

Hermetic Centrifugal Liquid Chillers

SAFETY GUIDE

Centrifugal machines 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

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.

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.

▲ WARNING

DO NOT WELD OR FLAME CUT 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 nor attempt to refill them. It is DANGEROUS AND ILLEGAL. When cylinder is emptied, bleed off remaining gas pressure, loosen the collar and unscrew and discard the valve stem. DO NOT INCINERATE.

CHECK THE REFRIGERANT TYPE before charging machine. High-pressure refrigerant in a low-pressure machine can cause vessels to rupture if the relief devices cannot handle the refrigerant volume.

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 VENT refrigerant relief valves within a building; vent to outside. The accumulation of refrigerant in an enclosed space can displace oxygen and cause asphyxiation.

DO NOT install relief valves 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.

▲ CAUTION

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.

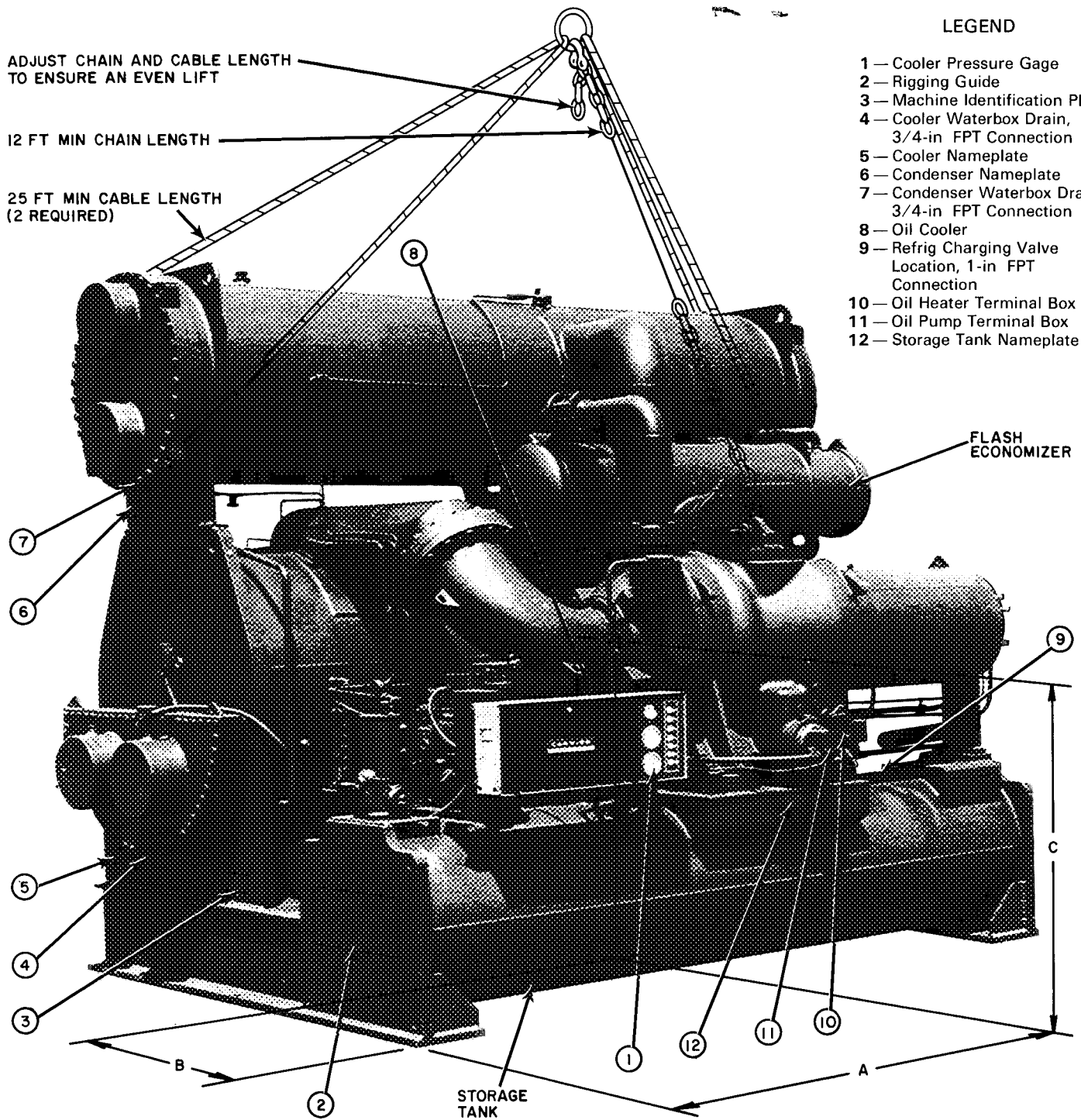
DO NOT LOOSEN water box cover bolts until the water box has been completely drained.

