Carrier®

17EX
Externally Geared Centrifugal Liquid Chillers
50/60 Hz
1500 to 2250 Nominal Tons (5280 to 7910 kW)

Start-Up, Operation, and Maintenance 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 chiller instructions as well as those listed in this guide.

⚠ DANGER

DO NOT VENT refrigerant relief valves within a building. Outlet from rupture disc or relief valve must be vented outdoors in accordance with the latest edition of ASHRAE (American Society of Heating, Refrigeration, and Air Conditioning Engineers) 15. The accumulation of refrigerant in an enclosed space can displace oxygen and cause asphyxiation.

PROVIDE adequate ventilation in accordance with 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. 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 chiller 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 USE air for leak testing. Use only refrigerant or dry nitrogen.

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 chiller 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 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 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 chiller. The introduction of the wrong refrigerant can cause damage or malfunction to this chiller.

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

DO NOT ATTEMPT TO REMOVE fittings, covers, etc., while chiller is under pressure or while chiller is running. Be sure pressure is at 0 psig (0 kPa) before breaking any refrigerant connection.

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

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 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.

RUN WATER PUMPS when removing, transferring, or charging refrigerant.

⚠ CAUTION

DO NOT STEP on refrigerant lines. Broken lines can whip about and cause personal injury.

DO NOT climb over a chiller. 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 waterboxes containing industrial brines, liquid, gases, or semisolids without 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.

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

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INTRODUCTION

Before initial start-up of the 17EX unit, those involved in the start-up, operation, and maintenance should be thoroughly familiar with these instructions and other necessary job data. This book is outlined so that you may become familiar with the control system before performing start-up procedures. Procedures in this manual are arranged in the sequence required for proper chiller start-up and operation.

⚠ WARNING

This unit uses a microprocessor controlled system. Do not short or jumper between terminations on circuit boards or modules; control or board failure may result.

Be aware of electrostatic discharge (static electricity) when handling or making contact with circuit boards or module connections. Always touch a chassis (grounded) part to dissipate body electrostatic charge before working inside the control center.

Use extreme care when handling tools near boards and when connecting or disconnecting terminal plugs. Circuit boards can easily be damaged. Always hold boards by the edges and avoid touching components and connections.

This equipment uses, and can radiate, radio frequency energy. If not installed and used in accordance with the instruction manual, it may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

Always store and transport replacement or defective boards in anti-static shipping bag.

ABBREVIATIONS

Frequently used abbreviations in this manual include:

CCN — Carrier Comfort Network
CCW — Counterclockwise
CHW — Chilled Water
CHWR — Chilled Water Return
CHWS — Chilled Water Supply
CW — Clockwise
ECW — Entering Chilled Water
ECDW — Entering Condenser Water
EMS — Energy Management System
HGBP — Hot Gas Bypass
I/O — Input/Output
LCD — Liquid Crystal Display
LCDW — Leaving Condenser Water
LCW — Leaving Chilled Water
LED — Light-Emitting Diode
LID — Local Interface Device
OLTA — Overload Trip Amps
PIC — Product Integrated Control
PSIO — Processor Sensor Input/Output Module
RLA — Rated Load Amps
SCR — Silicon Control Rectifier
SMM — Starter Management Module
TXV — Thermostatic Expansion Valve

17EX CHILLER FAMILIARIZATION

Chiller Identification Label (Fig. 1) — The identification label is located on the right side of the chiller control center panel. The label contains information on model number, refrigerant charge, rated voltage, etc.

System Components (Fig. 2) — The components include the cooler and condenser heat exchangers in separate vessels, compressor, compressor and gear lubrication packages, control center, speed increaser economizer/storage vessel, motor, and starter. The compressor drive consists of an external gear (speed increaser) and an electric motor. All connections from pressure vessels have external threads to enable each component to be pressure tested with a threaded pipe cap during factory assembly.

Cooler — This vessel (also known as the evaporator) is located underneath the condenser, next to the economizer/storage vessel. The cooler is maintained at lower temperature and pressure so that evaporating refrigerant can remove heat from water flowing through its internal tubes.

Condenser — The condenser operates at a higher temperature and pressure than the cooler 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 cooler to the condenser.

Control Center — The control center is the user interface for controlling the chiller and regulates the chiller capacity as required to maintain proper leaving chilled water temperature. The control center:

- registers cooler, condenser, and lubricating system pressures
- shows chiller operating and alarm shutdown conditions
- records the total chiller operating hours and how many hours the chiller has been running
- sequences chiller start, stop, and recycle under microprocessor control
- provides access to other CCN (Carrier Comfort Network) devices

Motor Starter (Purchased Separately) — The starter allows the proper start and disconnect of electrical energy for the compressor-motor, oil pump, oil heater, and control panels.

Economizer/Storage Vessel — During normal operation, this vessel functions as an economizer, returning flash gas to the second stage of the compressor and increasing the efficiency of the refrigeration cycle. During periods of shutdown and service, the economizer/storage vessel can serve as a storage tank for the refrigerant.

REFRIGERATION CYCLE (Fig. 3)

The 17EX chiller can be used to chill either water or brine. The data in this book applies to either application. Applications using corrosive brines may require using special tubes, tubesheet, and waterbox materials which are special order items.

17EX 48 57 599 J FA 66 1 –

Model Description
17EX — Open Drive Centrifugal Liquid Chiller

Cooler Size*
45-48

Condenser Size
45-47
55-57

Compressor Size
531 through 599

Gear Code

G (60 Hz)	P (50 Hz)
J (60 Hz)	S (50 Hz)
L (50 and 60 Hz)	
N (50 and 60 Hz)	

Special Order Code
– — Standard
S — Special Order

Waterbox Code
1 — Marine Waterbox Cooler/ Marine Waterbox Condenser
2 — Marine Waterbox Cooler/ NIH Waterbox Condenser
3 — NIH Waterbox Cooler/ Marine Waterbox Condenser
4 — NIH Waterbox Cooler/ NIH Waterbox Condenser

Motor Voltage

64 — 2400-3-60	53 — 3000-3-50
65 — 3300-3-60	54 — 3300-3-50
66 — 4160-3-60	55 — 6300-3-50
67 — 6900-3-60	

Motor Size

FA	FF	HA	HF	JA	JF
FB	FG	HB	HG	JB	JG
FC	FH	HC	HH	JC	JH
FD	FJ	HD	HJ	JD	JJ
	FK		HK		JK

LEGEND
NIH — Nozzle-In-Head
*Any available cooler size can be combined with any available condenser size.
NOTE: For details on motor size designations, see below.

F A

Open Drive Motor Type
F — ODP (Open Drip Proof)
H — WPII (Weather Protected, Type II)
J — TEWAC (Totally Enclosed Water-to-Air Cooled)

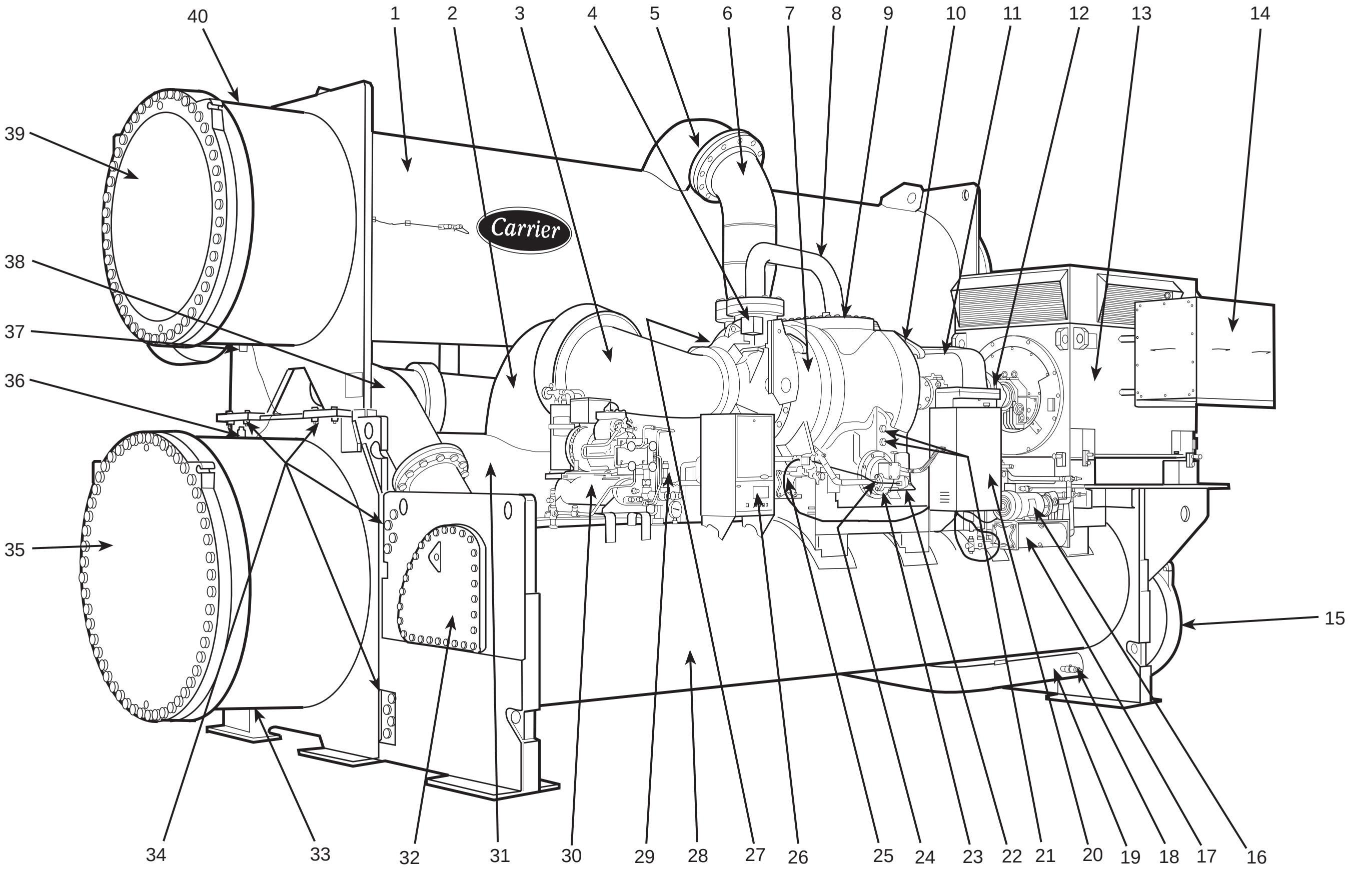
Motor Horsepower (kW)

	hp	(kW)	S.F. (Service Factor)
A —	1250	(932)	1.15
B —	1500	(1119)	1.15
C —	1750	(1305)	1.15
D —	2000	(1492)	1.15
F —	1250	(932)	1.05
G —	1500	(1119)	1.05
H —	1600	(1194)	1.05
J —	1750	(1305)	1.05
K —	2000	(1492)	1.05

ASME 'U' STAMP

ARI (Air Conditioning and Refrigeration Institute) PERFORMANCE CERTIFIED (60 Hz Only)

Fig. 1 — Model Number Identification



LEGEND

1 —	Condenser	**22** —	Oil Drain and Charging Valve
2 —	Cooler Suction Pipe	**23** —	Oil Heater (Hidden)
3 —	Compressor Suction Elbow	**24** —	Compressor Oil Pump
4 —	Guide Vane Actuator	**25** —	Compressor Oil Cooler/Filter
5 —	Condenser Discharge Pipe	**26** —	Local Interface Display Control Panel
6 —	Compressor Discharge Elbow	**27** —	Cooler Relief Valves (Behind Compressor, Hidden)
7 —	Two-Stage Compressor	**28** —	Economizer Storage Vessel
8 —	Economizer Gas Line to Compressor	**29** —	Economizer/Storage Vessel Relief Valves
9 —	Compressor Housing Access Cover	**30** —	Pumpout Unit
10 —	High-Speed Coupling (Hidden)	**31** —	Cooler
11 —	External Gear (Speed Increaser)	**32** —	High Side Float Box Cover
12 —	Low-Speed Coupling (Hidden)	**33** —	Cooler Waterbox Drain
13 —	Open-Drive Compressor Motor	**34** —	Take-Apart Connections
14 —	Compressor Motor Terminal Box	**35** —	Cooler Marine Waterbox
15 —	Low-Side Float Box Cover	**36** —	Cooler Waterbox Vent
16 —	Gear Oil Pump	**37** —	Condenser Waterbox Drain
17 —	Gear Oil Cooler/Filter	**38** —	Refrigerant Liquid Line to Economizer/ Storage Vessel
18 —	Refrigerant Charging/Service Valve	**39** —	Condenser Marine Waterbox
19 —	Refrigerant Liquid Line to Cooler	**40** —	Condenser Waterbox Vent
20 —	Power Panel		
21 —	Oil Level Sight Glasses (2)		

17EX WITH EXTERNAL GEAR (SPEED INCREASER)

Fig. 2 — Typical 17EX Chiller Components

The chiller compressor continuously draws large quantities of refrigerant vapor from the cooler at a rate determined by the amount of guide vane opening. This compressor suction reduces the pressure within the cooler, allowing the liquid refrigerant to boil vigorously at a fairly low temperature (typically 38 to 42 F [3 to 6 C]).

The liquid refrigerant obtains the energy needed to vaporize by removing heat from the water or brine in the cooler tubes. The cold water or brine can then be used in air conditioning and/or other processes.

After removing heat from the water or brine, the refrigerant vapor enters the first stage of the compressor, is compressed, and flows into the compressor second stage. Here it is mixed with flash-economizer gas and is further compressed.

Compression raises the refrigerant temperature above that of the water flowing through the condenser tubes. When the warm (typically 98 to 102 F [37 to 40 C]) refrigerant vapor comes into contact with the condenser tubes, the relatively cool condensing water (typically 85 to 95 F [29 to 35 C]) removes some of the heat, and the vapor condenses into a liquid.

The liquid refrigerant passes through an orifice into the FLASC chamber. The coolest condenser water flows through the FLASC and allows a lower saturated temperature and pressure. Part of the entering liquid refrigerant will flash to vapor once it has passed through the FLASC orifice, thereby cooling the remaining liquid. The vapor is then recondensed by the condenser water flowing through the FLASC chamber.

The subcooled liquid refrigerant drains into a high-side valve chamber that meters the refrigerant liquid into a flash economizer chamber. Pressure in this chamber is intermediate between condenser and cooler pressures. At this lower pressure, some of the liquid refrigerant flashes to gas, further cooling the remaining liquid. The flash gas, having absorbed heat, is returned directly to the compressor second stage. Here it is mixed with discharge gas that is already compressed by the first-stage impeller. Since the flash gas has to pass through only half the compression cycle to reach condenser pressure, there is a savings in power.

The cooled liquid refrigerant in the economizer is metered through the low-side valve chamber, reducing the refrigerant pressure. Pressure in the cooler is lower than in the economizer. Some of the liquid flashes as it passes through the low side float valve. The cycle is now complete.

OIL COOLING CYCLE

Compressor Oil Cooling — The compressor oil is water cooled. Water flow through the oil cooler is manually adjusted by a plug valve to maintain an operating temperature at the reservoir of approximately 145 F (63 C). An oil heater in the reservoir helps to prevent oil from being diluted by the refrigerant. The heater is controlled by the PIC (Product Integrated Control) and is energized when the oil temperature is outside the operating temperature range of 150 to 160 F (66 to 71 C).

External Gear Oil Cooling — The external gear oil is also water cooled. Water flow through the gear oil cooler is manually adjusted by a plug valve to maintain an operating temperature of approximately 130 F (54 C). If so equipped, an oil heater in the reservoir helps to maintain the oil temperature under cold ambient operating conditions. The heater is controlled by an internal thermostat.

LUBRICATION CYCLE

Compressor Lubrication Cycle (Refer to item numbers shown in Fig. 4) — The compressor oil pump and oil reservoir are contained in the compressor base. Oil is pumped through an oil cooler and filter to remove heat and any foreign particles. A portion of the oil is then directed to the shaft-end bearing and the shaft seal. The balance of the oil lubricates the thrust and journal bearings and the thrust end seal. The bearing and transmission oil returns directly to the reservoir to complete the cycle. Contact-seal oil leakage, however, is collected in an atmospheric float chamber to be pumped back to the main reservoir as the oil accumulates.

Oil may be charged into the compressor oil reservoir (Item 8) through a charging valve (Item 6) which also functions as an oil drain. If there is refrigerant in the chiller, however, a hand pump will be required for charging at this connection.

An oil-charging elbow (Item 3) on the seal-oil return chamber allows oil to be added without pumping. The seal-oil return pump (Item 4) automatically transfers the oil to the main reservoir. Sight glasses (11) on the reservoir wall permit observation of the oil level.

A motor-driven oil pump (Item 10) discharges oil to an oil cooler/filter (Item 16) at a rate and pressure controlled by an oil regulator (Item 10). The differential oil pressure (bearing supply versus oil reservoir) is registered on the control panel.

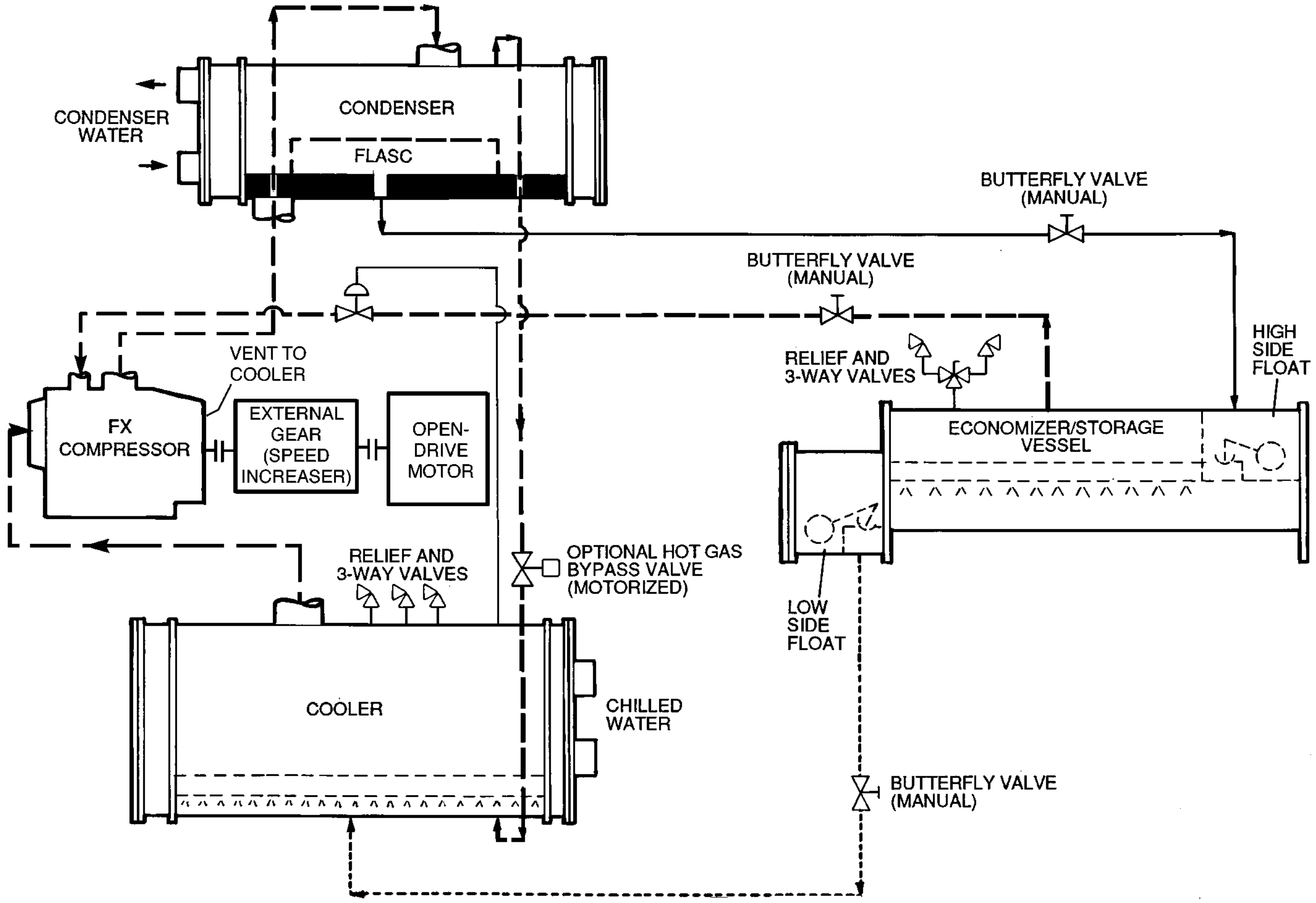
Water flow through the oil cooler is manually adjusted by a plug valve (Item 17) to maintain the oil at an operating temperature of approximately 145 F (63 C). During shutdown, the oil temperature is also maintained at 150 to 160 F (65 to 71 C) by an immersion heater (Item 7) in order to minimize absorption of refrigerant by the oil.

Upon leaving the cooler section of the oil cooler/filter, the oil is filtered (Item 15) and a portion is directed to the seal-end bearing (Item 1) and the shaft seal (Item 2). The remainder lubricates thrust (Item 14) and journal bearings (Item 12). Thrust bearing temperature is indicated on the PIC controls. Oil from both circuits returns by gravity to the reservoir.

The shaft seal of the open compressor drive must be kept full of lubrication oil, even when the chiller is not operating, to prevent loss of refrigerant.

If the chiller is not operating and the oil pump has not operated during the last 12 hours, the control system automatically runs the oil pump for one minute in order to keep the contact seal filled with oil.

> IMPORTANT: If the control power is to be deenergized for more than one day, the chiller refrigerant should be pumped over to the economizer/storage vessel.



LEGEND

TXV — Thermostatic Expansion Valve
——— Liquid
– – – – Liquid/Vapor
▬ ▬ ▬ Vapor

*The FX compressor and the gear have a water cooled oil cooler.

Fig. 3 — Refrigeration, Cycle

External Gear Lubrication Cycle (Refer to Item numbers shown in Fig. 5) — Oil reservoir is contained in the gear base. The external gear oil pump is mounted below the gear with the cooler/filter. Oil is pumped through an oil cooler/filter to remove heat and any foreign particles. A portion of the oil is directed to the gear bearings and gear mesh spray. The remainder is bypassed to the sump. The bearing and transmission oil returns directly to the reservoir to complete the cycle.

Oil may be charged into the external gear oil reservoir as described in the section, External Gear Pre-Start Checks, page 51. Observe the oil level in the oil level glass (Item 4) on the reservoir wall.

A motor driven oil pump (Item 10) discharges oil to the oil cooler/filter (Item 12). The pump has an internal pressure regulator to protect the pump in the event of an obstruction downstream. Water flow through the oil cooler is manually adjusted by a plug valve (Item 14) to maintain the oil at an operating temperature of approximately 130 F (54 C).

Upon leaving the cooler section (Item 13) of the oil cooler/filter, the oil is filtered (Item 11) and is directed to the pressure control valve (Item 7). Before entering the pressure control valve, the oil pressure (Item 16) and temperature (Item 8) are monitored by the PIC.

A portion of the oil then lubricates the gear bearings (Item 2). Another portion is directed through an orifice (Item 5) to the gear mesh spray (Item 3) to lubricate the gear mesh (Item 1) during operation. Oil from both circuits returns by gravity to the reservoir.

