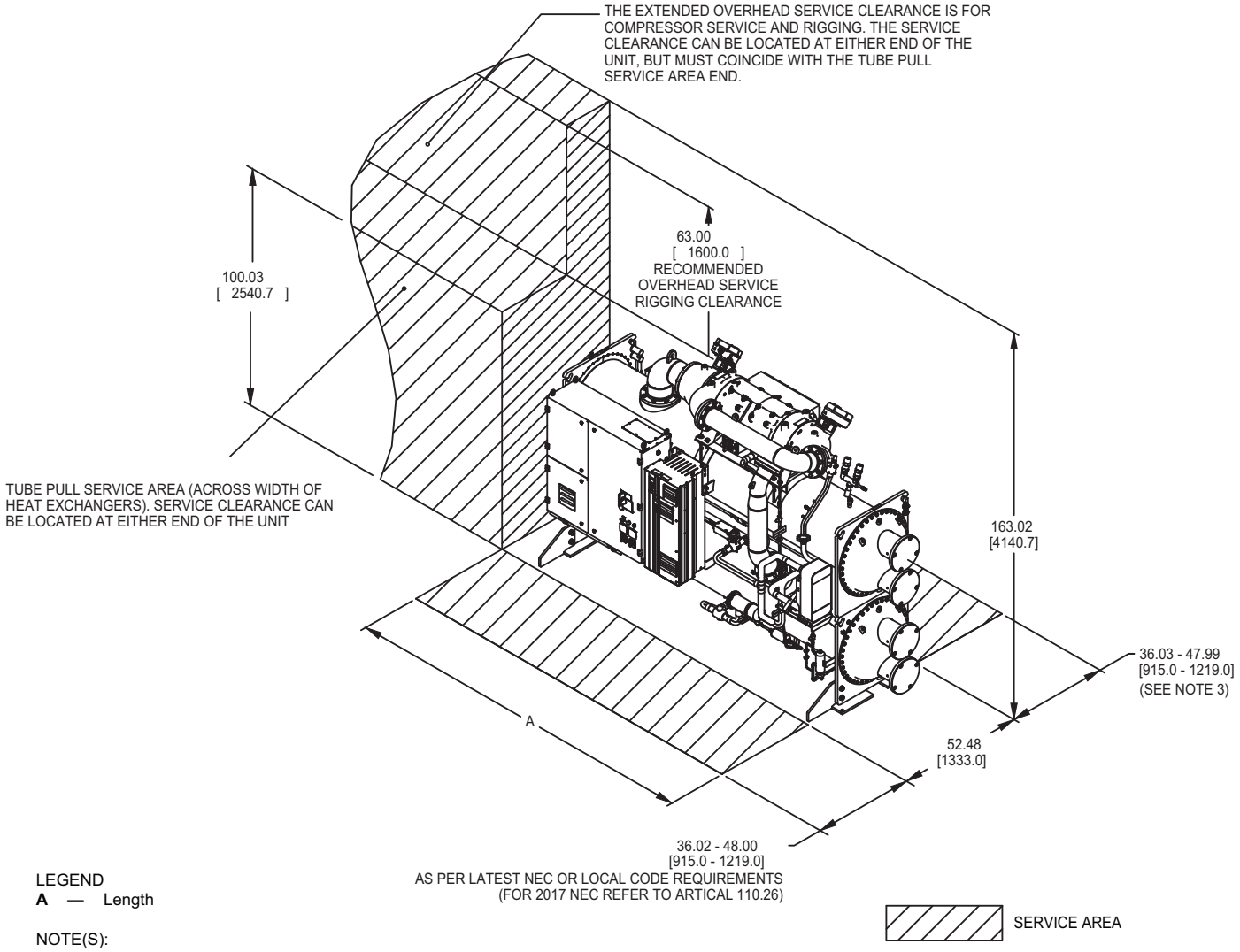
Fig. 6 — Typical 19MV3 Compressor Chiller Components, High Tier, Magnetic Bearing Option



LEGEND
A — Length
B — Width
C — Height

NOTE(S):
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.
5. Pressure relief device sizing is based on the assumption that there are no combustible materials within 20 ft (7.7 m) of the pressure vessels.
6. If the service clearances are not met, extraordinary actions to perform equipment repairs will not be covered by warranty.

Fig. 7 — 19MV3 Service Clearances

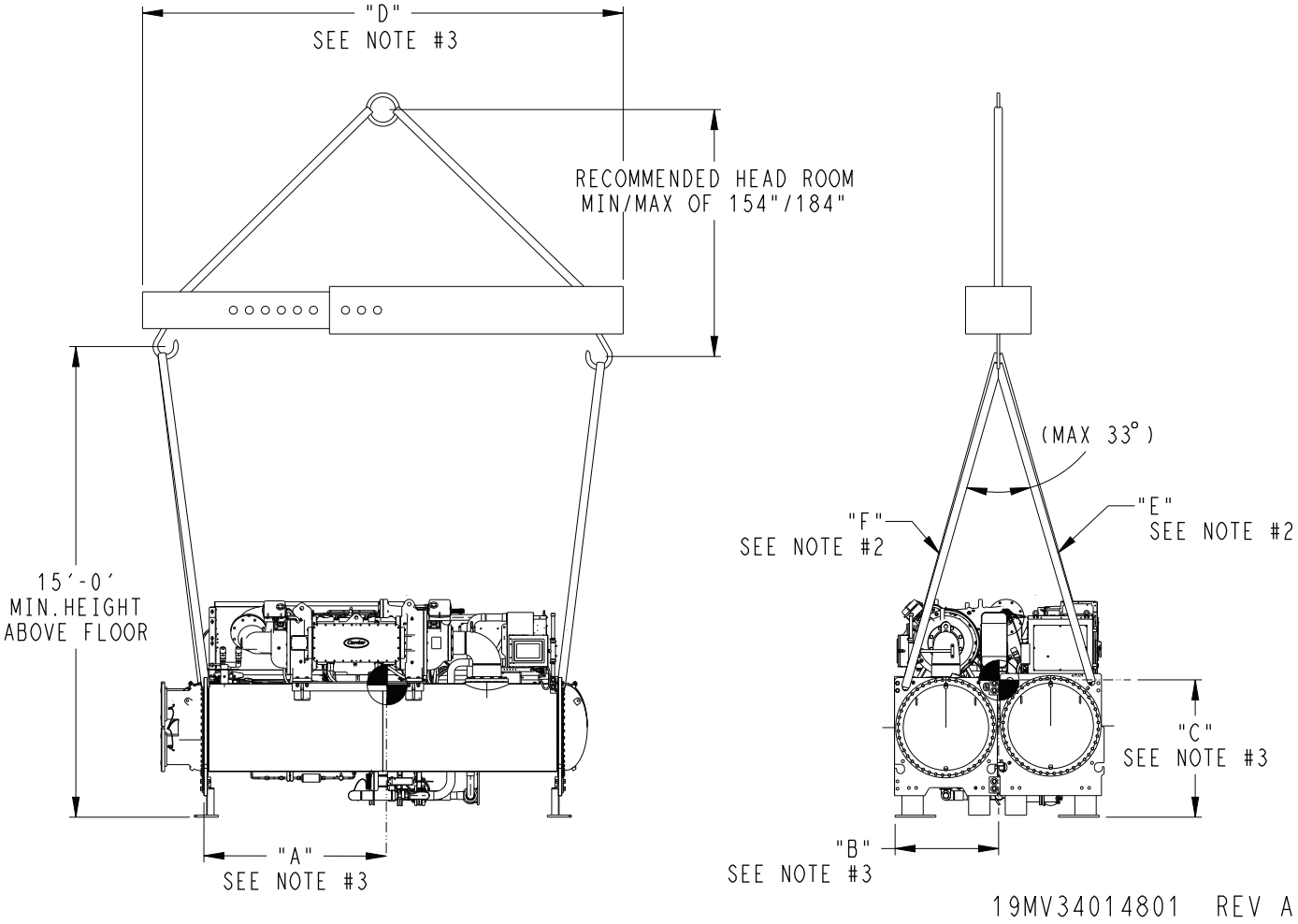


LEGEND
A — Length

NOTE(S):
1. Dished head (NIH) waterbox shown.
2. Service areas are minimum space required.
3. Allow 48" [1219 mm] on either side of the chiller.
4. Provide free space above the tube pull area equal to the height of the chiller plus 63" [1600 mm]. The overhead rigging space will allow the tube pull area to be utilized for service area.
5. For actual unit dimensions, contact your Carrier sales professional for certified drawings.
6. If the service clearances are not met, extraordinary actions to perform equipment repairs will not be covered by warranty.

Fig. 8 — 19MV2 Service Clearances

COMPRESSOR FRAME	EVAPORATOR CODE	MAX. WEIGHT lb (kg)	VESSEL LENGTH ft	DIM. "A" in.	DIM. "B" in.	DIM. "C" in.	DIM. "D" in.	CHAIN LENGTH	
								"E" in.	"F" in.
19MV3	31E-31N, 31R-31Z	19,100 (8662)	11	73	34	37	158	134	136
	33E-33N, 33R-33Z	19,600 (8909)	13	84	33	36	178	137	139
	41E-41N, 41R-41Z	21,700 (9855)	11	75	34	37	158	134	136
	43E-43N, 43R-43Z	23,200 (10503)	13	87	34	37	178	137	139
	51E-51N, 51R-51Z	23,600 (10723)	11	75	37	39	158	134	136
	53E-53N, 53R-53Z	25,300 (11478)	13	87	37	39	178	137	139



LEGEND

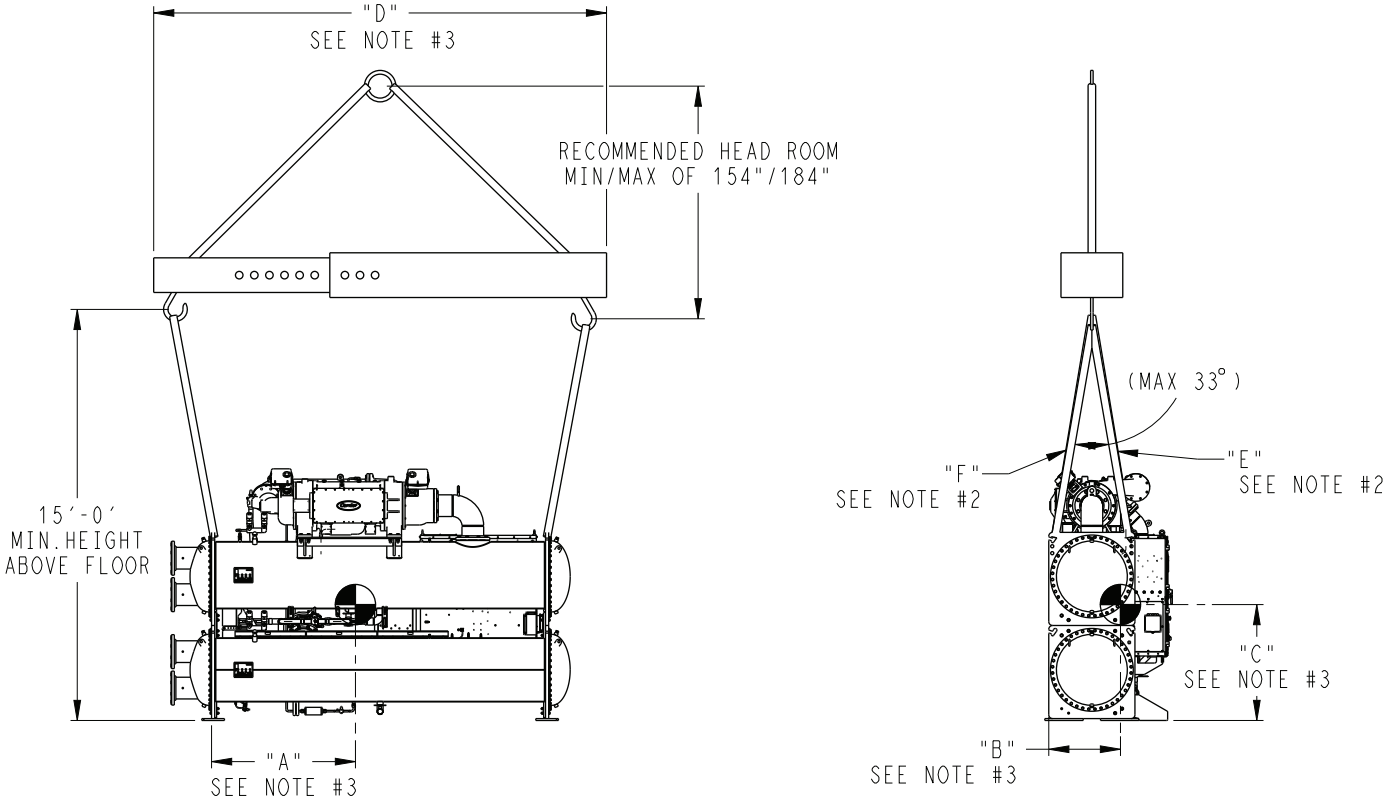
MWB — Marine Waterbox
NIH — Nozzle in Head

NOTES:

1. Each chain must be capable of supporting the entire weight of the machine. See chart for maximum weights. (The maximum weights shown cover weights from steel and copper tubing, insulation, and refrigerant charge, excluding water weight.)
2. Chain lengths shown are typical for 15 ft lifting height. Some minor adjustments may be required.
3. Dimensions "A" and "B" define distance from machine center of gravity to tube sheet outermost surfaces. Dimension "C" defines distance from machine center of gravity to floor. Dimension "D" defines distance measured between the chain lifting hooks.
4. Marine waterbox values are for 150 PSI rated.

Fig. 9 — Machine Rigging Guide, 19MV3

COMPRESSOR FRAME	EVAPORATOR CODE	MAX. WEIGHT lb (kg)	VESSEL LENGTH ft	DIM. "A" in.	DIM. "B" in.	DIM. "C" in.	DIM. "D" in.	CHAIN LENGTH	
								"E" in.	"F" in.
19MV2	11E-11N	12,571 (5,702)	11	61	17	41	158	124	124
	13E-13N	13,185 (5,981)	13	73	17	41	178	124	124
	21E-21N	14,552 (6,601)	11	52	32	51	158	124	124
	23E-23N	15,580 (7,034)	13	64	32	50	178	124	124



NOTES:

1. Each chain must be capable of supporting the entire weight of the machine. See chart for maximum weights. (The maximum weights shown cover weights from steel and copper tubing, insulation, and refrigerant charge, excluding water weight.)
2. Chain lengths shown are typical for 15 ft lifting height. Some minor adjustments may be required.
3. Dimensions "A" and "B" define distance from machine center of gravity to evaporator tube sheet outermost surfaces.
   Dimension "C" defines distance from machine center of gravity to floor.
   Dimension "D" defines distance measured between the chain lifting hooks.

Fig. 10 — Machine Rigging Guide, 19MV2

Table 1 — 19MV Dimensions (Nozzle-In-Head Waterbox)[a,b,c,d,e,f,g,h]

HEAT EXCHANGER SIZE	PASSES	A (LENGTH)		B (WIDTH)		C (HEIGHT)	
		in.	mm	in.	mm	in.	mm
1	2	182.5	4636	50	1267	90.75	2305
2	2	182.5	4636	62.5	1333	100	2541
3	2	182.5	4636	71	1803	71	1803
4[i]	2	183	4648	71	1803	74.25	1886
5[i]	2	183.5	4661	79.25	2013	81.5	2070

NOTE(S):

a. Service access should be provided per American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) 15, latest edition, National Fire Protection Association (NFPA) 70, local safety code, and Carrier drawings.
b. Overhead clearance for service rigging compressor should be at minimum 5 ft (1524 mm) with floor space identified adjacent to unit as per service clearance illustration to allow for compressor service.
c. Dimensions are approximate. Certified drawings available upon request.
d. Waterboxes typically add to the width of the machine. See certified drawings for details.
e. 'A' length dimensions shown are for standard 150 psig (1034 kPa) design and flanged connections. See certified drawings.
f. 19MV unit heights can vary depending on the configuration. Check 19MV certified drawings for height information.
g. Table contains heat exchanger dimensions. For arrangements where the compressor motor housing extends past the waterbox, consult the 19MV certified drawings.
h. Consult factory for configurations not listed in the above table.
i. Assumes both evaporator and condenser nozzles on same end of chiller; nozzle-in-head waterboxes, 150 psi rated.

Table 2 — 19MV Nozzle Size

FRAME SIZE	NOZZLE TYPE	PASSES	NOMINAL PIPE SIZE (in.)	
			EVAPORATOR	CONDENSER
1	Nozzle-in-Head	1	8	8
		2	N/A	6
		3	6	N/A
	Marine	1	N/A	6
		2	6	6
		3	N/A	N/A
2	Nozzle-in-Head	1	10	10
		2	8	8
		3	8	N/A
	Marine	1	10	10
		2	6	6
		3	6	N/A
3	Nozzle-in-Head	1	10	10
		2	8	8
		3	6	6
	Marine	1	10	8
		2	8	8
		3	6	8
4	Nozzle-in-Head	1	10	10
		2	8	8
		3	6	6
	Marine	1	10	8
		2	8	8
		3	6	8
5	Nozzle-in-Head	1	10	10
		2	10	10
		3	6	8
	Marine	1	10	10
		2	10	10
		3	6	10

Table 3 — 19MV Dimensions (Marine Waterbox, 150 psig)[a,b,c,d,e,f,g,h]

HEAT EXCHANGER SIZE	PASSES	A (LENGTH)		B (WIDTH)		C (HEIGHT)	
		in.	mm	in.	mm	in.	mm
1	2	188	477	50.5	1280	90.75	2305
2	2	191	4851	52.5	1333	100	2541
3	2	193	4902	71	1803	71	1803
4[i]	2	193.5	4915	71	1803	74.25	1886
5[i]	2	194	4928	79.25	2013	81.5	2070

NOTE(S):

a. Service access should be provided per American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) 15, latest edition, National Fire Protection Association (NFPA) 70, local safety code, and Carrier drawings.
b. Overhead clearance for service rigging compressor should be at minimum 5 ft (1524 mm) with floor space identified adjacent to unit as per service clearance illustration to allow for compressor service.
c. Dimensions are approximate. Certified drawings available upon request.
d. Marine waterboxes typically add to the width of the machine. See certified drawings for details.
e. 'A' length dimensions shown are for standard 150 psig (1034 kPa) design and flanged connections. See certified drawings.
f. 19MV unit heights can vary depending on the configuration. Check 19MV certified drawings for height information.
g. Table contains heat exchanger dimensions. For arrangements where the compressor motor housing extends past the waterbox, consult the 19MV certified drawings.
h. Consult factory for configurations not listed in the above table.
i. Assumes both evaporator and condenser nozzles on same end of chiller; marine waterboxes, 150 psi rated.

Table 4 — 19MV Compressor and Motor Weights[a]

BEARING TYPE	COMPONENT WEIGHT (lb)			COMPONENT WEIGHT (kg)		
	Compressor[b]	Stator and Housing	Rotor and Shaft	Compressor[b]	Stator and Housing	Rotor and Shaft
19MV2 MAGNETIC BEARING	1698	948	99	770	430	45
19MV3 MAGNETIC BEARING	2674	1184	150	1213	537	68
19MV3 ROLLER BEARING	2383	1248	134	1081	566	61

NOTE(S):

a. Total compressor weight is the sum of the compressor aerodynamic components (compressor weight column), stator, and rotor.
b. Compressor aerodynamic component weight only; motor weight and interstage piping is not included. Applicable to standard compressors only.