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.



LEGEND

- 1 — Cooler Pressure Gage
- 2 — Rigging Guide
- 3 — Machine Identification Plate
- 4 — Cooler Waterbox Drain, 3/4-in FPT Connection
- 5 — Cooler Nameplate
- 6 — Condenser Nameplate
- 7 — Condenser Waterbox Drain, 3/4-in FPT Connection
- 8 — Oil Cooler
- 9 — Refrig Charging Valve Location, 1-in FPT Connection
- 10 — Oil Heater Terminal Box
- 11 — Oil Pump Terminal Box
- 12 — Storage Tank Nameplate

MACHINE SIZE	BASE CODE*	APPROX WT (lb)	APPROX CENTER OF GRAVITY (CG) (ft-in.)			MACHINE SIZE	BASE CODE†	APPROX WT (lb)	APPROX CENTER OF GRAVITY (CG) (ft-in.)		
			A	B	C				A	B	C
19,20,21	1	40,199	6-9-1/2	4-10-3/4	4-9-1/4	19,20,21	2	37,671	6-9-1/4	5-4-1/2	4-0-1/8
22,24,25,26		46,070	6-9-1/4	4-11-1/4	5-0-3/4	22,24,25,26		43,584	6-8-1/4	5-6	4-2-7/8
27,28,29		58,596	6-8-3/4	5-0-3/4	5-11-1/2	27,28,29		56,144	6-7	5-8-3/8	5-2-1/2
49,50,51		43,314	8-1-1/4	5-0-1/4	4-7	49,50,51		40,738	6-10-1/2	5-5-1/4	3-11-5/8
52,54,55,56		50,000	8-0-1/2	5-0	4-9-3/4	52,54,55,56		47,480	6-10-3/4	5-6-7/8	2-11-3/4
57,58,59		63,285	7-11-1/2	5-2	5-8-1/4	57,58,59		60,758	6-7	5-9	5-0-1/2

*Machine shown with storage tank (Base Code 1)

†Machine with Compr Base without storage tank (Base Code 2)

Fig. 1 — Rigging Guide

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INTRODUCTION

General — The 19EF Hermetic Centrifugal Liquid Chiller is assembled, wired, tested and charged 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. The scope of Carrier's duties at time of start-up are listed in the introduction of the 19EF Start-Up, Operation and Maintenance Instructions.

Refrigerant Storage Tank — Service work on this unit may require removal of the refrigerant (both liquid and vapor). This requires a refrigerant pump-down 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

RECEIVING MACHINE

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 Air Conditioning Company 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 office of Carrier Air Conditioning Company.
3. To prevent damage or loss, leave all parts in their original packages until installation.

Machine Identification — Identify machine by machine model and serial number shown on identification plate (Item 3, Fig. 1).

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) 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). 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). Rigging equipment and procedure must be suitable for the machine weight listed on the guide.

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 (item 1, Fig. 1). 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.

Field Insulation — Apply insulation as specified in the job data. If the pressure gage reading (above) indicates a significant loss of the 10 psig holding charge, do not apply insulation. Contact your nearest Carrier Air Conditioning 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 1. When insulating the cooler water boxes and economizer, apply so that all covers may be removed for service access. Do not cover nameplates.