STARTERS

All starters, whether supplied by Carrier or the customer, must meet Carrier Starter Specification Z-375. This specification can be obtained from a Carrier Sales Representative. The purpose of this specification is to ensure the compatibility of the starter and the chiller. Many styles of compatible starters are available, including solid-state , auto-transformer, full-voltage, and, in the case of low-voltage main power supply, wye-delta closed transition.

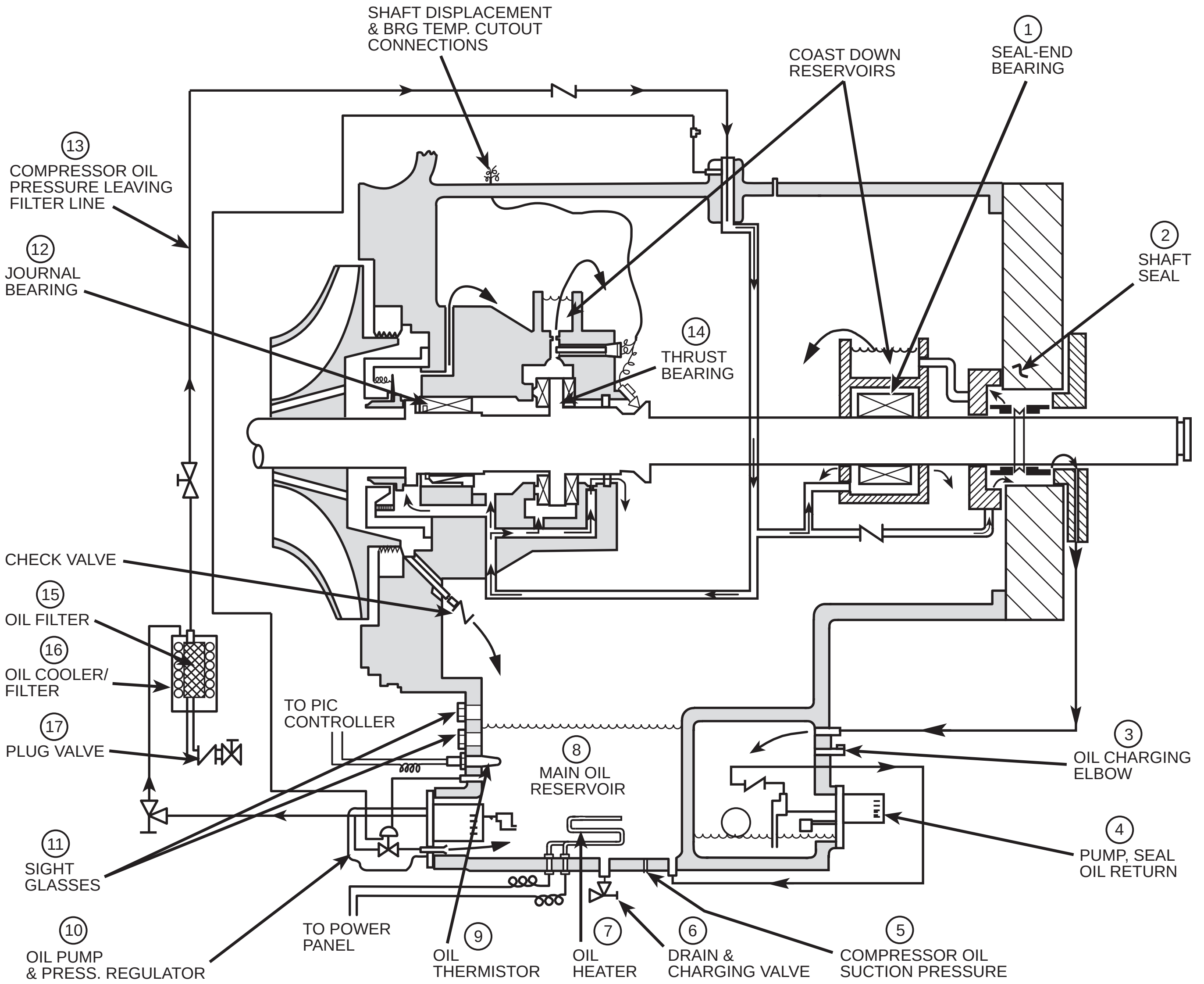
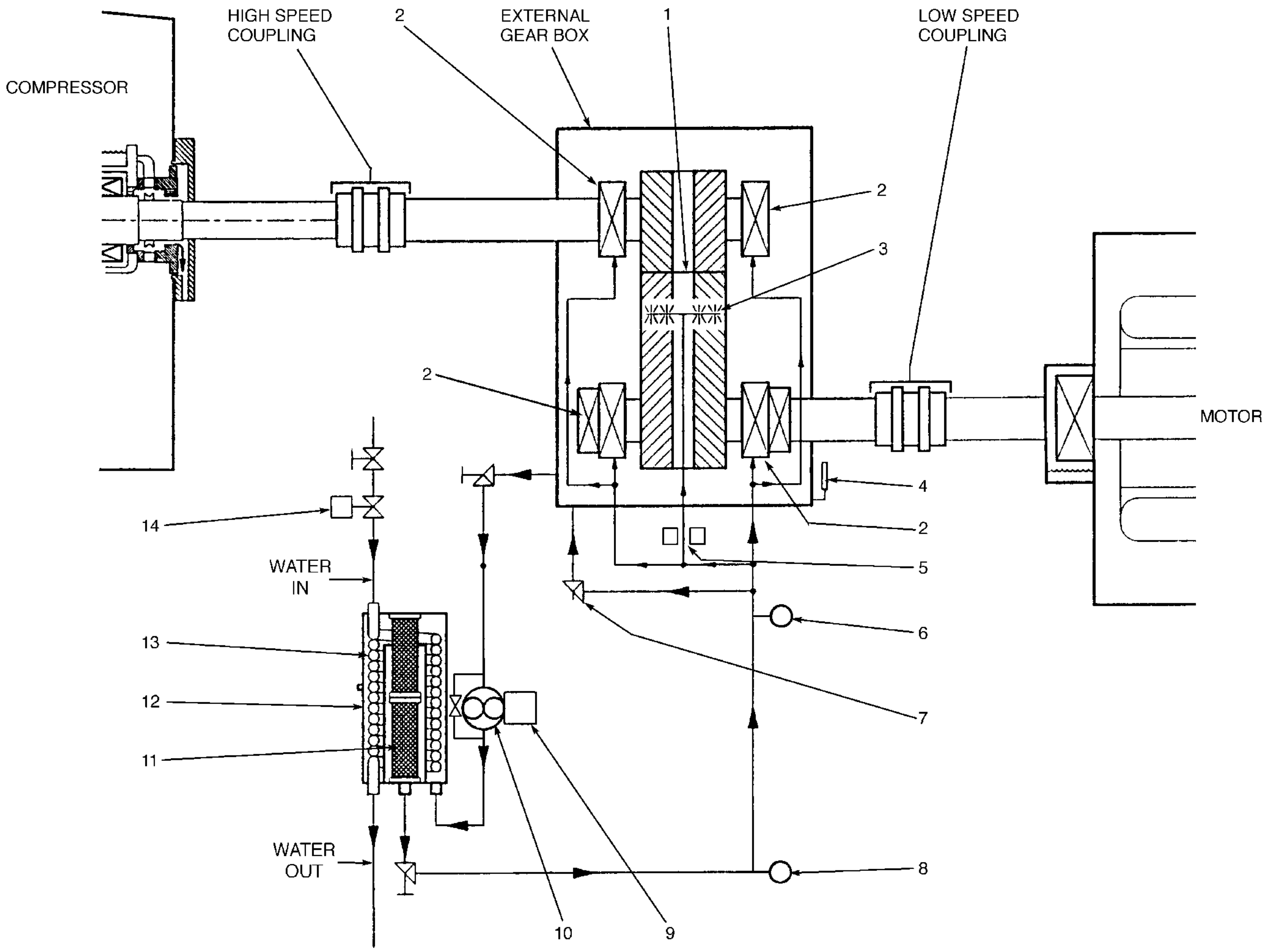


Fig. 4 — 17EX Compressor Lubrication Cycle



1 — Gear Mesh
2 — Bearings
3 — Gear Mesh Spray
4 — Oil Level Glass
5 — Orifice
6 — Oil Supply Pressure Transducer
7 — Pressure Control Valve
8 — Oil Supply Temperature Thermistor
9 — Oil Pump Motor
10 — Oil Pump and Pressure Regulator
11 — Oil Filter
12 — Oil Cooler/Filter
13 — Oil Cooler
14 — Plug Valve

NOTE: The oil reservoir is at the base of the gear box.

Fig. 5 — External Gear Oil Lubrication Cycle (Plan View)

CONTROLS

Definitions

ANALOG SIGNAL — *An analog signal* varies in proportion to the monitored source. It quantifies values between operating limits. (Example: A temperature sensor is an analog device because its resistance changes in proportion to the temperature, generating many values.)

DIGITAL SIGNAL — *A digital (discrete) signal* is a 2-position representation of the value of a monitored source. (Example: A switch is a digital device because it only indicates whether a value is above or below a set point or boundary by generating an on/off, high/low, or open/closed signal.)

VOLATILE MEMORY — *Volatile memory* is memory incapable of being sustained if power is lost and subsequently restored.

⚠ CAUTION

The memories of the PSIO and LID modules are volatile. If the battery in a module is removed or damaged, all programming will be lost.

General — The 17EX externally geared open-drive centrifugal liquid chiller contains a microprocessor-based control center that monitors and controls all operations of the chiller. The microprocessor control system matches the cooling capacity of the chiller to the cooling load while providing state-of-the-art chiller protection. The system controls cooling load within the set point plus the deadband by sensing the leaving chilled water or brine temperature and regulating the inlet guide vane via a mechanically linked actuator motor. The guide vane is a variable flow prewhirl assembly that controls the refrigeration effect in the cooler by regulating the amount of refrigerant vapor flow into the compressor. An increase in guide vane opening increases capacity. A decrease in guide vane opening decreases capacity. Chiller protection is provided by the processor which monitors the digital and analog inputs and executes capacity overrides or safety shutdowns, if required.

PIC System Components — The Product Integrated Control (PIC) is the control system on the chiller. See Table 1. The PIC controls the operation of the chiller by monitoring all operating conditions. The PIC can diagnose a problem and let the operator know what the problem is and what to check. It promptly positions the guide vanes to maintain leaving chilled water temperature. It can interface with auxiliary equipment such as pumps and cooling tower fans to turn them on only when required. It continually checks all safeties to prevent any unsafe operating condition. It also regulates the oil heater while the compressor is off and the hot gas bypass valve, if installed. See Fig. 6-10 for the locations of sensors, transducers, and other devices controlled and/or monitored by the PIC system.

The PIC can be interfaced with the Carrier Comfort Network (CCN) if desired. It can communicate with other PIC-equipped chillers and other CCN devices.

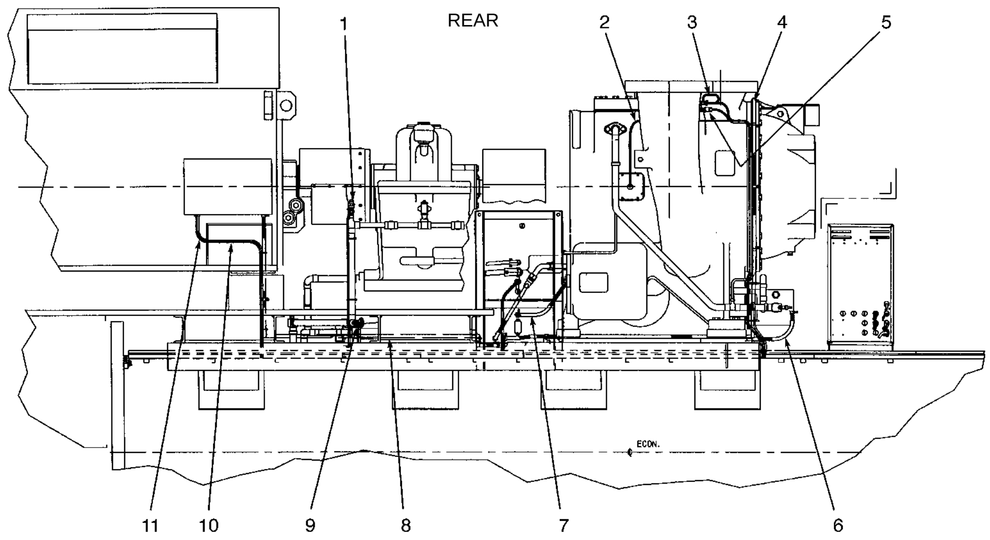
The PIC consists of 4 modules housed inside one of 3 locations: the control center, the power panel, or the starter cabinet. The component names and the control voltage of each location are listed below (also see Table 1):

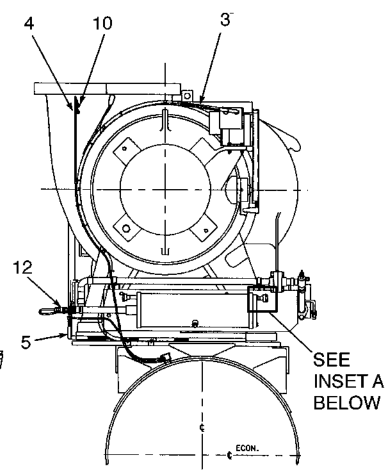
- control center
  — all extra low-voltage wiring (24 v or less)
- power panel
  — 115 v control voltage
  — up to 600 v for oil pump power
- starter cabinet
  — chiller power wiring (per job requirement)

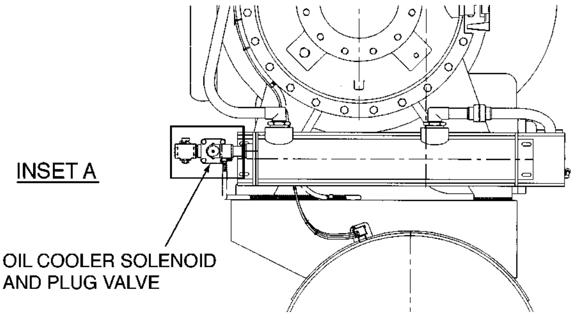
Table 1 — Major PIC Components and Panel Locations*

PIC COMPONENT	PANEL LOCATION
Processor Sensor Input/Output Module (PSIO)	Control Center
Starter Management Module (SMM)	Starter Cabinet
Local Interface Device (LID)	Control Center
6-Pack Relay Board	Control Center
8-Input Modules (Optional)	Control Center
4-In/2-Out Module	Power Panel
Oil Differential Pressure/Power Supply Module	Control Center
Oil Heater Contactor (1C)	Power Panel
Compressor Oil Pump Contactor (2C)	Power Panel
Gear Oil Pump Contactor (5C)	Power Panel
Hot Gas Bypass Relay (3C) (Optional)	Power Panel
Control Transformers (T1-T4)	Power Panel
Control and Oil Heater Voltage Selector (S1)	Power Panel
Temperature Sensors	See Fig. 7
Pressure Transducers	See Fig. 7

*See Fig. 6-10.





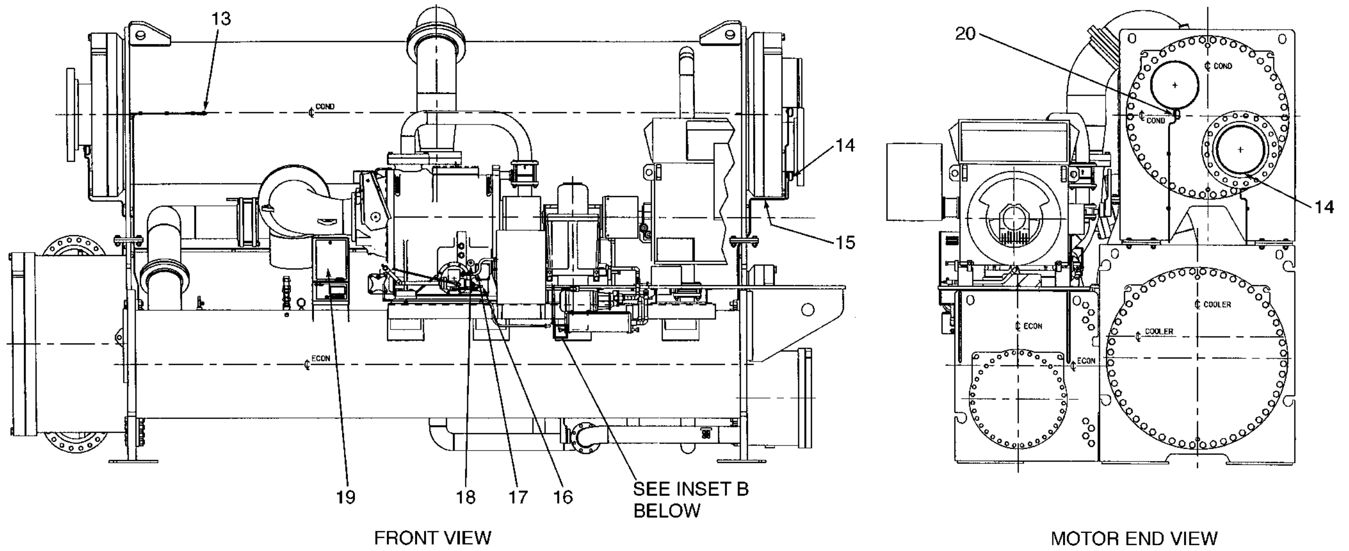


LEGEND

1 — Gear Oil Pressure Sensor
2 — Thrust Bearing Temperature and Impeller Displacement Cable
3 — Discharge Temperature Sensor
4 — Guide Vane Conduit and Cable
5 — High Pressure Cutout Switch
6 — Compressor Oil Cooler Solenoid Conduit
7 — Oil Heater Conduit
8 — Motor Space Heater Conduit
9 — Gear Oil Temperature Sensor
10 — Motor High Temperature Switch Cable
11 — Motor Water Cooling Leak Detector Cable (TEWAC Motor Only)
12 — Discharge Oil Pressure Sensor

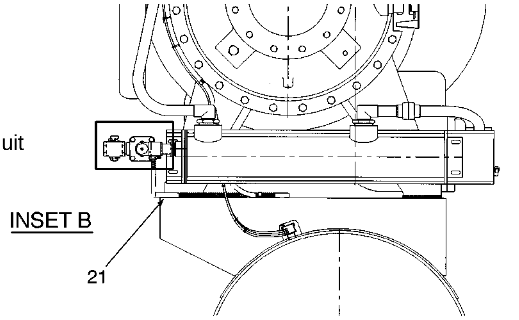
TEWAC — Totally Enclosed Water-to-Air Cooled

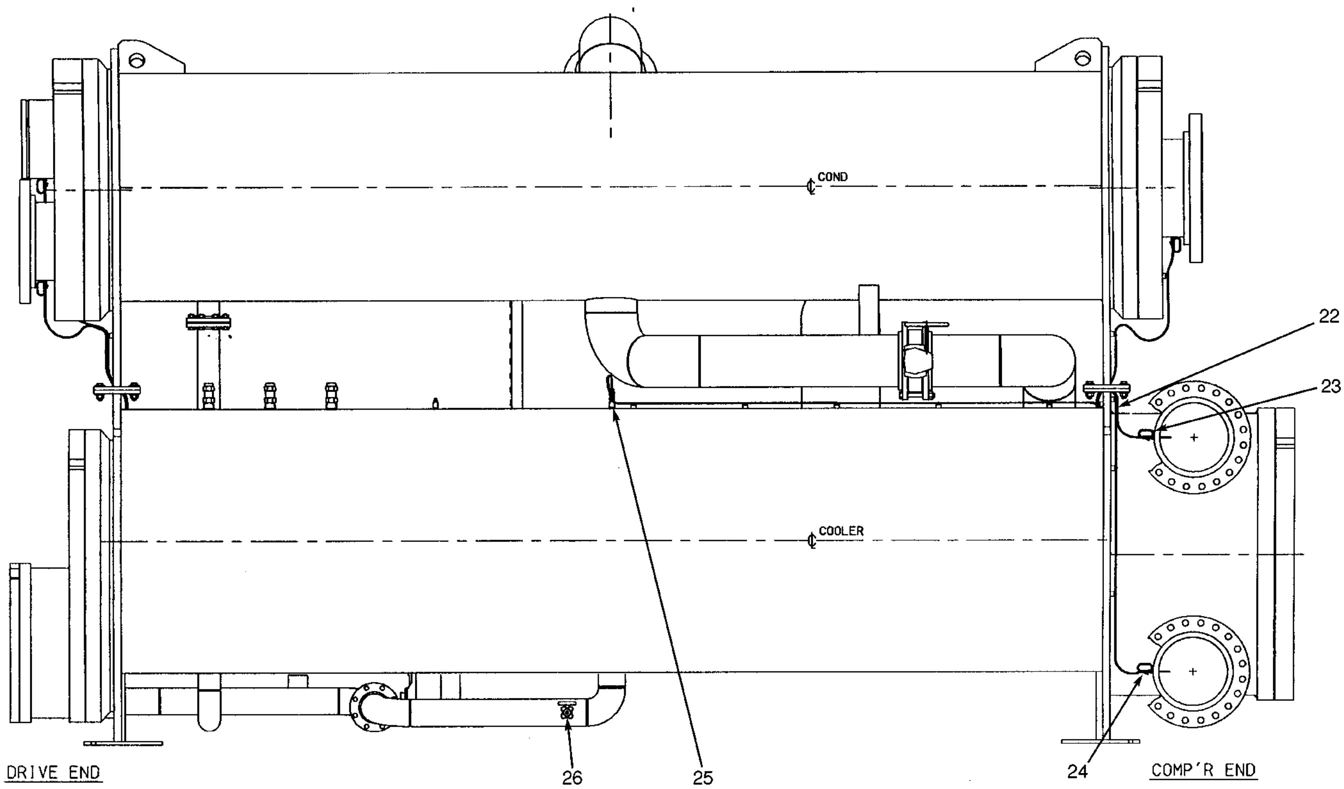
Fig. 6 — 17EX Controls and Sensor Locations



LEGEND

13 — Condenser Pressure Transducer
14 — Condenser Entering Water Temperature Sensor
15 — Condenser Entering and Leaving Water Temperature Cable
16 — Oil Suction Pressure Sensor
17 — Oil Pump Conduit
18 — Oil Pump Sensor
19 — PIC Control Panel
20 — Condenser Leaving Water Temperature Sensor
21 — Gear Oil Cooler Solenoid Conduit





LEGEND

22 — Cooler Temperature Cable
23 — Cooler Leaving Water Temperature Sensor
24 — Cooler Entering Water Temperature Sensor
25 — Cooler Pressure Sensor
26 — Refrigerant Charging Valve

Fig. 6 — 17EX Controls and Sensor Locations (cont)