Table 5 — VFD and Power Panel Weights

VFD CODE	FRAME	VFD NAME	WEIGHT lb [kg]	POWER PANEL			TOTAL WEIGHT lb [kg]
				With Oil	Without Oil	Weight, lb [kg]	
7	D1h (110-160kw)	DD212,DD260,DD315	136.7 [62]		X	253.1 [241]	668.0 [303.0]
7	D2h (200-315kw)	DD395,DD480,DD588	276.9 [125.6]	X		478.4 [217]	755.3 [342.6]
					X	253.1 [241]	808.2 [366.6]
7	E1h (355-450kw)	DE658,DE745,DE800	650.4 [295.0]	X		478.4 [217]	1128.8 [512.0]
					X	253.1 [241]	1181.7 [536.0]
7	E2h (500-560kw)	DE880,DE990	701.1 [318.0]	X		478.4 [217]	1179.5 [535.0]
					X	253.1 [241]	1232.4 [559.0]
5	PF755	617 (Rockwell)	1962.1 [890.0]		X	478.4 [217]	2462.6 [1117.0]

Table 6 — 19MV Evaporator and Condenser Weights[a,b,c]

EVAPORATOR FRAME AND BUNDLE SIZE	DRY RIGGING WEIGHT[d]		CONDENSER FRAME AND BUNDLE SIZE	DRY RIGGING WEIGHT[d]	
	lb	kg		lb	kg
11E-11N	2376	1078	11K-11N	2532	1148
13E-13N	2646	1200	13K-13N	2838	1287
21E-21N	3285	1490	21K-21P	3816.5	1731.1
23E-23N	3662	1661	23K-23P	4262.2	1933.3
31E-31N	3450	1565	31C-31N	3680	1669
33E-33N	3835	1740	33C-33N	4086	1853
31R-31Z	268	1308			
33R-33Z	3164	1435			
41E-41N	4508	2045	41C-41N	4690	2127
43E-43N	5079	2304	43C-43N	5327	2416
41R-41Z	3736	1695			
43R-43Z	4167	1890			
51E-51N	5444	2470	51C-51N	5511	2500
53E-53N	6144	2787	53C-53N	6245	2833
51R-51Z	4339	1968			
53R-53Z	4830	2191			

NOTE(S):

a. Dry Rigging Weight includes standard 0.025 in. wall tubes and 150-lb 2-pass NIH covers. No refrigerant charge is included in the weight.
b. Evaporator weight includes 2-pass grooved dished heads.
c. Condenser weight includes the discharge pipe and 2-pass grooved dished heads; does not include economizer weight.
d. Actual evaporator refrigerant charge weight is calculated based on pass and nozzle arrangement as well as selected capacity. Therefore charge weight is not included in this publication. Charge weight for condenser and economizer are for reference only. User must consult unit name plate or the as-sold performance sheet or E-Cat selection sheet in order to obtain accurate refrigerant charge information.

Table 7 — 19MV Economizer Weight[a]

FRAME	ASSEMBLY WEIGHT (lb)	ASSEMBLY WEIGHT (kg)
1 - 2	201	91
3 - 5	379	172

NOTE(S):

a. Economizer assembly weight includes BPHX, economizer tubing and EXV, economizer mounting bracket, and piping/tubing from liquid line and from economizer to compressor.

Table 8 — 19MV Nozzle-in-Head Waterbox Weights

DESIGN PRESSURE [psig]	FRAME SIZE	WATER PASSES	EVAPORATOR NOZZLE-IN-HEAD STEEL WEIGHT (RIGGING)				CONDENSER NOZZLE-IN-HEAD STEEL WEIGHT (RIGGING)			
			kg Flanged	kg Grooved	lb Flanged	lb Grooved	kg Flanged	kg Grooved	lb Flanged	lb Grooved
150	1	2	73	59	161	130	50	36	110	79
		2 (return)	24	24	53	53	24	24	53	53
	2	2	108	85	238	186	108	85	238	186
		2 (return)	56	56	123	123	56	56	123	123
	3	2	108	85	238	186	108	85	238	186
		2 (return)	56	56	123	123	56	56	123	123
	4	2	116	93	256	204	108	85	238	186
		2 (return)	56	56	123	123	56	56	123	123
	5	2	141	107	311	236	141	107	311	236
		2 (return)	71	71	155	155	71	71	155	155

Table 9 — 19MV Marine Waterbox Weights[a]

DESIGN PRESSURE [psig]	FRAME SIZE	WATER PASSES	EVAPORATOR MARINE WATERBOX STEEL WEIGHT (RIGGING)				CONDENSER MARINE WATERBOX STEEL WEIGHT (RIGGING)			
			kg Flanged	kg Grooved	lb Flanged	lb Grooved	kg Flanged	kg Grooved	lb Flanged	lb Grooved
150	1	2	140	125	309	276	154	139	340	306
		2 (return)	—		—		—		—	
	2	2	273	258	602	569	273	258	602	569
		2 (return)	—		—		—		—	
	3	2	166	166	365	365	166	166	365	365
		2 (return)	—		—		—		—	
	4	2	428	428	944	944	449	449	989	989
		2 (return)	—		—		—		—	
	5	2	555	555	1223	1223	542	542	1195	1195
		2 (return)	—		—		—		—	

NOTE(S):

a. This table is the additional weight adder compared to150-lb unit with NIH covers.

RIG MACHINE COMPONENTS

Refer to instructions below, Fig. 11-12, and Carrier Certified Prints for machine component disassembly.

IMPORTANT: Only a qualified service technician should perform this operation. Disassembly is only allowed with Carrier supervision. To deviate from this requires written approval from your Carrier Technician Service Manager.

⚠ WARNING

Do not attempt to disconnect flanges or tubing while the machine is under pressure or contains refrigerant. Failure to relieve pressure can result in personal injury or damage to the unit.

⚠ CAUTION

Before rigging the compressor, disconnect all wires connected to the control/power panel to avoid damage to electrical components.

NOTE: If the evaporator, economizer, and condenser vessels must be separated, the heat exchangers should be kept level by placing a support plate under the tube sheets. The support plate will also help to keep the vessels level and aligned when the vessels are bolted back together. It is also suggested that some type of alignment method, such as dowels are used, to confirm the components are returned to their original position when the unit is reassembled.

NOTE: Wiring must also be disconnected. Label each wire before removal (see Carrier Certified Prints). In order to disconnect the VFD from the machine, remove wiring and flex cables between the VFD and the control panel, and the main motor leads at the starter lugs.

Remove all transducer and sensor wires at the sensor. Clip all wire ties necessary to pull heat exchangers apart. Remove the oil from the compressor (oil lubricated compressor only) and store in clean, dry containers or dispose of as required by local regulations. The oil is hygroscopic and will absorb moisture from the atmosphere, so do not reuse moisture contaminated oil.

To Separate Evaporator and Condenser:

1. Place a support plate under each tube sheet leg to keep each vessel level.
2. Cut liquid line tubing between evaporator and condenser before the EXV valve.
3. Remove discharge pipe from compressor by attaching a lifting eye and rigging chain/strap to check valve; then unbolt discharge pipe flange and remove check valve or optional refrigerant isolation valve for oil lubricated unit.
4. Disconnect the O-ring face seal on the compressor end and the O-ring face seal at the filter underneath the condenser.
5. Unbolt economizer vapor line from first stage volute.
6. Cover all openings.
7. Disconnect all wires and cables that cross from evaporator side of the machine to the condenser side.
8. Disconnect the marriage brackets connecting the evaporator and condenser tubesheets (both ends).

To Separate the Compressor from the Evaporator:

1. Unbolt motor drain flange.
2. Unbolt suction pipe flange.
3. Remove discharge pipe from compressor by attaching a lifting eye and rigging chain/strap to check valve; then unbolt discharge pipe flange and remove check valve.
4. Unbolt economizer vapor line from first stage volute.
5. Disconnect the O-ring face seal on the compressor end and the O-ring face seal at the filter underneath the condenser.
6. Disconnect all power and control wires connected to the compressor.

   NOTE: Many wires have connectors that can be easily disconnected from the back of the power panel.
7. Cover all openings.
8. Disconnect compressor motor power cables to motor.
9. Unbolt compressor mounting from the evaporator.

Additional Notes

1. Use silicone grease on new O-rings when refitting.
2. Use gasket sealant on new gaskets when refitting.
3. Use VicLube on grooved coupling gasket on discharge line.
4. Review compressor handling procedure due to permanent magnet rotor.
5. All fasteners should be torqued to the rated value of the fastener.

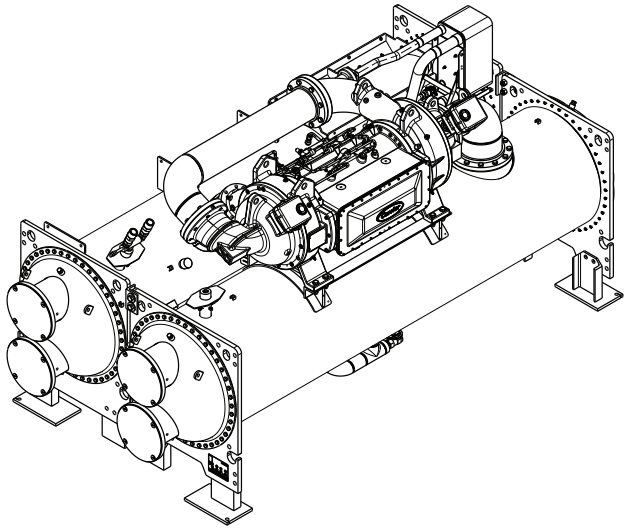
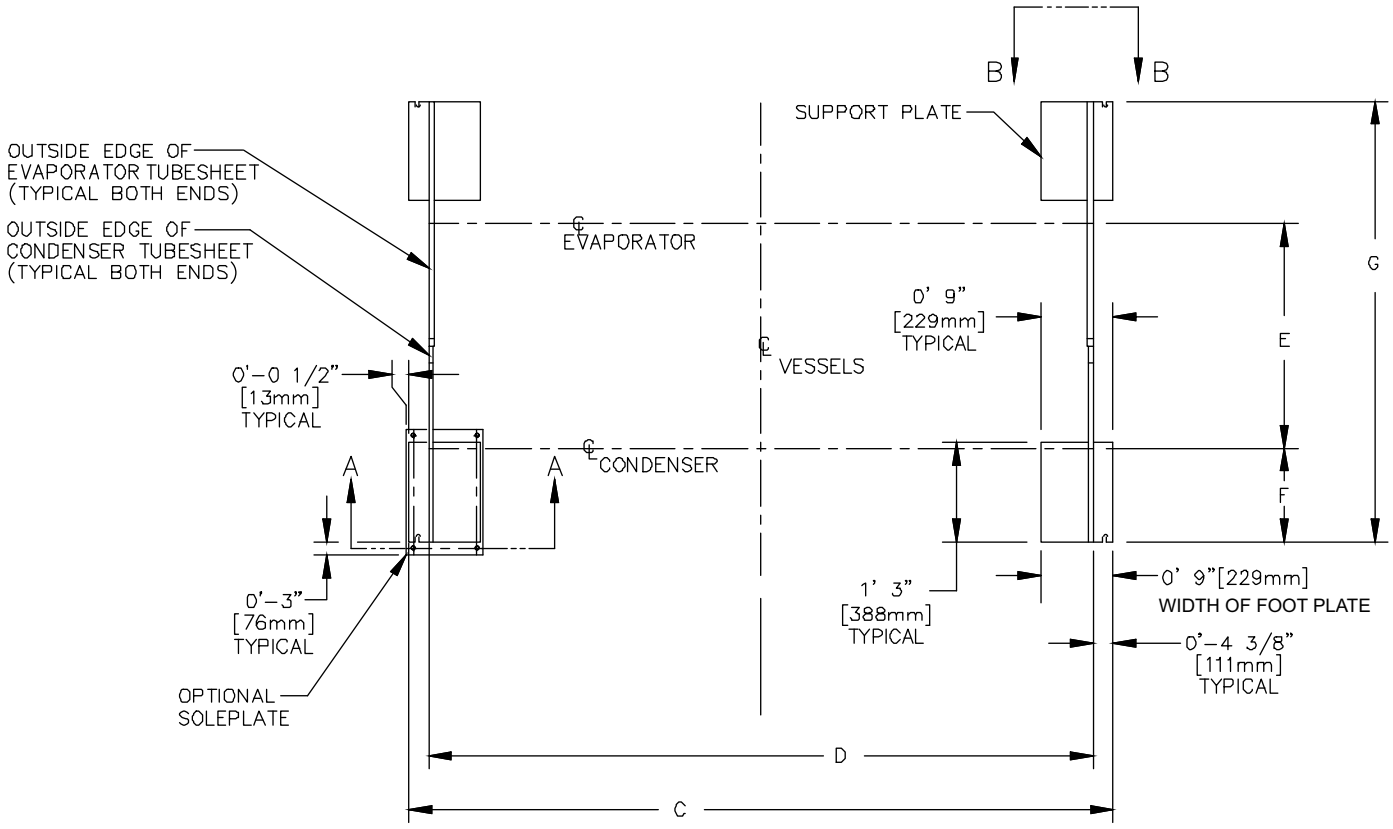


Fig. 11 — 19MV, Side View (19MV3 Shown)



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
1	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
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

NOTE(S):
1. View A-A refers to accessory soleplate.
2. View B-B refers to standard support plate.
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).

Fig. 12 — 19MV Machine Footprint

Step 3 — Install Machine Supports

INSTALL STANDARD ISOLATION

Figure 13 shows the position of support plates and shear flex pads, which together form the standard machine support system.

IMPORTANT: Chiller housekeeping pad, anchor bolts, and attachment points that are designed by others must be in accordance with all applicable national and local codes.

INSTALL ACCESSORY ISOLATION (IF REQUIRED)

Uneven floors or other considerations may dictate the use of accessory soleplates (supplied by Carrier for field installation) and leveling pads. Refer to Fig. 13.

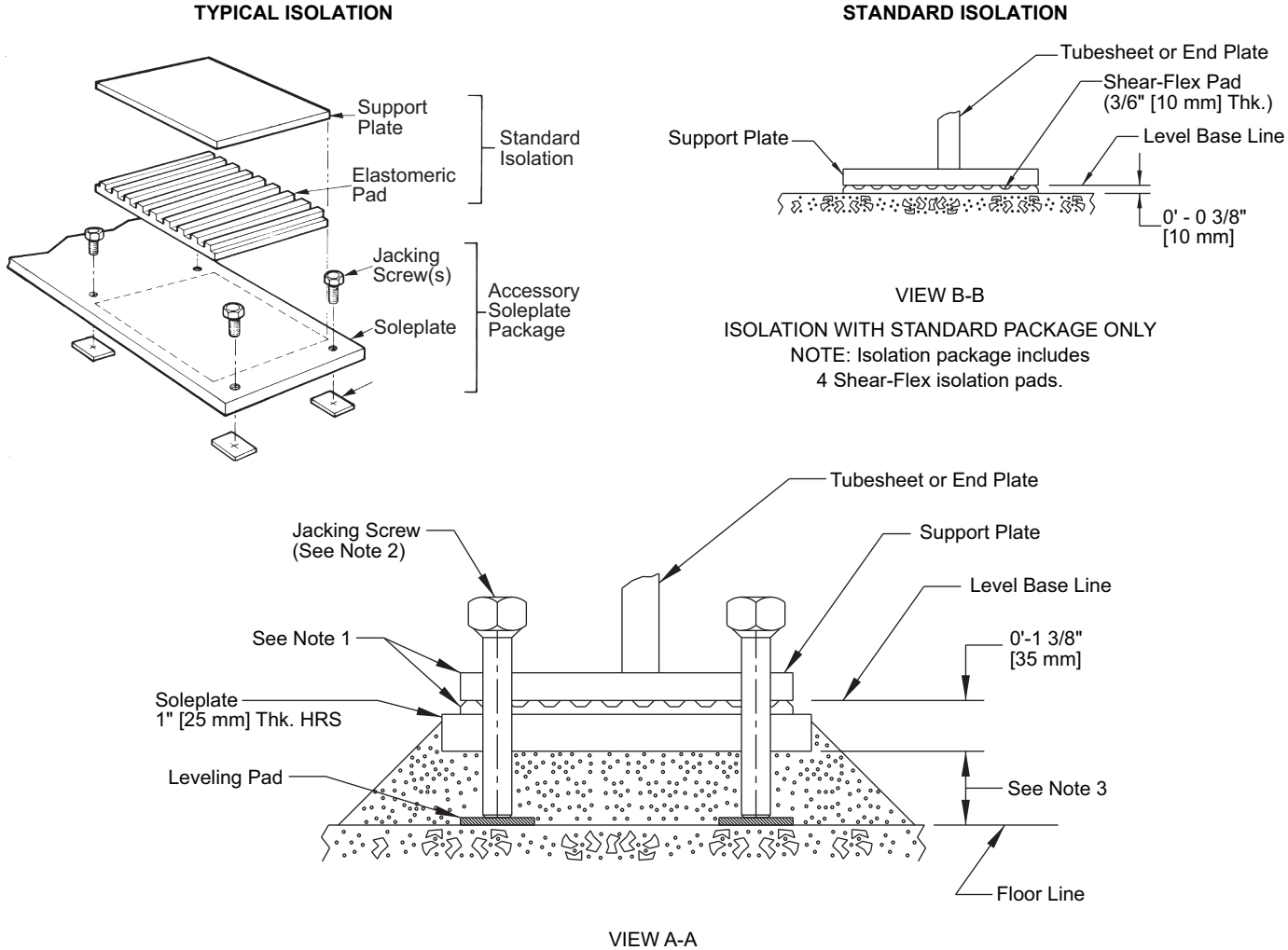
Chiller support plates must be level within 1/4 in. (6 mm) from one end to the other.

Level machine by using jacking screws in isolation soleplates. Use a level at least 24 in. (600 mm) long.

For adequate and long lasting machine support, proper grout selection and placement is essential. Carrier recommends that only pre-mixed, epoxy type, non-shrinking grout be used for machine installation. Follow manufacturer's instructions in applying grout.

1. Check machine location prints for required grout thickness.
2. Carefully wax jacking screws for easy removal from grout.
3. Grout must extend above the base of the soleplate and there must be no voids in grout beneath the plates.
4. Allow grout to set and harden, per manufacturer's instructions, before starting machine.
5. Remove jacking screws from leveling pads after grout has hardened.

NOTE: If transmission of vibrations from mechanical equipment is of concern, Carrier suggests that a structural engineer be consulted. Sound transmission from the equipment to the structure is not the responsibility of the manufacturer.



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 MasterFlow[1] 885, 0'-1-1/2" (38.1 mm) to 0'-2-1/4" (57 mm) thick.

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

Fig. 13 — Accessory Isolation with Soleplate Package

INSTALL SPRING ISOLATION

Spring isolation may be purchased as an accessory from Carrier for field installation. It may also be field supplied and installed. Spring isolators may be placed directly under machine support plates or located under machine soleplates. See Fig. 14. Consult job data for specific arrangement. Low profile spring isolation assemblies can be field supplied to keep the machine at a convenient working height.

Obtain specific details on spring mounting and machine weight distribution from job data. Also, check job data for methods to support and isolate pipes that are attached to spring isolated machines.

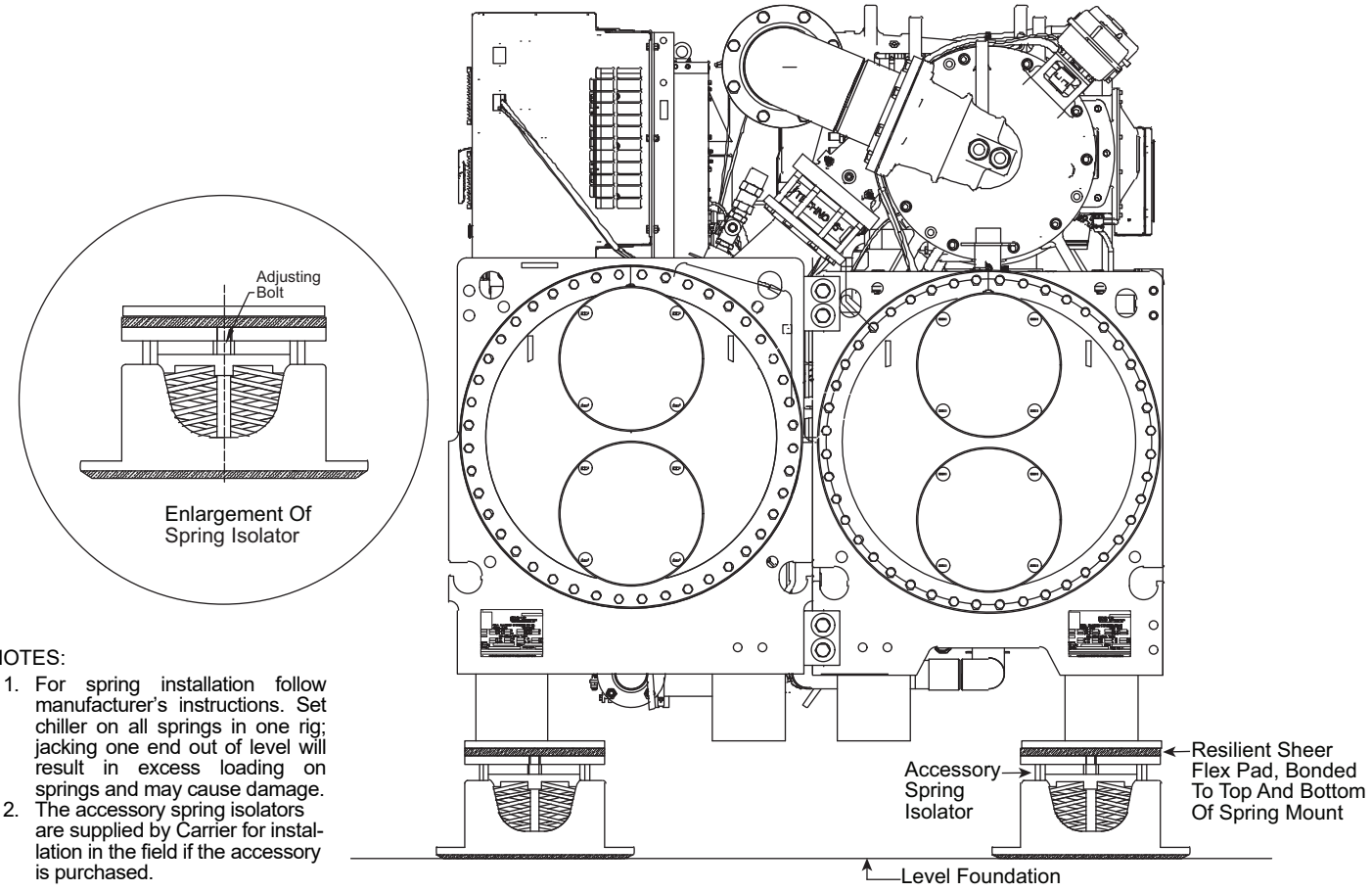
NOTE: The springs are designed to support the weight of the chiller only. Connected piping must be supported independently of the chiller.

