Microprocessor Control 19EF Hermetic Centrifugal Liquid Chillers with R-12, R-134a, and R-500

Installation Instructions

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.

DO NOT VENT refrigerant relief devices within a building. Outlet from rupture disc or relief valve must be vented outdoors in accordance with the latest edition of ANSI/ASHRAE 15 (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.

DO NOT WELD OR FLAMECUT any refrigerant line or vessel until all refrigerant *(liquid and vapor)* has been removed from chiller. Traces of vapor should be displaced with dry air or nitrogen and the work area should be well ventilated. *Refrigerant in contact with an open flame produces toxic gases.*

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, starters, or oil heater until you are sure ALL POWER IS OFF and no residual voltage can leak from capacitors or solid-state components.

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

DO NOT syphon refrigerant by mouth.

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 any 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 overpressure can result. When 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 low-pressure refrigerants.

DO NOT ATTEMPT TO REMOVE fittings, covers, etc., while machine is under pressure or while machine is running. Be sure pressure is at zero psig before breaking any refrigerant connection.

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

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

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.

DO NOT STEP on refrigerant lines. Broken lines can whip about and cause 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 such equipment when there is a risk of slipping or losing your balance.

BE AWARE that certain automatic start arrangements CAN ENGAGE THE STARTER. Open the disconnect *ahead of* the starter in addition to shutting off the machine or pump.

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

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

DO NOT LOOSEN water box cover bolts until the water box 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.

CONTENTS

INTRODUCTION

General — The 19EF Hermetic Centrifugal Liquid Chiller is assembled, wired, and tested at the factory. Installation work (not by Carrier) consists primarily of installing the water and electrical services to the machine.

Rigging, installation, field wiring, and field piping are the responsibility of the contractor and/or customer. Carrier has no installation responsibilities for the equipment.

Refrigerant Storage Tank — Service work on this unit may require removal of the refrigerant (both liquid and vapor). This requires a refrigerant pumpdown unit and storage vessel. On installations where a pumpdown unit and storage vessel have not been supplied, the customer is responsible for providing a pumpdown unit and storage vessel with sufficient holding capacity and suitable pressure relief devices for the entire machine refrigerant charge before service work can be performed.

Job Data — Necessary information consists of:

- machine location prints
- piping prints and details
- field wiring diagrams
- starter installation and wiring details
- rigging guide
- other prints or specifications necessary for complete installation

INSTALLATION

Check Equipment and Prepare for Installation

INSPECT SHIPMENT — *Do not open any valves or break any connections. The 19EF machine is shipped with the refrigerant charge in the storage tanks (if supplied) and a holding charge in the other vessels.*

1. Inspect for shipping damage while machine is still on the shipping conveyance. If machine appears damaged, or if it has been torn loose from its anchorage, have it examined by transportation inspectors before removal. Forward claim papers directly to the transportation company.

   Carrier Corporation will not be responsible for any damage incurred in transit.
2. Check all items against shipping list. If any item is missing, notify the nearest Carrier office.
3. To prevent damage or loss, leave all parts in their original packages until installation.

IDENTIFY MACHINE — Identify machine by machine model and serial number shown on identification plate (Fig. 1, Item 10).

PROVIDE MACHINE PROTECTION — Protect machine and starter from construction dirt and moisture. Do not remove protective shipping covers until machine is ready for installation.

If machine will be exposed to freezing temperatures after water circuits have been installed, open water box drains (Fig. 1, Item 11) and drain all water from cooler and condenser. Leave drains open until system is to be refilled. Drain all water from oil cooler (Fig. 1, Item 1). Disconnect water supply line, if already installed, remove drain plug, and use compressed air to remove any water from the oil cooler coil. Follow the same procedure with the pumpout unit condenser, if supplied.

RIGGING — Refer to the rigging instructions attached to the machine (Fig. 1, Item 9). Rigging equipment and procedure must be suitable for the machine weight listed on the guide (Table 1).