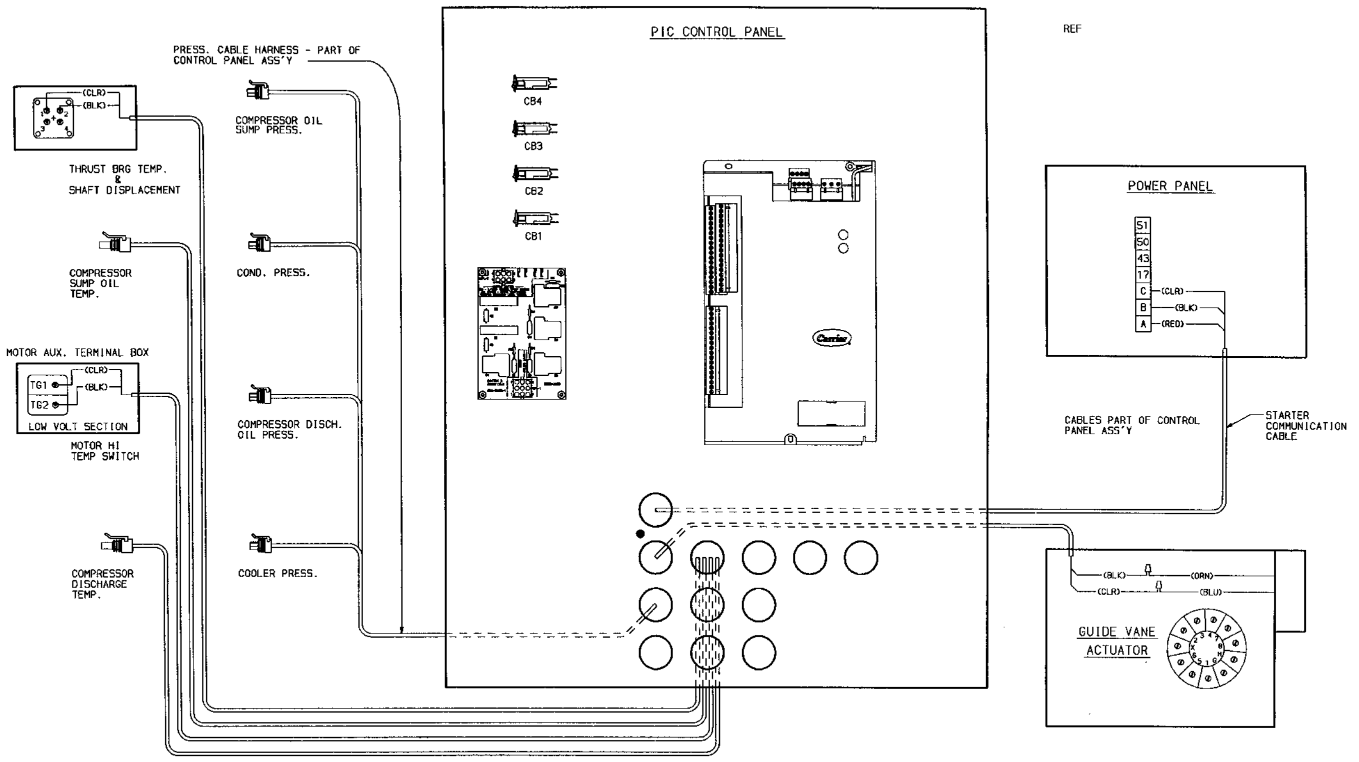


Fig. 6 — 17EX Controls and Sensor Locations (cont)

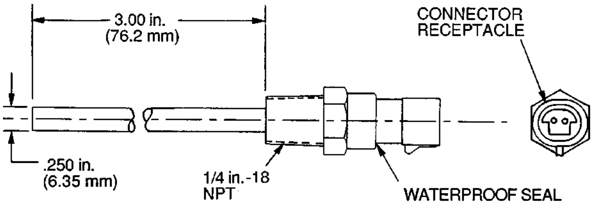


Fig. 7 — Control Sensors (Temperature)

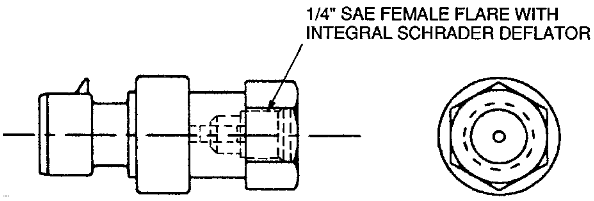
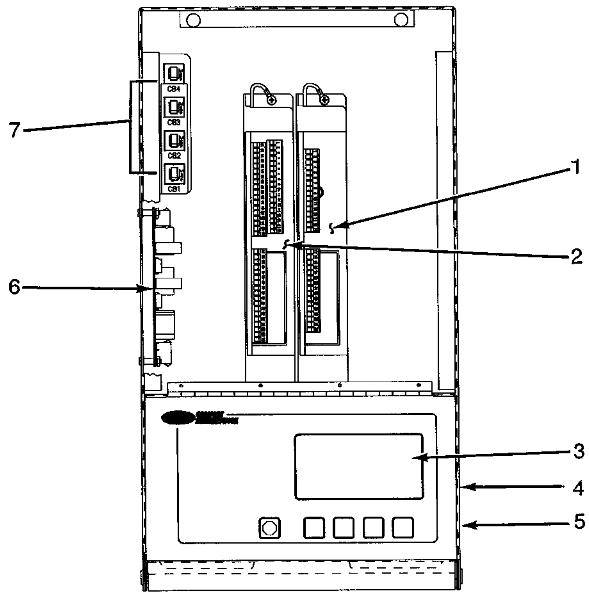


Fig. 8 — Control Sensors (Pressure Transducer, Typical)

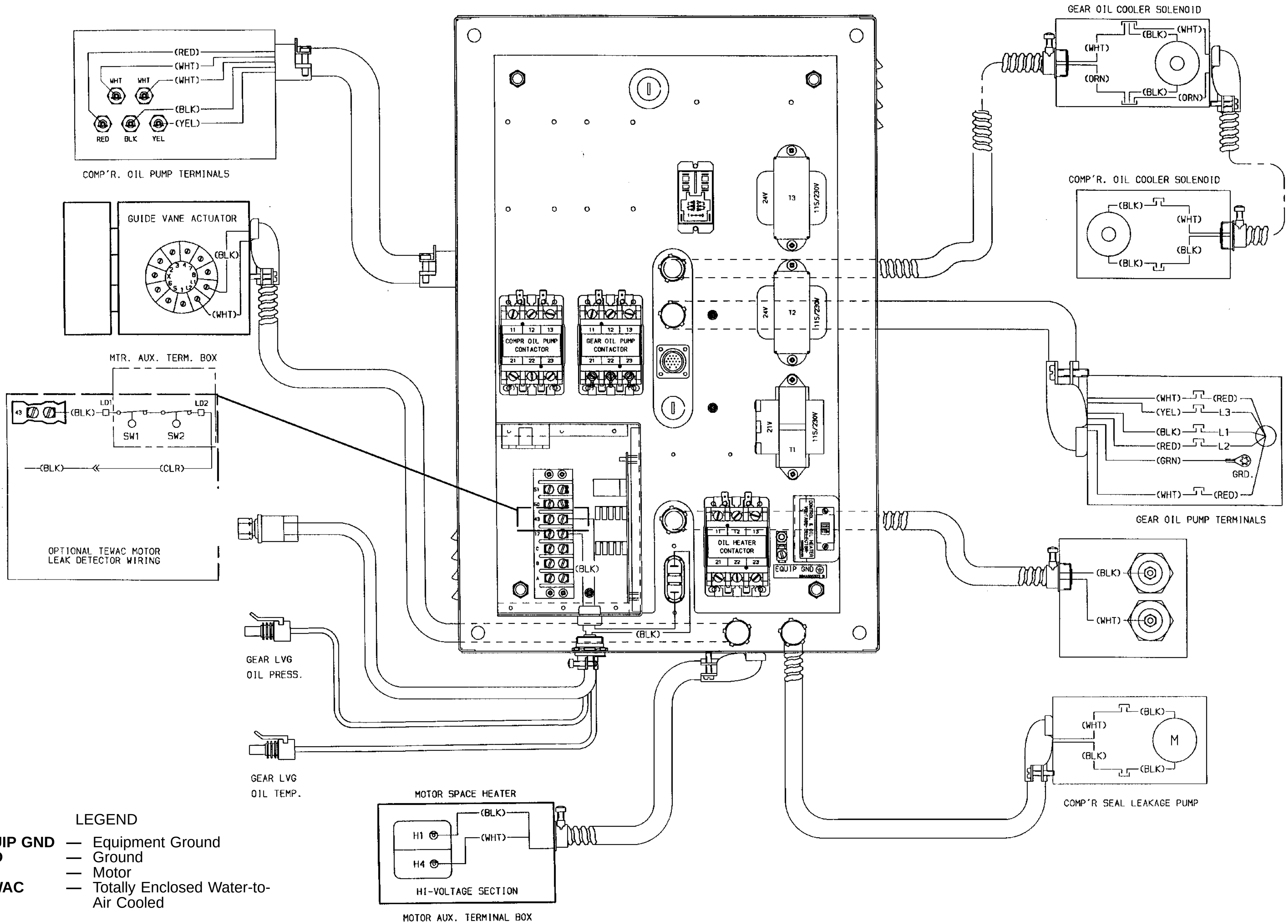


LEGEND

LID — Local Interface Device
PIC — Product Integrated Controls
PSIO — Processor Sensor Input/Output Module

1 — Optional 8-Input Module for Spare Inputs to Control Interface (One of Two Available)
2 — PSIO
3 — LID Input/Output Interface Panel Display
4 — Oil Differential Pressure/Power Supply Module (Hidden)
5 — LID Light (Hidden)
6 — 6-Pack Relay Board
7 — Circuit Breakers (4)

Fig. 9 — Control Center (Front View); Shown with Options Module



LEGEND

EQUIP GND	—	Equipment Ground
GRD	—	Ground
M	—	Motor
TEWAC	—	Totally Enclosed Water-to-Air Cooled

Fig. 10 — 17EX Chiller Power Panel and Controls Connections

PROCESSOR/SENSOR INPUT/OUTPUT MODULE (PSIO) — This module contains all the operating software needed to control the chiller. The 17EX uses 5 pressure transducers and 8 thermistors to sense pressures and temperatures. These inputs are connected to the PSIO module. The PSIO also provides outputs to the guide vane actuator, compressor and gear oil pumps, oil heater, hot gas bypass (optional), and alarm contact. The PSIO communicates with the LID, the SMM, and the optional 8-input modules for user interface and starter management.

STARTER MANAGEMENT MODULE (SMM) — This module is located within the starter cabinet. This module initiates PSIO commands for starter functions such as start/stop of the compressor; start/stop of the condenser and chilled water pumps; start/stop of the tower fan, spare alarm contacts, and the shunt trip. The SMM monitors starter inputs such as flow switches, line voltage, remote start contact, spare safety, condenser high pressure, oil pump interlock, motor current signal, starter 1M and run contacts, and the kW transducer input (optional). The SMM contains logic capable of safely shutting down the chiller if communication with the PSIO is lost.

LOCAL INTERFACE DEVICE (LID) — The LID is mounted to the control center and allows the operator to interface with the PSIO or other CCN devices. It is the input center for all local chiller set points, schedules, set-up functions, and options. The LID has a STOP button, an alarm light, 4 buttons for logic inputs, and a display. The function of the 4 buttons or ''softkeys'' are menu driven and are shown on the display directly above the key.

SIX-PACK RELAY BOARD (6-Pack Relay Board) — This device is a cluster of 6 pilot relays located in the control center. It is energized by the PSIO for the compressor oil pump, oil heater, alarm, optional hot gas bypass relay, auxiliary oil pump.

EIGHT-INPUT (8-Input) MODULES — One optional module is factory installed in the control center panel when ordered. There can be up to 2 of these modules per chiller with 8 spare inputs each. They are used whenever chilled water reset, demand reset, or reading a spare sensor is required. The sensors or 4 to 20 mA signals are field-installed.

The spare temperature sensors must have the same temperature/resistance curve as the other temperature sensors on this unit. These sensors are rated 5,000 ohm at 75 F (25 C).

FOUR-IN/TWO-OUT (4-IN/2-OUT) MODULE — This module monitors and controls the external gear lubrication system. It energizes the gear oil pump and is located in the power panel.

OIL HEATER CONTACTOR (1C) — This contactor is located in the power panel and operates the heater at 115 v. It is controlled by the PIC to maintain oil temperature during chiller shutdown.

COMPRESSOR OIL PUMP CONTACTOR (2C) AND GEAR OIL PUMP CONTACTOR (5C) — These contactors are located in the power panel. They operate all 200 to 575-v oil pumps. The PIC energizes the contactor to turn on the oil pumps as necessary.

HOT GAS BYPASS CONTACTOR RELAY (3C) (Optional) — This relay, located in the power panel, controls the opening of the hot gas bypass valve. The PIC energizes the relay during low load, high lift conditions.

OIL AUXILIARY RELAY (4C) — This relay opens the oil cooler solenoid valve and interlocks the oil pump with the compressor (special order).

CONTROL TRANSFORMERS (T1-T4) — These transformers are located in the power panel and convert incoming control voltage to either 21 vac power for the PSIO module and options modules, or 24 vac power for 3 power panel contactor relays and a control solenoid valve.

CONTROL AND OIL HEATER VOLTAGE SELECTOR (S1) — It is necessary to use 115 v incoming control power in the power panel. The switch must be set to the 115-v position.

OIL DIFFERENTIAL PRESSURE/POWER SUPPLY MODULE — This module, which is located in the control center, provides 5 vdc power for the transducers and LID backlight. This module outputs the difference between two pressure transducer input signals. The module subtracts oil supply pressure from transmission sump pressure and outputs the difference as an oil differential pressure signal to the PSIO. The PSIO converts this signal to differential oil pressure. To calibrate this reading, refer to the Troubleshooting, Checking Pressure Transducers section on page 84.

LID Operation and Menus (Fig. 11-17)

GENERAL

- The LID display automatically reverts to the default screen (Fig. 11) after 15 minutes if no softkey activity takes place and if the chiller is not in PUMPDOWN mode
- When not displaying the default screen, the upper right-hand corner of the LID displays the name of the screen that you have entered (Fig. 12).
- The LID may be configured in English or SI units, through the LID configuration screen.
- Local Operation — Pressing the $\boxed{\text{LOCAL}}$ softkey places the PIC in LOCAL operation mode, and the control accepts modification to programming from the LID only. The PIC uses the Local Time Schedule to determine chiller start and stop times.
- CCN Operation — Pressing the $\boxed{\text{CCN}}$ softkey places the PIC in the CCN operation mode, and the control accepts modifications from any CCN interface or module (with the proper authority), as well as the LID. The PIC uses the CCN time schedule to determine start and stop times.

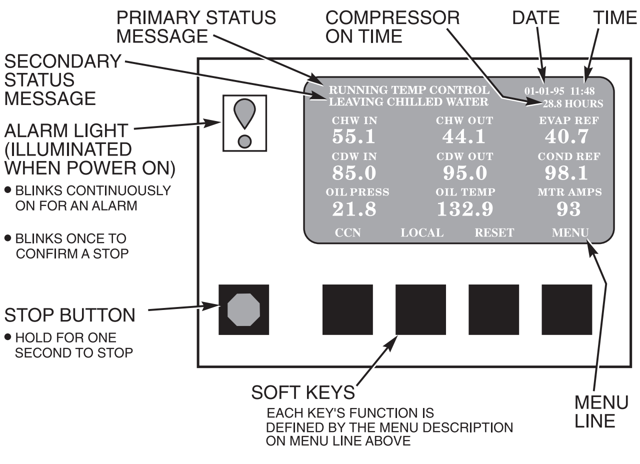


Fig. 11 — LID Default Screen

ALARMS AND ALERTS — An alarm (*) or alert (!) status is indicated on the default screen and the status tables. An alarm (*) shuts down the compressor. An alert (!) notifies the operator that an unusual condition has occurred. The chiller continues to operate when an alert is shown.

Alarms are indicated when the control center alarm light (!) flashes. The primary alarm message is viewed on the default screen and an additional, secondary, message and troubleshooting information are sent to the ALARM HISTORY table.

NOTE: When an alarm is detected, the LID default screen freezes (stops updating) at the time of alarm. The freeze enables the operator to view the chiller conditions at the time of the alarm. The status tables show the updated information. Once all alarms have been cleared (by pressing the RESET softkey), the default LID screen returns to normal operation.

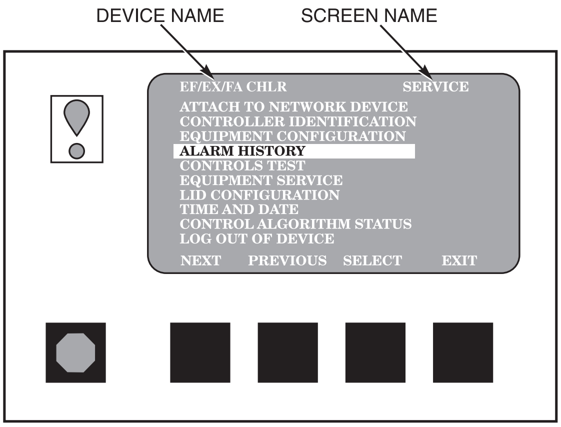


Fig. 12 — LID Service Screen

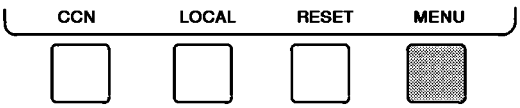
LID DEFAULT SCREEN MENU ITEMS — To perform any of the operations described below, the PIC must be powered up and have successfully completed its self test.

The default screen menu selection offers four options (STATUS, SCHEDULE, SETPOINT, and SERVICE). The STATUS menu allows viewing and limited calibration/modification of control points and sensors, relays and contacts, and the options board. The SCHEDULE menu allows viewing and modification of the Local Control, CCN Control, and Ice Build time schedules. Numerous set points including Base Demand Limit, LCW, ECW, and Ice Build can be adjusted under the SETPOINT menu. The SERVICE menu can be used to revise alarm history, control test, control algorithm status, equipment configuration, equipment service, time and date, attach to network, log out of device, controller identification, and LID configurations. Figures 15 and 16 provide additional information on the menu structure.

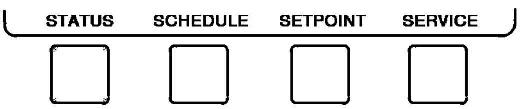
Press the MENU softkey to select from the 4 options. To view or change parameters within any menu structure, use the SELECT softkey to choose the desired table or item. The softkey modification choices displayed will depend on whether the selected item is a discrete point, analog point, or an override point. Press the softkey that corresponds to your configuration selection or press the QUIT softkey. If the QUIT softkey is depressed, the configuration will not be modified. Use the following softkeys to access and select the desired section.

MENU STRUCTURE — To perform any of the operations described below, the PIC must be powered up and have successfully completed its self test.

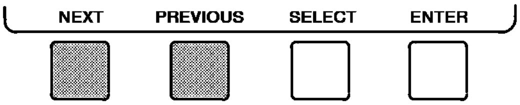
- Press MENU to select from the four available options.



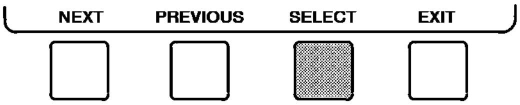
- Press the softkey that corresponds to the desired menu structure.



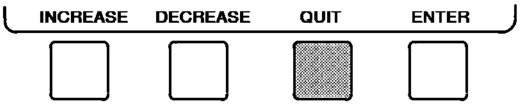
- Press NEXT or PREVIOUS to highlight the desired entry.



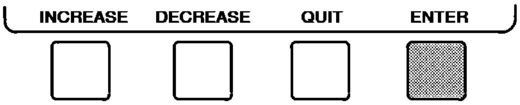
- Press SELECT to access the highlighted point.



- Press QUIT to leave the selected decision or field without saving any changes.

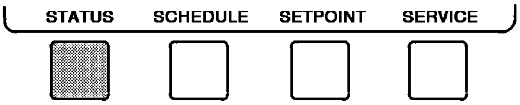


- Or, press ENTER to leave the selected decision or field and save changes.

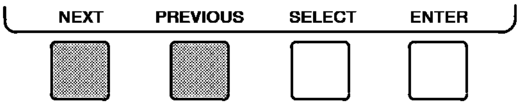


TO VIEW OR CHANGE POINT STATUS (Fig. 13) — Point Status is the actual value of all of the temperatures, pressures, relays, and actuators sensed and controlled by the PIC.

1. On the Menu screen, press STATUS to view the list of Point Status tables.



2. Press NEXT or PREVIOUS to highlight the desired status table. The list of tables is:
   - STATUS01 — Status of control points and sensors
   - STATUS02 — Status of relays and contacts
   - STATUS03 — Status of both optional 8-input modules and sensors
   - STATUS04 — Gear oil temperature and pressure



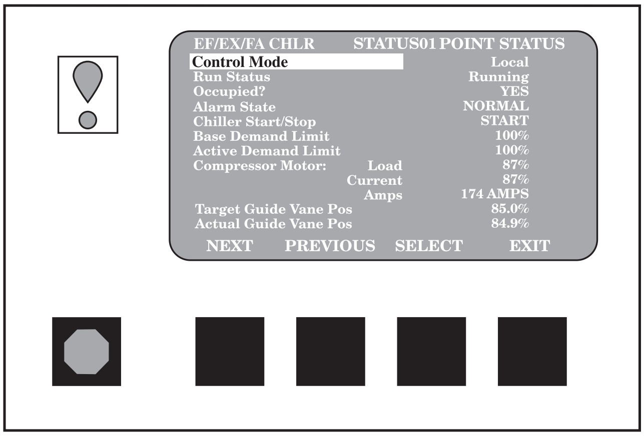
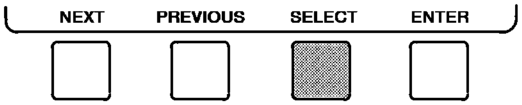
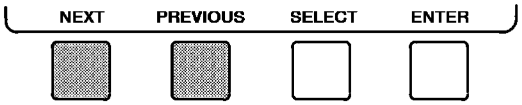


Fig. 13 — Example of Point Status Screen (Status01)

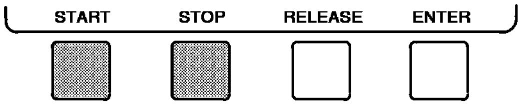
3. Press [SELECT] to view the desired Point Status table.



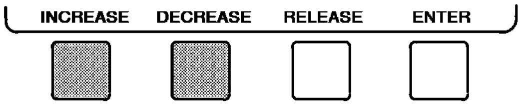
4. On the Point Status table press [NEXT] or [PREVIOUS] until desired point is displayed on the screen.



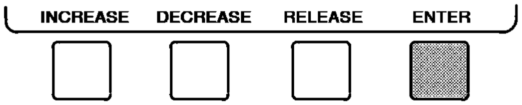
For Discrete Points — Press [START] or [STOP], [YES] or [NO], [ON] or [OFF], etc. to select the desired state.



For Analog Points — Press [INCREASE] or [DECREASE] to select the desired value.



5. Press [ENTER] to register new value.

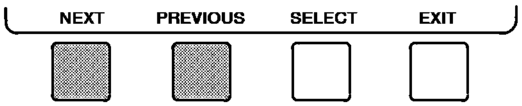


OVERRIDE OPERATIONS

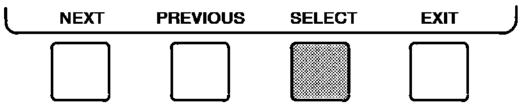
NOTE: When overriding or changing metric values, it is necessary to hold the softkey down for a few seconds in order to see a value change, especially on kilopascal values.

To Remove an Override

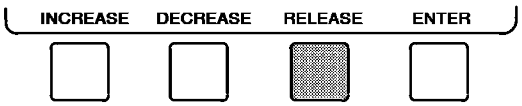
1. On the Point Status table press [NEXT] or [PREVIOUS] to highlight the desired point.