NOTE: It is recommended that any installation other than the ground floor should have spring isolation for the chiller and piping vibration isolation.

NOTE: These isolators are not intended for seismic duty, but are intended to reduce the vibration and noise levels transmitted from the chiller to the surrounding environment. For installations adjacent to areas that are sensitive to noise and/or vibration, use the services of a qualified consulting engineer or acoustics expert to determine whether these springs will provide adequate noise/vibration suppression.

INSTALL TOPHAT

The tophat is shipped separately (strapped HMI near end of cooler). To install, remove existing cover on top of the control panel and install tophat with removable access cover facing outwards. Cut holes in top cover as appropriate for the selected conduit size and run the individual wires to the appropriate termination points. The tophat is required to extend the distance for bending the field installed power wiring before the connection in the power panel. See Fig. 15.



NOTES:

1. For spring installation follow manufacturer's instructions. Set chiller on all springs in one rig; jacking one end out of level will result in excess loading on springs and may cause damage.
2. The accessory spring isolators are supplied by Carrier for installation in the field if the accessory is purchased.

Fig. 14 — 19MV Accessory Spring Isolation (Shown with Accessory Soleplates)

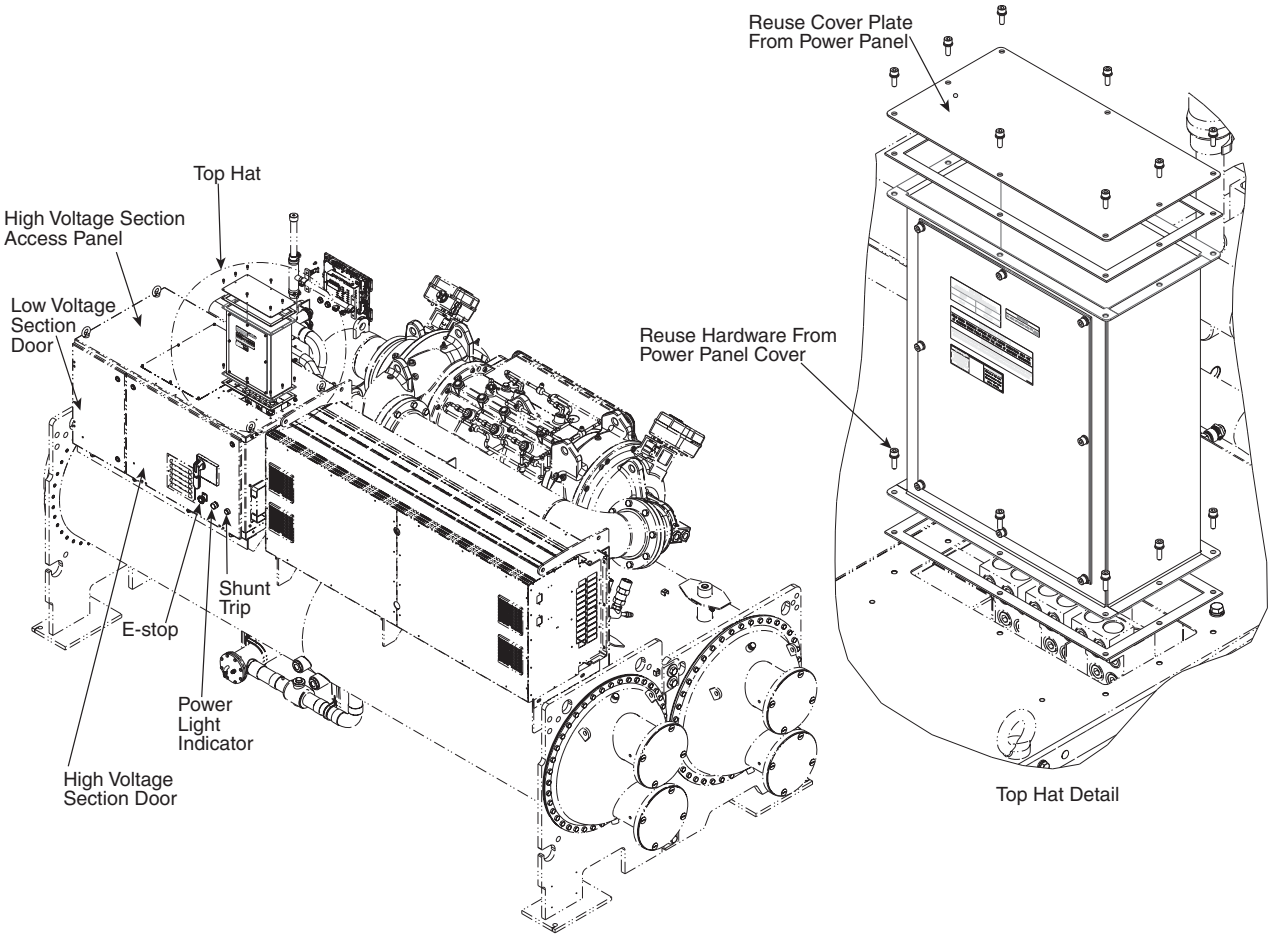


Fig. 15 — Tophat Installation (19MV3 Only)

Step 4 — Connect Piping

INSTALL WATER PIPING TO HEAT EXCHANGERS

Install piping using job data, piping drawings, and procedures outlined below. A typical piping installation is shown in Fig. 16.

⚠ CAUTION

Factory-supplied insulation is not flammable but can be damaged by welding sparks and open flame. Protect insulation with a wet canvas cover.

⚠ CAUTION

To prevent damage to sensors, remove evaporator and condenser water temperature sensors before welding connecting piping to water nozzles. Replace sensors after welding is complete.

⚠ CAUTION

When flushing the water systems, isolate the chiller from the water circuits to prevent damage to the heat exchanger tubes.

⚠ CAUTION

Piping design must ensure separation of chiller heat-exchanger water/brine from building potable water.

⚠ CAUTION

Particulate that is large enough to result in damage should be removed by a temporary or permanent screen/strainer before it can enter the heat exchanger.

1. Offset pipe flanges to permit removal of waterbox cover for maintenance and to provide clearance for pipe cleaning. No flanges are necessary with marine waterbox option; however, water piping should not cross in front of the waterbox or compressor because service access will be blocked.
2. Provide openings in water piping for required pressure gauges and thermometers. For thorough mixing and temperature stabilization, wells in the leaving water pipe should extend inside pipe at least 2 in. (50 mm).
3. Install air vents at all high points in piping to remove air and prevent water hammer.
4. Field-installed piping must be arranged and supported to avoid stress on the equipment and transmission of vibration from the equipment. Piping must be installed to prevent interference with routine access for the reading, adjusting, and servicing of the equipment. Provisions should be made for adjusting the piping in each plane for periodic and major servicing of the equipment.
5. Water flow direction must be as specified in Fig. 17-20.

NOTE: Entering water is always the lower of the 2 nozzles. Leaving water is always the upper nozzle for evaporator or condenser for two and three pass arrangements.

6. Install waterbox vent and drain piping according to individual job data. Consult certified drawings for connection size.

7. Isolation valves are recommended on the evaporator and condenser piping to each chiller for service.
8. Apply appropriate torque on the retaining bolts in a crisscross pattern for the water box covers before insulating the water box cover. The gasket can relax during transportation and storage and the water box cover requires retightening of the bolts during installation.

INSTALL VENT PIPING TO RELIEF DEVICES

The 19MV chiller is factory equipped with relief valves on the evaporator and condenser shell. See Table 10 and Fig. 21 for size and location of relief devices.

⚠DANGER

EXPLOSION HAZARD

Failure to follow the safety warnings exactly could result in serious injury, death, or property damage.

Pressure relief device sizing is based on the assumption that there are no combustible materials within 20 ft (7.7 m) of the pressure vessels.

Vent relief devices to the outdoors in accordance with ANSI/ASHRAE 15 (latest edition) Safety Code for Mechanical Refrigeration and all other applicable codes.

⚠DANGER

Refrigerant discharged into confined spaces can displace oxygen and cause asphyxiation.

1. If relief devices are manifolded, the cross-sectional area of the relief pipe must at least equal the sum of the areas required for individual relief pipes.
2. Provide a removable fitting near outlet side of each relief device for leak testing. Provide pipe fittings that allow vent piping to be disconnected periodically for inspection of valve mechanism.
3. Piping to relief devices must not apply stress to the device. Adequately support piping. A length of flexible tubing or piping near the device is essential on spring-isolated machines.
4. Cover the outdoor vent with a rain cap and place a condensation drain at the low point in the vent piping to prevent water build-up on the atmospheric side of the relief device.
5. If modulating valves are installed on the evaporator or condenser, they should be installed on the outlet piping.

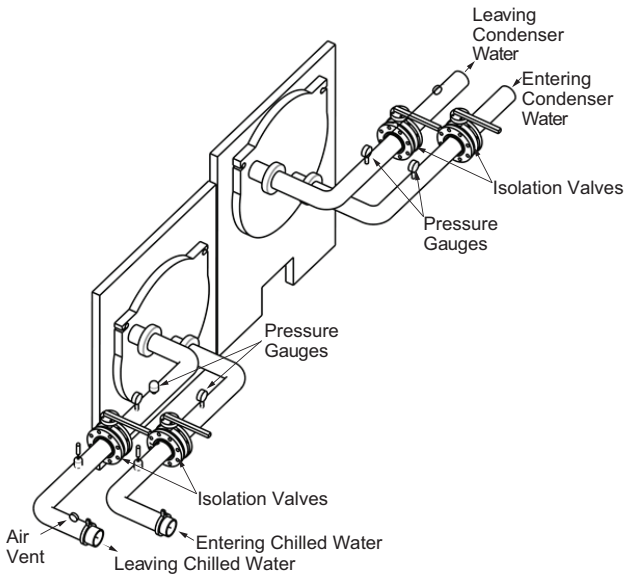
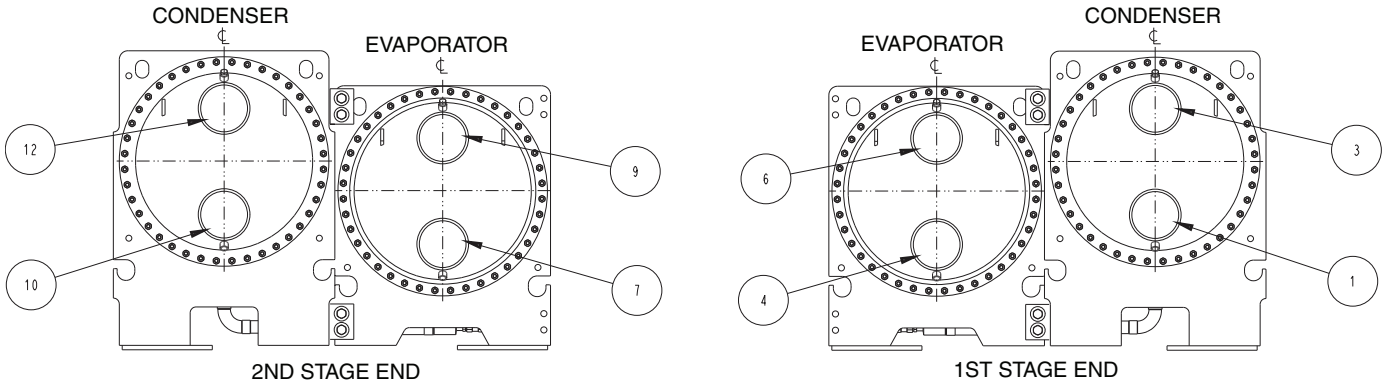


Fig. 16 — Typical Nozzle Piping

NOZZLE-IN-HEAD (NIH) 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

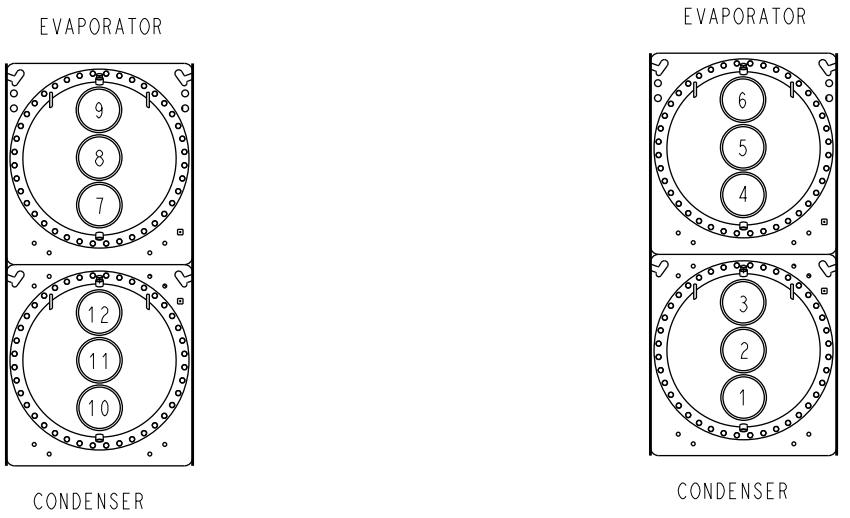
CONDENSER WATERBOXES[a]			
PASS	In	Out	Arrangement Code[b]
2	10	12	R
	1	3	S

NOTE(S):

a. Vents and drains are 3/4 in., FPT, located on waterbox head.
b. Refer to certified drawings.
c. The drain plugs are not provided by the CLT Factory to confirm the water drains from the heat exchanger.

Fig. 17 — Nozzle Arrangement Codes for 19MV3 Nozzle-in-Head Waterboxes

19MV2 NOZZLE-IN-HEAD (NIH) WATERBOXES



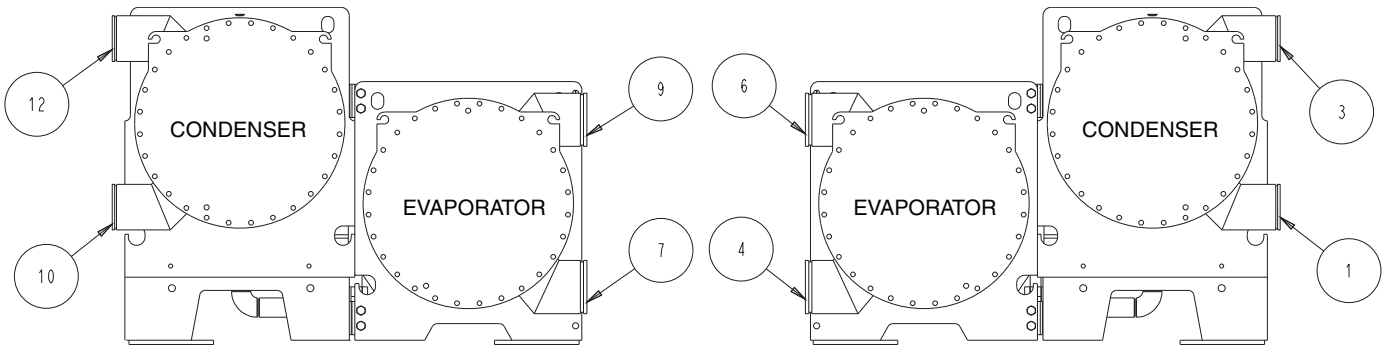
NOZZLE ARRANGEMENT CODES FOR NOZZLE-IN-HEAD WATERBOXES

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

Fig. 18 — Nozzle Arrangement Codes for 19MV2 Nozzle-in-Head Waterboxes

MARINE WATERBOXES (MWB)



NOZZLE ARRANGEMENT CODES FOR MARINE WATERBOXES

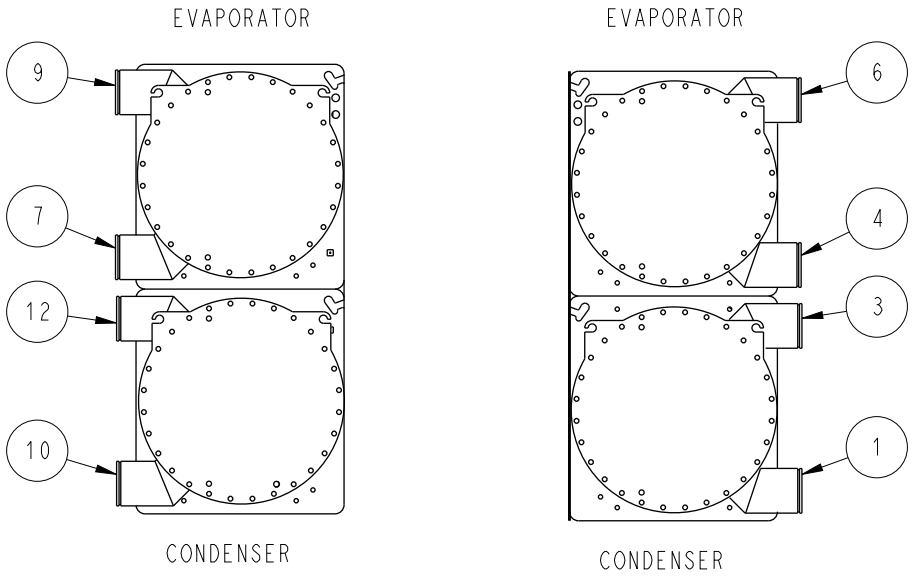
EVAPORATOR WATERBOXES[a]			
PASS	**In**	**Out**	**Arrangement Code[b]**
2	7	9	C
	4	6	D

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.
c. The drain plugs are not provided by the CLT Factory to confirm the water drains from the heat exchanger.

Fig. 19 — Nozzle Arrangement Codes for 19MV3 Marine Waterboxes



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.
c. The drain plugs are not provided by the CLT Factory to confirm the water drains from the heat exchanger.