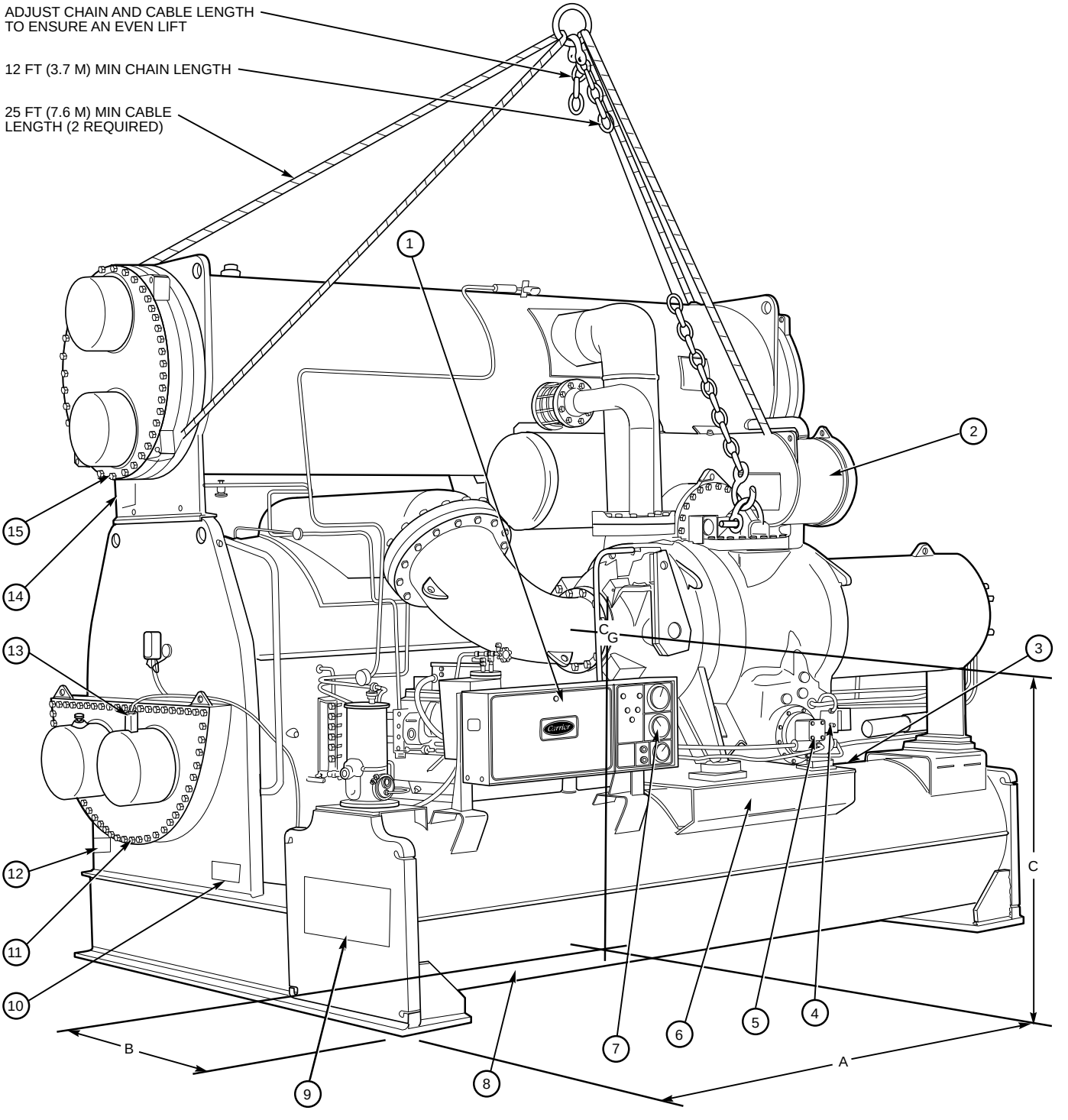
⚠ WARNING

Lift the machine only from the points designated on the rigging guide. Lifting machine from other points may cause serious damage.

Use a spreader bar, if necessary, to avoid damage to machine components, piping, or insulation.

Take care to avoid stress to piping and connections on the underside of the machine. Damage may cause loss of entire refrigerant charge.

RECORD AND DATE COOLER PRESSURE GAGE READING (Fig. 1, Item 7) — Keep a record of both the pressure and the ambient temperature at the time of reading. This information is required for checking machine tightness at initial start-up.