Table 1 — Insulation Areas (sq ft)

COOLER SIZE 17FA*	COOLER†	FLASH ECON	COMPR SUCT HSG	TOTAL
19,20,21,22	140		15	200
24,25,26	165	45	15	225
27,28,29	195			255
49,50,51,52	195		15	255
54,55,56	220	45	15	280
57,58,59	265			325

*First 6 digits of cooler assembly number as listed on machine identification plate, e.g. 37FA222 3-404

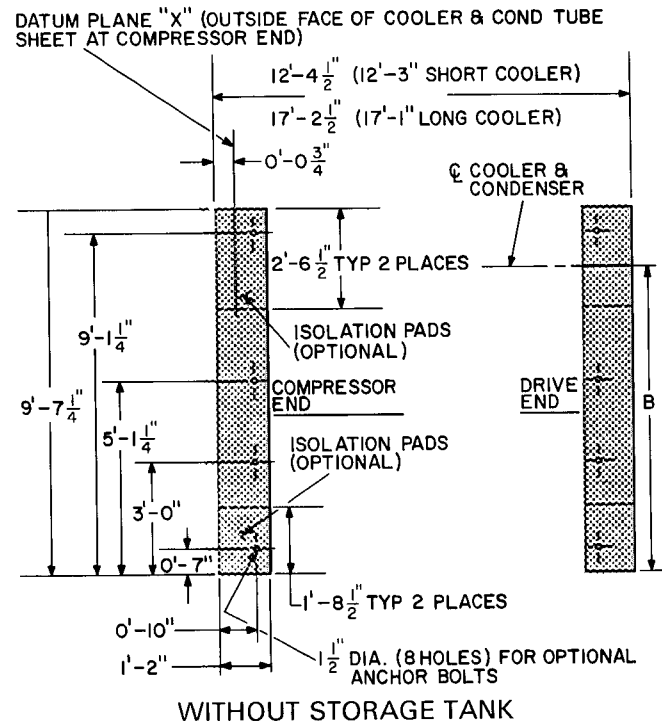
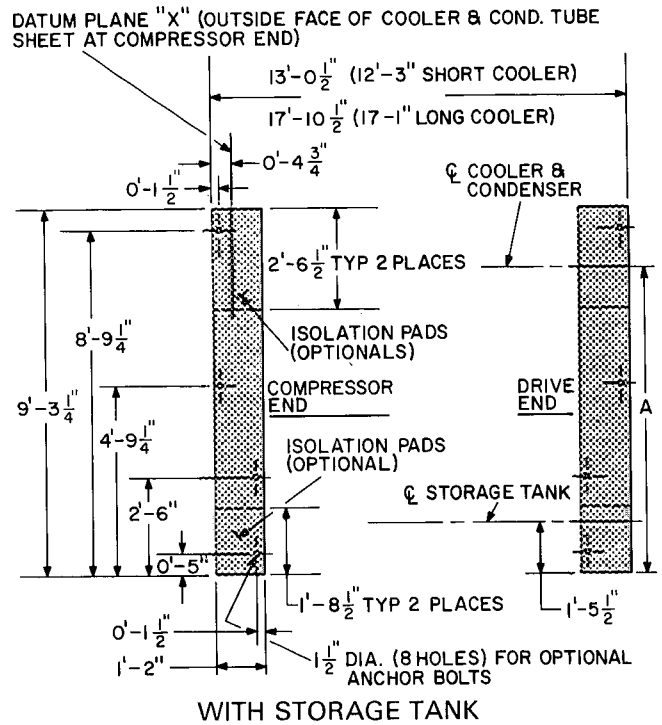
†Includes water boxes and suction elbow

MACHINE MOUNTING

Install Isolation — In most instances, the 19EF machine is placed directly on a level floor without requiring isolation equipment. Check your specific 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 thru four 1-1/2 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, Form SM-15B. Obtain specific details on spring mounting and machine weight distribution from your individual Job Data.



COOLER SIZE	A	B
4	7'-4-7/8"	7'-8-7/8"
5	7'-1-1/16"	7'-5-1/16"
6	6'-9-3/4"	7'-1-3/4"

Fig. 2 — 19EF Standard Contact Surfaces

At the time of installation, the 19EF machine may have refrigerant in excess of 2000 pounds in the integral storage tank. This refrigerant is re-distributed throughout the machine at initial start-up. To avoid damage to machine and piping, spring isolators must remain blocked until machine is started.