Fig. 20 — Nozzle Arrangement Codes for 19MV2 Marine Waterboxes

Table 10 — Relief Device Locations

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

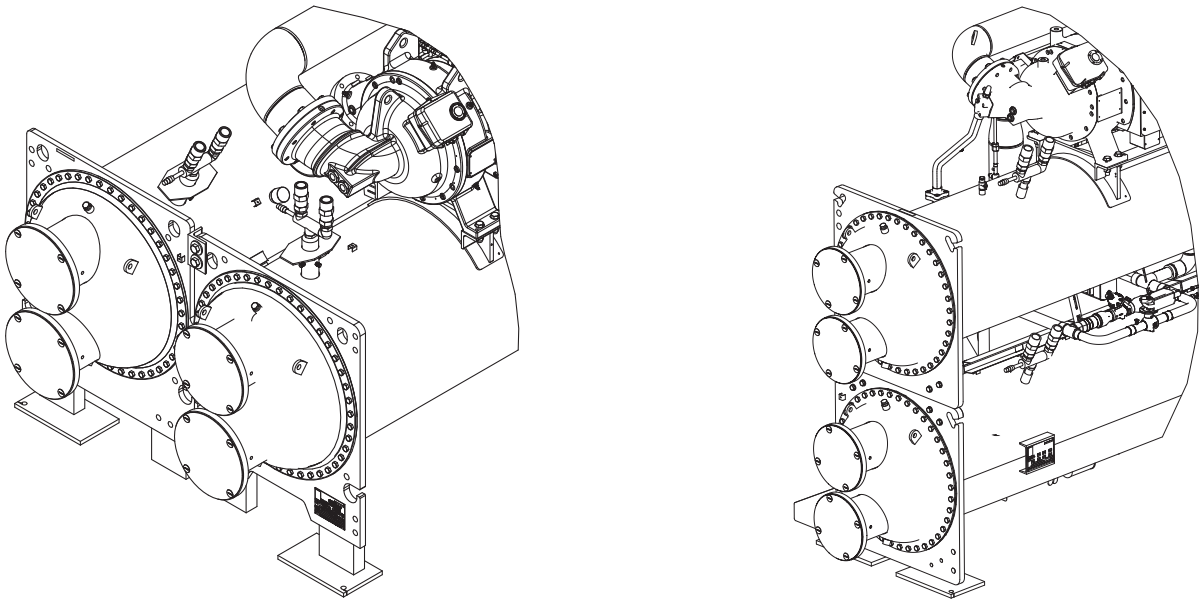


Fig. 21 — Relief Device Arrangements

Step 5 — Make Electrical Connections

Field wiring must be installed in accordance with job wiring diagrams and all applicable electrical codes.

⚠ CAUTION

Do not run any hazardous voltage wiring in the control panel sections associated with extra-low voltage wiring. Damage to machine could occur as a result.

Wiring diagrams in this publication are for reference only and are not intended for use during actual installation; follow job specific wiring diagrams.

⚠ CAUTION

Do not attempt to start compressor or any motor (even for a rotation check) or apply test voltage of any kind to the VFD or motor while the chiller is under a dehydration vacuum. Motor insulation breakdown and serious damage may result.

NOTE: The dry contacts for the field inputs should be located as close to the unit as possible. The field wiring should be capable of preventing electrical noise or induced voltage and should not be routed with any wires with voltage over 50-v.

CONNECT CONTROL INPUTS

Wiring may be specified for a spare safety switch, and a remote start/stop contact can be wired to terminal 4TB in the control panel. Additional spare sensors and control modules may be specified as well. See communication wiring in Fig. 22.

CONNECT CONTROL OUTPUTS

Connect auxiliary equipment, chilled and condenser water pumps, and spare alarms as required and indicated on job wiring drawings.

With the optional third and fourth IOB configured, the hydraulic control function will be available; with this function, the tower fan can be controlled through the Carrier controller. It also will support three types of water flow measurement: water flow switch, water flow meter, and water pressure differential sensor. See Fig. 23-30. Control board contact output can control loads rated 1 amp AC RMS steady state and 4 amps surge. Coil voltage of output relay is 24 vac. If equipment is supplied without pilot relays, be sure to install a pilot relay between the IOB and outputs to devices such as evaporator pump, condenser pump, tower fan low, tower fan high, and other outputs with large starters. Suggested rating of pilot relay is 10 amps; for example, 19XV05005503.

⚠ CAUTION

Provision for Carrier to start water pumps and establish flows must be provided to assure machine protection. If primary pump and flow are controlled by other means, also provide parallel means for control by Carrier. Failure to do so could result in machine freeze-up or overpressure and loss of warranty.

CONNECT POWER

The 19MV chiller has a unit-mounted, factory-installed VFD starter. See Fig. 31-33. The VFD is fully wired to the Carrier control panel and HMI. To apply power, attach power leads by routing them through the tophat to the line side of the chiller main circuit breaker. Connect stranded wire to pressure connectors and torque. For specifics, see Conductor Usage Table in “NOTES FOR FIG. 22-30” on page 35.

NOTE: A Carrier-provided tophat is required to be installed to the top of the power panel for adequate wire installation space (Fig. 15).

IMPORTANT: Be sure to ground the power circuit in accordance with the National Electrical Code (NEC), applicable local codes, and job wiring diagrams. Also, make sure correct phasing is observed for proper rotation. The only acceptable power supply to this chiller is a transformer with a wye secondary with solidly grounded neutral configuration. If there is a different type of power supply, the chiller may require an isolation transformer to be installed to prevent damage to the VFD. Contact Carrier Service Engineering or Technical Service Manager.

⚠ CAUTION

Use the knockouts provided in the control / power panels for wiring connections. Do not punch holes or drill into the top surface of any control enclosure. Damage to machine could result and could require component replacement.

⚠ CAUTION

Do not punch holes or drill into the top surface of power panel. Damage to machine could result. Use knockouts provided in the control / power panels for wiring connections.

⚠ WARNING

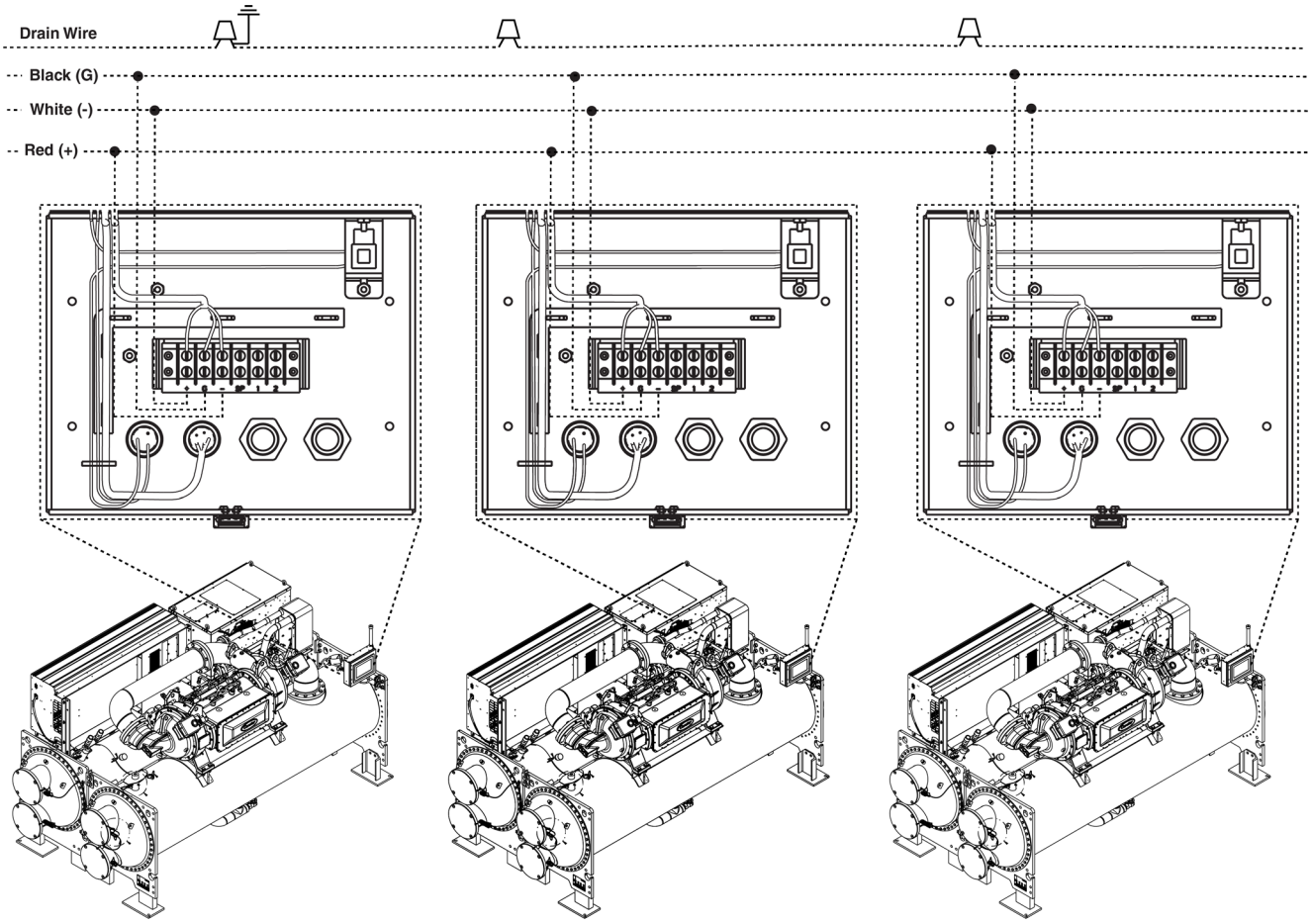
For a control transformer built to Carrier specifications, do not connect an outside source of control power. An outside power source will produce dangerous voltage at the line side of the starter, because supplying voltage at the transformer secondary terminals produces input level voltage at the transformer primary terminals. Severe injury could result.

⚠ CAUTION

The control transformers are sized for the existing chiller components. Do not connect any external loads such as actuators, solenoid valves, etc., or equipment damage could result.

⚠ WARNING

The chiller control power is connected to the primary side of the main breaker inside the power panel. To turn the chiller power off, the Main Circuit Breaker (MCB), Service Circuit Breaker (SCB), and Uninterruptible Power Supply (UPS) are all required to be turned off even when the source of power to the chiller is turned off.



NOTE : Field-supplied terminal strip must be located in control panel.

Fig. 22 — CCN Communication Wiring for Multiple Chillers (Typical)

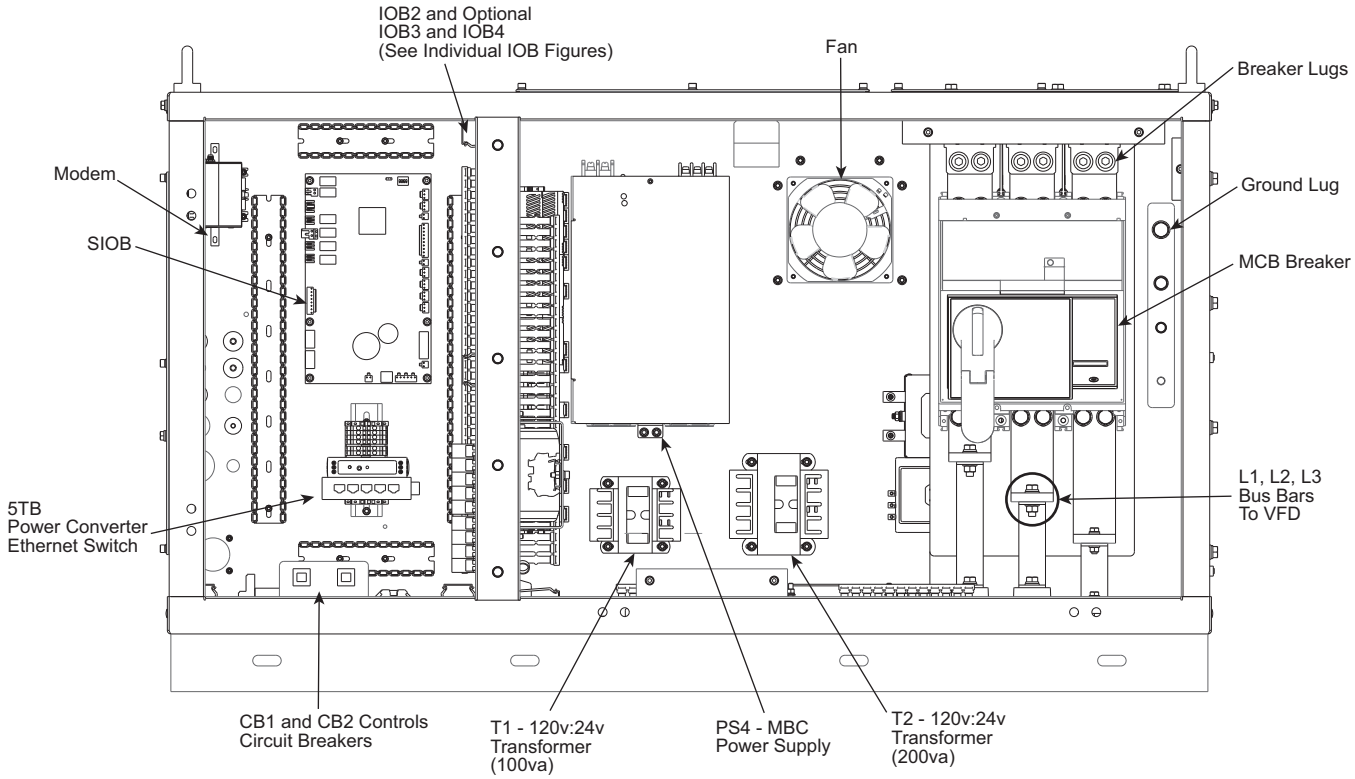


Fig. 23 — Control Panel - Front View

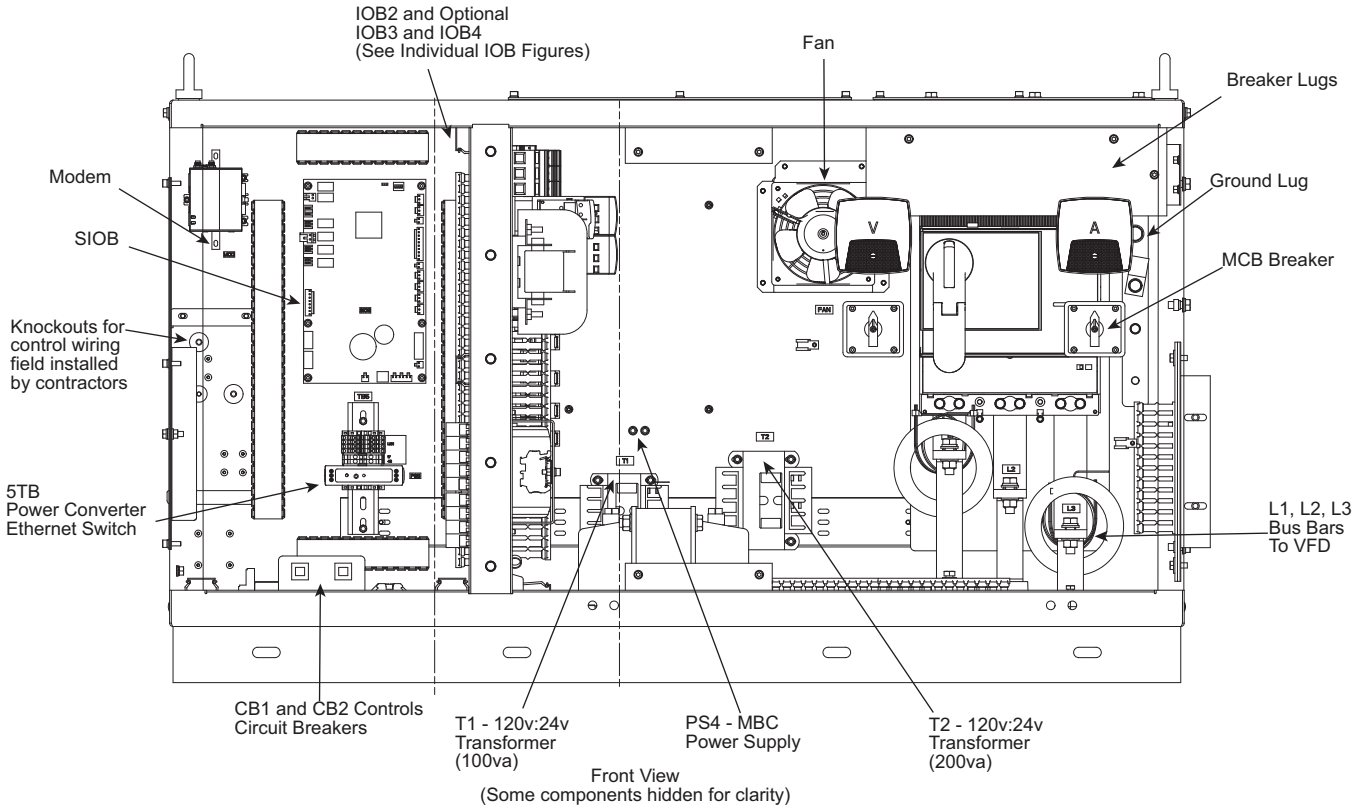
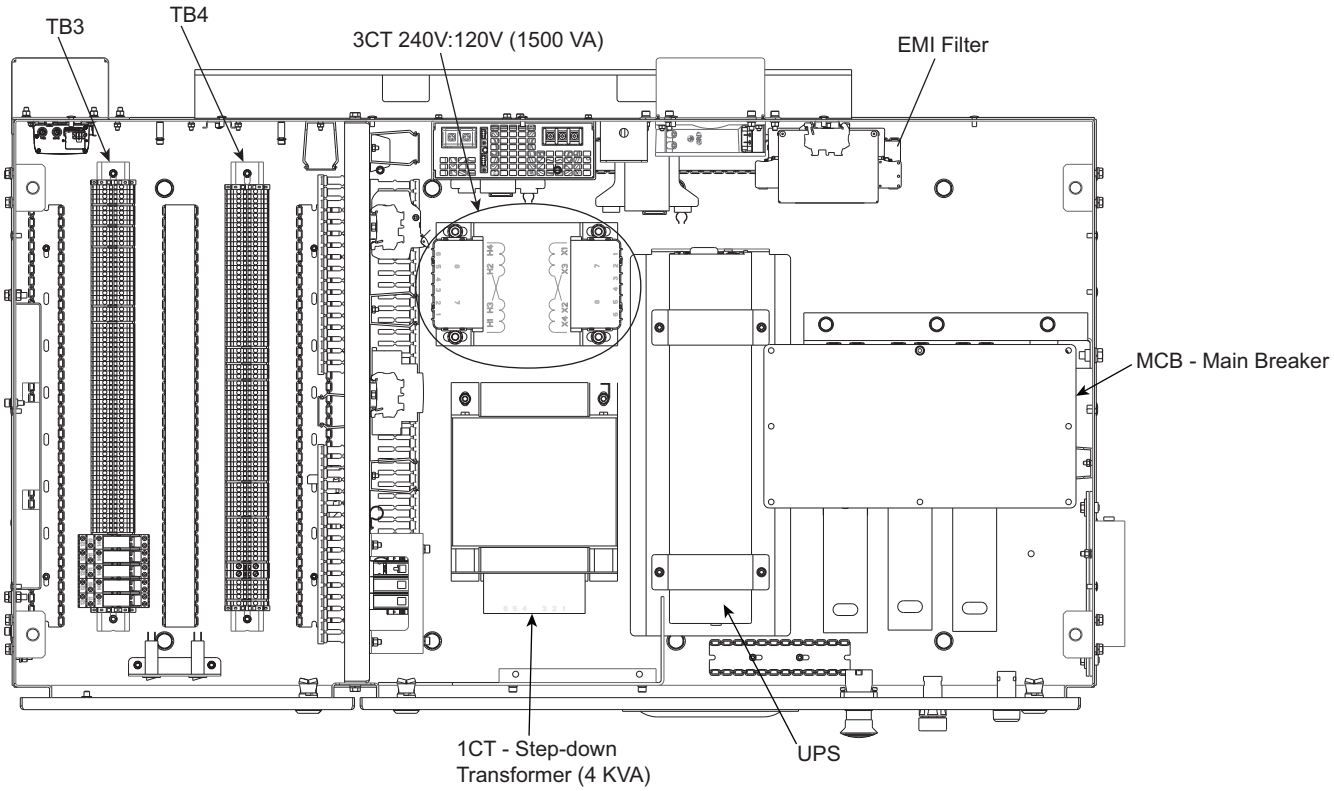


Fig. 24 — 19MV3 (Oil Lubricated Option) Control Panel - Front View



NOTE: Field Wiring Connections Are All on Terminal Blocks TB3 and TB4 (Located on Floor of Low Voltage Section)