1 — Oil Cooler (Behind Control Panel)
2 — Flash Economizer
3 — Refrigerant Charging Valve Location, 1-in.FPT
4 — Oil Heater Terminal Box
5 — Oil Pump Terminal Box
6 — Storage Tank Nameplate
7 — Cooler Pressure Gage
8 — Storage Tank
9 — Rigging Guide
10 — Machine Identification Plate
11 — Cooler Waterbox Drain, ¾-in. FPT Connection
12 — Cooler Nameplate
13 — Chilled Water Sensor
14 — Condenser Nameplate
15 — Condenser Waterbox Drain, ¾-in. FPT Connection

Fig. 1 — Rigging Guide

Table 1 — Physical Data

ENGLISH

FRAME SIZE	MACHINE SIZE	BASE CODE*	APPROX. WT	APPROX. CENTER OF GRAVITY (CG) (ft-in.)			FRAME SIZE	MACHINE SIZE	BASE CODE†	APPROX. WT	APPROX. CENTER OF GRAVITY (CG) (ft-in.)		
			lb	A	B	C				lb	A	B	C
5	22.24.25. 26	1	46,070	6- 9¼	4-11¼	5- 0¾	5	22,24,25, 26	2	43,584	6- 8¼	5-6	4- 2⅞
6	27,28,29		58,596	6- 8¾	5- 0¾	5-11½	6	27,28,29		56,144	6- 7	5-8⅜	5- 2½
5	52,54,55, 56		50,000	8- 0½	5- 0	4- 9¾	5	52,54,55, 56		47,480	6-10¾	5-6⅞	2-11¾
6	57,58,59		63,285	7-11½	5- 2	5- 8¼	6	57,58,59		60,758	6- 7	5-9	5- 0½

SI METRIC

FRAME SIZE	MACHINE SIZE	BASE CODE*	APPROX. WEIGHT	APPROX. CENTER OF GRAVITY (CG) (m)			FRAME SIZE	MACHINE SIZE	BASE CODE†	APPROX. WEIGHT	APPROX. CENTER OF GRAVITY (CG) (m)		
			Kg	A	B	C				Kg	A	B	C
5	22,24,25, 26	1	20 897	206	150	154	5	22,24,25, 26	2	19 769	205	168	129
6	27,28,29		26 579	205	154	182	6	27,28,29		25 466	201	174	159
5	52,54,55, 56		22 680	245	152	147	5	52,54,55, 56		21 537	210	170	91
6	57,58,59		28 706	243	157	173	6	57,58,59		27 559	201	175	154

*Machine shown (Fig. 1) with storage tank (Base Code 1).
†Machine with compressor base without storage tank (Base Code 2).

Install Machine Supports

INSTALL ISOLATION — In most instances, the 19EF machine is placed directly on a level floor without requiring isolation equipment. Check your job data. The standard contact surfaces for floor mounting are shown in Fig. 2.

When isolation pads are specified by the customer, 6 Shearflex pads are shipped with the machine, strapped to the cooler shell. Place these pads under the machine base as shown in Fig. 2. If desired, anchor the base through four, 1½-in. diameter holes provided for optional, customer-supplied anchor bolts.

Machines ordered with spring isolation normally have outriggers factory-welded to the machine support base. The springs are shipped separately. General principles for spring isolator adjustment are given in Carrier Standard Service Techniques Manual, Chapter 15. Obtain specific details on spring mounting and machine weight distribution from your individual job data.

At the time of installation, the 19EF machine may have refrigerant in excess of 200 pounds in the integral storage tank. This refrigerant is redistributed throughout the machine at initial start-up. To avoid damage to machine and piping, spring isolators must remain blocked until machine is started.

Make Piping Connections

INSTALL WATER PIPING TO OIL COOLER (Fig. 3) — Water supply may be either city water, chilled water, or condenser water.

City water must be clean and noncorrosive. Water side erosion or corrosion of the oil cooler coil may lead to extensive machine damage not covered by the standard warranty.

Pipe city water to an open sight drain.

If water from the machine chilled water circuit is used for oil cooling, it should enter the oil cooler inlet from the entering water line of the machine cooler. Water leaving the oil cooler should connect to the leaving-water line of the machine cooler at a point downstream from the chilled water sensor, so that oil cooler leaving-water temperature does not affect the sensor readings.

Locate the oil cooler leaving-water connection at some distance from any chilled water temperature indicator. On single-pass machines, water leaving the oil cooler should be connected into the suction side of the chilled water pump so that adequate pressure drop is assured for oil cooling.

The nominal conditions for oil cooler water flow are (check nameplate on oil cooler):

Maximum inlet water temperature . . . . . 85 F (29 C)

Maximum inlet working pressure . . . . 150 psi or 300 psi (1034 or 2068 kPa)

Water flow, minimum . . . . . 15 gpm (56.8/min.)

Water pressure drop, psi (kPa) differential at oil cooler at 15 gpm (56.8/min.) . . . 0.7 psid (4.8 kPa)

The oil cooler inlet connection at the plug valve is 1-in. FPT. The outlet connection is 1½-in. FPT. Use back-up wrench while tightening connections.