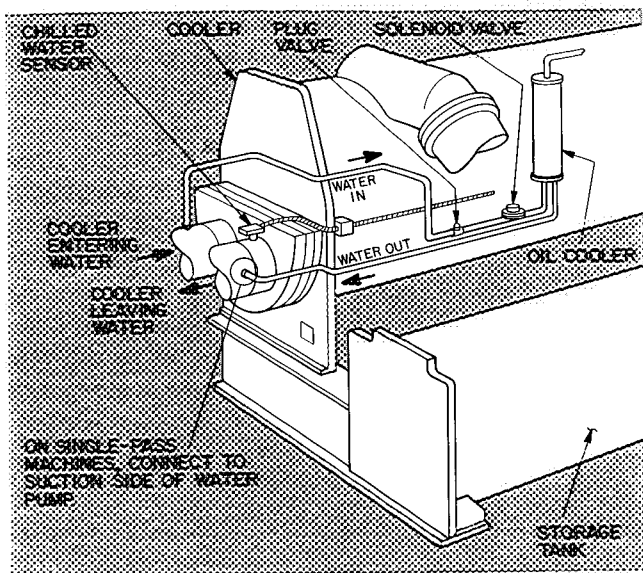


Fig. 3 — Water Piping, Oil Cooler to Chilled Water Circuit (Typical)

PIPING

Water to Oil Cooler — Water supply may be either city water or chilled 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 (Fig. 3). 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 (Fig. 3).

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:

Max. inlet water temp	85 F
Max. inlet working press.	200 psi
Water flow, gpm	7 max., 4 min
Water press. drop, psi diff	5 max., 2 min

The oil cooler inlet connection at the plug valve is 1/2-in. FPT. The outlet connection is 1/2-in. MPT. Use back-up wrench while tightening connections.

Water to Pumpout Condenser — Obtain water from the source (usually city water) specified in the job data. Attach water supply and return lines to 1/2-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.

Water to Heat Exchangers — Install piping per job data piping prints and details, and as outlined below.

Machine insulation can be damaged by welding sparks or open flame. Protect insulation with wet canvas cover or asbestos.

1. Chilled water control element (Fig. 4) can be severely damaged by weld heat. Remove element before welding water nozzle. Carefully replace the control element after welding.
2. Offset the pipe connections to permit the removal of water box covers for maintenance and provide clearance for tube cleaning.

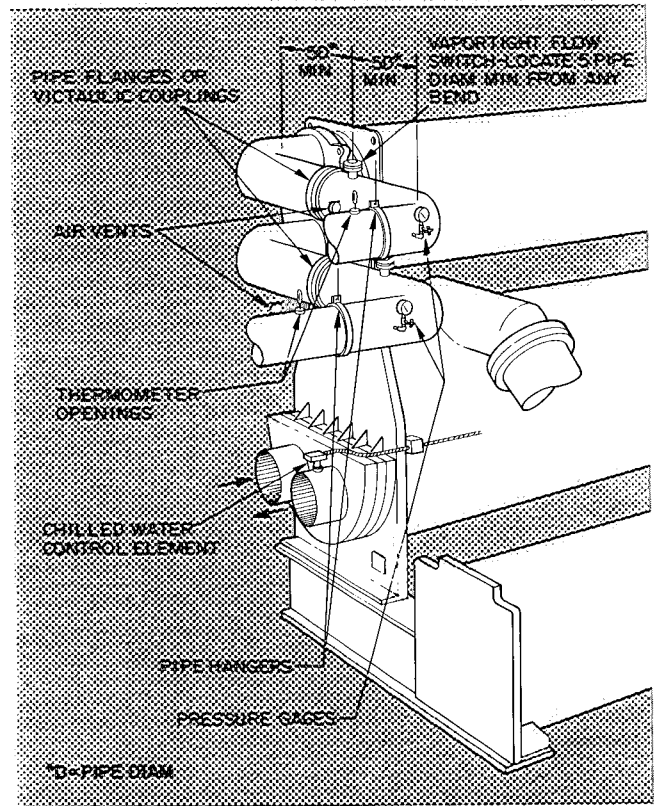


Fig. 4 — Typical Nozzle Piping

3. 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 inches. This allows thorough mixing and temperature stabilization before the water reaches the thermometer.
4. Install air vents at all high points in piping to remove air and prevent water hammer.
5. Water flow direction must be as specified on job flow diagrams.

6. 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.
7. Install water box vent and drain piping as specified in the job data. Plug unused drain holes in water boxes.
8. Install pipe hangers where needed. There must be no weight or stress on water box nozzles or flanges.