Fig. 25 — Control Panel - Top View

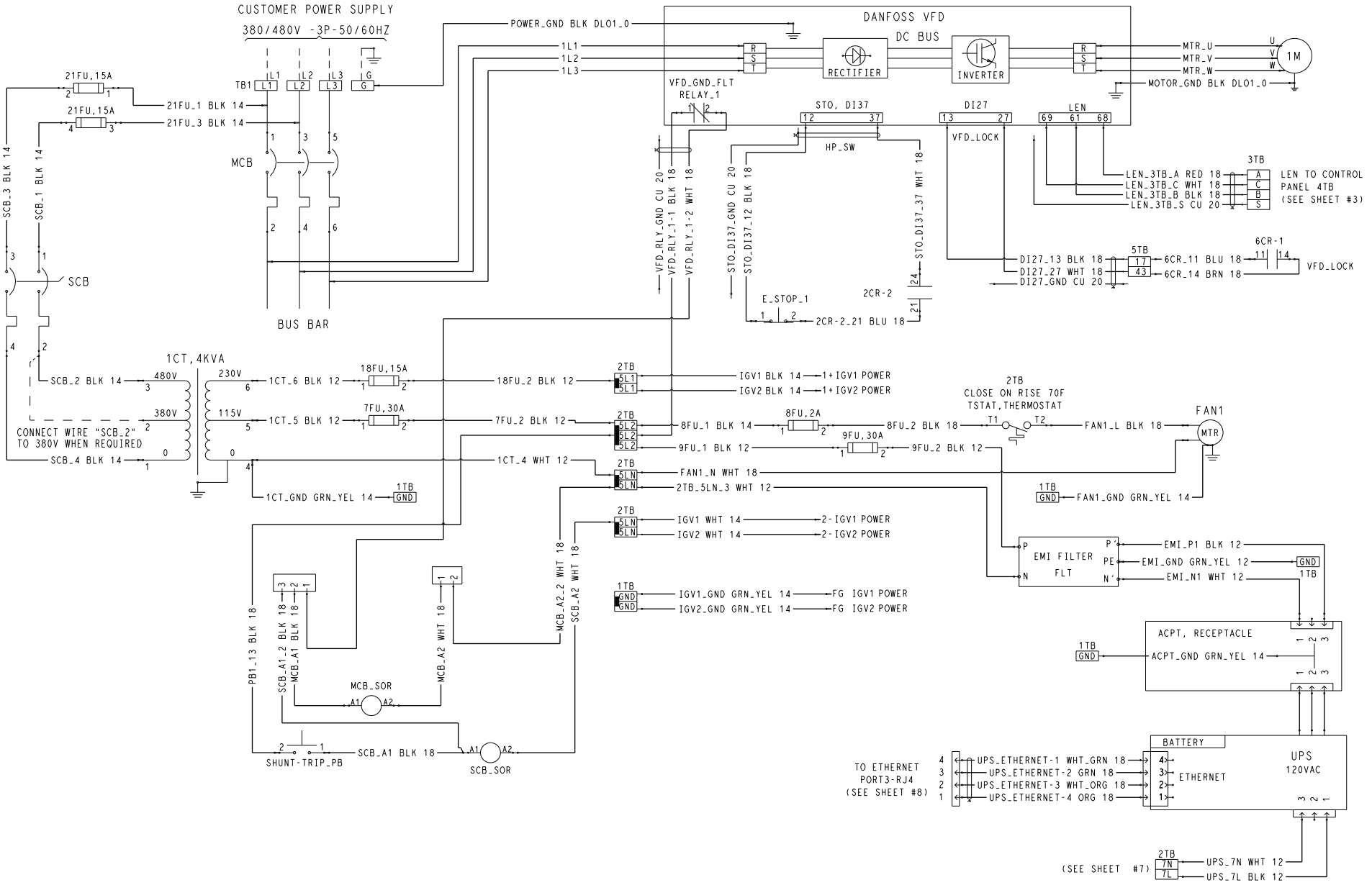


Fig. 26 — Customer Power Supply and Danfoss Standard Tier VFD Wiring

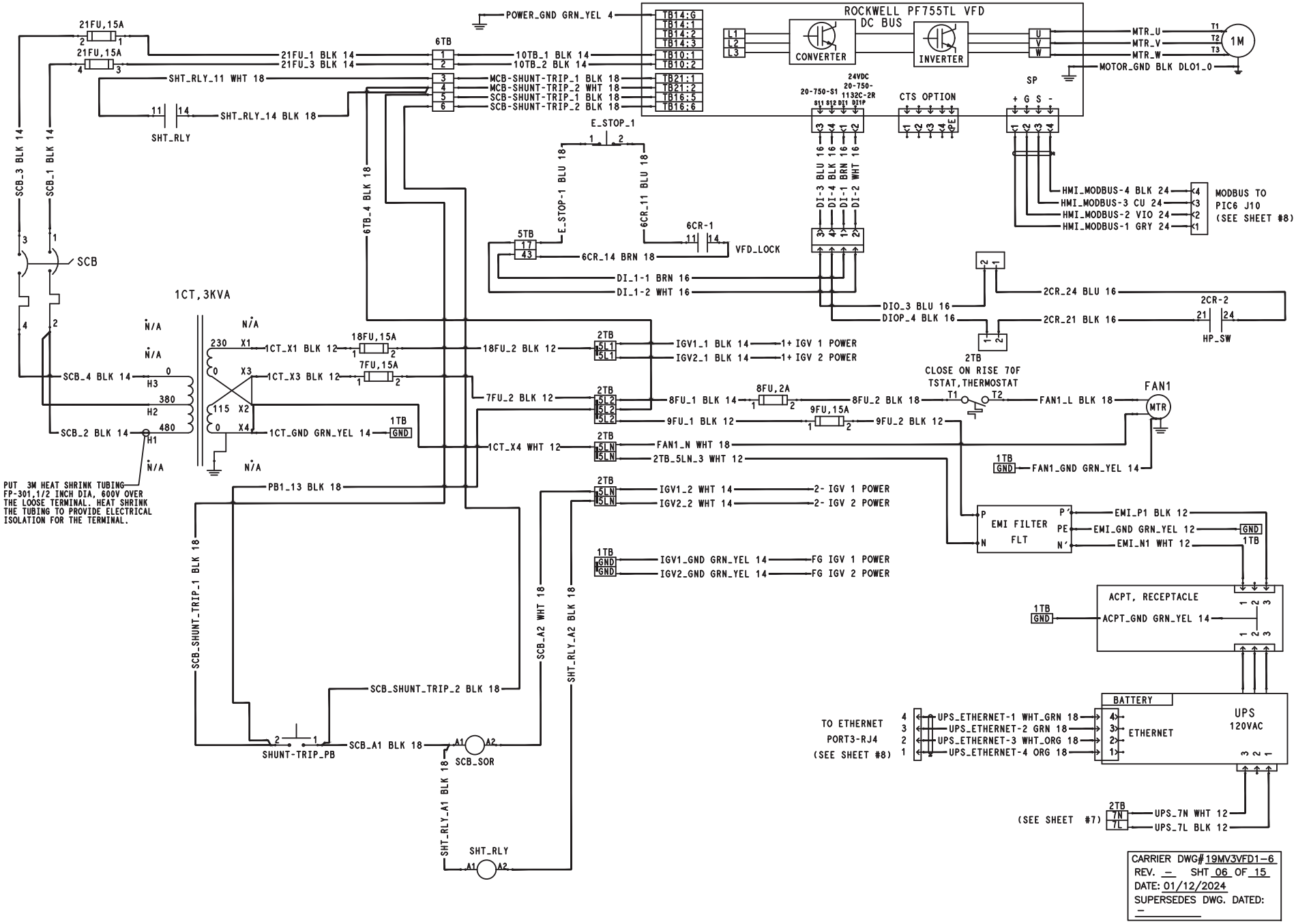


Fig. 27 — Customer Power Supply and Rockwell High Tier VFD Wiring

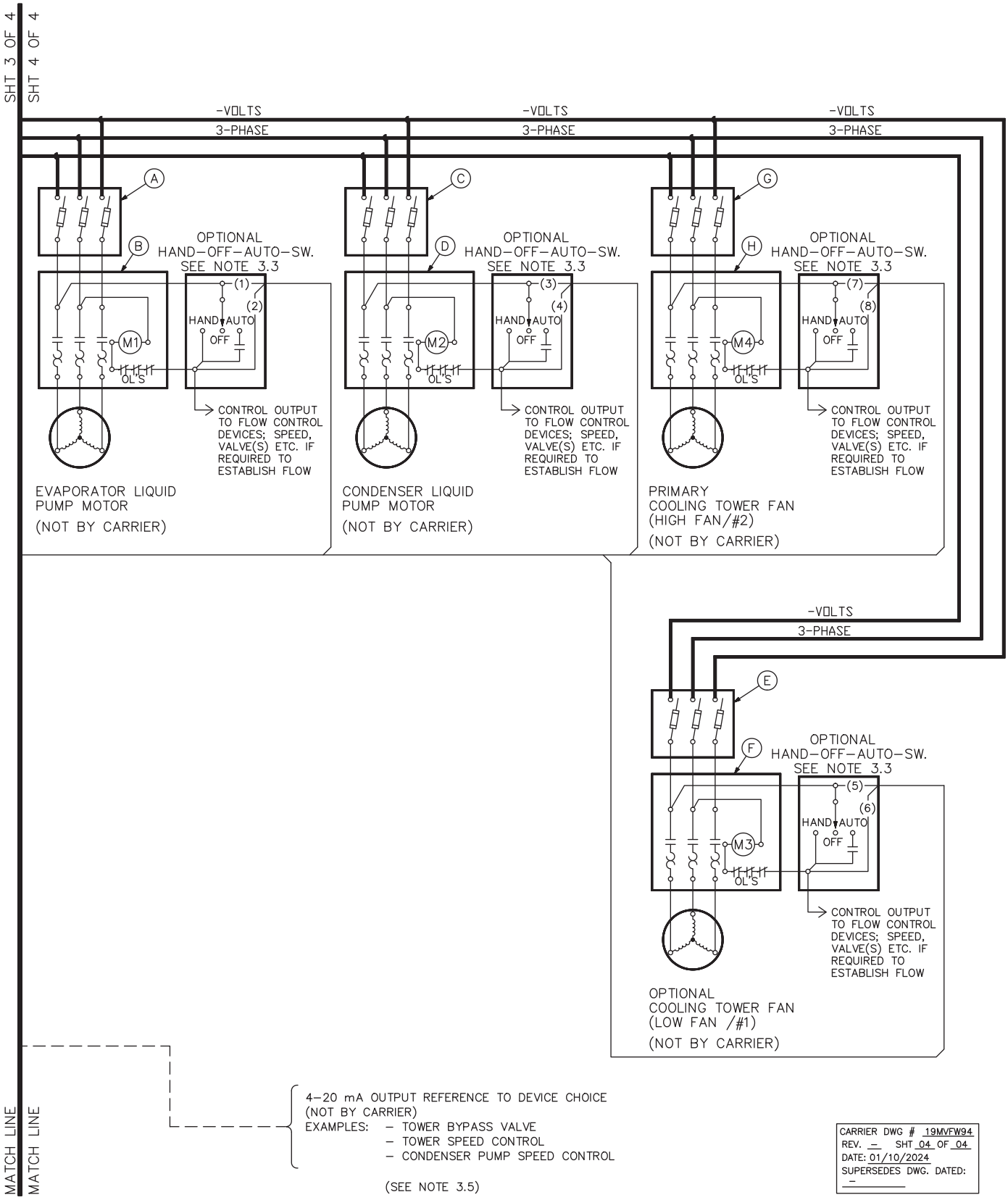
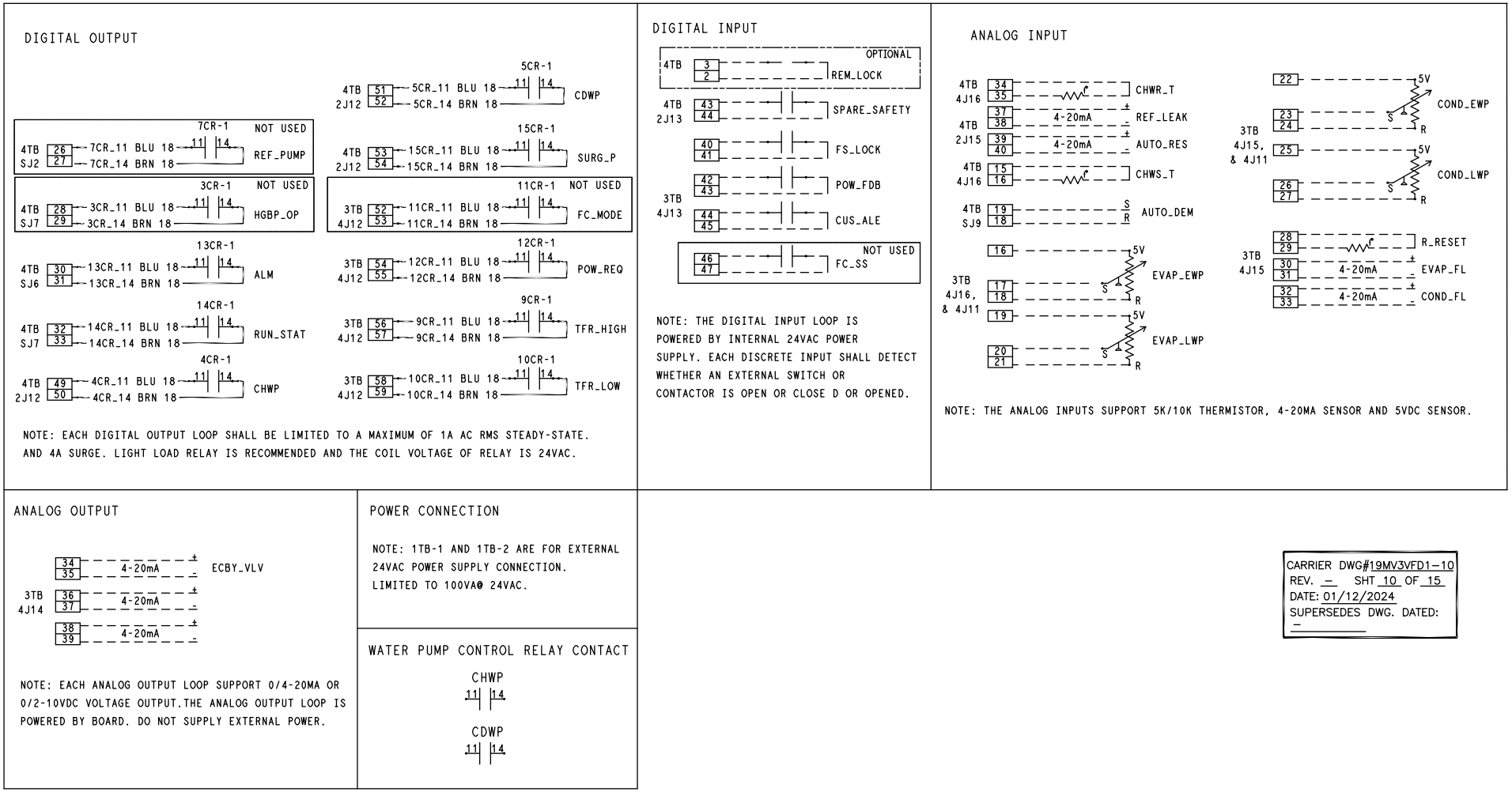


Fig. 28 — Rockwell High Tier VFD Field Wiring



For details, see Fig. 30-33.

Fig. 29 — Field Wiring

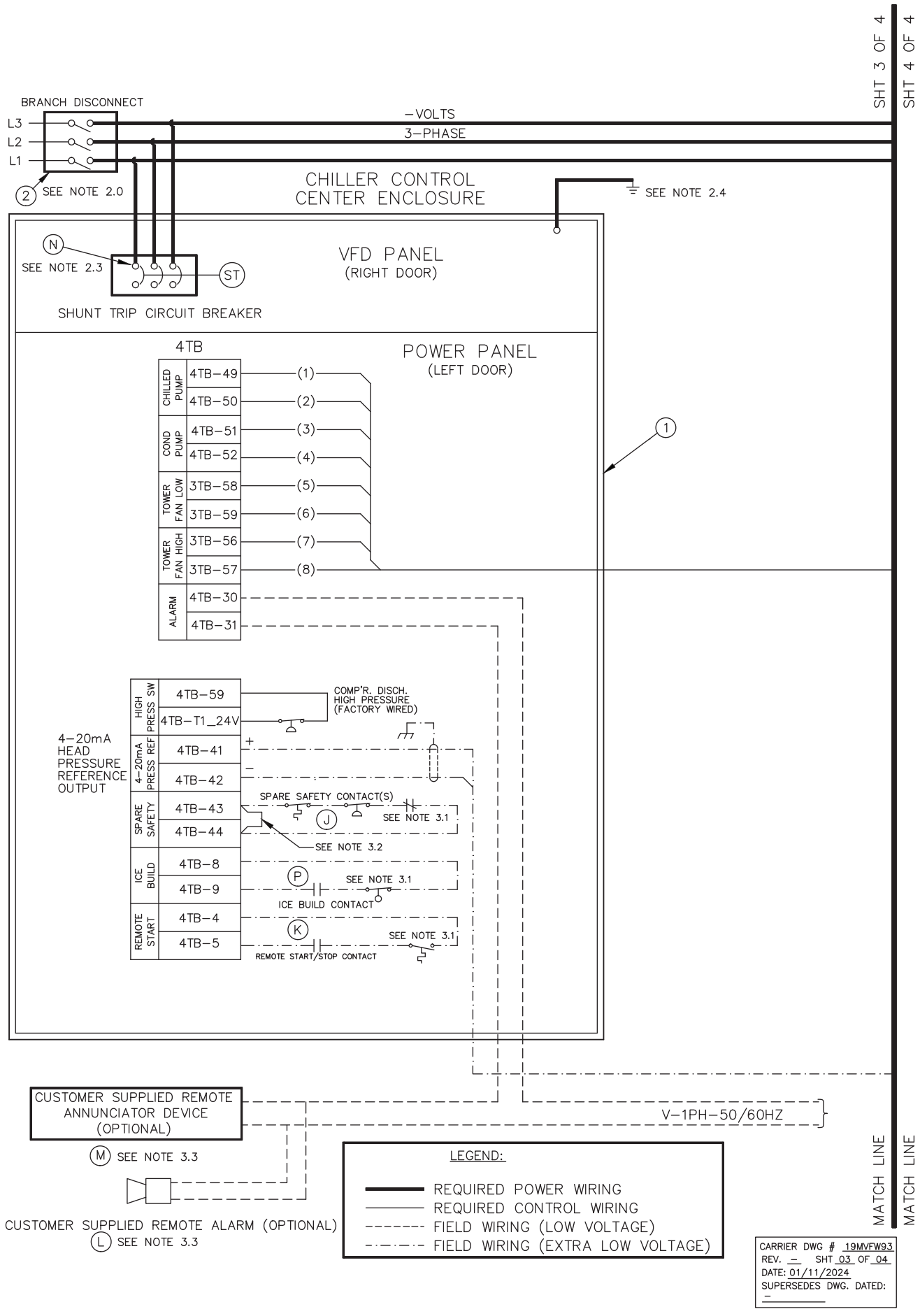


Fig. 30 — Danfoss Standard Tier VFD Field Wiring

LEGEND FOR FIG. 22-30

Abbreviations

1-5TB	—	Terminal Block 1-5
2-4IOB	—	Carrier Input Output Board 2-4
ALM	—	Chiller Alarm Relay
AUTO_DEM	—	Auto Demand Limit Input
AUTO_RES	—	Auto Water Temp Reset
CB	—	Circuit Breaker
CDWP	—	Condenser Water Pump
CDWP_V	—	Condenser Water Pump (Variable Speed)
CHWP	—	Chilled Water Pump
CHWP_V	—	Chilled Water Pump (Variable Speed)
CHWR_T	—	Common Chilled Water Return Temperature
CHWS_T	—	Common Chilled Water Supply Temperature
COND_EWP	—	Entering Cond Water Pressure
COND_FL	—	Cond Water Flow Measurement
COND_FS	—	Cond Water Flow Switch
COND_LS	—	Liquid Level Condenser
COND_LWP	—	Leaving Cond Water Pressure
COND_P	—	Condenser Pressure
CT	—	Control Transformer
CUS_ALE	—	Customer Alert
DGT	—	Compressor Discharge Temperature
E_STOP	—	Remote Emergency Stop Input
ECBY_VLV	—	Not Used
ECDW	—	Entering Condenser Water Temperature
ECON_GT	—	Economizer Gas Temperature
ECON_P	—	Economizer Pressure
ECW	—	Entering Chilled Water Temperature
EVAP_EWP	—	Entering Evap Water Pressure
EVAP_FL	—	Evap Water Flow Measurement
EVAP_FS	—	Evap Water Flow Switch
EVAP_LWP	—	Leaving Evap Water Pressure
EVAP_P	—	Evaporator Pressure
EVAP_T	—	Evap. Refrigerant Liquid Temperature
EXCSV	—	Expansion Control System Valve Connections
FC_MODE	—	Not Used
FC_SS	—	Not Used
FS_LOCK	—	Fire Security Interlock
HDPV_OU2	—	Head Pressure Output 2
HMI	—	Human Machine Interface (Touch Screen)
HP_SW	—	High Pressure Switch
ICE_CON	—	Ice Build Contact
IGV1_OUT	—	Guide Vane 1 Analog Output
IGV1_POS	—	Guide Vane 1 Actual Position
IGV2_OUT	—	Guide Vane 2 Analog Output
IGV2_POS	—	Guide Vane 2 Actual Position
LCDW	—	Leaving Condenser Water Temperature
LCW	—	Leaving Chilled Water Temperature
MCB	—	Main Circuit Breaker
MCB_SOR	—	MCB Shunt Trip
MTRW1	—	Motor Winding Temperature 1
MTRW2	—	Motor Winding Temperature 2
PB	—	Push Button
POW_FDB	—	Power Request Feedback
POW_REQ	—	Power Request Output
PS	—	Power Supply
R_RESET	—	Remote Reset Sensor
REF_LEAK	—	Refrigerant Leak Sensor
REF_PUMP	—	Refrigerant Pump
REM_CON	—	Remote Contact Input
REM_E_STOP	—	Remote E-Stop
REM_LOCK	—	Chiller Lockout Input
RUN_STAT	—	Chiller Run Status
SCB	—	Service Circuit Breaker
SCB_SOR	—	SCB Shunt Trip
SIOB	—	Standard Input Output Board
SURGE_P	—	Surge Proximity
T1/2	—	Transformer 1/2
TFR_HIGH	—	Tower Fan High
TFR_LOW	—	Tower Fan Low
TOW_FAN_V	—	Tower Fan (Variable Speed)
VFD_LOCK	—	VFD Interlock