INSTALL WATER PIPING TO PUMPOUT CONDENSER — Obtain water from the source (usually city water or cooler water) specified in the job data. Attach water supply and return lines to ½-in. FPT connections at end of pumpout condenser. Shutoff valves or other controls are customer supplied. Water must be clean and noncorrosive. Pipe the leaving water to an open sight drain, and provide for water drainage during extended shutdown.

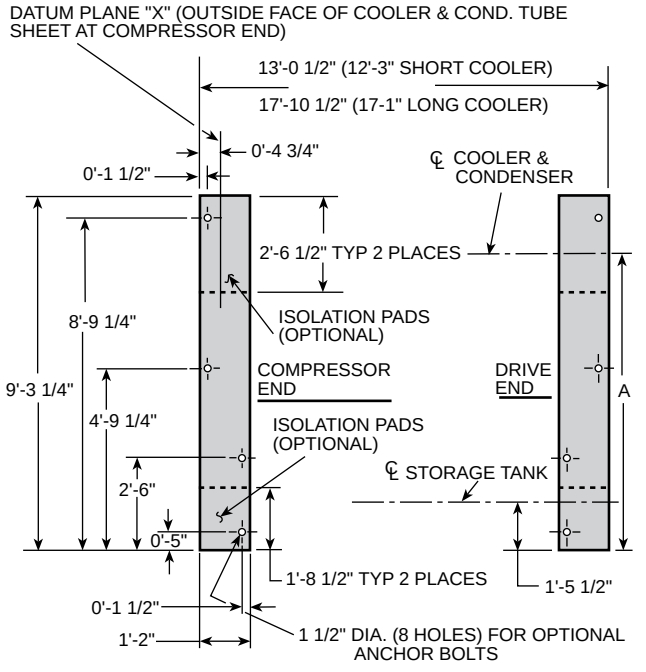
INSTALL WATER PIPING TO HEAT EXCHANGERS — Install piping per job data piping prints and details, and as outlined below.

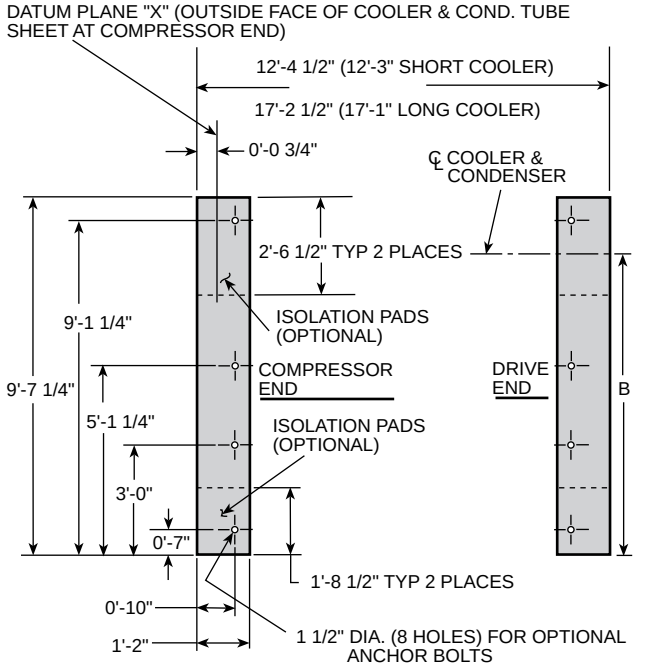
⚠ CAUTION

Machine insulation can be damaged by welding sparks or open flame. Protect insulation with wet canvas cover or other suitable flame-retardant material.

⚠ CAUTION

Chilled water sensor (Fig. 4) can be severely damaged by weld heat. Remove sensor before welding water nozzle. Carefully replace the sensor after welding.





WITHOUT STORAGE TANK

COOLER FRAME SIZE	A	B
5	7′-1 1/16″	7′-5 1/16″
6	6′-9 3/4″	7′-1 3/4″

Fig. 2 — Standard Contact Surfaces

1. Offset the pipe connections to permit the removal of water box covers for maintenance and provide clearance for tube cleaning.
2. Provide openings in the water piping for required gages and thermometers (Fig. 4). To ensure accurate readings, thermometer wells in the leaving water pipe should be 6 to 10 pipe diameters from the water box and should extend inside the pipe a minimum of 2 in. (49 mm). This allows thorough mixing and temperature stabilization before the water reaches the thermometer.
3. Install air vents at all high points in piping to remove air and prevent water hammer.
4. Water flow direction must be as specified on job flow diagrams.
5. Water flow switches must be of vaportight construction. Locate switches at top of pipe, in a horizontal run and at least 5 pipe diameters from any bend.
6. Install water box vent and drain piping as specified in the job data. Plug unused drain holes in water boxes.
7. Install pipe hangers where needed. There must be no weight or stress on water box nozzles or flanges.