2. Press [SELECT] to access the highlighted point.



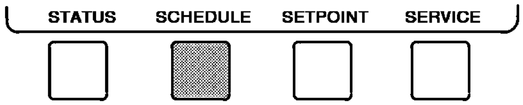
3. Press [RELEASE] to remove the override and return the point to the PIC's automatic control.



Override Indication — An override value is indicated by "SUPVSR," "SERVC," or "BEST" flashing next to the point value on the Status table.

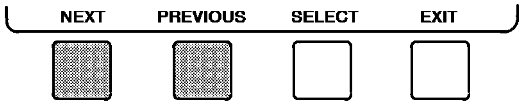
TO VIEW OR CHANGE TIME SCHEDULE OPERATION (Fig. 14)

1. On the Menu screen, press [SCHEDULE].

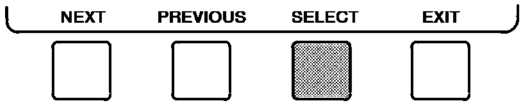


2. Press [NEXT] or [PREVIOUS] to highlight one of the following schedules.

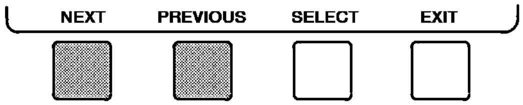
   OCCPC01S — LOCAL Time Schedule
   OCCPC02S — ICE BUILD Time Schedule
   OCCPC03-99S — CCN Time Schedule (Actual number is defined in CONFIG table.)



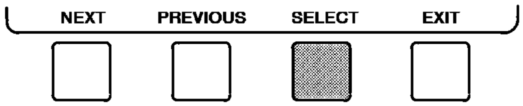
3. Press [SELECT] to access and view the time schedule.



4. Press [NEXT] or [PREVIOUS] to highlight the desired period or override that you wish to change.



5. Press [SELECT] to access the highlighted period or override.



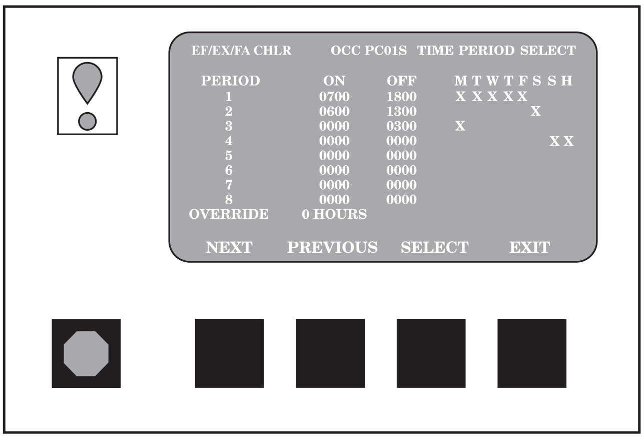


Fig. 14 — Example of Time Schedule Operation Screen

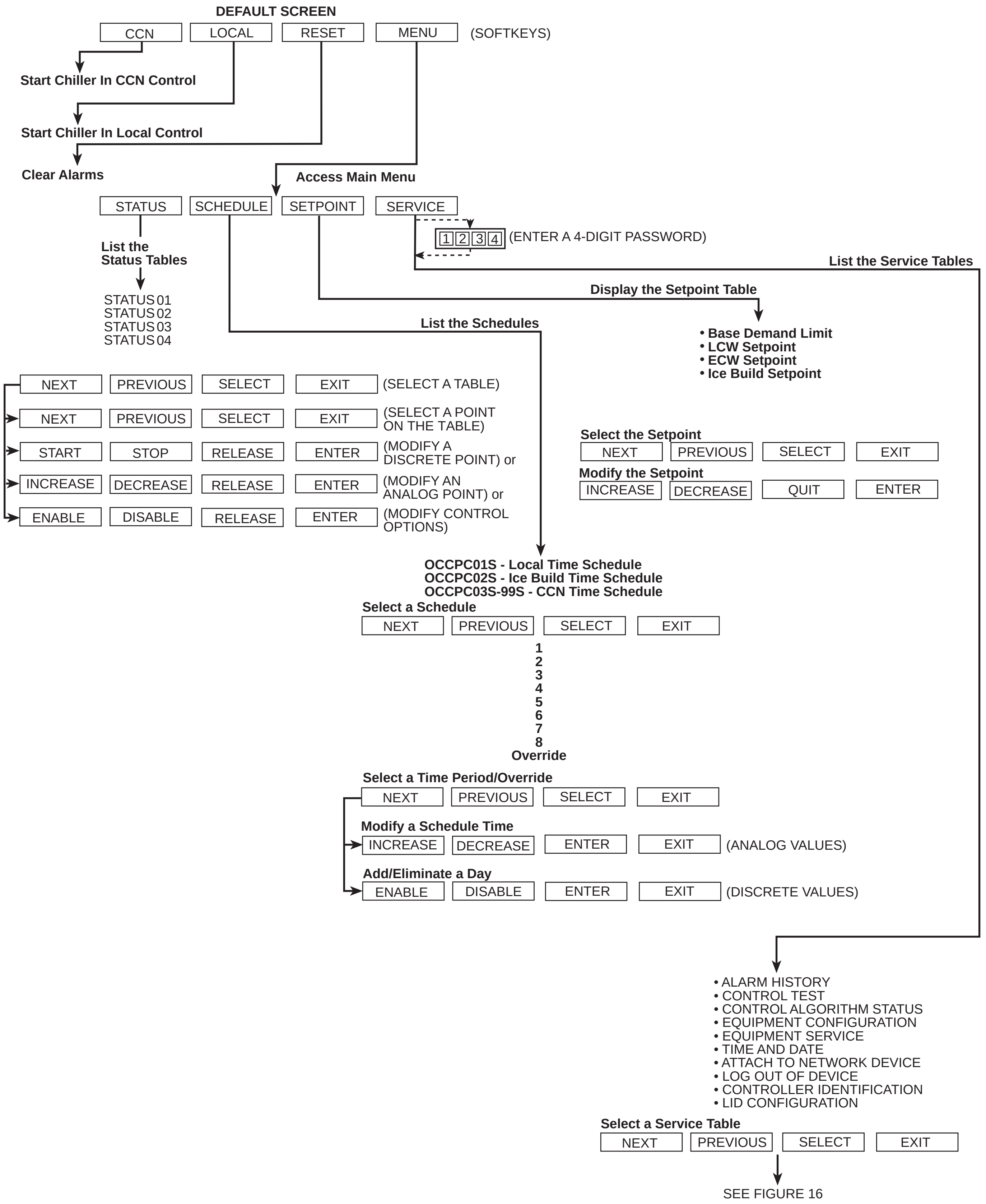


Fig. 15 — 17EX LID Menu Structure

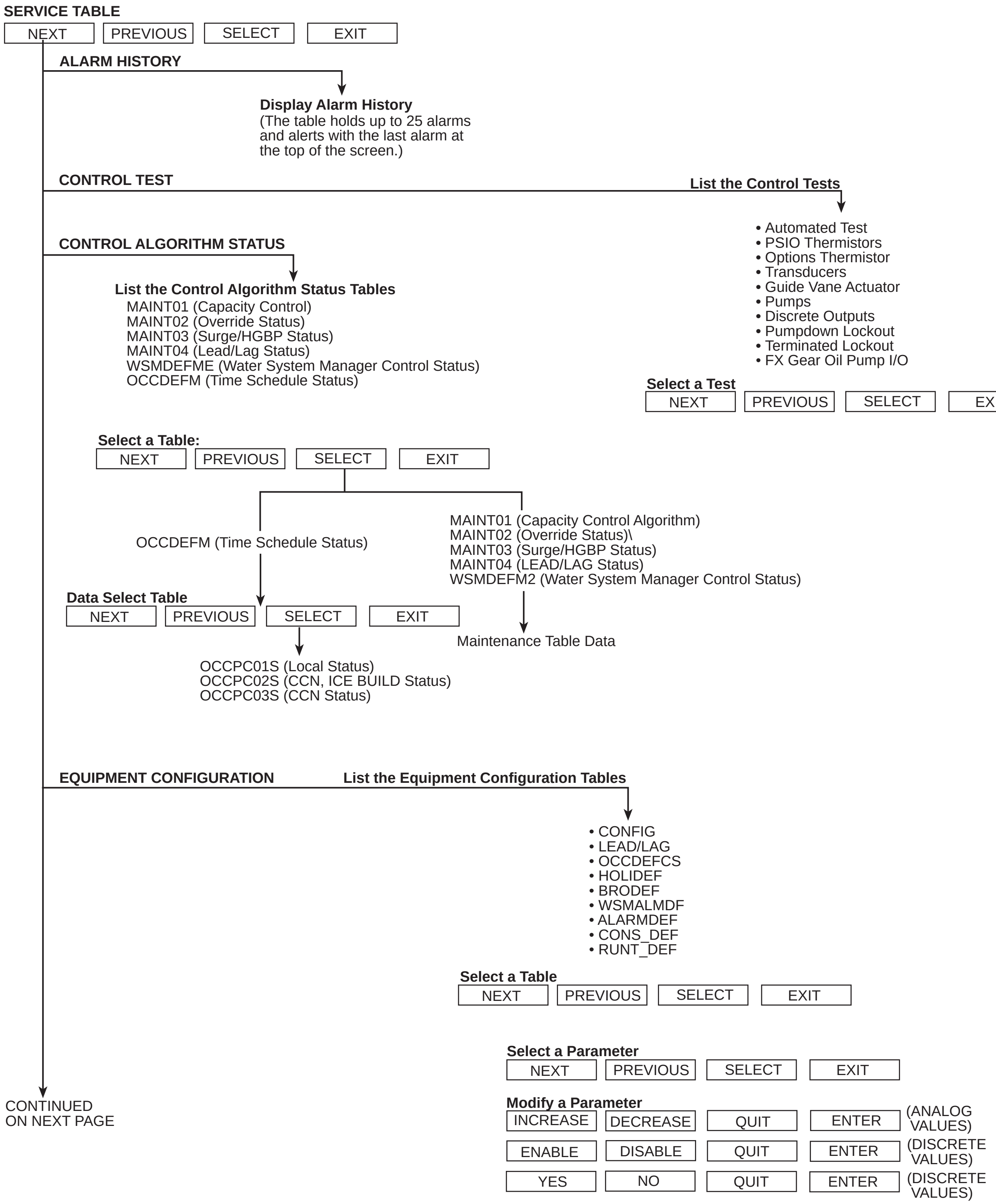
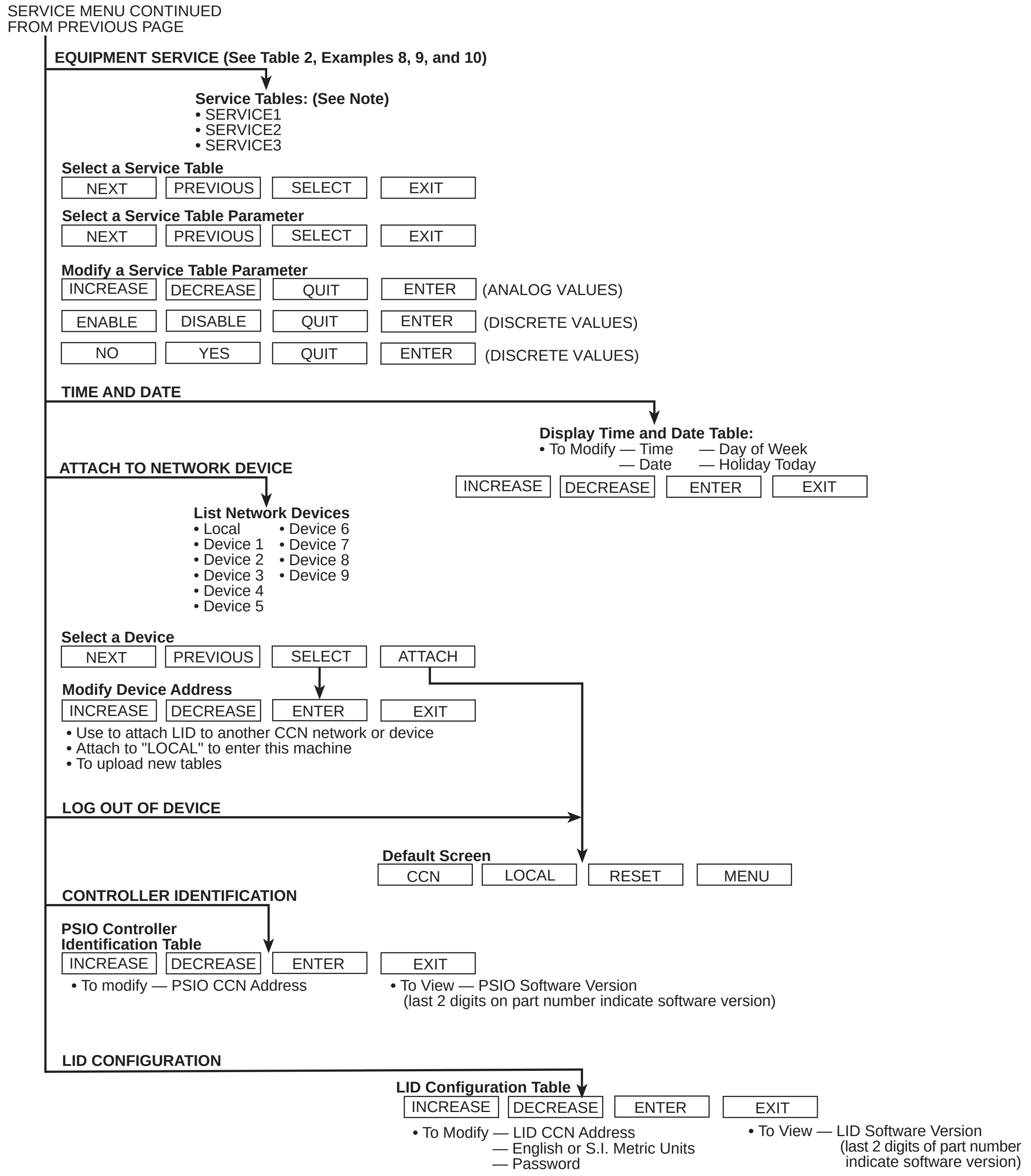


Fig. 16 — 17EX Service Menu Structure



LEGEND

CCN — Carrier Comfort Network
HGBP — Hot Gas Bypass
LID — Local Interface Device

NOTE: SERVICE TABLES:

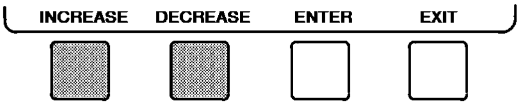
SERVICE1:
— Capacity Override
— Type of Chilled Medium
— Alert Temperature
— Flow Verification
— Deadband
— Recycle Restart Time
— Surge/HGBP Operation
— Motor Voltage, RLA, and Frequency
— Starter Type
— Condenser Freeze Safety
— Soft Stop Configuration
— Start to Stop Timer
— Gear Oil Pump Configuration

SERVICE2:
— 8-input Modules
— 20 mA Power Source

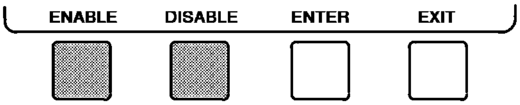
SERVICE3:
— Proportional Inc each Band
— Proportional Dec each Band
— Proportional ECW Gain
— Maximum Guide Vane Opening

Fig. 16 — 17EX Service Menu Structure (cont)

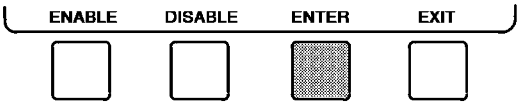
6. a. Press INCREASE or DECREASE to change the time values. Override values are in one-hour increments, up to 4 hours.



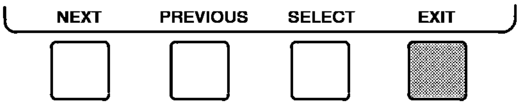
b. Press ENABLE to select days in the day-of-week fields. Press DISABLE to eliminate days from the period.



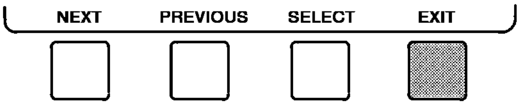
7. Press ENTER to register the values and to move horizontally (left to right) within a period.



8. Press EXIT to leave the period or override.



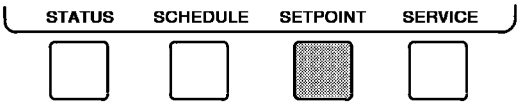
9. Either return to Step 4 to select another period or override, or press EXIT again to leave the current time schedule screen and save the changes.



10. Holiday Designation (HOLIDEF table) may be found in the Service Operation section, page 42. You must assign the month, day, and duration for the holiday. The Broadcast function in the BRODEF table also must be enabled for holiday periods to function.

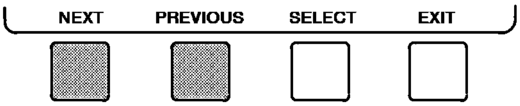
TO VIEW AND CHANGE SET POINTS (Fig. 17)

1. To view the Set Point table, at the Menu screen press SETPOINT .

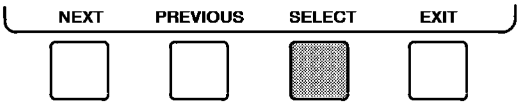


2. There are 4 set points on this screen: Base Demand Limit; LCW Set Point (leaving chilled water set point); ECW Set Point (entering chilled water set point); and ICE BUILD set point. Only one of the chilled water set points can be active at one time, and the type of set point is activated in the Service menu. ICE BUILD is also activated and configured in the Service menu.

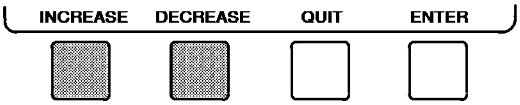
3. Press NEXT or PREVIOUS to highlight the desired set point entry.



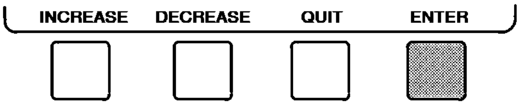
4. Press SELECT to modify the highlighted set point.



5. Press INCREASE or DECREASE to change the selected set point value.



6. Press ENTER to save the changes and return to the previous screen.



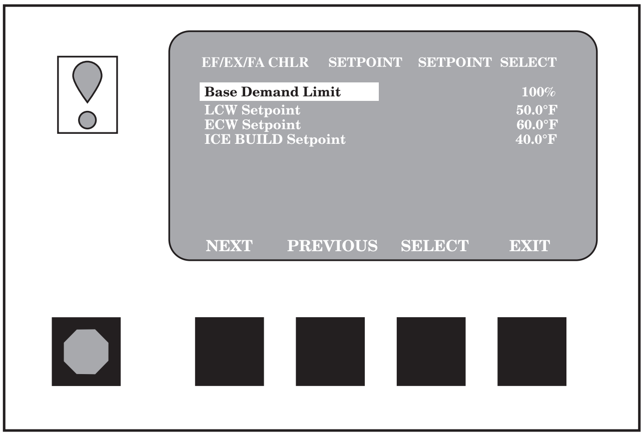


Fig. 17 — Example of Set Point Screen

SERVICE OPERATION — To view the menu-driven programs available for Service Operation, see the Service Operation section, page 42. For examples of LID display screens, see Table 2.

LEGEND FOR TABLE 2 — LID DISPLAY DATA

CCN	—	Carrier Comfort Network
CHWR	—	Chilled Water Return
CHWS	—	Chilled Water Supply
Compr	—	Compressor
Dec	—	Decrease
Ecw	—	Entering Chilled Water
HGBP	—	Hot Gas Bypass
Inc	—	Increase
LCW	—	Leaving Chilled Water
mA	—	Milliamps
P	—	Pressure
PIC	—	Product Integrated Controls
Refrig	—	Refrigerant
T	—	Temperature
Temp	—	Temperature

Table 2 — LID Display Data

NOTES:

IMPORTANT: The following notes apply to all Table 2 examples.

1. Only 12 lines of information appear on the LID screen at any one time. Press the NEXT or PREVIOUS softkey to highlight a point or to view items below or above the current screen. If you have a chiller with a backlit LID, press the NEXT softkey twice to page forward; press the PREVIOUS softkey twice to page back.
2. To access the information shown in Examples 6 through 14, enter your 4-digit password after pressing the SERVICE softkey. If no softkeys are pressed for 15 minutes, the LID automatically logs off (to prevent unrestricted access to PIC controls) and reverts to the default screen. If this happens, you must reenter your password to access the tables shown in Examples 6 through 14.
3. Terms in the Description column of these tables are listed as they appear on the LID screen.
4. The LID may be configured in English or Metric (SI) units using the LID CONFIGURATION screen. See the Service Operation section, page 42, for instructions on making this change.
5. The items in the Reference Point Name column *do not appear on the LID screen*. They are data or variable names used in CCN or Building Supervisor software. They are listed in these tables as a convenience to the operator if it is necessary to cross reference CCN/BS documentation or use CCN/BS programs. For more information, see the 17EX CCN literature.
6. Reference Point Names shown in these tables in all capital letters can be read by CCN and Building Supervisor software. Of these capitalized names, those preceded by an asterisk can also be changed (that is, written to) by the CCN, Building Supervisor software and the LID. Capitalized Reference Point Names preceded by two asterisks can be changed only from the LID. Reference Point Names in lower case type can be viewed by CCN or Building Supervisor software only by viewing the whole table.
7. Alarms and Alerts: An asterisk *in the far right field of a LID status screen* indicates that the chiller is in an alarm state; an exclamation point in the far right field of the LID screen indicates an alert state. The asterisk (or exclamation point) indicates that the value on that line has exceeded (or is approaching) a limit. For more information on alarms and alerts, see the Alarms and Alerts section, page 16.