Symbols


Terminal Block Connection


Female Connector


Male Connector

Optional Wiring


Normally Open (NO)


Normally Closed (NC)


Contact, NO


Contact, NC


Thermostat

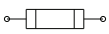

Thermistor


Coil


Cable


Pressure Switch


Pressure Transducer


Fuse

Circuit Breaker


Flow Switch


Ground

BLK	Black
BLU	Blue
BRN	Brown
CU	Copper
GRN	Green
GRY	Gray
ORG	Orange
RED	Red
WHT	White
YEL	Yellow
Y/G	Yellow/Green

NOTES FOR FIG. 22-30
19MV FIELD WIRING

I. General

1.0 Variable Frequency Drive (VFD) shall be designed and manufactured in accordance with Carrier engineering requirements.
1.1 All field-supplied conductors and devices and the field-installation wiring and termination of conductors and devices must be in compliance with all applicable codes and job specifications.
1.2 The routing of field-installed conduit and conductors and the location of field-installed devices must not interfere with equipment access or the reading, adjusting, or servicing of any component.
1.3 Equipment installation and all starting and control devices must comply with details in equipment submittal drawings and literature.
1.4 Contacts and switches are shown in the position they would assume with the circuit deenergized and the chiller shut down.
1.5 ***Warning*** — Do not use aluminum conductors.
1.6 ***Warning*** — Remove panel above VFD main circuit breaker before drilling. Do not drill into any other VFD cabinet panels.
1.7 All field-installed wiring in field supplied.

II. Power Wiring to Power Panel

2.0 Provide a means of disconnecting branch feeder power to VFD. Provide short circuit protection and interrupt capacity for branch feeder in compliance with all applicable codes.
2.1 Metal conduit must be used for the power wires, from VFD to branch feeder.
2.2 Line side power conductor rating must meet VFD nameplate voltage and chiller full load amps (minimum circuit ampacity).
2.3 Lug adapters may be required if installation conditions dictate that conductors be sized beyond the minimum ampacity required. Lugs will accommodate the quantity (#) and size cables (per phase) as follows. If larger lugs are required, they may be purchased from the manufacturer of the circuit breaker. See Conductor Usage table for lug sizes.

CONDUCTOR USAGE

AMPACITY RANGE	VFD TYPE	Standard 100 kAIC Lug Capacity (Per Phase)	
		Maximum No. of Conductors	Conductor Range
405-602	Standard Tier Danfoss DD Frames	3	4/0 - 500 kcmil
594-894	Standard Tier Danfoss DE Frames	4	4/0 - 600 kcmil
592-617	High Tier Rockwell Drive	2	500 - 750 kcmil

2.4 Compressor motor and controls must be grounded by using equipment grounding lug provided inside unit-mounted power panel enclosure.

III. Control Wiring

3.0 Field-supplied control conductors to be at least 18 AWG (American Wire Gauge) or larger.
3.1 Ice build start/terminate device contacts, remote start/stop device contacts, and spare safety device contacts (devices not supplied by Carrier) 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 Connect spare safety instruments between 41B-43 and 41B-44 in the control panel.
3.3 Integrated digital outputs are rated for 18 to 32 vac and 1.5 amps at steady state and a maximum in-rush current of 5 amps.

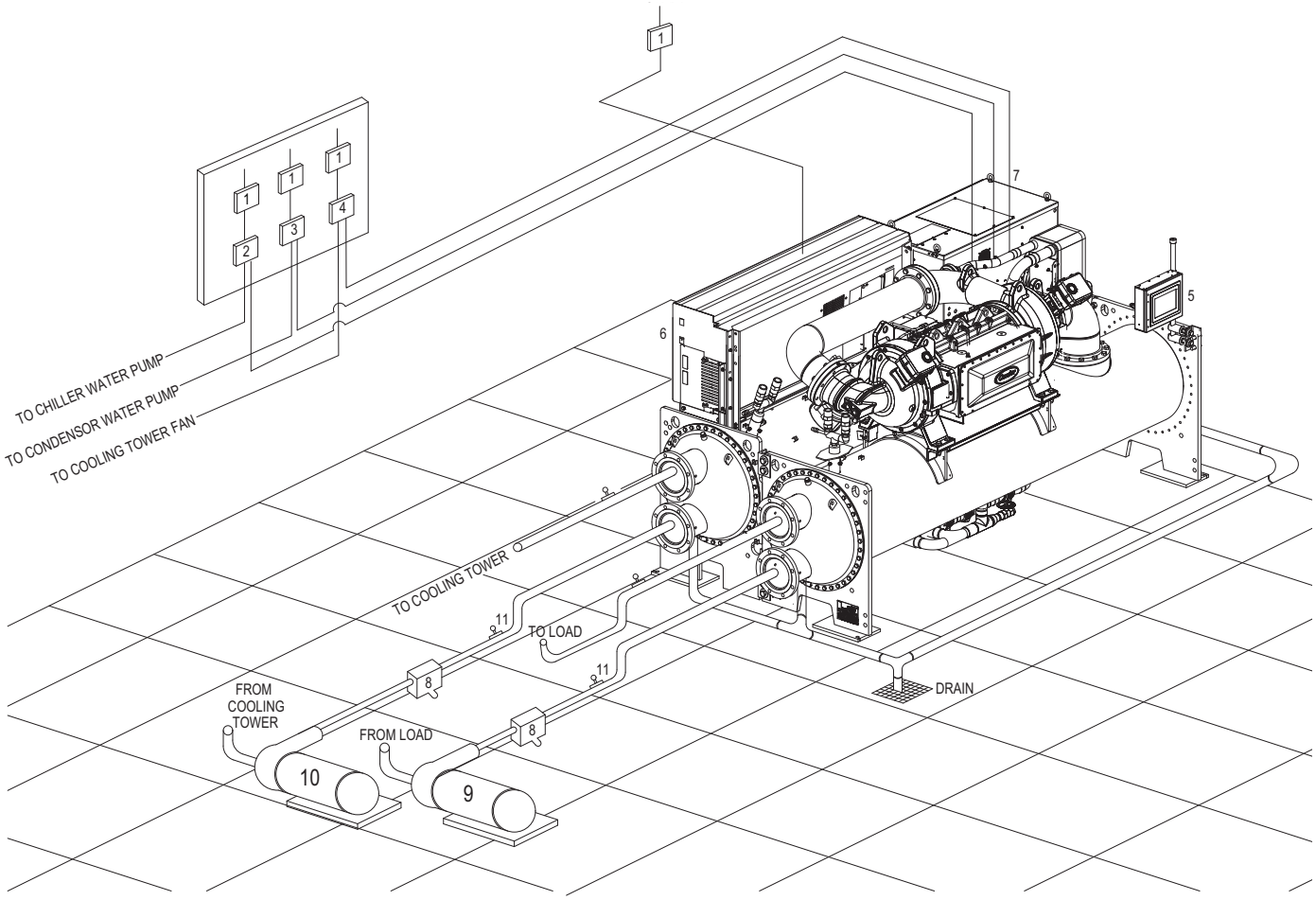
⚠ WARNING

Control wiring required for Carrier to start pumps and establish flows must be provided to assure machine protection. If primary pump and flow are controlled by other means, also provide a parallel means for control by Carrier. Failure to do so could result in machine freeze-up or overpressure. Or Building Automation System Controls should be capable of providing water flow through the heat exchangers if there is a start request for the water pump and the refrigerant temperature is less than refrigerant alert value. Equipment damage due to absence of water flow when requested by the chiller is not covered by warranty.

3.4 Do not use control transformers in the VFD enclosure or power panel as the power source for external or field-supplied contactor coils, actuator motors, or other loads.
3.5 Do not route control wiring carrying 30-v or less within a conduit which has wires carrying 50-v or higher or along side wires carrying 50-v or higher.
3.6 Spare 4 to 20 mA output signal is designed for controllers with a non-grounded 4 to 20 mA input signal and a maximum input impedance of 500 ohms.
3.7 For Rockwell VFDs, the shield on the 4-20 mA head pressure reference cable is connected to TB4-1.

IV. Uninterrupted Power Supplier (UPS)

4.0 The UPS battery needs to be recharged every 6 months to preserve its shelf life. In cases where the UPS is in storage for more than 6 months, a new battery is required.
4.1 The UPS is shipped with battery terminals disconnected for safety. Prior to commissioning the chiller, plug in the battery terminals and power up the chiller, then plug in the battery terminals and power up the chiller to charge it. Follow all safety guidelines when connecting the battery and powering up the chiller.



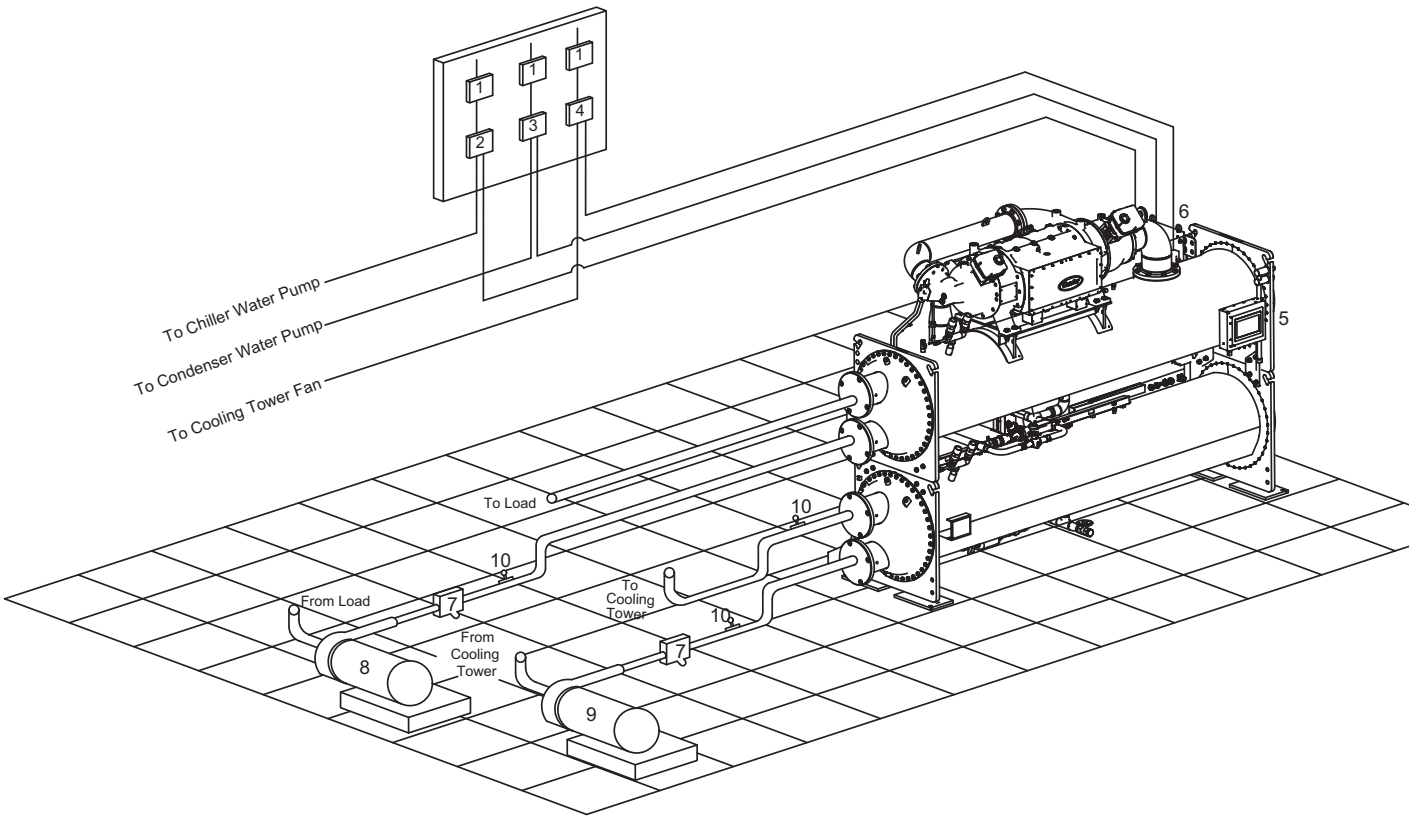
LEGEND

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— Power Panel
8 — Strainers
9 — Chilled Water Pump
10 — Condenser Water Pump
11 — Pressure Gages
12 — Local Disconnect (hidden - in power panel)
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. 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 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.

Fig. 31 — 19MV3 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 — Strainers
8 — Chilled Water Pump
9 — Condenser Water Pump
10 — Pressure Gages
11 — Local Disconnect (hidden - in power panel)
Piping
Control Wiring
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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.
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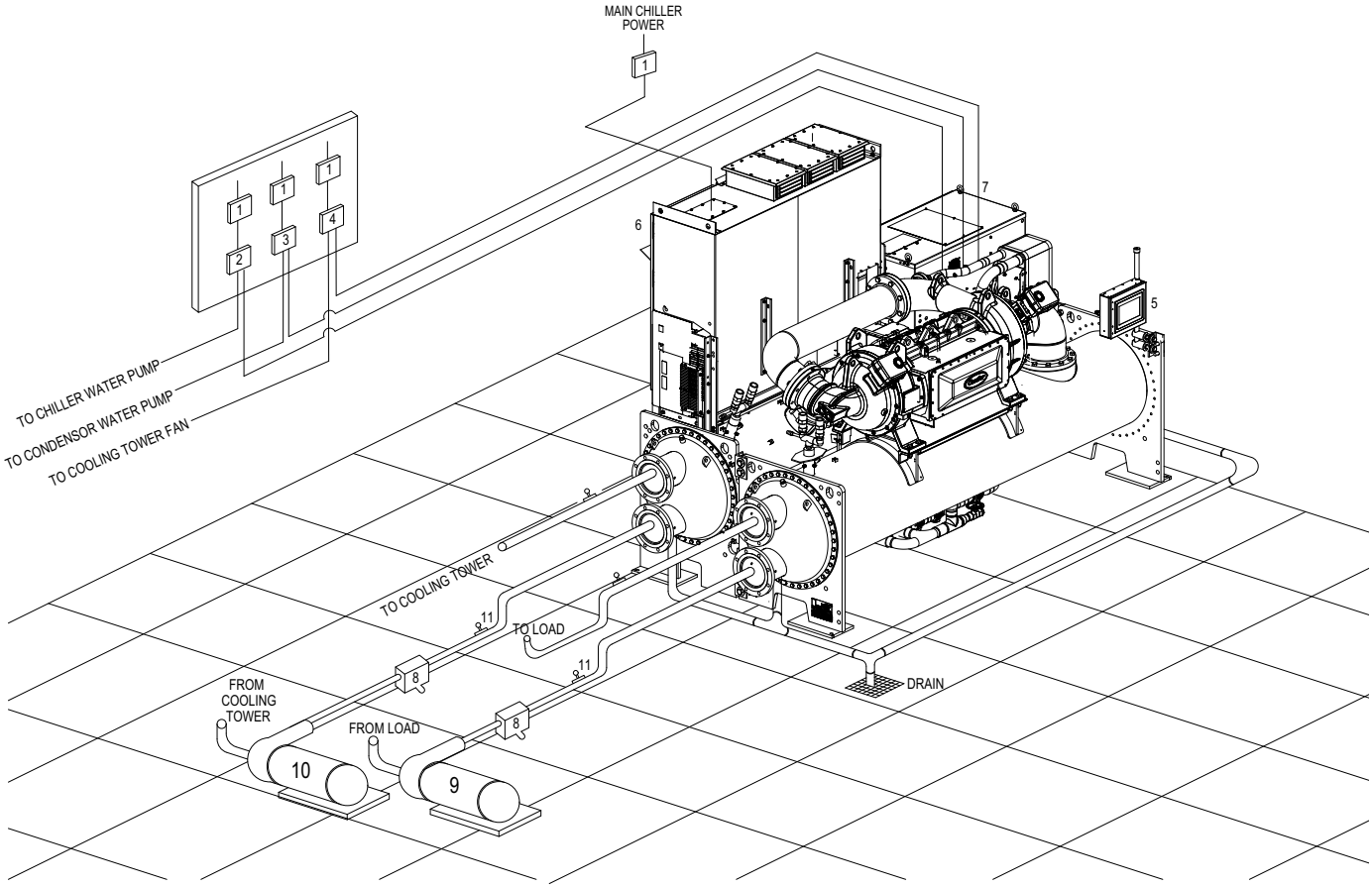
   a. Remote Start/Stop
   b. Remote Alarms
   c. Optional Safety Device
   d. 4 to 20 mA Resets
   e. Optional Remote Sensors
4. IMPORTANT: Carrier suggests that a structural engineer be consulted if transmission of vibrations from mechanical equipment is of concern.
5. Isolation valves are recommended 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.

Fig. 32 — 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 — Unit-Mounted VFD
7— Power Panel
8 — Strainers
9 — Chilled Water Pump
10 — Condenser Water Pump
11 — Pressure Gauges
12 — Local Disconnect (hidden - in power panel)
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. 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 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.

Fig. 33 — 19MV3 Chiller with Unit-Mounted VFD Diagram — High Tier Option

CARRIER COMFORT NETWORK INTERFACE

The Carrier Comfort Network® (CCN) communication bus wiring is supplied and installed by the electrical contractor. It consists of shielded, 3-conductor cable with drain wire.

The system elements are connected to the communication bus in a daisy chain arrangement. The positive pin of each system element communication connector must be wired to the positive pins of the system element on either side of it. The negative pins must be wired to the negative pins. The signal ground pins must be wired to the signal ground pins. Refer to Fig. 22 for location of the CCN network connections on the terminal strip labeled CCN.

NOTE: Conductors and drain wire must be 20 AWG (American Wire Gauge) minimum stranded, tinned copper. Individual conductors must be insulated with PVC, PVC/nylon, vinyl, Teflon[1], or polyethylene. An aluminum/polyester 100% foil shield and an outer jacket of PVC, PVC/nylon, chrome vinyl, or Teflon with a minimum operating temperature range of –4°F to 140°F (–20°C to 60°C) is required. See table below for cables that meet the requirements.

MANUFACTURER	CABLE NO.
Alpha	2413 or 5463
American	A22503
Belden	8772
Columbia	02525

When connecting the CCN communication bus to a system element, a color code system for the entire network is recommended to simplify installation and checkout. The following color code is recommended:

SIGNAL TYPE	CCN BUS CONDUCTOR INSULATION COLOR	CCN NETWORK INTERFACE (Control Panel)
+	Red	+
Ground	White	–
–	Black	G

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

If a cable with a different color scheme is selected, a similar color code should be adopted for the entire network.

At each system element, the shields of its communication bus cables must be tied together. If the communication bus is entirely within one building, the resulting continuous shield must be connected to ground at only one single point. If the communication bus cable exits from one building and enters another, the shields must be connected to ground at the lightning suppressor in each building where the cable enters or exits the building (one point only).