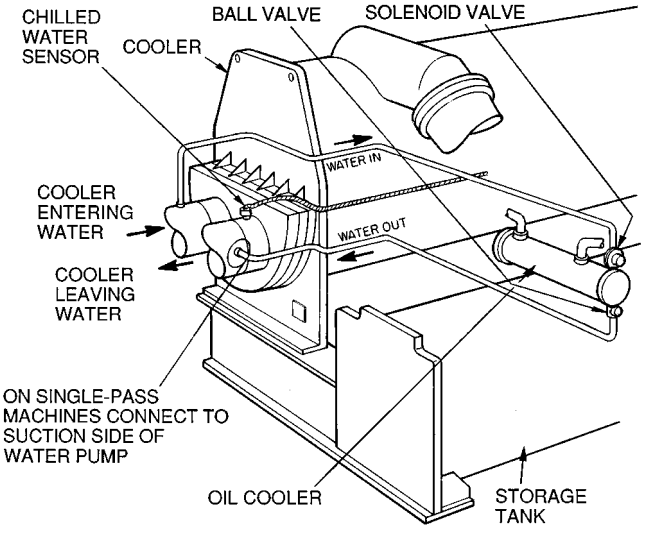


Fig. 3 — Typical Water Piping, Oil Cooler to Chilled Water Circuit

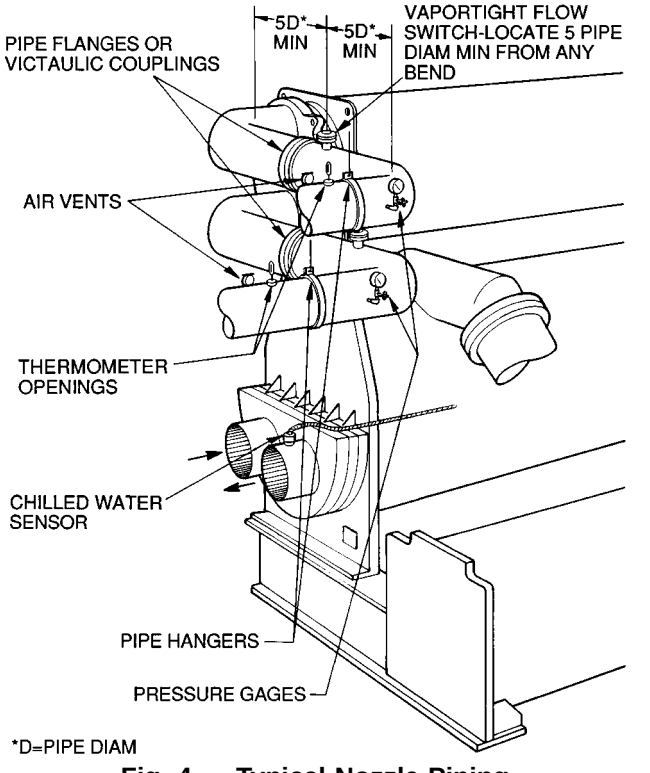


Fig. 4 — Typical Nozzle Piping

INSTALL VENT PIPING TO RELIEF DEVICES

⚠ DANGER

Vent all relief devices to the outdoors in accordance with the latest ANSI/ASHRAE 15 Safety Code for Mechanical Refrigeration and all other applicable codes. Refrigerant discharged into closed spaces can displace oxygen and cause asphyxiation.

The machine cooler, storage tank, and pumpout condenser are provided with relief devices as listed in Table 2.

Table 3 gives the maximum allowable equivalent length of discharge pipe for cooler, storage tank, and pumpout condenser. The table values are based on manifolding the cooler relief devices into one single line and manifolding the storage tank relief devices into another line. If the relief devices are manifolded into a common line, the cross-sectional area of the common line must equal or exceed the sum of the areas of the individual lines.

Provide a pipe plug near outlet side of each relief device for leak testing. Provide fittings so that vent piping can be periodically disconnected for inspection of the relief device mechanism.

Piping to the relief device must not apply stress to the device. Make sure piping is adequately supported. A length of flexible tubing or piping near the device outlet is essential on spring-isolated machines.