Table 2 — 19EF Relief Valve Data

LOCATION	OUTLET SIZE		
	1-in. FPT	1/2-in. FPT	3/8-in. FPT
	Number of Valves		
Cooler (Size) 19	2	—	—
20,21,22,24, 25,26,49	2	1	—
27,28,29,50 51,52,54,55, 56,57,58,59	3	—	—
Storage Tank	2	—	—
Pumpout Condenser	—	—	1

Table 3 — Maximum Allowable Equivalent Length of Discharge Pipe (ft)*

LOCATION	SCHEDULE 40 PIPE SIZE (in.)						
	1/2	3/4	1	1-1/2	2	3	4
Cooler (Size) 19,20,21,22 24,25,26	—	—	—	18 14 11	65 49 40	467 351 292	1817 1365 1135
27,28,29 49 50,51,52	—	—	—	— 13	34 47 35	244 339 251	948 1319 976
54,55,56 57,58,59	—	—	—	—	29 23	206 167	800 649
Storage Tank Short (Base Size) Long	—	—	—	147 76	513 267	3695 1922	— —
Pumpout Condenser	16	65	219	1867	—	—	—

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

Relief Valve Piping — Vent all relief devices (Table 2) to the outdoors in accordance with the ANSI B9.1 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 valves into a single line and manifolding the storage tank valves into another. If the valves 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 valve 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.

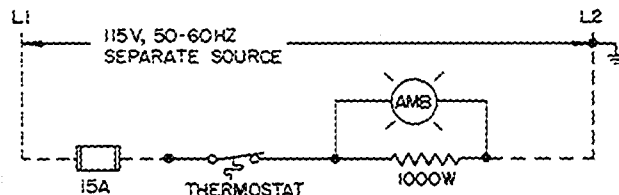
Cover the outdoor vent with a rain cap and place a condensation drain at the low point in the vent piping to prevent water build-up on the atmospheric side of the relief device.

FIELD WIRING

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.*

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 for terminal box location.



NOTE Power must be from a separate source
 --- Field Wiring

Fig. 5 — Oil Heater Wiring Schematic (Typical)

Oil Pump — 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 for oil pump terminal box location.

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.

Water Flow Switches — Wire flow switches or other interlocks into machine safety circuits as shown on job wiring drawings.

Control Wiring — 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. Figure 8 shows the numbering sequence on the field wiring terminal strip within the control center.

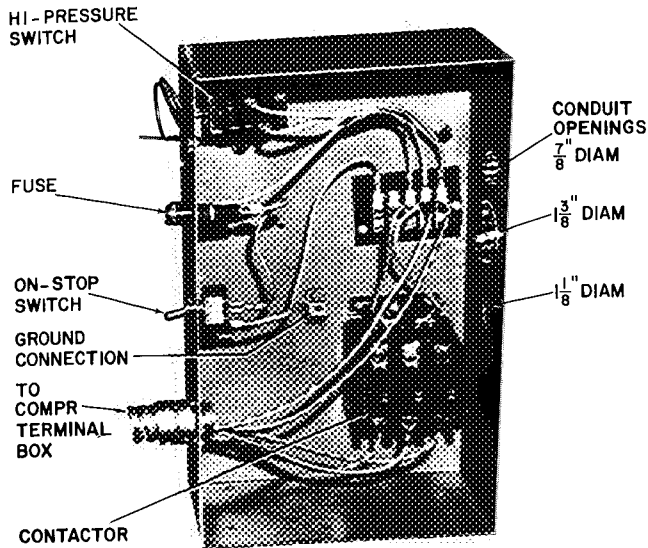
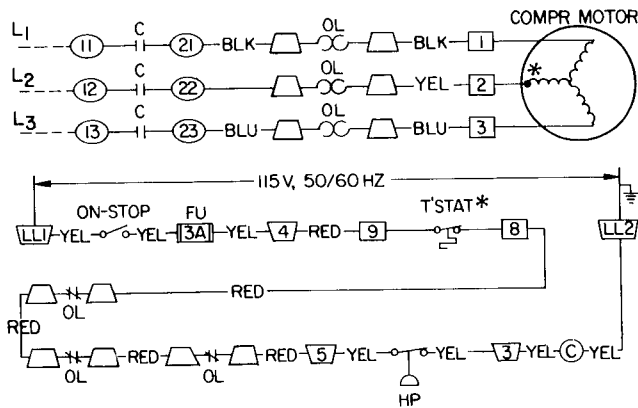