To connect the 19MV chiller to the network, proceed as follows (Fig. 22):

1. Route wire through knockout in back of control panel.
2. Strip back leads.
3. Crimp one no. 8 size spring spade terminal on each conductor.
4. Attach red to "+" terminal and black to "G" terminal and white to "–" terminal of CCN Network interface located in the control panel.

Step 6 — Install Field Insulation

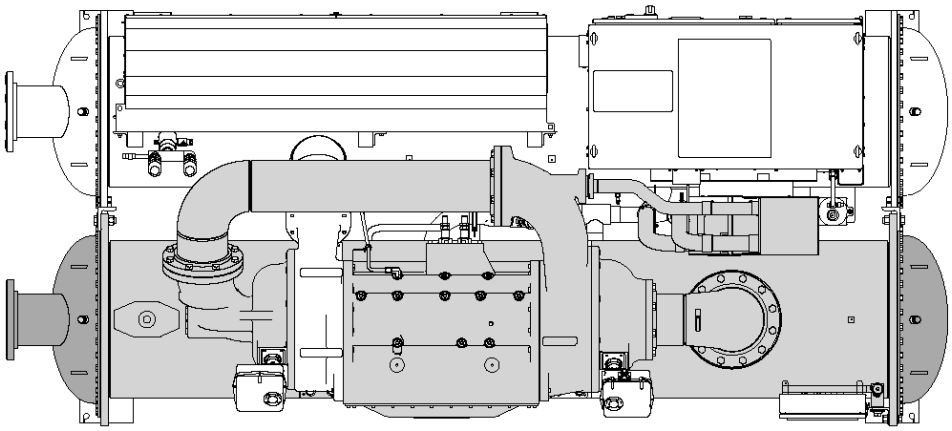
⚠ CAUTION

Protect insulation from weld heat damage and weld splatter. Cover with wet canvas cover during water piping installation.

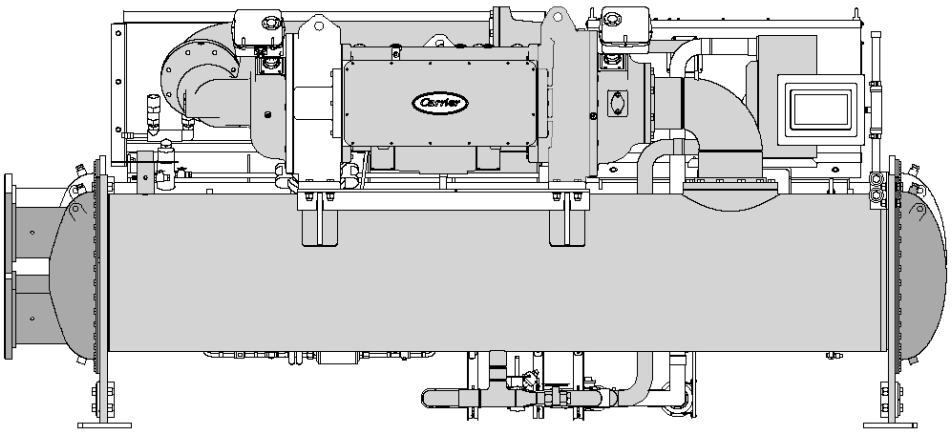
When installing insulation at the jobsite, insulate the following components:

- compressor motor
- economizer
- evaporator shell
- evaporator tube sheets
- suction piping
- motor cooling drain
- refrigerant liquid line to evaporator

NOTE: Insulation of the waterbox covers is applied only at the jobsite by the contractor. When insulating the covers, make sure there is access for removal of waterbox covers for servicing. See Fig. 34 or 35.



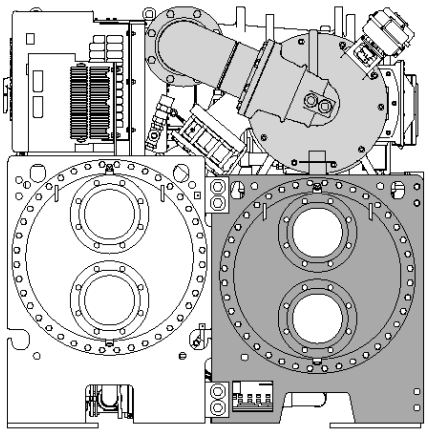
Top View

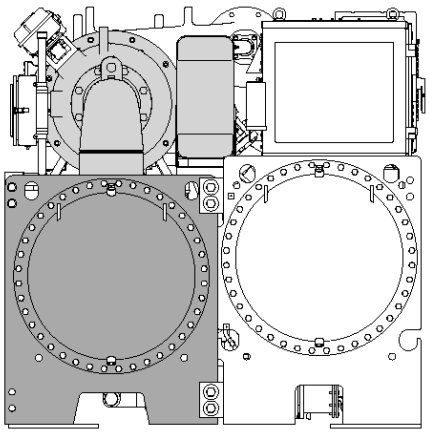


2nd Stage End

Front View

1st Stage End





2nd Stage End

1st Stage End

Fig. 34 — 19MV3 Standard Insulation Area

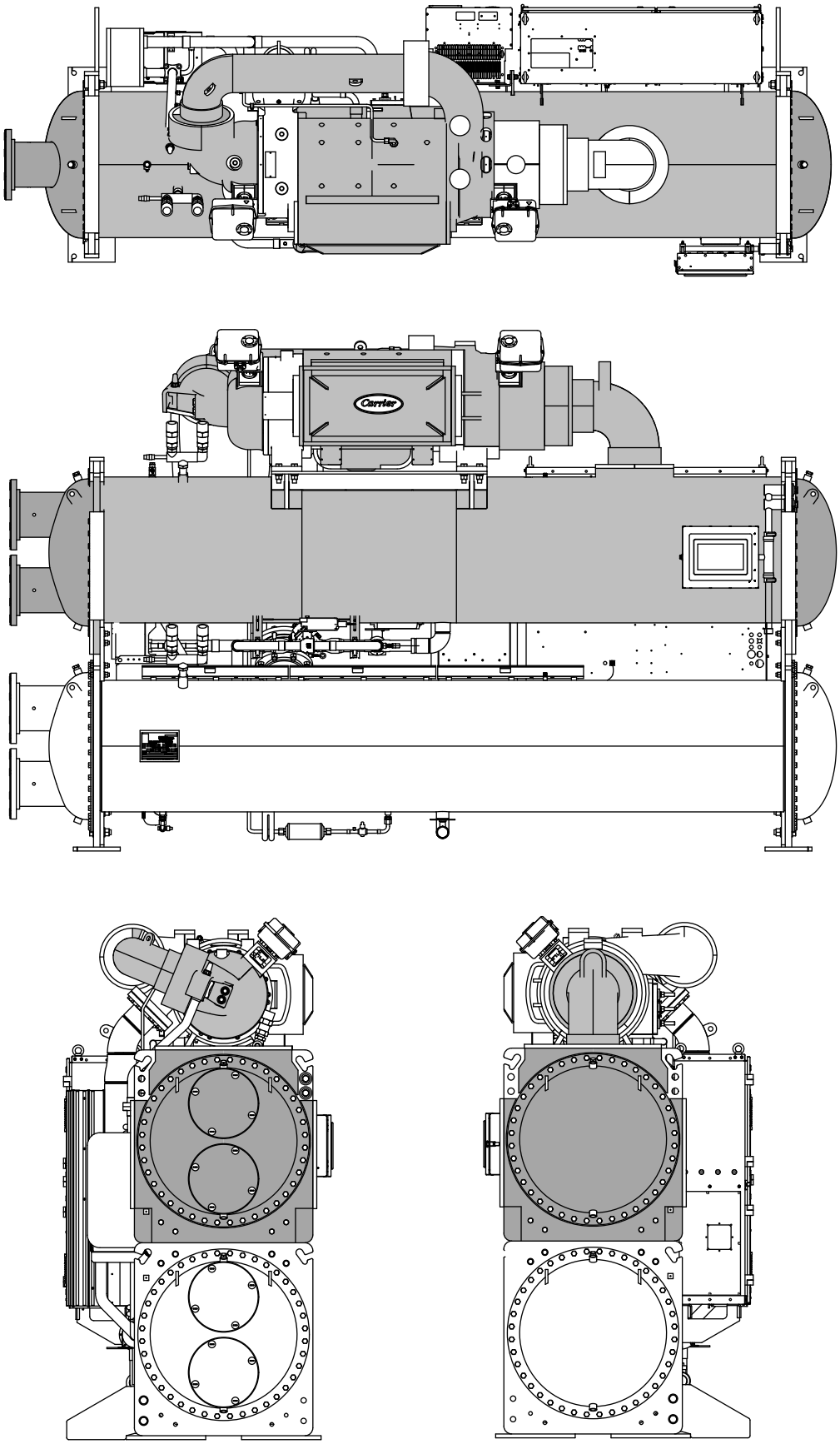


Fig. 35 — 19MV2 Standard Insulation Area

APPENDIX A — A2L Refrigerant Installation Supplement

SAFETY CONSIDERATIONS

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air-conditioning equipment.

Untrained personnel can perform basic maintenance functions of cleaning and replacing filters. All other operations should be performed by trained service personnel. When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply.

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for unbrazing operations. Have fire extinguisher available for all brazing operations.

It is important to recognize safety information. This is the safety-alert symbol ⚠. When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

Understand the signal words DANGER, WARNING, CAUTION, and NOTE. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies hazards which **could** result in personal injury or death. CAUTION is used to identify unsafe practices, which **may** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

Centrifugal liquid chillers are designed to provide safe and reliable service when operated within design specifications. When operating this equipment, use good judgment and safety precautions to avoid damage to equipment and property or injury to personnel.

INTRODUCTION

This document is to be used in conjunction with the 19MV Installation Instructions as a supplement. It provides specific information for ASHRAE Standard 34 and ISO 817 Class A2L refrigerants.

The 19MV chillers may contain R-1234ze(E) refrigerant. This refrigerant is classified as A2L, considered mildly flammable and nontoxic.

PURPOSE

This document provides specific guidance for safe installation of the 19MV chillers due to this lower flammable refrigerant use for indoor applications isolated from the general public per ANSI/ASHRAE Standard 15 (latest edition) and in compliance with UL 60335-2-40.

R-1234Ze(E) CHARACTERISTICS

R-1234ze(E) refrigerant is classified as Class 2L since it meets all four of the following conditions:

1. Exhibits flame propagation when tested at 140°F (60°C) and 14.7 psia (101.3 kPa).
2. Lower Flammability Limit (LFL) is as follows:
   LFL > 0.0062 lbm/ft^3 (0.10 kg/m^3)
   R-1234ze(E) LFL = 0.0189 lbm/ft^3 (0.303 kg/m^3)
3. Heat of combustion is as follows:
   Heat of Combustion < 8169 Btu/lbm (19,000 kJ/kg) at 77°F (25°C) and 14.7 psia (101.3 kPa)
   R-1234ze(E) Heat of Combustion = 4.34 Btu/lbm (10.1 kJ/kg)
4. Maximum burning velocity is as follows:
   Maximum burning velocity ≤3.9 in/sec (10 cm/s) when tested at 73.4°F (23.0°C) and 14.7 psia (101.3 kPa) in dry air
   R-1234ze(E) Burning Velocity = 0.47 in/sec (1.2 cm/s)
   R-1234ze(E) Refrigerant Concentration Limit (RCL) = 16,000 ppm
   R-1234ze(E) Occupational Exposure Limit (OEL) = 800 ppm

⚠ WARNING

This manual is intended for use by owner or Carrier authorized service personnel.

Be sure you understand and follow the procedures and safety precautions contained in the chiller instructions as well as those listed in this guide.

⚠ CAUTION

Centrifugal liquid chillers are designed to provide safe and reliable service when operated within design specifications. When operating this equipment, use good judgment and safety precautions to avoid damage to equipment and property or injury to personnel.

⚠ CAUTION

The refrigeration system including piping must be installed in accordance with national and local codes and standards, such as ASHRAE 15 (latest edition), IAPMO Uniform Mechanical Code, ICC International Mechanical Code, or CSA B52, and UL 48416 or UL/CSA 60335-2-40 listings, the manufacturer's instructions, and any markings on the equipment restricting the installation.

TERMINOLOGY

Immediately Dangerous to Life or Health (IDLH)

The maximum concentration from which unprotected persons are able to escape within 30 minutes without escape-impairing symptoms or irreversible health effects.

Refrigerant Concentration Limit (RCL)

The refrigerant concentration limit, in air, determined in accordance with ASHRAE34 standard and intended to reduce the risks of acute toxicity, asphyxiation, and flammability hazards in normally occupied, enclosed spaces.

Occupational Exposure Limit (OEL)

The time-weighted average (TWA) concentration for a normal eight-hour workday and a 40-hour workweek to which nearly all workers can be repeatedly exposed without adverse effect, based on the OSHA PEL, ACGIH TLV-TWA, TERA OARS-WEEL, or consistent value.

Effective Dispersal Volume Charge (EDVC)

The maximum amount of refrigerant charge permitted to disperse in the event of a leak for a volume.

Lower Flammability Limit (LFL)

The minimum concentration of a refrigerant can ignite with air at sea level. The refrigerant/air mixture won't ignite below that.

LABELING

For appliances containing a flammable refrigerant, ensure there are labels on the equipment stating FLAMMABLE REFRIGERANT.

SAFETY INSTRUCTIONS

⚠ WARNING

Prior to beginning work on systems containing flammable refrigerants, safety checks are necessary to ensure that the risk of ignition is minimized.

The following recommendations should be carefully observed as part of installation, operation, maintenance or service prior to conducting work on the system:

Personal Training

This equipment must be installed and operated by trained and qualified personnel who have received suitable instruction in its use.

When a chiller is used with A2L Flammable Refrigerant, training is required for the working personnel for installation, service and repair operations. Training competency should be documented by a certificate from an accredited national training organization or manufacturer.

The training should include the substance of the following:

1. Information about the explosion potential of flammable refrigerants to show that flammables may be dangerous when handled without care.
2. Information about POTENTIAL IGNITION SOURCES, especially those that are not obvious, such as lighters, light switches, or electric heaters.
3. Information about different safety concepts such as:
   a. Unventilated areas
   b. Ventilated enclosures
   c. Ventilated rooms
4. Information about refrigerant detectors:
   a. Principle of function, including influences on the operation.
   b. Procedures to repair, check, or replace a refrigerant detector or parts of it in a safe way.
   c. Procedures to disable a refrigerant detector in case of repair work on the refrigerant carrying parts.
5. Information about the concept of sealed components and sealed enclosures according to IEC 60079-15:2010.
6. Information about correct working procedures such as:
   a. Commissioning
   b. Maintenance
   c. Repair
   d. Decommissioning
   e. Disposal

Ventilated Area

Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation should continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.

Cabling

Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges or any other adverse environmental effects. The check should also take into account the effects of aging or continual vibration from sources such as compressors or fans.

Presence of Fire Extinguisher

If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire extinguishing equipment should be available to hand. Have a dry powder or CO_2 fire extinguisher adjacent to the charging area.

General Work Area

All maintenance staff and others working in the local area should be instructed on the nature of work being carried out. Work in confined spaces should be avoided.

Work Procedure

Work should be undertaken under a controlled procedure so as to minimize the risk of a flammable gas or vapor being present while the work is being performed.

Checking for Presence of Refrigerant

The area should be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants; i.e., non-sparking, adequately sealed, or intrinsically safe.

For more information about refrigerant detectors, see Detection of Flammable Refrigerants in the next section.

No Ignition Sources

No person carrying out work in relation to a refrigerating system which involves exposing any pipe work should use any sources of ignition in such a manner that it may lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation repair, removal, and disposal, during which refrigerant can possibly be released to the surrounding space. Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks. “No Smoking” signs should be displayed.

Checks to the Refrigerant Equipment

Where electrical components are being changed, they should be fit for the purpose and to the correct specification. At all times the manufacturer’s maintenance and service guidelines should be followed. If in doubt, consult the manufacturer’s technical department for assistance.

The following checks should be applied to installations using flammable refrigerants:

1. The ventilation machinery and outlets are operating adequately and are not obstructed.
2. If an indirect refrigerating circuit is being used, the secondary circuit should be checked for the presence of refrigerant.
3. Marking to the equipment is visible and legible. Markings and signs that are illegible should be corrected.
4. Refrigerating pipe or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being so corroded.

⚠ WARNING

Do not use means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer. The equipment must be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance or an operating electric heater). Do not pierce or burn. Be aware that refrigerants may not contain an odor.

DETECTION OF FLAMMABLE REFRIGERANTS

Under no circumstances should potential sources of ignition be used in searching for or detection of refrigerant leaks. Do not use a halide torch or any other detector using a naked flame.

Each refrigerating machinery room should contain one or more refrigerant detectors with sensing element located in areas where refrigerant from a leak will concentrate, with one or more set points that activate response alarms automatically to deenergize the following:

- Refrigerant compressors
- Refrigerant pumps
- Normally closed automatic refrigerant valves
- Other unclassified electrical sources of ignition with apparent power rating greater than 1 kVA, where the apparent power is the product of the circuit voltage and current rating.

and for mechanical ventilation. Multiport-type devices should be prohibited.

Leak detection equipment should be set at a percentage of the LFL of the refrigerant and should be calibrated to the refrigerant employed, and the appropriate percentage of gas (25% maximum) is confirmed.

Detection of refrigerant concentration that exceeds the lower value of below:

0.004725 lbm/ft^3 (0.07575 kg/m^3) for R-1234ze(E)
OR
The upper detection limit of the refrigerant detector

should automatically deenergize the following equipment in the machinery room:

a. Refrigerant compressors
b. Refrigerant pumps
c. Normally closed automatic refrigerant valves
d. Other unclassified electrical sources of ignition with apparent power rating greater than 1 kVA, where the apparent power is the product of the circuit voltage and current rating.

The following leak detection methods are deemed acceptable for all refrigerant systems.

Electronic Leak Detectors

Electronic leak detectors may be used to detect refrigerant leaks capable of detecting each of the specific refrigerant designations in the machinery room.

In the case of flammable refrigerants, the sensitivity may not be adequate, or may need recalibration. (Detection equipment should be calibrated in a refrigerant-free area.) Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used.

CALIBRATION

Leak detection equipment should be set at a percentage of the LFL of the refrigerant and should be calibrated to the refrigerant employed, and the appropriate percentage of gas (25% maximum) is confirmed.

In the case for R-1234ze(E) below, the detection should be if it exceeds the lower value of:

0.004725 lbm/ft^3 (0.07575 kg/m^3)
OR
The upper detection limit of the refrigerant detector.

SET POINT

The refrigerant detectors should activate ventilation at a set point and response time, at an airflow rate not less than the value determined below. There are a couple of set points. One is based on OEL value and the other one is based on RCL value.

OEL Set Point

The refrigerant detector should have a set point not greater than 800 ppm for R-1234ze(E) ONLY IF this value is the lowest OEL value for any refrigerant designation in the machinery room.

For refrigerants that do not have a published OEL value, use a value approved by the Authority Having Jurisdiction (AHJ).

Response time required for this set point is 300 seconds or less. The Alarm Type is “Trouble Alarm”. It should activate Ventilation Level 1 and an “Automatic” reset type is required.

The refrigerant detector should have a set point not greater than the lowest RCL value for any refrigerant designation in the machinery room.

RCL Set Point

For R-1234ze(E), RCL value is 16,000 ppm. This value should be checked against the other refrigerants’ RCL value used in the machinery room and if it is lower than any others then the Set Point should be set to 16,000 ppm.

For refrigerants that do not have a published RCL value, use a value approved by Authority Having Jurisdiction (AHJ).

Response time required for this set point is 15 seconds or less. The Alarm Type is “Emergency Alarm”. It should activate Ventilation Level 2 and an “Manual” reset type is required.

Manual reset type alarms should have the reset located inside the refrigerating machinery room.

IMPORTANT: Alarms set at levels other than OEL and RCL (such as IDLH) and automatic reset alarms are permitted with the condition that the meaning of each alarm should be clearly marked by signage near the annunciators.

Leak Detection Fluids

Leak detection fluids are suitable for use with most refrigerants but the use of detergents containing chlorine should be avoided as the chlorine may react with the refrigerant and corrode the copper pipework. Examples of leak detection fluids are the bubble method and fluorescent method agents.

Alarm Testing

The refrigerant detector should provide a means for automatic self testing and in the event of failure, a trouble alarm signal should be transmitted to an approved monitored location.