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.

Table 2 — Relief Device Data

COOLER SIZE	OUTLET SIZE — FPT (in.)		
	1	½	⅜
	Number of Valves		
22,24,25,26	2	1	—
27,28,29, 52,54,55, 56,57,58,59	3	—	—
Storage Tank	2	—	—
Pumpout Condenser	—	—	1

Table 3 — Maximum Allowable Equivalent Length of Discharge Pipe*

ENGLISH (ft)

LOCATION		SCHEDULE 40 PIPE SIZE (in.)						
		½	¾	1	1½	2	3	4
COOLER SIZE	22	—	—	—	14	49	351	1365
	24,25,26	—	—	—	11	40	292	1135
	27,28,29	—	—	—	—	34	244	948
	52	—	—	—	—	35	251	976
	54,55,56	—	—	—	—	29	206	800
	57,58,59	—	—	—	—	23	167	649
STORAGE TANK	Short Base	—	—	—	147	513	3695	—
	Long Base	—	—	—	76	267	1922	—
PUMPOUT CONDENSER		16	65	219	1867	—	—	—

SI METRIC (m)

LOCATION		SCHEDULE 40 PIPE SIZE (in.)						
		½	¾	1	1½	2	3	4
COOLER SIZE	22	—	—	—	4	15	107	416
	24,25,26	—	—	—	4	12	89	346
	27,28,29	—	—	—	—	11	74	289
	52	—	—	—	—	11	77	297
	54,55,56	—	—	—	—	9	63	244
	57,58,59	—	—	—	—	7	51	198
STORAGE TANK	Short Base	—	—	—	44.8	156	1126	—
	Long Base	—	—	—	23.2	81	586	—
PUMPOUT CONDENSER		4.88	19.81	66.75	569.1	—	—	—

*Based on one discharge pipe for the cooler, one for the storage tank, and one for the pumpout unit.

Make Electrical Connections

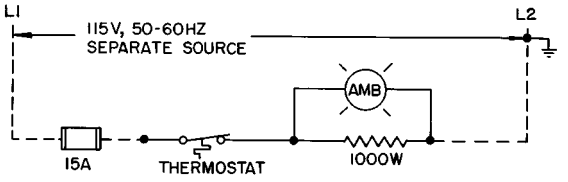
GENERAL — Wiring must be in accordance with all applicable electrical codes and with wiring drawings furnished by Carrier and by the starter manufacturer.

Wiring schematics and electrical controls shown in this book are typical but may differ from your particular job arrangement; check your Job Data.

⚠ WARNING

Do not attempt to start compressor, oil pump, or purge motor — even for a rotation check — nor apply test voltage of any kind while machine is under dehydration vacuum. Motor insulation breakdown and serious damage may result.

CONNECT POWER WIRING TO OIL HEATER AND THERMOSTAT — Use power from separate source with fused disconnect to ensure that proper oil temperature is maintained at machine shutdown. Wiring schematic is shown in Fig. 5. See Fig. 1, Item 4 for terminal box location.



LEGEND

– – – – Field Wiring

NOTE: Power must be from a separate source.

Fig. 5 — Typical Oil Heater Wiring Schematic

CONNECT POWER WIRING TO OIL PUMP STARTER — Use separate starter, overloads, and fused disconnect as shown on job wiring drawings. Check oil pump nameplate near terminal box for pump voltage requirements. See Fig. 1, Item 5 for oil pump terminal box location.

CONNECT POWER WIRING TO PUMPOUT UNIT — Connect power wires to contactor in pumpout control box as shown on job wiring drawings. Check pumpout compressor nameplate for proper voltage. Figures 6 and 7 illustrate typical pumpout controls and wiring. Use separate disconnect.

CONNECT CONTROL WIRING TO WATER FLOW SWITCHES — Wire flow switches or other interlocks into machine safety circuits as shown on job wiring drawings.

CONNECT WIRING TO MACHINE CONTROL CENTER — Connect control wires from main starter, oil pump starter, and water pump starters to terminals in machine control center as shown on job wiring drawings.

INSTALL COMPRESSOR POWER WIRING

Assemble Terminal Box — Assemble and install compressor terminal box after cutting necessary conduit openings in conduit support plates.

Attach Power Leads — Attach power leads to compressor terminals in accordance with job wiring drawings, *observing caution label in terminal box.* Use only copper conductors. Ground motor in accordance with NEC (National Electrical Code, U.S.A.) and applicable local codes.