EXAMPLE 1 — STATUS01 DISPLAY SCREEN

To access this display from the **LID default** screen:

1. Press **MENU** .
2. Press **STATUS** (**STATUS01** will be highlighted).
3. Press **SELECT** .

DESCRIPTION	RANGE	UNITS	REFERENCE POINT NAME (ALARM HISTORY)
Control Mode	Reset.Off. Local. CCN		MODE
Run Status	Timeout. Recycle. Startup. Ramping. Running. Demand. Override. Shutdown. Abnormal. Pumpdown		STATUS
Occupied ?	No/Yes		OCC
Alarm State	Normal/Alarm		ALM
***Chiller Start/Stop**	Stop/Start		CHIL_S_S
Base Demand Limit	40-100	%	DLM
***Active Demand Limit**	40-100	%	DEM_LIM
Compressor Motor Load	0-999	%	CA_L
Current	0-999	%	CA_P
Amps	0-9999	AMPS	CA_A
***Target Guide Vane Pos**	0-100	%	GV_TRG
Actual Guide Vane Pos	0-100	%	GV_ACT
Water/Brine: Setpoint	10-120 (–12.2-48.9)	DEG F (DEG C)	SP
*** Control Point**	10-120 (–12.2-48.9)	DEG F (DEG C)	LCW_STPT
Entering Chilled Water	–40-245 (–40-118)	DEG F (DEG C)	ECW
Leaving Chilled Water	–40-245 (–40-118)	DEG F (DEG C)	LCW
Entering Condenser Water	–40-245 (–40-118)	DEG F (DEG C)	ECDW
Leaving Condenser Water	–40-245 (–40-118)	DEG F (DEG C)	LCDW
Evaporator Refrig Temp	–40-245 (–40-118)	DEG F (DEG C)	ERT
Evaporator Pressure	–6.7-420 (–46-2896)	PSI (kPa)	ERP
Condenser Refrig Temp	–40-245 (–40-118)	DEG F (DEG C)	CRT
Condenser Pressure	–6.7-420 (–46-2896)	PSI (kPa)	CRP
Discharge Temperature	–40-245 (–40-118)	DEG F (DEG C)	CMPD
Bearing Temperature	–40-245 (–40-118)	DEG F (DEG C)	MTRB
Motor Winding Temp†	–40-245 (–40-118)	DEG F (DEG C)	MTRW
Motor Winding Hi Temp Cutout	Normal/Alarm		MTRW
Oil Sump Temperature	–40-245 (–40-118)	DEG F (DEG C)	OILT
Oil Pressure Transducer†	–6.7-420 (–46-2896)	PSI (kPa)	OILP
Oil Pressure**	–6.7-420 (–46-2896)	PSID (kPad)	OILPD
Line Voltage: Percent	0-999	%	V_P
Actual	0-9999	VOLTS	V_A
***Remote Contacts Input**	Off/On		REMCON
Total Compressor Starts	0-65535		c_starts
Starts in 12 Hours	0-8		STARTS
Compressor Ontime	0-500000.0	HOURS	c_hrs
***Service Ontime**	0-32767	HOURS	S_HRS
***Compressor Motor kW**	0-9999	kW	CKW

†Information is applicable to hermetic chillers (19EX) only.
**Oil pressure is read directly from a differential pressure module on 17EX chillers.

NOTE: values preceded by an asterisk (*) can be forced (changed by an operator) from the LID screen or from another control device (such as a Carrier Comfort Network [CCN] terminal).

Table 2 — LID Display Data (cont)

EXAMPLE 2 — STATUS02 DISPLAY SCREEN

To access this display from the **LID default** screen:

1. Press MENU .
2. Press STATUS .
3. Scroll down to highlight **STATUS02**.
4. Press SELECT .

DESCRIPTION	POINT TYPE		UNITS	REFERENCE POINT NAME (ALARM HISTORY)
	INPUT	OUTPUT		
Hot Gas Bypass Relay		X	OFF/ON	HGBR
***Chilled Water Pump**		X	OFF/ON	CHWP
Chilled Water Flow	X		NO/YES	EVFL
***Condenser Water Pump**		X	OFF/ON	CDP
Condenser Water Flow	X		NO/YES	CDFL
Compressor Start Relay		X	OFF/ON	CMPR
Compressor Start Contact	X		OPEN/CLOSED	1CR_AUX
Compressor Run Contact	X		OPEN/CLOSED	RUN_AUX
Starter Fault Contact	X		OPEN/CLOSED	STR_FLT
Pressure Trip Contact	X		OPEN/CLOSED	PRS_TRIP
Single Cycle Dropout	X		NORMAL/ALARM	V1_CYCLE
Oil Pump Relay		X	OFF/ON	OILR
Oil Heater Relay		X	OFF/ON	OILH
Motor Cooling Relay†		X	OFF/ON	MTRC
Auxiliary Oil Pump Relay		X	OFF/ON	AUXOILR
***Tower Fan Relay**		X	OFF/ON	TFR
Compr. Shunt Trip Relay		X	OFF/ON	TRIPR
Alarm Relay		X	NORMAL/ALARM	ALM
Spare Prot Limit Input	X		ALARM/NORMAL	SPR_PL

†Information is applicable to hermetic machines only.

NOTE: values preceded by an asterisk (*) can be forced (changed by an operator) from the LID screen or from another control device (such as a Carrier Comfort Network [CCN] terminal).

EXAMPLE 3 — STATUS03 DISPLAY SCREEN

To access this display from the **LID default** screen:

1. Press MENU .
2. Press STATUS.
3. Scroll down to highlight **STATUS03**.
4. Press SELECT .

DESCRIPTION	RANGE	UNITS	REFERENCE POINT NAME (ALARM HISTORY)
OPTIONS BOARD 1			
***Demand Limit 4-20 mA**	4-20	mA	DEM_OPT
***Temp Reset 4-20 mA**	4-20	mA	RES_OPT
***Common CHWS Sensor**	–40-245 (–40-118)	DEG F (DEG C)	CHWS
***Common CHWR Sensor**	–40-245 (–40-118)	DEG F (DEG C)	CHWR
***Remote Reset Sensor**	–40-245 (–40-118)	DEG F (DEG C)	R_RESET
***Temp Sensor — Spare 1**	–40-245 (–40-118)	DEG F (DEG C)	SPARE1
***Temp Sensor — Spare 2**	–40-245 (–40-118)	DEG F (DEG C)	SPARE2
***Temp Sensor — Spare 3**	–40-245 (–40-118)	DEG F (DEG C)	SPARE3
OPTIONS BOARD 2			
***4-20 mA — Spare 1**	4-20	mA	SPARE1_M
***4-20 mA — Spare 2**	4-20	mA	SPARE2_M
***Temp Sensor — Spare 4**	–40-245 (–40-118)	DEG F (DEG C)	SPARE4
***Temp Sensor — Spare 5**	–40-245 (–40-118)	DEG F (DEG C)	SPARE5
***Temp Sensor — Spare 6**	–40-245 (–40-118)	DEG F (DEG C)	SPARE6
***Temp Sensor — Spare 7**	–40-245 (–40-118)	DEG F (DEG C)	SPARE7
***Temp Sensor — Spare 8**	–40-245 (–40-118)	DEG F (DEG C)	SPARE8
***Temp Sensor — Spare 9**	–40-245 (–40-118)	DEG F (DEG C)	SPARE9

NOTE: values preceded by an asterisk (*) can be forced (changed by an operator) from the LID screen or from another control device (such as a Carrier Comfort Network [CCN] terminal).

Table 2 — LID Display Data (cont)

EXAMPLE 4 — STATUS04 DISPLAY SCREEN

To access this display from the **LID default** screen:

1. Press **MENU** .
2. Press **STATUS** .
3. Scroll down to highlight **STATUS04**.
4. Press **SELECT** .

DESCRIPTION	RANGE	UNITS	REFERENCE POINT NAME (ALARM HISTORY)
Main Gear Oil Pump		OFF/ON	MAINPMP1
Auxiliary Gear Oil Pump		OFF/ON	AUXPMP2
Gear Oil Pressure	−6.7 to 420 (−46 to 2896)	psi (kPa)	GEAROILP
Gear Oil Temperature	−40 to 245 (−40 to 118)	DEG F (DEG C)	GEAROILT

EXAMPLE 5 — SETPOINT DISPLAY SCREEN

To access this display from the **LID default** screen:

1. Press **MENU** .
2. Press **SETPOINT** .

DESCRIPTION	CONFIGURABLE RANGE	UNITS	REFERENCE POINT NAME	DEFAULT VALUE
Base Demand Limit	40-100	%	DLM	100
LCW Setpoint	20-120 (–6.7-48.9)	DEG F (DEG C)	lcw_sp	50.0 (10.0)
ECW Setpoint	20-120 (–6.7-48.9)	DEG F (DEG C)	ecw_sp	60.0 (15.6)
ICE BUILD Setpoint	20- 60 (–6.7-15.6)	DEG F (DEG C)	ice_sp	40.0 (4.4)

Table 2 — LID Display Data (cont)

EXAMPLE 6 — CONFIGURATION (CONFIG) DISPLAY SCREEN

To access this display from the **LID default** screen:

1. Press **MENU** .
2. Press **SERVICE** .
3. Scroll down to highlight **EQUIPMENT CONFIGURATION**.
4. Press **SELECT** .
5. Scroll down to highlight **CONFIG**.
6. Press **SELECT** .

DESCRIPTION	CONFIGURABLE RANGE	UNITS	REFERENCE POINT NAME	DEFAULT VALUE
RESET TYPE 1				
Degrees Reset at 20 mA	–30-30 (–17-17)	DEG F (DEG C)	deg_20ma	10Δ(6Δ)
RESET TYPE 2				
Remote Temp (No Reset)	–40-245 (–40-118)	DEG F (DEG C)	res_rt1	85 (29)
Remote Temp (Full Reset)	–40-245 (–40-118)	DEG F (DEG C)	res_rt2	65 (18)
Degrees Reset	–30-30 (–17-17)	DEG F (DEG C)	res_rt	10Δ(6Δ)
RESET TYPE 3				
CHW Delta T (No Reset)	0-15 (0-8)	DEG F (DEG C)	restd_1	10Δ(6Δ)
CHW Delta T (Full Reset)	0-15 (0-8)	DEG F (DEG C)	restd_2	0Δ(0Δ)
Degrees Reset	–30-30 (–17-17)	DEG F (DEG C)	deg_chw	5Δ(3Δ)
Select/Enable Reset Type	0-3		res_sel	0
ECW CONTROL OPTION	DISABLE/ENABLE		ecw_opt	DISABLE
Demand Limit At 20 mA	40-100	%	dem_20ma	40
20 mA Demand Limit Option	DISABLE/ENABLE		dem_sel	DISABLE
Auto Restart Option	DISABLE/ENABLE		astart	DISABLE
Remote Contacts Option	DISABLE/ENABLE		r_contact	DISABLE
Temp Pulldown Deg/Min	2-10		tmp_ramp	3
Load Pulldown %/Min	5-20		kw_ramp	10
Select Ramp Type: Temp = 0, Load = 1	0/1		ramp_opt	1
Loadshed Group Number	0-99		ldsgrp	0
Loadshed Demand Delta	0-60	%	ldsdelta	20
Maximum Loadshed Time	0-120	MIN	maxldstm	60
CCN Occupancy Config:				
Schedule Number	3-99		occpcxxe	3
Broadcast Option	DISABLE/ENABLE		occbrcst	DISABLE
ICE BUILD Option	DISABLE/ENABLE		ibopt	DISABLE
ICE BUILD TERMINATION				
0 =Temp, 1 =Contacts, 2 =Both	0-2		ibterm	0
ICE BUILD Recycle Option	DISABLE/ENABLE		ibrecyc	DISABLE

NOTE: Δ = delta degrees.

Table 2 — LID Display Data (cont)

EXAMPLE 7 — LEAD/LAG CONFIGURATION DISPLAY SCREEN

To access this display from the **LID default** screen:

1. Press **MENU** .
2. Press **SERVICE** .
3. Scroll down to highlight **EQUIPMENT CONFIGURATION**.
4. Press **SELECT** .
5. Scroll down to highlight **LEAD/LAG**.
6. Press **SELECT** .

LEAD/LAG CONFIGURATION SCREEN

DESCRIPTION	CONFIGURABLE RANGE	UNITS	REFERENCE POINT NAME	DEFAULT VALUE
LEAD/LAG SELECT DISABLE =0, LEAD =1, LAG =2, STANDBY =3	0-3		leadlag	0
Load Balance Option	DISABLE/ENABLE		loadbal	DISABLE
Common Sensor Option	DISABLE/ENABLE		commsens	DISABLE
LAG Percent Capacity	25-75	%	lag_per	50
LAG Address	1-236		lag_add	92
LAG START Timer	2-60	MIN	lagstart	10
LAG STOP Timer	2-60	MIN	lagstop	10
PRESTART FAULT Timer	0-30	MIN	preflt	5
STANDBY Chiller Option	DISABLE/ENABLE		stndopt	DISABLE
STANDBY Percent Capacity	25-75	%	stnd_per	50
STANDBY Address	1-236		stnd_add	93

Table 2 — LID Display Data (cont)

EXAMPLE 8 — SERVICE1 DISPLAY SCREEN

To access this display from the **LID default** screen:

1. Press **MENU** .
2. Press **SERVICE** .
3. Scroll down to highlight **EQUIPMENT SERVICE**.
4. Press **SELECT** .
5. Scroll down to highlight **SERVICE1**.
6. Press **SELECT** .

DESCRIPTION	CONFIGURABLE RANGE	UNITS	REFERENCE POINT NAME	DEFAULT VALUE
Motor Temp Override*	150-200 (66-93)	DEG F (DEG C)	mt_over	200 (93)
Cond Press Override	90-200 (620-1379)	PSI (kPa)	cp_over	125 (862)
Refrig Override Delta T	2-5 (1-3)	DEG F (DEG C)	ref_over	3Δ (1.6Δ)
Chilled Medium	Water/Brine		medium	WATER
Brine Refrig Trippoint	8-40 (–13.3-4)	DEG F (DEG C)	br_trip	33 (1)
Compr Discharge Alert	125-200 (52-93)	DEG F (DEG C)	cd_alert	200 (93)
Bearing Temp Alert	165-210 (74-99)	DEG F (DEG C)	tb_alert	175 (79)
Water Flow Verify Time	0.5-5	MIN	wflow_t	5
Oil Press Verify Time	15-300	SEC	oilpr_t	15
Water/Brine Deadband	0.5-2.0 (0.3-1.1)	DEG F (DEG C)	cw_db	1.0 (0.6)
Recycle Restart Delta T	2.0-10.0 (1.1-5.6)	DEG F (DEG C)	rcycrdt	5 (2.8)
Recycle Shutdown Delta	0.5-4.0 (.27-2.2)		rcycsdt	1.0 (0.6)
Surge Limit/HGBP Option	0/1		srg_hgbp	0
Select: Surge=0, HGBP=1				
Surge/HGBP Delta T1	0.5-15 (0.3-8.3)	DEG F (DEG C)	hgb_dt1	1.5 (0.8)
Surge/HGBP Delta P1	30-170 (207-1172)	PSI (kPa)	hgb_dp1	50 (345)
Min. Load Points (T1/P1)				
Surge/HGBP Delta T2	0.5-15 (0.3-8.3)	DEG F (DEG C)	hgb_dt2	10 (5.6)
Surge/HGBP Delta P2	30-170 (207-1172)	PSI (kPa)	hgb_dp2	85 (586)
Full Load Points (T2/P2)				
Surge/HGBP Deadband	1-3 (0.6-1.6)	DEG F (DEG C)	hgb_dp	1 (0.6)
Surge Delta Percent Amps	10-50	%	surge_a	25
Surge Time Period	1-5	MIN	surge_t	2
Demand Limit Source	0/1		dem_src	0
Select: Amps=0, Load=1				
Amps Correction Factor	1-8		corfact	3
Motor Rated Load Amps	1-9999	AMPS	a_fs	200
Motor Rated Line Voltage	1-9999	VOLTS	v_fs	460
Meter Rated Line kW	1-9999	kW	kw_fs	600
Line Frequency	0/1	HZ	freq	0
Select: 0=60 Hz, 1=50 Hz				
Compr Starter Type	REDUCE/FULL		starter	REDUCE
Condenser Freeze Point	–20-35 (–28.9-1.7)	DEG F (DEG C)	cdfreeze	34 (1)
Soft Stop Amps Threshold	40-100	%	softstop	100
Stop to Start Timer	3-50	MIN	stopmtr	20
External Gear Option		ENABLE/DSABLE	exg_opt	ENABLE
Mechanical Gear Oil Pump		ENABLE/DSABLE	mech_pmp	DSABLE
Auxiliary Gear Oil Pump		ENABLE/DSABLE	aux_pmp	DSABLE
Gear Oil Pressure Alert	15-20 (103-138)	PSI (kPa)	gearp_al	15 (103)
Gear Oil Temperature Alert	130-145 (54-63)	DEG F (DEG C)	geart_al	130 (54)

*Information is applicable to hermetic machines (19EX) only.

NOTE: Δ = delta degrees.

Table 2 — LID Display Data (cont)

EXAMPLE 9 — SERVICE2 DISPLAY SCREEN

To access this display from the **LID default** screen:

1. Press **MENU** .
2. Press **SERVICE** .
3. Scroll down to highlight **EQUIPMENT SERVICE**.
4. Press **SELECT** .
5. Scroll down to highlight **SERVICE2**.
6. Press **SELECT** .

DESCRIPTION	CONFIGURABLE RANGE	UNITS	REFERENCE POINT NAME	DEFAULT VALUE
OPTIONS BOARD 1				
20 mA POWER CONFIGURATION **External = 0, Internal = 1**				
RESET 20 mA Power Source	0,1		res_20 ma	0
DEMAND 20 mA Power Source	0,1		dem_20 ma	0
SPARE ALERT ENABLE **Disable = 0, 1 = High Alert, 2 = Low Alert,** **3 = High Alarm, 4 = Low Alarm** **Temp = Alert Threshold**				
CHWS Temp Enable	0-4		chws_en	0
CHWS Temp Alert	–40-245 (–40-118)	DEG F (DEG C)	chws_al	245 (118)
CHWR Temp Enable	0-4		chwr_en	0
CHWR Temp Alert	–40-245 (–40-118)	DEG F (DEG C)	chwr_al	245 (118)
Reset Temp Enable	0-4		rres_en	0
Reset Temp Alert	–40-245 (–40-118)	DEG F (DEG C)	rres_al	245 (118)
Spare Temp 1 Enable	0-4		spr1_en	0
Spare Temp 1 Alert	–40-245 (–40-118)	DEG F (DEG C)	spr1_al	245 (118)
Spare Temp 2 Enable	0-4		spr2_en	0
Spare Temp 2 Alert	–40-245 (–40-118)	DEG F (DEG C)	spr2_al	245 (118)
Spare Temp 3 Enable	0-4		spr3_en	0
Spare Temp 3 Alert	–40-245 (–40-118)	DEG F (DEG C)	spr3_al	245 (118)
OPTIONS BOARD 2				
20 mA POWER CONFIGURATION **External = 0, Internal = 1**				
SPARE 1 20 mA Power Source	0,1		sp1_20 ma	0
SPARE 2 20 mA Power Source	0,1		sp2_20 ma	0
SPARE ALERT ENABLE **Disable = 0, 1 = High Alert, 2 = Low Alert,** **3 = High Alarm, 4 = Low Alarm** **Temp = Alert Threshold**				
Spare Temp 4 Enable	0-4		spr4_en	0
Spare Temp 4 Alert	–40-245 (–40-118)	DEG F (DEG C)	spr4_al	245 (118)
Spare Temp 5 Enable	0-4		spr5_en	0
Spare Temp 5 Alert	–40-245 (–40-118)	DEG F (DEG C)	spr5_al	245 (118)
Spare Temp 6 Enable	0-4		spr6_en	0
Spare Temp 6 Alert	–40-245 (–40-118)	DEG F (DEG C)	spr6_al	245 (118)
Spare Temp 7 Enable	0-4		spr7_en	0
Spare Temp 7 Alert	–40-245 (–40-118)	DEG F (DEG C)	spr7_al	245 (118)
Spare Temp 8 Enable	0-4		spr8_en	0
Spare Temp 8 Alert	–40-245 (–0-118)	DEG F (DEG C)	spr8_al	245 (118)
Spare Temp 9 Enable	0-4		spr9_en	0
Spare Temp 9 Alert	–40-245 (–40-118)	DEG F (DEG C)	spr9_al	245 (118)

NOTE: This screen provides the means to generate alert messages based on exceeding the ‘‘Temp’’ threshold for each point listed. If the ‘‘Enable’’ is set to 1, a value above the ‘‘Temp’’ threshold generates an alert message. If the ‘‘Enable’’ is set to 2, a value below the ‘‘Temp Alert’’ threshold generates an alert message. If the ‘‘Enable’’ is set to 0, alert generation is disabled. If the ‘‘Enable’’ is set to 3, a value above the ‘‘Temp’’ threshold generates an alarm. If the ‘‘Enable’’ is set to 4, a value below the ‘‘Temp’’ threshold generates an alarm.

EXAMPLE 10 — SERVICE3 DISPLAY SCREEN

To access this display from the **LID default** screen:

1. Press **MENU** .
2. Press **SERVICE** .
3. Scroll down to highlight **EQUIPMENT SERVICE**.
4. Press **SELECT** .
5. Scroll down to highlight **SERVICE3**.

DESCRIPTION	CONFIGURABLE RANGE	UNITS	REFERENCE POINT NAME	DEFAULT VALUE
Proportional Inc Band	2-10		gv_inc	6.5
Proportional Dec Band	2-10		gv_de	6.0
Proportional ECW Gain	1-3		gv_ecw	2.0
Guide Vane Travel Limit	30-100	%	gv_lim	50

EXAMPLE 11 — MAINTENANCE (MAINT01) DISPLAY SCREEN

To access this display from the **LID default** screen:

1. Press MENU .
2. Press SERVICE .
3. Scroll down to highlight **CONTROL ALGORITHM STATUS**.
4. Press SELECT .
5. Scroll down to highlight **MAINT01**.

DESCRIPTION	RANGE/STATUS	UNITS	REFERENCE POINT NAME
CAPACITY CONTROL			
Control Point	10-120 (–12.2-48.9)	DEG F (DEG C)	ctrlpt
Leaving Chilled Water	–40-245 (–40-118)	DEG F (DEG C)	LCW
Entering Chilled Water	–40-245 (–40-118)	DEG F (DEG C)	ECW
Control Point Error	–99-99 (–55-55)	DEG F (DEG C)	cperr
ECW Delta T	–99-99 (–55-55)	DEG F (DEG C)	ecwdt
ECW Reset	–99-99 (–55-55)	DEG F (DEG C)	ecwres
LCW Reset	–99-99 (–55-55)	DEG F (DEG C)	lcwres
Total Error + Resets	–99-99 (–55-55)	DEG F (DEG C)	error
Guide Vane Delta	–2-2	%	gvd
Target Guide Vane Pos	0-100	%	GV_TRG
Actual Guide Vane Pos	0-100	%	GV_ACT
Proportional Inc Band	2-10		gv_inc
Proportional Dec Band	2-10		gv_dec
Proportional ECW Gain	1-3		gv_ecw
Water/Brine Deadband	0.5-2 (0.3-1.1)	DEG F (DEG C)	cwdb

NOTE: Overriding is not supported on this maintenance screen. Active overrides show the associated point in alert (*). Reference point names with capital letters can be read by CCN and Building Supervisor software.

EXAMPLE 12 — MAINTENANCE (MAINT02) DISPLAY SCREEN

To access this display from the **LID default** screen:

1. Press MENU .
2. Press SERVICE .
3. Scroll down to highlight **CONTROL ALGORITHM STATUS**.
4. Press SELECT .
5. Scroll down to highlight **MAINT02**.
6. Press SELECT .

DESCRIPTION	RANGE/STATUS	UNITS	REFERENCE POINT NAME
OVERRIDE/ALERT STATUS			
MOTOR WINDING TEMP†	–40-245 (–40-118)	DEG F (DEG C)	MTRW
Override Threshold	150-200 (66-93)	DEG F (DEG C)	mt_over
CONDENSER PRESSURE	–6.7-420 (–42-2896)	PSI (kPa)	CRP
Override Threshold	90-245 (621-1689)	PSI (kPa)	cp_over
EVAPORATOR REFRIG TEMP	–40-245 (–40-118)	DEG F (DEG C)	ERT
Override Threshold	2-45 (1-7.2)	DEG F (DEG C)	rt_over
DISCHARGE TEMPERATURE	–40-245 (–40-118)	DEG F (DEG C)	CMPD
Alert Threshold	125-200 (52-93)	DEG F (DEG C)	cd_alert
BEARING TEMPERATURE	–40-245 (–40-118)	DEG F (DEG C)	MTRB
Alert Threshold	175-185 (79-85)	DEG F (DEG C)	tb_alert

†Information is applicable to hermetic machines (19EX) only.