The refrigerant detector should be tested during installation and annually thereafter, or at an interval not exceeding the manufacturer’s installation instructions, whichever is less.

The alarm should have visual and audible annunciation inside the refrigerating machinery room and outside each entrance to the refrigerating machinery room.

The refrigerant detector set points should activate an alarm in accordance with the type of reset.

⚠ WARNING

When a remote located refrigerant sensor is specified by the manufacturer, the instructions should state when it is required and how to install and connect the sensor.

VENTILATION

Ventilation System

Machinery rooms should be vented to the outdoors by a mechanical ventilation system, to prevent accumulation of refrigerant due to leaks or a rupture of a refrigerating system or portion thereof.

This mechanical ventilation system should be in accordance with all of the following:

1. Contain at least one power-driven or multi-speed fan.
2. Electric motors driving fans should not be placed inside ducts; fan rotating elements should be nonferrous or nonsparking, or the casing should consist of or be lined with such material.
3. Include provision to supply makeup air to replace the air being exhausted; ducts for supply to and exhaust from the machinery room should serve no other area; the makeup air supply locations should be positioned relative to the exhaust air locations to avoid short circuiting.

⚠ WARNING

Chillers using A2L refrigerants, connected via an air duct system to one or more rooms, the supply and return air should be directly ducted to the space. Open areas such as false ceilings should not be used as a return air duct.

4. The exhaust air inlet ducts should be located in an area where refrigerant from a leak is expected to concentrate, in consideration of the location of the replacement supply air paths, refrigerating machines, and the density of the refrigerant relative to air.

⚠ WARNING

Upon detection of a leak, the zoning dampers are driven fully open and additional mechanical ventilation is activated.

5. The bottom of the exhaust air ducts elevation where air is exhausted from the room should not be more than 4 in. (100 mm) above the floor of the lowest point of the machinery room for R-1234ze(E) refrigerants that are heavier than air.
6. The location where the mechanical ventilation air extracted from the space is discharged should be separated by a sufficient distance, but not less than 9 ft 83 in. (3 m), from the mechanical ventilation air intake openings, to prevent recirculation to the space.
7. The discharge of the exhaust air should be to the outdoors in such a manner as not to cause a nuisance or danger.
8. When multiple refrigerant designations are in the machinery room, evaluate the required airflow according to each refrigerating system, and the highest airflow quantity should apply.

⚠ WARNING

Keep any required ventilation openings clear of obstruction.

IMPORTANT: Servicing should be performed only as recommended by the manufacturer

Ventilation Volumetric Air Flow Rates

Ventilation airflow rates for Levels 1 and 2 are not less than the value determined below.

LEVEL 1 VENTILATION FOR 19MV

Case 1: Operated when occupied, and operated when activated

The greater of:

- 0.5 (ft^3/min per cubic foot) x Machine Room Volume (ft^3) or 20 (ft^3/min per Person) x No of People

OR

- 0.00254 (m^3/s per cubic meter) x Machine Room Volume (m^3) or 0.00944 (m^3/s per Person) x No of People

Case 2: Operable when occupied

With or without mechanical cooling of the machinery room, the greater of:

- the airflow rate required to not exceed a temperature rise of 18°F (10°C) above inlet air temperature

OR

- the airflow rate required to not exceed a maximum air temperature of 122°F (50°C) in the machinery room

LEVEL 2 VENTILATION FOR 19MV

- 19,000 ft^3/min Ventilation for > 440 lbm of R-1234ze(E) Refrigerant in the Chiller
- 8.6 m^3/s Ventilation for > 190 kg of R-1234ze(E) Refrigerant Charge in the Chiller

⚠ WARNING

Check that the total airflow rate for Level 2 ventilation is not less than Level 1 ventilation airflow rate.

Unventilated Machine Room

The unventilated machine room area should be defined as the room area enclosed by the projection to the floor of the walls, partitions and doors of the space in which the equipment is installed with these specific definitions below:

- Spaces connected by only drop ceilings, ductwork, or similar connections should not be considered a single space.
- Spaces divided by partition walls which are no higher than 6 ft (1.8 m) should be considered a single space.
- Rooms on the same floor and connected by an open passageway between the spaces can be considered a single room if the passageway complies with all of the following.
  - It is a permanent opening.
  - It extends to the floor.
  - It is intended for people to walk through.
- The area of the adjacent rooms, on the same floor, connected by permanent opening in the walls and/or doors between occupied spaces, including gaps between the wall and the floor, can be considered a single room.

Natural Ventilation for Unventilated Machine Room

Connected spaces should be provided with permanent natural ventilation opening(s).

The minimum size of the permanent natural ventilation opening(s) for 19MV with R-1234ze(E) refrigerant should be calculated using the following formula:

A_{vent} = 25.89 x (1550 – m) x Sqrt (A / m) (I-P)
A_{vent} = 0.01173 x (700 – m) x Sqrt (A / m) (SI)
where
A_{vent} = minimum net free area of a permanent opening, ft^2 (m^2)
A = actual area of the individual room, ft^2 (m^2)
m = allowable refrigerant charge of an individual room, lbm (kg)

- The lower edge of the natural ventilation opening between rooms should be located a maximum of 12 in. (305 mm) above the finished floor.
- The area of any openings above 12 in. (305 mm) from the floor should not be considered in determining compliance with A_{vent}.
- At least 50% of the required opening area A_{vent} should be below 8 in. (200 mm) from the floor.
- The bottom of the lowest openings should not be higher than the point of release when the unit is installed and not more than 4 in. (100 mm) from the floor.
- Openings are permanent openings which cannot be closed.
- The height of the openings between the wall and floor which connect the rooms are not less than 0.787 in. (20 mm).
- A second higher opening should be provided. The total size of the second opening should not be less than 50% of minimum opening area for A_{vent} and should be at least 5 ft (1.5 m) above the floor.

IMPORTANT: The requirement for the second opening can be met by drop ceilings, ventilation ducts, or similar arrangements that provide an airflow path between the connected rooms.

IMPORTANT: 19MV2 Charge is nominal 1300 lbm (590 kg). 19MV3 Charge is nominal 1500 lbm (680 kg).

MACHINE ROOM GENERAL REQUIREMENTS

When a refrigerating system with A2L refrigerant is located indoors with other mechanical equipment in a machinery room, then the machinery room should be in accordance with the following:

- A machinery room should be so dimensioned that parts are accessible with space for service, maintenance, and operations. There should be clear head room of not less than 7.25 ft (2.2 m) below equipment situated over passageways.
- With the exception of access doors and panels in air ducts and air-handling units, there should be no openings that will permit passage of escaping refrigerant to other parts of the building.
- There should be no airflow to or from an occupied space through a machinery room unless the air is ducted and sealed in such a manner as to prevent any refrigerant leakage from entering the air stream. Access doors and panels in ductwork and air-handling units should be gasketed and tight fitting.
- Access to the refrigerating machinery room should be restricted to authorized personnel. Doors should be clearly marked, or permanent signs should be posted at each entrance to indicate this restriction.
- There should be no flame-producing device or hot surface over 1290°F (700°C) in the room, other than that used for maintenance or repair. However, if there is combustion equipment installed in the same machinery room with refrigerant-containing equipment, then combustion air is ducted from outside the machinery room and sealed in such a manner as to prevent any refrigerant leakage from entering the combustion chamber. In addition, a refrigerant detector (see “Detection of Flammable Refrigerants” on page 44) is employed to automatically shut down the combustion process in the event of refrigerant leakage.
- Doors communicating with the building should be approved, tight-fitting fire doors, should be self-closing if they open into the building, and should be adequate in number to ensure freedom for persons to escape in an emergency.
- Walls, floor, and ceiling should be tight and of noncombustible construction. Walls, floor, and ceiling separating the refrigerating machinery room from other occupied spaces should be of at least one-hour fire-resistive construction.
- Exterior openings, if present, should not be under any fire escape or any open stairway.
- The machinery room should comply with both ventilation requirements (See “Ventilation” on page 45) and refrigerant detection requirements (see “Detection of Flammable Refrigerants” on page 44), or should be designated as Class I, Division 2 hazardous (classified) electrical location in accordance with the National Electrical Code.
- The mechanical ventilation system should either run continuously with failure of the mechanical ventilation system actuating an alarm, or an alarm will be activated by one or more refrigerant detectors.

Piping

- Keep the installation of pipe-work to a minimum.
- All pipes piercing the interior walls, ceiling, or floor of such rooms should be tightly sealed to the walls, ceiling, or floor through which they pass.
- Pipe-work in the case of flammable refrigerants should not be installed in an unventilated space.
- Flexible pipe elements should be protected against mechanical damage, excessive stress by torsion, or other forces, and they should be checked for mechanical damage annually.
- Precautions should be taken to avoid excessive vibration or pulsation.
- Provision should be made for expansion and contraction of long runs of piping.
- Protection devices, piping, and fittings should be protected as far as possible against adverse environmental effects; for example, the danger of water collecting and freezing in relief pipes or the accumulation of dirt and debris.

Freeze Protection of Water Piping

⚠ WARNING

An automatic air/refrigerant separator and pressure relief valve must be installed as close as possible to the heat exchanger water nozzle and at a high level in the water outlet from the evaporator or the condenser.

- The pressure relief valve should have a flow rating rated to discharge the refrigerant.
- The air/refrigerant separator and pressure relief valve should discharge the refrigerant to the outside or a double wall refrigerant storage.
- The refrigerant leak should be detected by the detection equipment according to "Detection of Flammable Refrigerants" on page 44.
- The ventilation should safely disperse any released refrigerant according to "Ventilation" on page 45.

⚠ WARNING

The use of untreated water can result in corrosion, erosion, sliming, scaling, or algae formation.

IMPORTANT: It is recommended that the service of a reliable water treatment company be used.

EFFECTIVE DISPERSAL VOLUME

The ***effective dispersal volume*** (V_{eff}) is the occupied or unoccupied space served by a refrigeration system in which the leaked refrigerant disperses. It should be used to determine the ***effective dispersal volume charge*** (EDVC) in the system.

The ***maximum charge permitted*** based on RCL for an effective dispersal volume should be calculated as follows:

For R-1234ze(E):

$EDVC = 4.7 \times V_{eff} \times F_{occ}$ (I-P)

$EDVC = 76 \times V_{eff} \times F_{occ} / 1000$ (SI)

where

EDVC = effective dispersal volume charge in lb (kg)

V_{eff} = effective dispersal volume in ft^3 (m^3)

F_{occ} = occupancy adjustment factor (= 0.5 for institutional occupancies; otherwise = 1)

Where a refrigeration system, or a part thereof, is located within an air distribution duct system, or in a space served by an air distribution duct system, the entire air distribution system should be analyzed to determine the worst case distribution of leaked refrigerant.

The ***effective dispersal volume*** should be established by the following physical enclosure elements:

- Walls
- Floors
- Ceilings
- Windows or doors which can be closed
- Partitions connecting to and extending from the finished floor to more than 5.5 ft (1.7 m) above the floor.
- The areas that contain only continuous refrigerant piping, or contain only joints and connections which are part of connected spaces on the same floor.
- Air ceiling plenum or floor plenum where plenum space is a part of the refrigeration system air distribution system.
- Supply and return ducts.
- Transfer air ductwork.
- Two or more spaces connected by a mechanical ventilation system.
- Closures in the air distribution system.

Where different stories and floor levels connect through an open atrium or mezzanine, the effective dispersal volume is calculated by:

$V_{eff} = A_{floor} \times H_{ceiling}$

Where

Effective dispersal volume V_{eff} (ft^3)

Floor area of the lowest floor level A_{floor} (ft^2)

Ceiling Height $H_{ceiling}$ = 8.2 ft (2.5 m)

Exemptions to the Effective Dispersal Volume

1. If one or more spaces of several arranged in parallel can be closed off from the source of the refrigerant leak, their volumes should not be used in the calculation.
2. Smoke dampers, fire dampers, and combination smoke/fire dampers that close only in an emergency not associated with a refrigerant leak should not be classified as closure devices.
3. Dampers, such as variable-air-volume (VAV) boxes, should not be considered closure devices provided the airflow is not reduced below 10% of its maximum.

REMOVAL AND EVACUATION

When breaking into the refrigerant circuit to make repairs — or for any other purpose — conventional procedures should be used. However, for flammable refrigerants it is important that best practice is followed since flammability is a consideration. The following procedure should be adhered to:

1. Safely remove refrigerant following local and national regulations. The refrigerant charge should be recovered into the correct recovery cylinders.
2. Purge the circuit with inert gas. For equipment containing flammable refrigerants, the system should be purged with oxygen-free nitrogen to render the equipment safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen should not be used for purging refrigerant systems.
3. Evacuate (optional for A2L).

⚠ CAUTION

Ensure that the outlet for the vacuum pump is not close to any potential ignition sources and that ventilation is available.

4. Purge with inert gas (optional for A2L). For equipment containing flammable refrigerants, refrigerants purging should be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum as in Step 2 (optional for A2L). Repeat this process until no refrigerant is within the system (optional for A2L). When the final oxygen-free nitrogen charge is used, the system should be vented down to atmospheric pressure to enable work to take place.
5. Open the circuit by cutting or brazing.

COMMISSIONING

⚠ CAUTION

Ensure that the floor area is sufficient for the refrigerant charge or that the ventilation duct is assembled in a correct manner.

⚠ CAUTION

Check safety equipment before putting into service.

IMPORTANT: Connect the pipes and carry out a leak test before charging with refrigerant.

DECOMMISSIONING

If the safety is affected when the equipment is putted out of service, the REFRIGERANT CHARGE should be removed before decommissioning.

Equipment shall be labeled/tagged stating that it has been decommissioned and emptied of refrigerant. The label/tag shall be dated and signed by authorized personnel.

Decommissioning of the equipment to be performed by trained personnel.

Refer to the section on Equipment Decommissioning for more information.

⚠ CAUTION

Ensure sufficient ventilation at the equipment location.

⚠ CAUTION

Be aware that malfunction of the equipment may be caused by refrigerant loss and a refrigerant leak is possible.

- Discharge capacitors in a way that won't cause any spark.
- Remove the refrigerant.

RECOVERY

IMPORTANT: When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good practice that all refrigerants are removed safely.

IMPORTANT: When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge is available.

IMPORTANT: All cylinders to be used are designated for the recovered refrigerant and labeled for that refrigerant; i. e., special cylinders for the recovery of refrigerant).

IMPORTANT: Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

⚠ CAUTION

Cylinders must be complete with pressure-relief valve and associated shut-off valves in good working order.

⚠ CAUTION

Recovery equipment must be in good working order with a set of instructions concerning the equipment that is at hand and must be suitable for the recovery of all appropriate refrigerants including, when applicable, flammable refrigerants.

⚠ CAUTION

Do not mix refrigerants in recovery units and especially not in cylinders.

⚠ CAUTION

Before using the recovery machine, check that it is in satisfactory working order, has been properly maintained, and that any associated electrical components are sealed to prevent ignition in the event of a refrigerant release.

Consult manufacturer if in doubt.

In addition:

- A set of calibrated weighing scales should be available and in good working order.
- Hoses should be complete with leak-free disconnect couplings and in good condition.

IMPORTANT: The recovered refrigerant should be returned to the refrigerant supplier in the correct recovery cylinder, and the relevant waste transfer note arranged.

⚠ CAUTION

If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant.

The evacuation process should be carried out prior to returning the compressor to the suppliers. Only electric heating to the compressor body should be employed to accelerate this process.

⚠ CAUTION

When oil is drained from system, it must be carried out safely.

DISPOSAL

⚠ CAUTION

Ensure sufficient ventilation at the working place.

- Remove the refrigerant.
- Evacuate the refrigerant circuit.
- Cut out the compressor and drain the oil.

19MV INSTALLATION START-UP REQUEST CHECKLIST

NOTE: To avoid injury to personnel and damage to equipment or property when completing the procedures listed in this start-up checklist, use good judgment, follow safe practices, and adhere to the safety considerations/information as outlined in the preceding sections of this Installation Instructions document.

Machine Model Number: _____ Serial Number: _____

To: _____ Date: _____

_____ Project Name: _____

Attn: _____

Carrier Sales Order Number _____

The following information provides the status of the chiller installation.

	YES/NO (N/A)	DATE TO BE COMPLETED
The machine is level.		
The machine components are installed and connected in accordance with the installation instructions.		
The isolation package and grouting (if necessary) are installed.		
The relief devices are piped to the atmosphere.		
All piping is installed and supported. Direction of flow is indicated in accordance with the installation instructions and job prints.		
Chilled water piping		
Condenser water piping		
Waterbox drain piping		
Pumpout unit piping (if installed)		
VFD drain piping		
Other _____		
Gauges are installed as called for on the job prints required to establish design flow for the evaporator and condenser.		
Water pressure gauges IN and OUT		
Water temperature gauges IN and OUT		
The machine's wiring is complete. The wiring is installed per installation instructions and certified prints.		
Power wiring to Carrier Power Panel (line side) completed with Carrier supplied tophat installed. (If chiller was disassembled during installation, motor leads must not be taped until the Carrier technician megger-tests the motor.)		
Carrier controls can independently energize water pumps.		
The transformer feeding the chiller is confirmed to have a Wye secondary with a solidly grounded Neutral. Immediately contact Carrier Service if this is not the case.		
Line side voltage is within ±10% of chiller nameplate voltage		
Other _____		
Was the chiller disassembled/reassembled during the installation?		
Was this work supervised by a Carrier Service Representative?		
The mechanical room meets ASHRAE 15-2022 requirements or current ASHRAE standard.		

Comments:

_____

_____

_____

_____

_____

TESTING

	YES/NO	DATE TO BE COMPLETED
The cooling tower fan has been checked for blade pitch and proper operation.	_____	_____
The chilled water and condenser water lines have been:		
Filled	_____	_____
Tested	_____	_____
Flushed	_____	_____
Vented	_____	_____
Strainers cleaned	_____	_____
Chemically treated	_____	_____
The chilled water and condenser water pumps have been checked for proper rotation and flow.	_____	_____
The following cooling load will be available for start-up:		
25%	_____	_____
50%	_____	_____
75%	_____	_____
100%	_____	_____
Unless unit is factory charged, the charge is near the machine.	_____	_____
Services such as electrical power and control air will be available at start-up, up over evaporator for gravity feed.	_____	_____
The building automation system is operational.	_____	_____
The electrical, building automation and mechanical representatives will be available to assist in commissioning the machine. Note that while BACnet/Modbus is included with PIC6 the integration with building automation system (BAS) is not included in the standard start-up time. Please coordinate with the local Carrier Service Office that will be performing the equipment startup, for control technician pricing associated with the BAS integration.	_____	_____
The customer's operators will be available to receive instructions for proper operation of the chiller after start-up.	_____	_____
There will be no grinding, welding, or any other activity that would generate a possible ignition source of an A2L refrigerant during the commissioning of the chiller.	_____	_____

Concerns about the installation/request for additional assistance:

_____

_____

_____

I am aware that the start-up time for a Carrier chiller can take between 2 and 6 days depending on the model of the machine and the options and accessories used with it.

Your contact at the jobsite will be _____

Phone number _____

Pager/Cell number _____

Fax number _____

In accordance with our contract, we hereby request the services of your technician to render start-up services per contract terms for this job on _____ (Date). I understand that the technician's time will be charged as extra services due to correcting items in this checklist that are incomplete.

Signature of Purchaser _____

Signature of Jobsite Supervisor _____

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EQUIPMENT DECOMMISSIONING

Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its detail. It is recommended good practice that all refrigerant be recovered safely. Prior to the task being carried out, an oil and refrigerant sample shall be taken in case analysis is required prior to re-use of recovered refrigerant. It is essential that electrical power is available before the task is commenced.

a. Become familiar with the equipment and it's operation.
b. Isolate system electrically.
c. Before attempting the procedure, ensure that:
   - Mechanical handling equipment is available, if required, for handling refrigerant cylinders;
   - All personal protective equipment is available and being used correctly;
   - The recovery process is supervised at all times by a competent person;
   - Recovery equipment and cylinders conform to the appropriate standards.
d. Pump down refrigerant system, if possible.
e. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
f. Make sure that cylinder is situated on the scales before recovery takes place.
g. Start the recovery machine and operate in accordance with instructions.
h. Do not overfill cylinders (no more than 80 % volume liquid charge).
i. Do not exceed the maximum working pressure of the cylinder, even temporarily.
j. When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.
k. Recovered refrigerant shall not be charged into another REFRIGERATING SYSTEM unless it has been cleaned and checked.

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Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

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