NOTE: Do not insulate terminals until wiring arrangement has been checked and approved by Carrier start-up personnel.

After confirmation of proper motor wiring by start-up personnel, insulate the motor terminals and lead wire ends both thermally and electrically to prevent moisture condensation and electrical arcing.

On low voltage units (to 600 v), obtain insulation material, consisting of 3 rolls of insulation putty and one roll of vinyl tape, from machine shipping package.

1. Thermally insulate each terminal by wrapping with one layer of insulation putty.
2. Overwrap the putty with a high voltage insulation (not by Carrier). Do not use low voltage vinyl tape.

Installer is responsible for any damage caused by improper wiring between starter and compressor motor.

Figures 8, 9, and 10 illustrate 3 methods for assembling multiple lead wires within the compressor terminal box. For the purposes of illustration, the terminal insulation has been omitted.

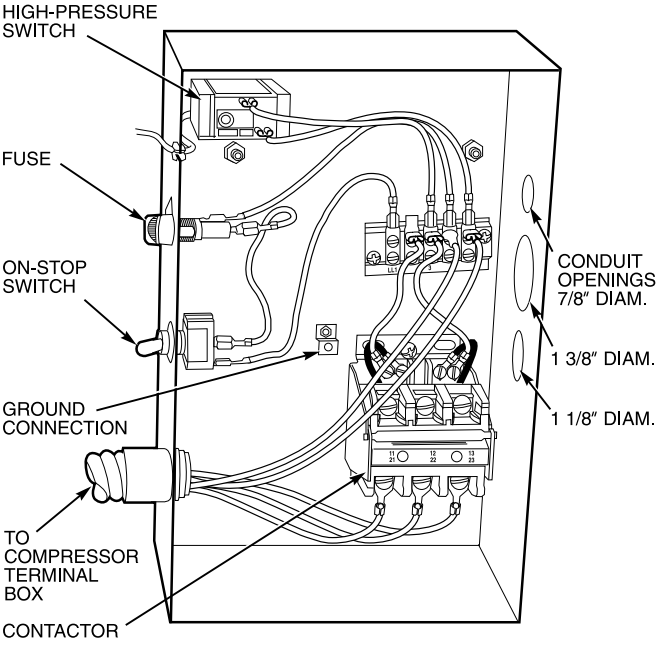
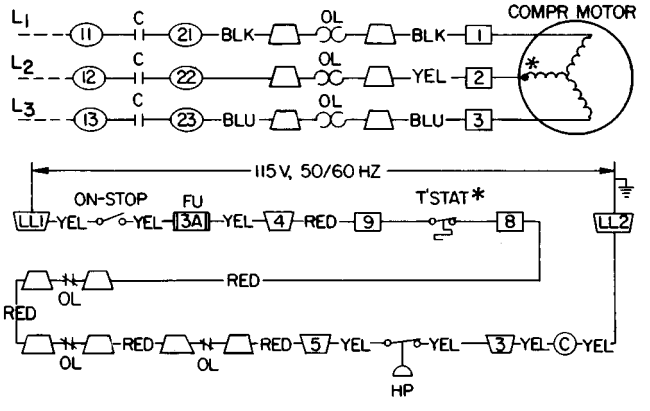


Fig. 6 — Pumpout Unit Controls



LEGEND

C	— Contactor		Compressor Terminal
Fu	— Fuse, 3 Amps		Contactor Terminal
HP	— High-Pressure Cutout		Overload Terminal
OL	— Compressor Overload		Pumpout Unit Terminal
T'STAT	— Internal Thermostat		

*Bimetal thermal protector imbedded in motor winding.