NOTE: Overriding is not supported on this maintenance screen. Active overrides show the associated point in alert (*). Reference point names with capital letters can be read by CCN and Building Supervisor software.

Table 2 — LID Display Data (cont)

EXAMPLE 13 — MAINTENANCE (MAINT03) DISPLAY SCREEN

To access this display from the **LID default** screen:

1. Press **MENU** .
2. Press **SERVICE** .
3. Scroll down to highlight **CONTROL ALGORITHM STATUS**.
4. Press **SELECT** .
5. Scroll down to highlight **MAINT03**.
6. Press **SELECT** .

DESCRIPTION	RANGE/STATUS	UNITS	REFERENCE POINT NAME
SURGE/HGBP ACTIVE ?	NO/YES		
Active Delta P	0-200 (0-1379)	PSI (kPa)	dp_a
Active Delta T	0-200 (0-111)	DEG F (DEG C)	dt_a
Calculated Delta T	0-200 (0-111)	DEG F (DEG C)	dt_c
Surge Protection Counts	0-12		spc

NOTE: Override is not supported on this maintenance screen. Only values with capital letter reference point names are variables available for read operation.

EXAMPLE 14 — MAINTENANCE (MAINT04) DISPLAY SCREEN

To access this display from the **LID default** screen:

1. Press **MENU** .
2. Press **SERVICE** .
3. Scroll down to highlight **CONTROL ALGORITHM STATUS**.
4. Press **SELECT** .
5. Scroll down to highlight **MAINT04**.
6. Press **SELECT** .

DESCRIPTION	RANGE/STATUS	UNITS	REFERENCE POINT NAME
LEAD/LAG: Configuration	DISABLE,LEAD,LAG,STANDBY, INVALID		leadlag
Current Mode	DISABLE,LEAD,LAG,STANDBY, CONFIG		llmode
Load Balance Option	DISABLE/ENABLE		loadbal
LAG Start Time	0-60	MIN	lagstart
LAG Stop Time	0-60	MIN	lagstop
Prestart Fault Time	0-30	MIN	preflt
Pulldown: Delta T/Min	x.xx	Δ DEG F (Δ DEG C)	pull_dt
Satisfied?	No/Yes		pull_sat
LEAD CHILLER in Control	No/Yes		leadctrl
LAG CHILLER: Mode	Reset,Off,Local,CCN		lagmode
Run Status	Timeout,Recycle,Startup,Ramping,Running Demand,Override,Shutdown,Abnormal,Pumpdown		lagstat
Start/Stop	Stop,Start,Retain		lag_s_s
Recovery Start Request	No/Yes		lag_rec
STANDBY CHILLER: Mode	Reset,Off,Local,CCN		stdmode
Run Status	Timeout,Recycle,Startup,Ramping,Running Demand,Override,Shutdown,Abnormal,Pumpdown		stdstat
Start/Stop	Stop,Start,Retain		std_s_s
Recovery Start Request	No/Yes		std_rec

NOTES:
1. Values on this screen cannot be ''forced'' (that is, changed by an operator, from the LID or from any other device [such as a CCN terminal]).
2. Δ = delta degrees.

PIC System Functions

NOTE: In the rest of this manual, words not part of paragraph headings and printed in all capital letters can be viewed on the LID (e.g., LOCAL, CCN, RUNNING, ALARM, etc.). Words printed both in capital letters and italics can also be viewed on the LID and are parameters (*CONTROL MODE, COOLING SETPOINT, OVERRIDE THRESHOLD,* etc.) with associated values (e.g., modes, temperatures, pressures, percentages, on, off, etc.). Words printed in all capital letters and in a box represent softkeys on the LID control panel (e.g., ENTER and EXIT). See Table 2 for examples of the information that can appear on the LID screens. Figures 11-17 give an overview of LID operation and menus.

CAPACITY CONTROL — The PIC controls the chiller capacity by modulating the inlet guide vanes in response to chilled water temperature changes away from the *WATER/BRINE CONTROL POINT.* The *WATER/BRINE CONTROL POINT* may be changed by a CCN network device or is determined when the PIC adds any active chilled water reset to the chilled water *SET POINT.* The PIC uses the *PROPORTIONAL INC (Increase) BAND, PROPORTIONAL DEC (Decrease) BAND,* and the *PROPORTIONAL ECW (Entering Chilled Water) GAIN* to determine how quickly or slowly to respond. *WATER/BRINE CONTROL POINT* may be viewed/overridden from the STATUS menu, STATUS01 screen.

ENTERING CHILLED WATER CONTROL — If this option is enabled, the PIC uses the *ENTERING CHILLED WATER* temperature to modulate the vanes instead of the *LEAVING CHILLED WATER* temperature. The *ENTERING CHILLED WATER* control option may be viewed/modified from the CONFIG screen, accessed from the EQUIPMENT CONFIGURATION table.

DEADBAND — This is the tolerance on the chilled water/brine temperature *WATER/BRINE CONTROL POINT.* If the water temperature goes outside the *WATER/BRINE DEADBAND,* the PIC opens or closes the guide vanes in response until it is within tolerance. The PIC may be configured with a 0.5° to 2° F (0.3° to 1.1° C) deadband. *WATER/BRINE DEADBAND* may be viewed or modified from the SERVICE1 screen, accessed from the EQUIPMENT SERVICE table.

For example, a 1° F (0.6° C) deadband setting controls the water temperature within ±0.5° F (0.3° C) of the control point. This may cause frequent guide vane movement if the chilled water load fluctuates frequently. A value of 1° F (0.6° C) is the default setting.

PROPORTIONAL BANDS AND GAIN — Proportional band is the rate at which the guide vane position is corrected in proportion to how far the chilled water/brine temperature is from the control point. Proportional gain determines how quickly the guide vanes react to how quickly the temperature is moving from *WATER/BRINE CONTROL POINT.* Proportional bands and gain values can be viewed/modified from the SERVICE3 screen (accessed from the EQUIPMENT CONFIGURATION table) and the MAINT01 screen (accessed from the CONTROL ALGORITHM STATUS table).

<u>The Proportional Band</u> — There are two response modes, one for temperature response above the control point, the other for response below the control point.

The first type is called *PROPORTIONAL INC BAND,* and it can slow or quicken vane response to chilled water/brine temperature above the *WATER/BRINE DEADBAND*. It can be adjusted from a setting of 2 to 10; the default setting is 6.5. *PROPORTIONAL DEC BAND* can slow or quicken vane response to chilled water temperature below deadband plus the control point. It can be adjusted on the LID from a setting of 2 to 10, and the default setting is 6.0. Increasing either of these settings causes the vanes to respond more slowly than at a lower setting.

<u>The *PROPORTIONAL ECW GAIN*</u> can be adjusted at the LID display from a setting of 1.0 to 3.0, with a default setting of 2.0. Increase this setting to increase guide vane response to a change in entering chilled water temperature.

DEMAND LIMITING — The PIC responds to the *ACTIVE DEMAND LIMIT* set point by limiting the opening of the guide vanes. It compares the set point to either *COMPRESSOR MOTOR LOAD* or *COMPRESSOR MOTOR LOAD CURRENT* (percentage), depending on how the control is configured for the *DEMAND LIMIT SOURCE* which is accessed on the SERVICE1 screen. The default setting is current limiting. The *ACTIVE DEMAND LIMIT* may be viewed on the STATUS01 screen.

CHILLER TIMERS — The PIC maintains 2 runtime clocks, known as *COMPRESSOR ONTIME* and *SERVICE ONTIME*. *COMPRESSOR ONTIME* indicates the total lifetime compressor run hours. This timer can register up to 500,000 hours before the clock turns back to zero. The *SERVICE ONTIME* is a resettable timer that can be used to indicate the hours since the last service visit or any other event. The time can be changed from the LID to whatever value is desired. This timer can register up to 32,767 hours before it rolls over to zero.

The chiller also maintains a start-to-start timer and a stop-to-start timer. These timers limit how soon the chiller can be started. See the Start-Up/Shutdown/Recycle Sequence section, page 43, for operational information.

OCCUPANCY SCHEDULE — The chiller schedule, described in the Time Schedule Operation section, page 18, determines when the chiller can run. Each schedule consists of 1 to 8 occupied/unoccupied time periods, set by the operator. These time periods can be enabled (or not enabled) on each day of the week and for holidays. The day begins with 0000 hours and ends with 2400 hours. The chiller is in an occupied state unless an unoccupied time period is in effect.

NOTE: To determine whether or not the chiller is in an occupied state and can be started, access the STATUS01 screen and scroll to the *OCCUPIED?* parameter. If the value in the right column is YES, the chiller is in an occupied state and can turn on or can be started. If the value is NO, the chiller is in an unoccupied state; that is, it can shut down or cannot be started without performing an override.

The schedules can be set to follow the building schedule or to be in an occupied state 100% of the time. The schedules also can be bypassed by forcing the *CHILLER START/STOP* parameter on the STATUS01 screen to START. For more information on forced starts, see Local Start-Up, page 43. The schedules also can be overridden to keep the chiller in an occupied state for up to 4 hours, on a one-time basis.

NOTE: A parameter value can be ″forced″ (changed by an operator) from the LID screen or from another control device such as a CCN terminal. For example, if the *CHILLER START/STOP* parameter is set to START, the operator can go to the LID and change the value to STOP to ″force″ the chiller to stop.

Figure 14 shows a schedule for a typical office building time schedule, with a 3-hour, off-peak cool down period from midnight to 3 a.m., following a weekend shutdown. For example, holiday periods are set to be unoccupied 24 hours per day. The building operates Monday through Friday, 7:00 a.m. to 6:00 p.m., with a Saturday schedule of 6:00 a.m. to 1:00 p.m., and includes the Monday midnight to 3:00 a.m. weekend cool-down schedule.

NOTE: This schedule is for illustration only, and is not intended to be a recommended schedule for chiller operation.

Depending on its operating mode, the chiller uses the following occupancy schedules:

- LOCAL mode — Occupancy Schedule 01(OCCPC01 on the SCHEDULE screen).
- ICE BUILD mode — Occupancy Schedule 02 (OCCPC02 on the SCHEDULE screen).
- CCN mode — Occupancy Schedule 03-99 (OCCPC02-OCCPC99 on the SCHEDULE screen).

The CCN schedule number is specified on the CONFIG screen, which is accessed from the EQUIPMENT CONFIGURATION table. The schedule number can be any value from 03 to 99. If this schedule number is changed on the CONFIG screen, the operator must use the ATTACH TO NETWORK DEVICE screen to upload the new number into the schedule screen. See Fig. 12.

Safety Controls — The PIC monitors all safety control inputs, and if required, shuts down the chiller or limits the guide vanes to protect the chiller from possible damage from several conditions, including:

- high bearing temperature
- high motor winding temperature
- high discharge temperature
- low compressor oil pressure
- low gear oil pressure
- high gear oil temperature
- low cooler refrigerant temperature/pressure
- condenser high pressure or low pressure
- inadequate water/brine cooler and condenser flow
- high, low, or loss of voltage
- excessive motor acceleration time
- excessive starter transition time
- lack of motor current signal
- excessive motor amps
- excessive compressor surge
- temperature and transducer faults

Starter faults or optional protective devices within the starter can shut down the chiller. These devices depend on what options have been purchased.

⚠ CAUTION

If a compressor motor overload or ground fault occurs, check the motor for grounded or open phases before attempting a restart.

If the PIC control initiates a safety shutdown, the control displays a primary and secondary alarm message on the LID, energizes an alarm relay in the starter, and blinks the alarm light on the control panel. The alarm information is stored in memory and can be viewed on the LID by accessing the ALARM HISTORY table along with a troubleshooting message.

To give a more specific operating condition warning, the operator can also define alert limits on various monitored inputs. Safety contact and alert limits are defined in Table 3. Alarm and alert messages are listed in the Troubleshooting Guide section, page 83.

SHUNT TRIP — The PIC can include an optional shunt trip function that acts as a safety trip. The shunt trip is wired from an output on the SMM to the motor circuit breaker. If the PIC tries to shut down the compressor using normal shutdown procedures but is unsuccessful for 30 seconds, the shunt trip output is energized and trips off the circuit breaker. If ground fault protection has been applied to the starter, the ground fault trip also energizes the shunt trip to trip the circuit breaker.

Default Screen Freeze — When the chiller is in an alarm state, the default LID display freezes; that is, it stops updating. The first line of the LID default screen displays a primary alarm message; the second line displays a secondary alarm message. The LID default screen freezes to allow the operator to see the condition of the chiller *at the time of the alarm.* Knowledge of the operating state of the chiller at the time an alarm occurs is useful when troubleshooting. Current chiller information can be viewed on the STATUS screens (see Table 2, Examples 1-4). Once all existing alarms are cleared by pressing the RESET softkey, the default LID screen returns to normal operation.

Auxiliary Compressor Oil Pump Control — The compressor oil pump (optional) is controlled by the PIC. If, during start-up, the main oil pump cannot raise pressure to 18 psi (124 kPa), the auxiliary oil pump (optional) is energized. During compressor operation, the auxiliary oil pump is energized if the oil pressure falls below the alert threshold (18 psi [124 kPa]). Once the auxiliary compressor oil pump is running, it stays on until the compressor is turned off and is deenergized along with the main oil pump after the post-lubrication period.

Auxiliary Gear Oil Pump Control — The optional auxiliary gear oil pump is controlled by the PIC. During start-up, if the main gear oil pump cannot raise the oil pressure at least 20 psi (139 kPa), the auxiliary gear oil pump is energized. If, after 30 seconds, the required oil pressure has not been established, the PIC initiates an alarm and does not allow the chiller to start. During operation, the auxiliary gear oil pump is energized if the oil pressure falls below the alert threshold (15 to 20 psi [103 to 139 kPa]). Once the auxiliary gear oil pump is running, it stays on until the compressor is turned off and is deenergized with the main gear oil pump after the post-lubrication period.

Shaft Seal Oil Control — For all open-drive chillers, the shaft seal must be bathed in oil at all times, especially when the chiller is not running. This ensures that refrigerant will not leak past the seal. The PIC energizes the compressor oil pump for one minute if the oil pump has not operated during the past 12 hours.

IMPORTANT: If control power is turned off for more than 12 hours, the refrigerant charge must be pumped into the economizer/storage vessel. Because the oil heater is also turned off during this time, storing the refrigerant prevents refrigerant from migrating into the oil.

Ramp Loading Control — Ramp loading control slows down the rate at which the compressor loads up. It prevents the compressor from loading up during the short time between chiller start-up and the time the chilled water loop has to be brought down to normal design conditions. Ramp loading helps to reduce electrical demand by slowly bringing the chilled water temperature to the control point temperature. The total power draw during this period stays almost unchanged.

The PIC bases ramp loading on either the chilled water temperature or on motor load. See the Table 2, Example 6 (CONFIG screen).

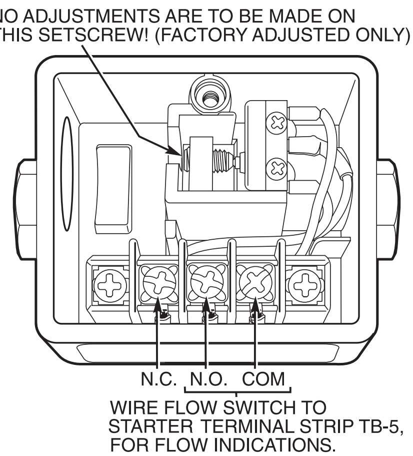
1. The temperature ramp loading rate is an operator-configured value that limits the rate at which either the leaving chilled water or entering chilled water temperature decreases (*TEMP PULLDOWN DEG/MIN* parameter on the CONFIG screen). The lowest temperature ramp rate is used the first time the chiller is started (at commissioning). The lowest temperature ramp rate is also used if chiller power has been off for 3 hours or more (even if the motor ramp load control method has been selected).

Table 3 — Protective Safety Limits and Control Settings

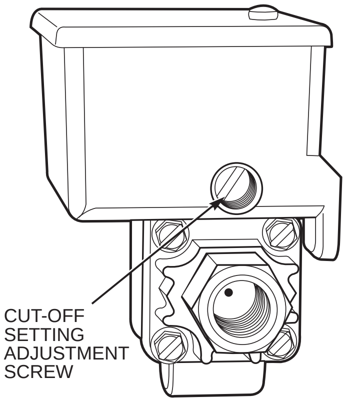
MONITORED PARAMETER	LIMIT	APPLICABLE COMMENTS
TEMPERATURE SENSORS OUT OF RANGE	–40 to 245 F (–40 to 118.3 C)	Must be outside range for 2 seconds
PRESSURE TRANSDUCERS OUT OF RANGE	0.08 to 0.98 Voltage Ratio	Must be outside range for 2 seconds. Ratio = Input Voltage ÷ Voltage Reference
COMPRESSOR DISCHARGE TEMPERATURE	>220 F (104.4 C)	Preset, alert setting configurable
BEARING TEMPERATURE	>220 F (104.4 C)	Preset, alert setting configurable
EVAPORATOR REFRIGERANT TEMPERATURE (Temp converted from Pressure Reading)	<33 F (for water chilling) (0.6° C)	Preset, configure chilled medium for water (Service1 table)
	<Brine Refrigerant Trippoint (set point adjustable from 0 to 40 F [–18 to 4 C] for brine chilling)	Configure chilled medium for brine (Service1 table). Adjust brine refrigerant trippoint for proper cutout
TRANSDUCER VOLTAGE	<4.5 vdc > 5.5 vdc	Preset (Read voltage at terminals 34 and 35 on PSIO module)
CONDENSER PRESSURE — SWITCH	>218 ± 7 psig (1503 ± 48 kPa), reset at 120 ± 10 (827 ± 69 kPa)	Preset
— CONTROL	215 psig (1482 kPa)	Preset
COMPRESSOR OIL PRESSURE — SWITCH	Cutout <11 psid (76 kPad) ± 1.5 psid (10.3 kPad) Cut-in >16.5 psid (114 kPad) ± 4 psid (27.5 kPad)	Preset, no calibration needed
— CONTROL	Cutout <15 psid (103 kPad) Alert <18 psid (124 kPad)	Preset
LINE VOLTAGE — HIGH	>110% for one minute	Preset, based on transformed line voltage to 24 vac rated-input to the Starter Management Module. Also monitored at PSIO power input.
— LOW	<90% for one minute or ≤85% for 3 seconds	
— SINGLE-CYCLE	<50% for one cycle	
COMPRESSOR MOTOR LOAD (% Compressor Amps)	>110% for 30 seconds	Preset
	<10% with compressor running	Preset
	>10% with compressor off	Preset
STARTER ACCELERATION TIME (Determined by inrush current going below 100% compressor motor load)	>45 seconds	For chillers with reduced voltage mechanical and solid-state starters
	>10 seconds	For chillers with full voltage starters (Configured on Service1 table)
STARTER TRANSITION	>75 seconds	Reduced voltage starters only
CONDENSER FREEZE PROTECTION	Energizes condenser pump relay if condenser refrigerant temperature or condenser entering water temperature is below the configured condenser freeze point temperature. Deenergizes when the temperature is 5 F (3 C) above condenser freeze point temperature.	CONDENSER FREEZE POINT configured in Service01 table with a default setting of 34 F (1 C).
IMPELLER CLEARANCE	Displacement switch open	Thrust movement excessive
MOTOR LEAK DETECTOR (TEWAC MOTORS ONLY)	Water from motor cooling is leaking	Water sensors are installed only on open-drive motors that use water cooling. (Totally enclosed, water-to-air cooled [TEWAC] motors)
GEAR OIL TEMPERATURE — CONTROL	Cut-Out > 150 F (66 C) Alert > 130-145 (54 - 63 C)	Preset Adjustable
GEAR OIL PRESSURE —CONTROL	Cut-out < 12 psi (83 kPa) Alert < 15-20 psi (103 - 139 kPa)	Preset Adjustable

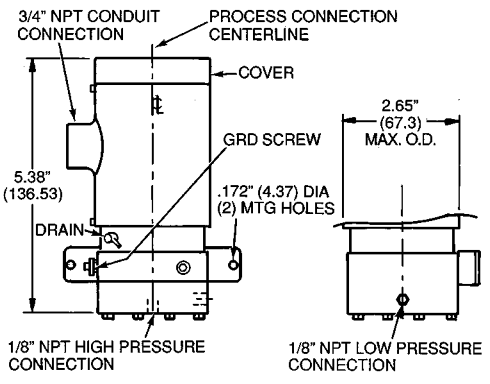
FLOW SWITCHES (Field Supplied)

Operate water pumps with chiller off. Manually reduce water flow and observe switch for proper cutout. Safety shutdown occurs when cutout time exceeds 3 seconds.



Carrier Part No. HK06ZC033





Carrier Part No. HK06ZC001

NOTE: Dimensions in parentheses are in millimeters.

2. The motor load ramp loading rate is an operator-configured value that limits the rate at which the compressor motor current or compressor motor load increases. (*LOAD PULL-DOWN %/MIN* on the CONFIG screen).

To select the ramp type, highlight the *SELECT RAMP TYPE* parameter on the CONFIG screen and select either 0 (*TEMP*) or 1 (*LOAD*). Motor load (1) is the default ramp loading control type.

Capacity Override (See Table 4) — Capacity overrides can prevent some safety shutdowns caused by exceeding the motor amperage limit, refrigerant low temperature safety limit, motor high temperature safety limit, and condenser high pressure limit. In all of these cases, there are 2 stages of compressor vane control.

1. The guide vanes are kept from opening further, and the status line on the LID displays the reason for the override.
2. The guide vanes are closed until the condition decreases below the first step set point. Then, the vanes are released to normal capacity control.

Whenever the motor current demand limit set point is reached, it activates a capacity override, again using the 2-step process. Exceeding 110% of the rated load amps for more than 30 seconds initiates a safety shutdown.

The compressor high lift (surge prevention) set point causes a capacity override as well. When the surge prevention set point is reached, the PIC normally prevents the guide vanes from opening. See the Surge Prevention Algorithm section, page 37. If the chiller is equipped with the hot gas bypass option, the PIC opens the hot gas bypass valve instead of holding the guide vanes.

High Discharge Temperature Control — If the discharge temperature increases above 200 F (93 C), the guide vanes are proportionally opened to increase gas flow through the compressor. If the leaving chilled water temperature drops 5° F (2.8° C) below the control point temperature, chiller enters the RECYCLE mode.

Oil Sump Temperature Control — The oil sump temperature control is regulated by the PIC which uses the oil heater relay when the chiller is shut down.

As part of the pre-start checks executed by the controls, the PIC compares the oil sump temperature to the evaporator refrigerant temperature. If the difference between these 2 temperatures is 50 F (27.8 C) or less, the start-up is delayed until the oil temperature difference is 50 F (27.8 C) or more. Once this temperature is confirmed, the start-up continues.

The oil heater relay is energized whenever the chiller compressor is off and the oil sump temperature is less than 150 F (65.6 C) or the oil sump temperature is less than the cooler refrigerant temperature plus 70° F (39° C). The oil heater is turned off when the oil sump temperature is either

- more than 160 F (71.1 C)
- or the oil sump temperature is more than 155 F (68.3 C) and more than the cooler refrigerant temperature plus 75° F (41.6° C).

The oil heater is always off during start-up or when the compressor is running.