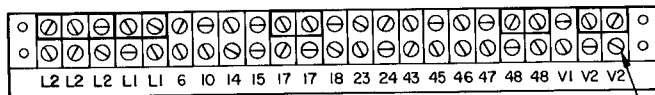
Fig. 6 — Pumpout Unit Controls



LEGEND

- C — Contactor
 - Fu — Fuse, 3 Amps
 - HP — Hi-Pressure Cutout
 - OL — Compressor Overload
 - T'STAT — Internal Thermostat
 - — Compressor Terminal
 - — Contactor Terminal
 - ◡ — Overload Terminal
 - ◣ — Pumpout Unit Terminal
- *Bimetal thermal protector imbedded in motor winding

Fig. 7 — Pumpout Unit Wiring Schematic



NO 6-32 SCREWS

Position of L1 and L2 terminals may be reversed on some machines

Fig. 8 — 19EF Field Wiring Terminal Strip

Compressor Power Wiring — 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 National Electrical code and all applicable local codes.

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.

Obtain insulation material from machine shipping package. Thermally insulate each terminal by wrapping with one layer of insulation putty. Then overwrap the putty with 4 layers of vinyl tape.

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

Figures 9, 10 and 11 illustrate 3 methods for assembling multiple lead wires within the compressor terminal box. For the purposes of illustration, the terminal insulation has been omitted.

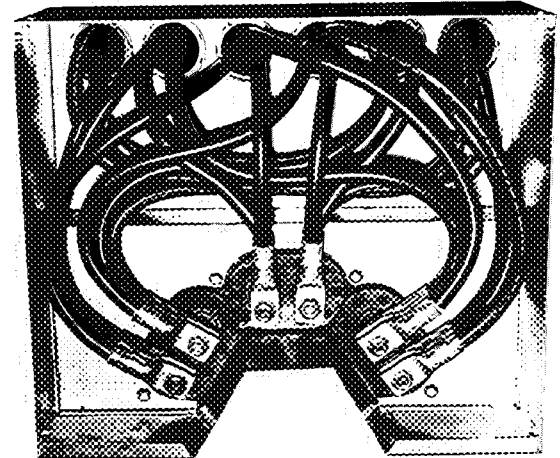


Fig. 9 — Compressor Terminal Arrangement 18-Lead, Rear Inlet

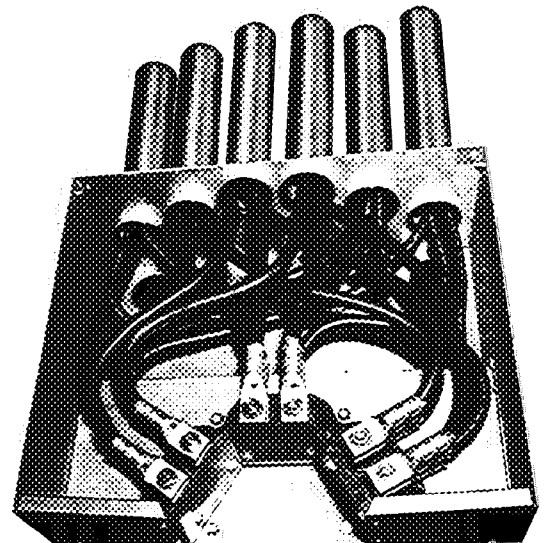


Fig. 10 — Compressor Terminal Arrangement 18 Lead, Top Inlet

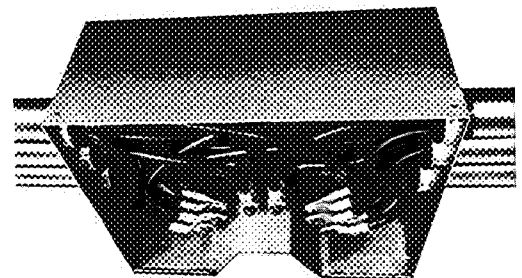


Fig. 11 — Compressor Terminal Arrangement 18 Lead, Side Inlet

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

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