Fig. 7 — Pumpout Unit Wiring Schematic

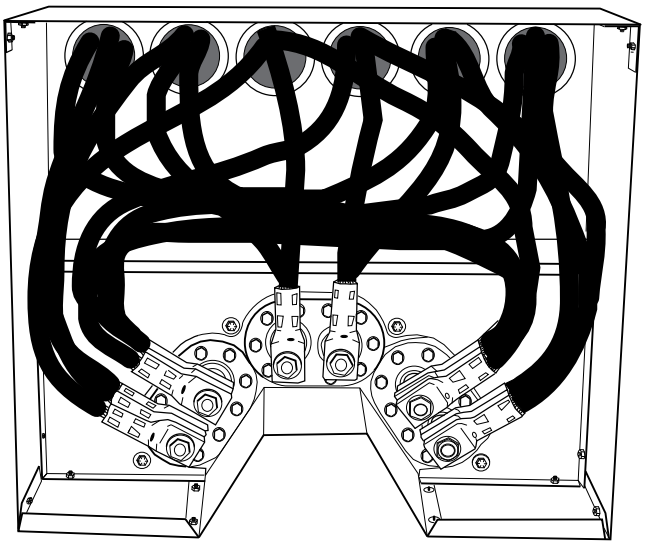


Fig. 8 — Compressor Terminal Arrangement 18-Lead, Rear Inlet

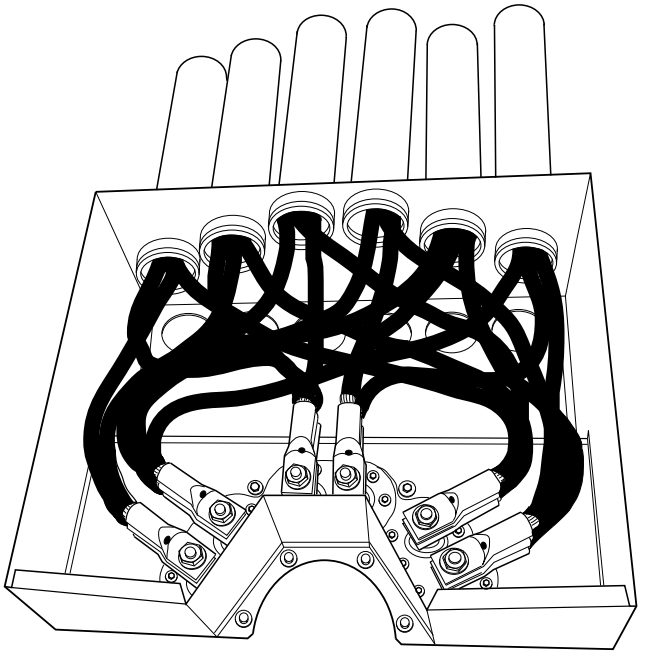


Fig. 9 — Compressor Terminal Arrangement 18-Lead, Top Inlet

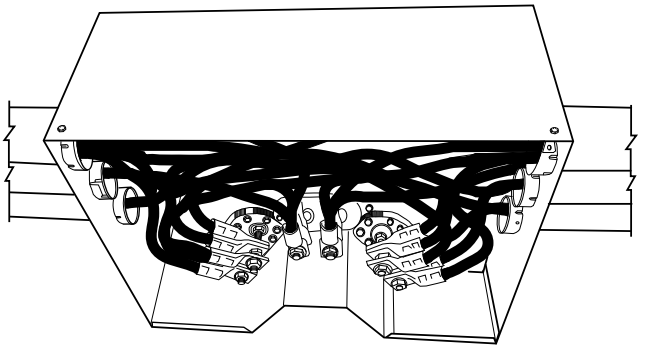


Fig. 10 — Compressor Terminal Arrangement 18-Lead, Side Inlet

Apply Field Insulation (If Required) — Apply insulation as specified in the job data. If the pressure gage reading (above) indicates a significant loss of the 10 psig (69 kPa) holding charge, do not apply insulation. Contact your nearest Carrier office as machine dehydration may be required.

Protect insulation from weld heat damage and weld splatter during installation.

Standard factory insulation covers the compressor motor shell, motor end cover, motor cooling line, and refrigerant drain from the compressor. Field coverage may include the compressor suction housing and suction elbow, flash economizer, cooler, and cooler water boxes. The approximate square footage required for insulating this area is given in Table 4. When insulating the cooler water boxes and economizer, apply so that all covers may be removed for service access. Do not cover nameplates.

Table 4 — Insulation Areas

ENGLISH (sq ft)

COOLER SIZE*	sq ft			
	Cooler†	Flash Economizer	Compressor Suction Housing	Total
22	140	45	15	200
24,25,26	165			225
27,28,29	195			255
52	195	45	15	255
54,55,56	220			280
57,58,59	265			325

SI METRIC (m^2)

COOLER SIZE*	m^2			
	Cooler†	Flash Economizer	Compressor Suction Housing	Total
22	13.0	4.2	1.4	18.6
24,25,26	15.3			20.9
27,28,29	18.1			23.7
52	18.1	4.2	1.4	23.7
54,55,56	20.4			26.0
57,58,59	24.6			30.2

*The fifth and sixth digits of the cooler assembly number as listed on the machine identification plate refer to cooler size, e.g., 17FA 22 .

†Includes water boxes and suction elbow.