When a power failure to the PSIO module has occurred for more than 3 hours (i.e., initial start-up), the compressor guide vane opening is slowed down to prevent excessive oil foaming that may result from refrigerant migration into the oil sump during the power failure. The vane opening is slowed via temperature ramp loading to a value of 2° F (1.1° C) per minute.

Table 4 — Capacity Overrides

OVERRIDE CAPACITY CONTROL	FIRST STAGE SETPOINT			SECOND STAGE SETPOINT	OVERRIDE TERMINATION
	View/Modify on LID Screen	Default Value	Configurable Range	Value	Value
HIGH CONDENSER PRESSURE	Equipment Service1	125 psig (862 kPa)	90 to 200 psig (620 to 1379 kPa)	$>$Override Set Point + 4 psid (28 kPad)	$<$Override Set Point
LOW REFRIGERANT TEMPERATURE (Refrigerant Override Delta Temperature)	Equipment Service1	$<$3° F (1.6° C) (Above Trippoint)	2° to 5° F (1° to 3° C)	$\leqslant$Trippoint + Override ΔT –1° F (0.56° C)	$>$Trippoint + Override ΔT +2° F (1.2° C)
HIGH COMPRESSOR LIFT (Surge Prevention)	Equipment Service1	Min: T1 — 1.5° F (0.8° C) P1 — 50 psid (345 kPad) Max: T2 — 10° F (5.6° C) P2 — 85 psid (586 kPad)	0.5° to 15° F (0.3° to 8.3° C) 30 to 170 psid (207 to1172 kPad) 0.5° to 15° F (0.3° to 8.3° C) 30 to 170 psid (207 to 1172 kPad)	None	Within Lift Limits Plus Surge/ HGBP Deadband Setting
MANUAL GUIDE VANE TARGET	Control Algorithm Maint01	Automatic	0 to 100%	None	Release of Manual Control
MOTOR LOAD — ACTIVE DEMAND LIMIT	Status01	100%	40 to 100%	$\geqslant$5% of Set Point	2% Lower Than Set Point

LEGEND

HGBP — High Gas Bypass
P1 — Minimum Pressure Load
P2 — Maximum Pressure Load
T1 — Minimum Temperature Load
T2 — Maximum Temperature Load

Oil Cooler — The oil for the external gear and the compressor must be cooled while the compressor is running. The compressor oil cooler is a water-cooled, helical, tube-in-shell type heat exchanger. A plug valve is manually set to maintain proper temperatures. Set the valve to maintain a 145 F (63 C) oil sump temperature while the compressor is running.

The gear oil cooler is a water-cooled, helical tube-in-shell type heat exchanger. A plug valve is manually set to maintain proper temperatures. Set the valve to maintain the oil temperature leaving the cooler at 130 F (54 C) while the compressor is running.

Remote Start/Stop Controls — A remote device, such as a time clock with a set of contacts, may be used to start and stop the chiller. However, the device should not be programmed to start and stop the chiller more than 2 or 3 times every 12 hours. If more than 8 starts in 12 hours occur, the Excessive Starts alarm is displayed, and the chiller is prevented from starting. The operator must reset the alarm at the LID in order to override the starts counter and start the chiller. If the automatic restart after a power failure (*AUTO RESTART OPTION*) is not activated (disabled) when a power failure occurs and the remote contact is closed, the PIC control activates an alarm because of the loss of voltage.

The contacts for remote starting are wired into the starter at terminal strip TB5, terminals 8A and 8B. See the certified drawings for further details on contact ratings. The contacts must be dry (no power).

Spare Safety Inputs — Normally closed (NC) digital inputs for additional field-supplied safeties may be wired to the spare protective limits input channel in place of the factory-installed jumper. (Wire multiple inputs in series.) Opening any contact results in a safety shutdown and LID display. Refer to the certified drawings for safety contact ratings.

Analog temperature sensors may also be added to the options modules, if installed. These may be programmed to activate an alert on the CCN network, but not shut down the chiller.

Spare Alarm Contacts — Two spare sets of alarm contacts are provided in the starter. The contact ratings are provided in the certified drawings. The contacts are located on terminal strip TB6, terminals 5A and 5B, and terminals 5C and 5D.

Condenser Pump Control — The chiller monitors the condenser pressure (*CONDENSER PRESSURE* parameter on the STATUS01 screen) and may turn on the condenser pump if the pressure becomes too high whenever the compressor is shut down. The condenser pressure override (*COND PRESSURE OVERRIDE* parameter on the SERVICE1 screen) is the value that determines this pressure point. Its default value is 125 psi (862 kPa). If the condenser pressure is greater than or equal to the condenser pressure override, and the entering condenser water temperature (*ENTERING CONDENSER WATER* parameter on the STATUS01 screen) is less than 115 F (46 C), then the condenser pump energizes to try to decrease the pressure. The pump turns off when the condenser pressure is 5psi (34 kPa) less than the pressure override, or when the condenser refrigerant temperature *(CONDENSER REFRIG TEMP* on the STATUS01 screen) is within 3° F (2° C) of the entering condenser water temperature.

Condenser Freeze Prevention — This control algorithm helps prevent condenser tube freeze-up by energizing the condenser pump relay. If the pump is controlled by the PIC, starting the pump helps prevent the water in the condenser from freezing. Condenser freeze prevention can occur whenever the chiller is not running except when it is either actively in pumpdown or in pumpdown lockout with the freeze prevention disabled.

When the condenser refrigerant temperature is less than or equal to the condenser freeze point *(CONDENSER FREEZE POINT* on the SERVICE1 screen), or the entering condenser water temperature is less than or equal to the condenser freeze point, then the condenser water pump *(CONDENSER WATER PUMP* on the STATUS02 screen) is energized until the condenser refrigerant temperature is greater than the condenser freeze point plus 5° F (2.7° C). If the chiller is in PUMPDOWN mode and the pump is energized, the PIC activates an alarm. If the chiller is not in PUMPDOWN mode and the pump is energized, the PIC activates an alert. If the chiller is in RECYCLE shutdown mode, the mode transitions to SHUTDOWN (non-recycle shutdown).

Tower-Fan Relay — This control can be used to assist the condenser water temperature control system (field supplied). Low condenser water temperature can cause the chiller to shut down on low refrigerant temperature. The tower fan relay, located in the starter, is controlled by the PIC to energize and deenergize as the pressure differential between cooler and condenser vessels changes. This function prevents low condenser water temperature and maximizes chiller efficiency. The tower-fan relay can only accomplish this if the relay has been added to the cooling tower temperature controller. The tower-fan relay *(TOWER FAN RELAY* on the STATUS02 screen) is turned on whenever the condenser water pump is running, flow is verified, and the difference between cooler and condenser pressure is more than 30 psid (207 kPad) or entering condenser water temperature is greater than 85 F (29 C). The tower-fan relay is deenergized whenever the condenser pump is off, flow is lost, the evaporator refrigerant temperature is less than the override temperature, or the differential pressure is less than 28 psid (193 kPad) and entering condensing water is less than 80 F (27 C).

IMPORTANT: A field-supplied water temperature control system for condenser water should be installed. The system should maintain the leaving condenser water temperature at 20° F (11° C) above the leaving chilled water temperature.

⚠ CAUTION

The tower-fan relay control is not a substitute for a condenser water temperature control. When used with a water temperature control system, the tower-fan relay control can be used to help prevent low condenser water temperatures and associated problems.

Auto. Restart After Power Failure — This option, which may be viewed or modified on the CONFIG screen (the *AUTO RESTART OPTION* parameter), can be enabled or disabled. If this option is enabled, the chiller starts up automatically after a single cycle dropout; low, high, or no voltage; and the power is within ±10% of normal. The 15-minute start-to-start timer and the stop-to-start timer are ignored during this type of start-up.

When power is restored after a power failure, and if the compressor had been running, the oil pump is energized for one minute before the evaporator pump is energized. The Auto. Restart function then continues like a normal start-up.

Water/Brine Reset — Three types of chilled water/brine reset are available, Reset Type 1, Reset Type 2, and Reset Type 3. They can be viewed or modified on the CONFIG screen (accessed from the EQUIPMENT CONFIGURATION table). See Table 2, Example 6.

The LID default screen status message indicates when a reset is active. The *WATER/BRINE CONTROL POINT* temperature on the STATUS01 table indicates the chiller's current reset temperature.

To configure a reset type, input all configuration information for that reset type on the CONFIG screen. Then activate the reset type by entering the reset type number in the *SELECT/ENABLE RESET TYPE* input line.

RESET TYPE 1 (Requires an optional 8-input module) — Reset Type 1 is an automatic chilled water temperature reset based on a 4 to 20 mA input signal. The value for Rest Type 1 is user configurable (*DEGREES RESET AT 20 mA*). It is a temperature that corresponds to a 20 mA signal. (4 mA corresponds to 0° F [0° C]; 20 mA corresponds to the temperature entered by the operator.)

This reset type permits up to ±30° F (±16° C) of automatic reset to the chilled water/brine temperature set point, based on the input from a 4 to 20 mA signal. The signal is hardwired into the No. 1 eight-input module.

If the 4 to 20 mA signal is externally powered from the 8-input module, the signal is wired to terminals J1-5(+) and J1-6(–). If the signal is powered internally by the 8-input module (for example, when using variable resistance), the signal is wired to J1-7(+) and J1-6(–). The PIC must be configured on the SERVICE2 screen to ensure that the appropriate power source is identified. See Table 2, Example 9, *20 mA POWER CONFIGURATION*.

RESET TYPE 2 (Requires an optional 8-input module) — Reset Type 2 is an automatic chilled water temperature reset based on a remote temperature sensor input.

This reset type permits ±30° F (±16° C) of automatic reset to the set point based on a temperature sensor wired to the No. 1 eight-input module (see wiring diagrams or certified drawings). The temperature sensor must be wired to terminal J1-19 and J1-20.

Configure Reset Type 2 on the CONFIG screen (Table 2, Example 6). Enter the temperature of the remote sensor at the point where no temperature reset will occur (*REMOTE TEMP [NO RESET*]). Next, enter the temperature at which the full amount of reset will occur (*REMOTE TEMP [FULL RESET]*). Then, enter the maximum amount of reset required to operate the chiller (*DEGREES RESET*). Reset Type 2 can now be activated.

RESET TYPE 3 — Reset Type 3 is an automatic chilled water temperature reset based on cooler temperature difference. This reset adds ±30° F (±16° C) based on the temperature difference between entering and leaving chilled water. Reset Type 3 is the only reset available without the need for a No. 1 eight-input module. No wiring is required for Reset Type 3, because it already uses the cooler water sensors.

Configure Reset Type 3 on the CONFIG screen (Table 2, Example 6). Enter the chilled water temperature difference (the difference between entering and leaving chilled water) at which no temperature reset occurs (*CHW DELTA T [NO RESET]*). This chilled water temperature difference is usually the full design load temperature difference. Enter the difference in chilled water temperature at which the full amount of reset occurs (*CHW DELTA T [FULL RESET]*). Next, enter the amount of reset (*DEGREES RESET*). Reset Type 3 can now be activated.

Demand Limit Control Option (Requires Optional 8-Input Module) — The demand limit may be externally controlled with a 4 to 20 mA signal from an Energy Management System (EMS). The option (*20 mA DEMAND LIMIT OPTION*) is enabled or disabled on the CONFIG screen (Table 2, Example 6). When enabled, the control is set for 100% demand with 4 mA and an operator configured minimum demand set point at 20 mA (*DEMAND LIMIT AT 20 mA*) .

The EMS demand reset input is hardwired into the No. 1 8-input module. The signal may be internally powered by the module or externally powered. If the signal is externally powered, the signal is wired to terminals J1-1(+) and J1-2(–). If the signal is internally powered, the signal is wired to terminals J1-3(+) and J1-2(–). When enabled, the control is set for 100% demand with 4 mA and an operator configured minimum demand set point at 20 mA *(DEMAND LIMIT AT 20 mA).*

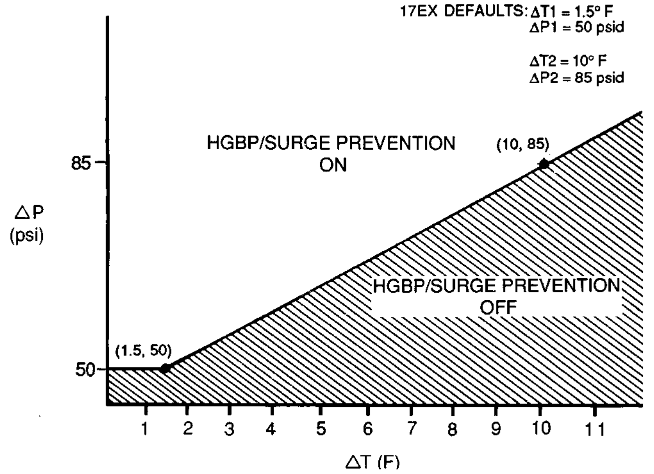
Surge Prevention Algorithm — Surge occurs when lift conditions become so high that the gas flow across the impeller reverses. This condition can eventually cause chiller damage. Lift is defined as the difference between the pressure at the impeller eye and the impeller discharge. The maximum lift that a particular impeller wheel can produce varies with the gas flow across the impeller and the size of the wheel.

The surge prevention algorithm is operator configurable and can determine if lift conditions are too high for the compressor. If they are, the PIC takes corrective action. The algorithm also notifies the operator, via the LID, that chiller operating conditions are marginal.

The surge prevention algorithm first determines if corrective action is necessary. This is done by checking 2 sets of operator configured data points: the minimum load points (*MIN. LOAD POINTS [T1/P1]*) and the maximum load points (*FULL LOAD POINTS [T2/P2]*). See the SERVICE1 screen or Table 2, Example 8. These points have default settings. Information on how to modifiy the default minimum and maximum load points can be found in the Input Service Configurations section on page 54.

Figures 18 and 19 graphically display these settings and the algorithm function. The 2 sets of load points (default settings) describe a line that the algorithm uses to determine the maximum lift of the compressor. Whenever the actual differential pressure between the cooler and condenser and the temperature difference between the entering and leaving chilled water are above the line on the graph (as defined by the minimum and maximum load points) the algorithm goes into a corrective action mode. If the actual values are below the line, the algorithm takes no action.

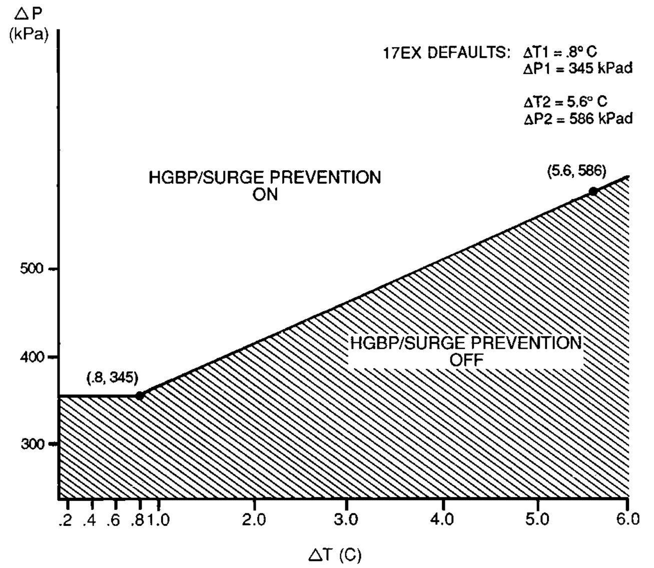
Corrective action can be taken by making one of 2 choices. If the optional hot gas bypass line is present, and the operator selects the hot gas bypass option on the SERVICE1 screen (selects 1 for the *SURGE LIMIT/HGBP OPTION*), then the hot gas bypass valve can be energized. If the hot gas bypass option is not present, then the *SURGE LIMIT/HGBP OPTION* is on the default setting (0), and the guide vanes are held. (Also see Table 4, Capacity Overrides.) Both corrective actions reduce the lift experienced by the compressor and help to prevent a surge condition.



LEGEND
ΔP = (Condenser psi) − (Cooler psi)
ΔT = (ECW) − (LCW)

ECW — Entering Chilled Water
HGBP — Hot Gas Bypass
LCW — Leaving Chilled Water

Fig. 18 — 17EX Hot Gas Bypass/Surge Prevention With Default Settings (English)



LEGEND
ΔP = (Condenser kPa) − (Cooler kPa)
ΔT = (ECW) − (LCW)

ECW — Entering Chilled Water
HGBP — Hot Gas Bypass
LCW — Leaving Chilled Water

Fig. 19 — 17EX Hot Gas Bypass/Surge Prevention With Default Settings (SI)

Surge Protection — Compressor surge can be detected by the PIC based on operator configured settings. Surge causes amperage fluctuations of the compressor motor. The PIC monitors these amperage swings, and if the swing is greater than the configured setting (*SURGE DELTA PERCENT AMPS*) in one second, then one surge event has occurred. The setting is displayed and configured on the SERVICE1 screen. Its default setting is 25% amps.

A surge protection chiller shutdown occurs when the surge protection counter reaches 12 within an operator specified time period, known as the surge time period. The surge protection count (*SURGE PROTECTION COUNTS* parameter, Table 2, Example 13) can be monitored on the MAINT03 screen. The *SURGE TIME PERIOD* parameter is displayed and configured on the SERVICE1 screen. See Table 2, Example 8. It has a default of 2 minutes.

Lead/Lag Control — Lead/lag is a control system process that automatically starts and stops a lag or second chiller in a 2-chiller system. Refer to Fig. 15 and 16 for menu, table, and screen selection information. On chillers that have PSIO software with lead/lag capability, it is possible to use the PIC controls to perform the lead/lag function on 2 chillers. A third chiller can be added to the lead/lag system as a standby chiller to start up if the lead or lag chiller in the system has shut down during an alarm condition and additional cooling is required.

NOTE: Lead/lag parameters can be viewed and modified on the LEAD/LAG CONFIGURATION screen, accessed from the EQUIPMENT CONFIGURATION table. See Table 2, Example 7. Lead/lag status during chiller operation is viewed on the MAINT04 screen, accessed from the CONTROL ALGORITHM STATUS table. See Table 2, Example 14.

Lead/Lag System Requirements:

- all chillers must have PSIO software capable of performing the lead/lag function
- water pumps MUST be energized from the PIC controls
- water flows should be constant
- CCN Time Schedules for all chillers must be identical

Operation Features:

- 2 chiller lead/lag
- addition of a third chiller for backup
- manual rotation of lead chiller
- load balancing if configured
- staggered restart of the chillers after a power failure
- chillers may be piped in parallel or in series chilled water flow

COMMON POINT SENSOR INSTALLATION — Lead/lag operation does not require a common chilled water point sensor. Common point sensors can be added to the 8-input option module, if desired. Refer to the certified drawings for termination of sensor leads.

NOTE: If the common point sensor option is chosen on a chilled water system, each chiller should have its own 8-input option module and common point sensor installed. A chiller uses its own common point sensor for control when that chiller is designated as the lead chiller. The PIC cannot read the value of common point sensors installed on other chillers in the chilled water system.

When installing chillers in series, use a common point sensor. If a common point sensor is not used, the leaving chilled water sensor of the upstream chiller must be moved into the leaving chilled water pipe of the downstream chiller.

If return chilled water control is required on chillers piped in series, the common point return chilled water sensor should be installed. If this sensor is not installed, the return chilled water sensor of the downstream chiller must be relocated to the return chilled water pipe of the upstream chiller.

To properly control the common supply point temperature sensor when chillers are piped in parallel, the water flow through the shutdown chiller(s) must be isolated so there is no water bypass around the operating chiller. The common point sensor option must not be used if water bypass around the operating chiller is occurring.

CHILLER COMMUNICATION WIRING — Refer to the chiller Installation Instructions and the Carrier Comfort Network Interface section on page 53 of this manual for information on chiller communication wiring.

LEAD/LAG OPERATION — The PIC control has the capability to operate 2 chillers in the lead/lag mode. It also has the additional capability to start a designated standby chiller when either the lead or lag chiller is not operating and capacity requirements are not being met. The lead/lag option operates in CCN mode only. If any other chiller configured for lead/lag is set to the LOCAL or OFF modes, it will be unavailable for lead/lag operation.

NOTE: Lead/lag configuration is viewed and edited on the LEAD/LAG screen, accessed from the EQUIPMENT CONFIGURATION table of the SERVICE menu. See Table 2, Example 7. Lead/lag status during chiller operation is viewed on the MAINT04 screen, accessed from the CONTROL ALGORITHM STATUS table. See Table 2, Example 14.

Lead/Lag Chiller Configuration and Operation — A chiller is designated the lead chiller when the *LEAD/LAG SELECT* parameter for that chiller is set to 1 on the LEAD/LAG CONFIGURATION screen. A chiller is designated the lag chiller when the *LEAD/LAD SELECT* parameter for that chiller is set to 2. A chiller is designated the standby chiller when the *LEAD/LAG SELECT* parameter for that chiller is set to 3. Setting the *LEAD/LAG SELECT* parameter to 0 disables the lead/lag function in that chiller.

To configure the *LAG ADDRESS* parameter on the LEAD/LAG CONFIGURATION screen, always use the address of the other chiller on the system. Using this address makes it easier to rotate the lead and lag chillers.

If improper address assignments are entered for the *LAG ADDRESS* and *STANDBY ADDRESS* parameters, the lead/lag is disabled and an alert (!) message displays on the LID. For example, if the lag chiller's address matches the lead chiller's address, the lead/lag function is disabled and an alert (!) message displays. The lead/lag maintenance screen (MAINT04) displays the message INVALID CONFIG in the *LEAD/LAG CONFIGURATION* and *CURRENT MODE* fields.

The lead chiller responds to normal start/stop controls such as occupancy schedule, forced start/stop, and remote start contact inputs. After completing start-up and ramp loading, the PIC evaluates the need for additional capacity. If additional capacity is needed, the PIC initiates the start-up of the chiller configured at the lag address. If the lag chiller is faulted (in alarm) or is in the OFF or LOCAL modes, then the chiller at the standby address (if configured) is requested to start. After the second chiller is started and is running, the lead chiller monitors conditions and evaluates whether the capacity has been reduced enough for the lead chiller to sustain the system alone. If the capacity is reduced enough for the lead chiller to sustain the control point temperatures alone, then the operating lag chiller is stopped.

If the lead chiller is stopped in CCN mode for any reason other than an alarm (*) condition, then the lag and standby chillers are stopped. If the configured lead chiller stops for an alarm condition, then the configured lag chiller takes the lead chiller's place as the lead chiller and the standby chiller serves as the lag chiller.

If the configured lead chiller does not complete the start-up before the *PRESTART FAULT TIMER* (a user configured parameter on the LEAD/LAG screen) elapses, then the lag chiller is started and the lead chiller shuts down. The lead chiller then monitors the request to start from the acting lead chiller. The pre-start fault timer is initiated at the time of a start request. This timer's function is to provide a time-out if there is a pre-start alert condition that prevents the chiller from starting in a timely manner.

If the lag chiller does not achieve start-up before the pre-start fault time elapses, then the lag chiller is stopped and the standby chiller is requested to start, if configured and ready.

Standby Chiller Configuration and Operation — The configured standby chiller is identified as such by having its *LEAD/LAG SELECT* parameter assigned a value of 3. The standby chiller can only operate as a replacement for the lag chiller if one of the other two chillers is in an alarm (*) condition (as indicated on the LID panel). If both lead and lag chillers are in an alarm (*) condition, the standby chiller defaults to operate in CCN mode based on its configured occupancy schedule and remote contacts input.

Lag Chiller Start-Up Requirements — Before the lag chiller can be started, the following conditions must be met.

1. Lead chiller ramp loading must be completed.
2. Lead chiller's chilled water temperature must be greater than the *WATER/BRINE CONTROL POINT* (STATUS01 screen) plus half the *WATER/BRINE DEADBAND* (SERVICE1 screen).

   NOTE: The chilled water temperature sensor may be the leaving chilled water sensor, the return water sensor, the common supply water sensor, or the common return water sensor, depending on which options are configured and enabled.
3. Lead chiller *ACTIVE DEMAND LIMIT* (STATUS01 screen) value must be greater than 95% of full load amps.
4. Lead chiller temperature pulldown rate (*TEMP PULLDOWN DEG/MIN* on the CONFIG screen) of the chilled water temperature is less than 0.5° F (0.27° C) per minute.
5. The lag chiller status indicates it is in CCN mode and is not faulted. If the current lag chiller is in an alarm condition, then the standby chiller becomes the active lag chiller, if it is configured and available.
6. The configured time for the *LAG START TIMER* parameter has elapsed. The lag start timer starts when the lead chiller ramp loading is completed. The *LAG START TIMER* parameter is on the LEAD/LAG screen, which is accessed from the EQUIPMENT CONFIGURATION table. See Table 2, Example 7.

When all the above requirements have been met, the lag chiller is forced to a STARTUP mode. The PIC control then monitors the lag chiller for a successful start. If the lag chiller fails to start, the standby chiller, if configured, is started.

Lag Chiller Shutdown Requirements — The following conditions must be met in order for the lag chiller to be stopped.

1. Lead chiller *COMPRESSOR MOTOR LOAD* (STATUS01 screen) value is less than the lead chiller percent capacity plus 15%. See STATUS01 screen or Table 2, Example 1.

   NOTE: Lead chiller percent capacity = 100 – *LAG PERCENT CAPACITY.*

   The *LAG PERCENT CAPACITY* value is configured on the LEAD/LAG CONFIGURATION screen.
2. The lead chiller chilled water temperature is less than the *WATER/BRINE CONTROL POINT* plus 1/2 of the *WATER/BRINE DEADBAND*. The *WATER/BRINE DEADBAND* parameter is on the SERVICE1 screen. See Table 2, Example 8.
3. The configured lag stop time (*LAG STOP TIMER* parameter on the LEAD/LAG CONFIGURATION screen) has elapsed. The lag start time starts when the *LEAVING CHILLED WATER* temperature is less than the *WATER/BRINE CONTROL POINT* plus 1/2 of the *WATER/BRINE DEADBAND*, and the lead chiller *COMPRESSOR MOTOR LOAD* is less than the lead chiller percent capacity plus 15%. The lag stop timer is ignored if the chilled water temperature reaches 3° F (1.67° C) below the *WATER/BRINE CONTROL POINT* and the lead chiller *COMPRESSOR MOTOR LOAD* value is less than the lead chiller percent capacity plus 15%.

FAULTED CHILLER OPERATION — If the lead chiller shuts down because of an alarm (*) condition, it stops communicating with the lag and standby chillers. After 30 seconds, the lag chiller becomes the acting lead chiller and starts and stops the standby chiller, if necessary.

If the lag chiller faults when the lead chiller is also faulted, the standby chiller reverts to a stand-alone CCN mode of operation.

If the lead chiller is in an alarm (*) condition (indicated on the LID), the RESET softkey is pressed to clear the alarm, and the lead chiller is placed in CCN mode, the lead chiller communicates and monitors the run status of the lag and standby chillers. If both the lag and standby chillers are running, the lead chiller does not attempt to start and does not assume the role of lead chiller until either the lag or standby chiller shuts down. If only one chiller is running, the lead chiller waits for a start request from the operating chiller. When the configured lead chiller starts, it assumes its role of lead chiller.

LOAD BALANCING — When the *LOAD BALANCE OPTION* (LEAD/LAG screen) is enabled, the lead chiller sets the *ACTIVE DEMAND LIMIT* in the lag chiller to the lead chiller's *COMPRESSOR MOTOR LOAD* value. This value has limits of 40% to 100%. When setting the lag chiller *ACTIVE DEMAND LIMIT,* the *WATER/BRINE CONTROL POINT* is modified to a value of 3° F (1.67° C) less than the lead chiller's *WATER/BRINE CONTROL POINT* value. If the *LOAD BALANCE OPTION* is disabled, the *ACTIVE DEMAND LIMIT* and the *WATER/BRINE CONTROL POINT* are forced to the same value as the lead chiller.

AUTO. RESTART AFTER POWER FAILURE — When an auto. restart condition occurs, each chiller may have a delay added to the start-up sequence, depending on its lead/lag configuration. The lead chiller does not have a delay. The lag chiller has a 45-second delay. The standby chiller has a 90-second delay. The delay time is added after the chiller water flow verification. The PIC controls ensure that the guide vanes are closed. After the guide vane position is confirmed, the delay for lag and standby chillers occurs before energizing the oil pump. The normal start-up sequence then continues. The auto. restart delay sequence occurs whether the chiller is in CCN or LOCAL mode and is intended to stagger the compressor motor start-up times. This helps reduce the in-rush of demand on the building power system.

Ice Build Control — Ice build control automatically sets the chilled *WATER/BRINE CONTROL POINT* of the chiller from a normal operation set point temperature to a temperature that allows an ice building operation for thermal storage.

NOTE: For ice build control to operate properly, the PIC controls must be placed in CCN mode.

The PIC can be configured for ice build operation by changing entries on the:

- CONFIG screen, accessed from the SERVICE menu
- OCCPC02S screen (ice build time schedule), accessed from the SCHEDULE menu
- SETPOINT screen, accessed from the SETPOINT menu.

Figures 15 and 16 show how to access each screen.

The ice build time schedule defines the periods during which the ice build option can be activated, if the ice build option is enabled. If the ice build time schedule overlaps other schedules, the ice build time schedule takes priority. During an ice build period, the *WATER/BRINE CONTROL POINT* is set to the *ICE BUILD SETPOINT* (SETPOINT screen) for temperature control.

The *ICE BUILD RECYCLE OPTION* and *ICE BUILD TERMINATION* parameters are on the CONFIG screen. The ice build recycle option can be enabled or disabled from this screen; the ice build termination value can be set to 0, 1, or 2, depending on the factor that determines termination (temperature, contacts, or both). Ice build termination can occur when:

- the *ENTERING CHILLED WATER* temperature is less than the *ICE BUILD SETPOINT*
- the *REMOTE CONTACTS INPUT* (STATUS01 screen) is opened based on input from an ice level indicator
- the end of the ice build time schedule has been reached.

ICE BUILD INITIATION — The ice build option is activated via the ice build time schedule on the OCCPC02S screen. If the current time is set as an ice build time on the OCCPC02S screen and the *ICE BUILD OPTION* on the CONFIG screen is enabled, then the ice build option is active and the following events automatically take place (unless overridden by a higher authority CCN device):

1. *CHILLER START/STOP* is forced to START.
2. The *WATER/BRINE CONTROL POINT* is forced to the *ICE BUILD SETPOINT*.
3. Any force (Auto) on the *ACTIVE DEMAND LIMIT* is removed.

NOTE: Items 1-3 (shown above) do not occur if the chiller is configured and operating as a lag or standby chiller for lead/lag operation and is actively controlled by a lead chiller. The lead chiller communicates the *ICE BUILD SETPOINT,* desired *CHILLER START/STOP* state, and *ACTIVE DEMAND LIMIT* to the lag or standby chiller as required for ice build, if configured to do so.

START-UP/RECYCLE OPERATION — If the chiller is not running when ice build activates, then the PIC checks the following parameters, based on the *ICE BUILD TERMINATION* value, to avoid starting the compressor unnecessarily:

- if the *ICE BUILD TERMINATION* parameter is set to 0 (temperature only), and the *ENTERING CHILLED WATER* temperature is less than or equal to the *ICE BUILD SETPOINT;*
- if the *ICE BUILD TERMINATION* parameter is set to 1 (contacts only) and the remote contacts are open;
- if the *ICE BUILD TERMINATION* parameter is set to 3 (both temperature and contacts), the *ENTERING CHILLED WATER* temperature is less than or equal to the *ICE BUILD SETPOINT,* and the remote contacts are open.

The *ICE BUILD RECYCLE OPTION* determines whether or not the PIC goes into a RECYCLE mode. If the *ICE BUILD RECYCLE OPTION* is set to DSABLE (disable) when the ice build terminates, the PIC reverts to normal temperature control duty. If the *ICE BUILD RECYCLE OPTION* is set to ENABLE, when ice build terminates, the PIC goes into an ice build recycle mode and the chilled water pump relay remains energized to keep the chilled water flowing. If the *ENTERING CHILLED WATER* (brine) temperature increases above the *ICE BUILD SETPOINT* plus the *RECYCLE RESTART DELTA T* value, the compressor restarts and controls the chilled water/brine temperature to the *ICE BUILD SETPOINT*.

TEMPERATURE CONTROL DURING ICE BUILD —During ice build, the capacity control algorithm uses the *WATER/BRINE CONTROL POINT* minus 5 F (2.7 C) to control the *LEAVING CHILLED WATER* temperature. The *ECW CONTROL OPTION* (see CONFIG screen), the *20 mA DEMAND LIMIT*, and any temperature reset option are ignored during ice build.

TERMINATION OF ICE BUILD — Ice build termination occurs under the following conditions:

1. Ice Build Time Schedule — The ice build function terminates when the current time is not designated as an ice build time period.
2. Entering Chilled Water Temperature — Compressor operation terminates based on temperature if the *ICE BUILD TERMINATION* parameter on the CONFIG screen is set to 0 (temperature only) and the *ENTERING CHILLED WATER* temperature is less than the *ICE BUILD SETPOINT*. If the *ICE BUILD RECYCLE OPTION* is set to ENABLE, a recycle shutdown occurs and recycle start-up is based on a *LEAVING CHILLED WATER* temperature greater than the *WATER/BRINE CONTROL POINT* plus *RECYCLE RESTART DELTA T* (see SERVICE1 screen).
3. Remote Contacts/Ice Level Input — Compressor operation terminates when the *ICE BUILD TERMINATION* parameter is set to 1 (contacts only) and the remote contacts are open. In this case, the contacts are used for ice level termination control. The remote contacts can still be opened and closed to start and stop the chiller if the current time is not a time designated as an ice build period. If the current time is designated as an ice build period, the contacts are used to stop the ice build function.
4. Entering Chilled Water Temperature and Remote Contacts — Compressor operation terminates when the *ICE BUILD TERMINATION* parameter is set to 2 (both temperature and contacts) and the previously described conditions for *ENTERING CHILLED WATER* temperature and remote contacts have occurred.

NOTE: Overriding the *CHILLER START/STOP*, *WATER/BRINE CONTROL POINT*, and *ACTIVE DEMAND LIMIT* values by CCN devices (with a priority less than 4) during the ice build period is not possible. However, overriding can be accomplished with CCN during two-chiller lead/lag operation.

RETURN TO NON-ICE BUILD OPERATIONS — When the ice build function terminates, the chiller returns to normal temperature control and start/stop schedule operation. If the *CHILLER START/STOP* or *WATER/BRINE CONTROL POINT* has been forced (with a priority less than 4), before the start of ice build operation, then *CHILLER START/STOP* and *WATER/BRINE CONTROL POINT* forces are removed; that is, under these circumstances, the ice build operation takes precedence over the force.

Attach to Network Device Control — One of the selections on the SERVICE menu is ATTACH TO NETWORK DEVICE. See Fig. 12. This table serves the following purposes:

- uploads the occupancy schedule number (OCCPC03S), if changed, as defined in the CONFIG screen (*SCHEDULE NUMBER*).
- attaches the LID to any CCN device, if the chiller has been connected to a CCN network. This may include other PIC controlled chillers.
- uploads changes from a new PSIO or LID module or upgraded software.

Figure 20 shows the ATTACH TO NETWORK DEVICE table as it appears on the LID. The *LOCAL* entry is always the PSIO module address of the chiller the LID is mounted on. Whenever the controller identification of the PSIO is changed, this change is reflected on the bus and address for the LOCAL DEVICE of the ATTACH TO DEVICE screen automatically.

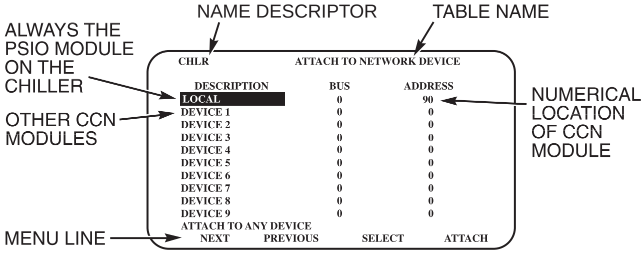


Fig. 20 — Example of Attach to Network Device Screen

Whenever the ATTACH TO NETWORK DEVICE table is accessed, no information can be read from the LID on any device until you attach one of the devices listed on the display. As soon as this screen appears, the LID erases information about the module to which it was attached to make room for information on another device. Therefore, a CCN module must be attached when this screen is entered.

To attach to a device listed on this screen, highlight it using the SELECT softkey. Then press the ATTACH softkey. The message, UPLOADING TABLES, PLEASE WAIT, flashes. The LID then uploads the highlighted device or module. If the device address cannot be found, the message, COMMUNICATION FAILURE, appears. The LID then reverts to the ATTACH TO NETWORK DEVICE screen. Try another device or check the address of the device that did not attach. The upload process time for each CCN module is different. In general, the uploading process takes 3 to 5 minutes.

NOTE: Before leaving the ATTACH TO NETWORK DEVICE screen, select the LOCAL device. Otherwise, the LID will be unable to display information on the local chiller.

ATTACHING TO OTHER CCN MODULES — If the chiller PSIO has been connected to a CCN network or other PIC controlled chillers through CCN wiring, the LID can be used to view or change parameters on the other controllers. Other PIC chillers can be viewed and set points changed (if the other unit is in CCN control) if desired from this particular LID module.

To view the other devices, access the ATTACH TO NETWORK DEVICE table. Move the highlight bar to any device number. Press the SELECT softkey to change to the bus number and address of the module to be viewed. Press the ENTER softkey. Press the EXIT softkey to return to the ATTACH TO NETWORK DEVICE table. If the device number is not valid, the message, COMMUNICATION FAILURE, displays. Enter a new address number or check the wiring. If the device is communicating properly, the message, UPLOAD IN PROGRESS, displays and the new device can now be viewed.

Whenever there is a question regarding which CCN device the LID is currently showing, check the device name descriptor on the upper left hand corner of the LID screen. See Fig. 20.When the CCN device has been viewed, use the ATTACH TO NETWORK DEVICE table to attach to the PSIO that is on the chiller. From the ATTACH TO NETWORK DEVICE table , highlight *LOCAL*, and press the SELECT softkey. Then, press the ATTACH softkey to upload the LOCAL device. The PSIO will upload.

NOTE: The LID does not automatically re-attach to the PSIO module on the chiller. Access the ATTACH TO NETWORK DEVICE table, scroll to *LOCAL*, and press the ATTACH softkey to upload the local device. The software for the local chiller will now be uploaded.

Service Operation — Figure 16 shows an overview of the service menu.

TO ACCESS THE SERVICE SCREENS

1. On the MENU screen, press the SERVICE softkey. The softkeys now correspond to the numerals 1, 2, 3, and 4.

NOTE: The factory-set password is 1 - 1 - 1 - 1. See the Input Service Configurations section, page 54, for information on how to change a password.

2. Press the four digits of your password, one at a time. An asterisk (*) appears as you enter each digit.

   If the password is incorrect, an error message is displayed. If this occurs, return to Step 1 and try to access the SERVICE tables again. If the password is correct, the softkey labels change to NEXT , PREVIOUS , SELECT , and EXIT , and the LID screen displays the following SERVICE tables:

- Alarm History
- Control Test
- Control Algorithm Status
- Equipment Configuration
- Equipment Service
- Time and Date
- Attach to Network Device
- Log Out of Device
- Controller Identification
- LID Configuration

See Fig. 16 for additional screens and tables available form the SERVICE tables listed above. Use the EXIT softkey to return to the MENU screen.

TO LOG OFF — Access the LOG OUT OF DEVICE table from the SERVICE menu. The LID exits the SERVICE menu. To re-enter the SERVICE menu, you must re-enter your password as described above.

NOTE: To prevent unauthorized persons from accessing the LID service screens, the LID automatically signs off and password-protects itself if a key has not been pressed for 15 minutes. The sequence is as follows. Fifteen minutes after the last key is pressed, the default screen displays, the LID screen light goes out (analogous to a screen saver), and the LID logs out of the password-protected SERVICE menu. Other screens and menus, such as the STATUS screen can be accessed without the password by pressing the appropriate softkeys.

HOLIDAY SCHEDULING (Fig. 21) — The time schedules may be configured for special operation during holiday periods. When modifying a time period, an ''H'' at the end of the days of the week field signifies that the period is applicable to a holiday. (See Fig. 14.)

The broadcast function must be activated for the holidays configured on the HOLIDEF screen to work properly. Access the BRODEF screen from the EQUIPMENT CONFIGURATION table and set the parameter that activates the BRODEF function to YES. Note that, when the chiller is connected to a CCN network, only one chiller or CCN device can be configured to be the broadcast device. The controller that is configured to be the broadcaster is the device responsible for transmitting holiday, time, and daylight-savings dates throughout the network.

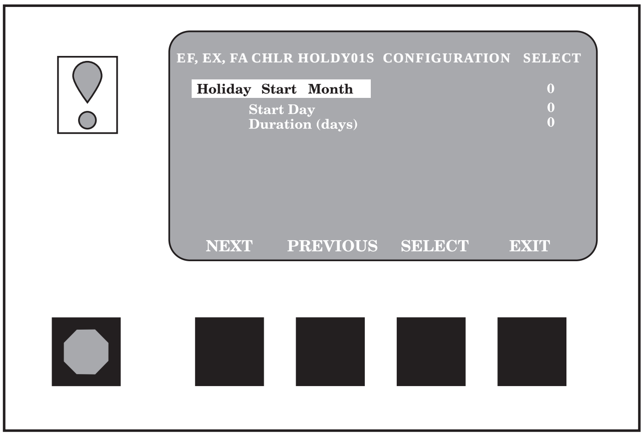
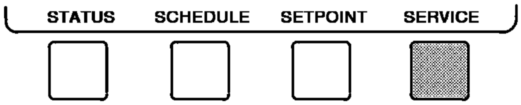


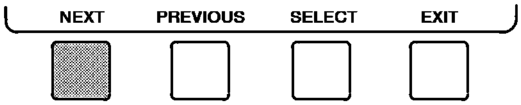
Fig. 21 — Example of Holiday Period Screen

To view or change the holiday periods for up to 18 different holidays, perform the following operation:

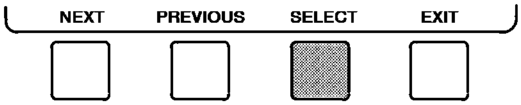
1. At the Menu screen, press SERVICE to access the SERVICE menu.



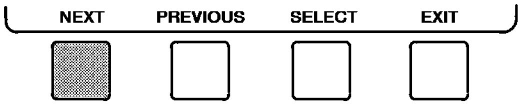
2. If not logged on, follow the instructions for entering your password. See the section, To Access the Service Screens, page 42. Once logged on, press NEXT until EQUIPMENT CONFIGURATION is highlighted.



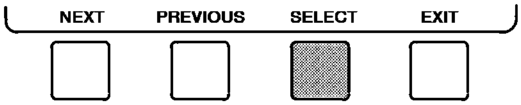
3. Press the SELECT softkey to access the EQUIPMENT CONFIGURATION tables.



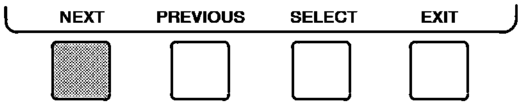
4. Press NEXT until HOLIDEF is highlighted. This is the holiday definition table.



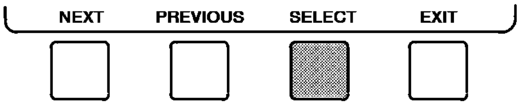
5. Press SELECT to access the HOLIDEF screen. This screen lists 18 holiday tables.



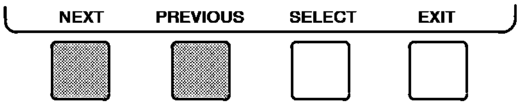
6. Press NEXT to highlight the holiday table that you wish to view or change. Each table is one holiday period, starting on a specific date, and lasting up to 99 days.



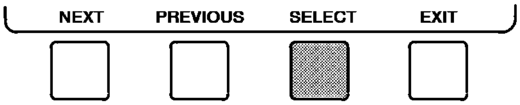
7. Press SELECT to access the holiday table. The LID screen now shows the holiday start month and day, and how many days the holiday period will last. See Fig. 24.



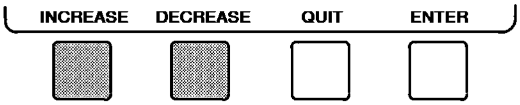
8. Press NEXT or PREVIOUS to highlight *HOLIDAY START MONTH, START DAY,* or *DURATION.*



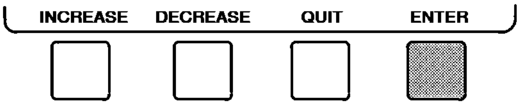
9. Press SELECT to modify the month, day, or duration.



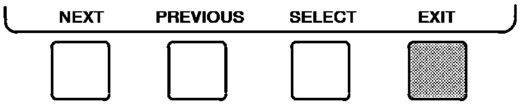
10. Press INCREASE or DECREASE to change the selected value.



11. Press ENTER to save the changes.



12. Press EXIT to return to the previous menu.



START-UP/SHUTDOWN/ RECYCLE SEQUENCE (Fig. 22)

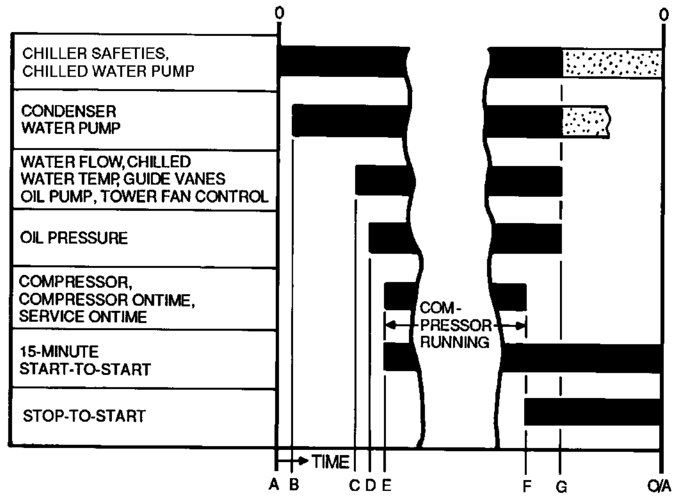
Local Start-Up — Local start-up (or a manual start-up) is initiated by pressing the LOCAL menu softkey which is on the default LID screen. Local start-up can proceed if the *OCCUPIED ?* parameter on the STATUS01 table is set to YES and after the internal 15-minute start-to-start timer and the stop-to-start inhibit timer have expired.

The *CHILLER START/STOP* parameter on the STATUS01 screen may be overridden to start, regardless of the time schedule, in order to start the chiller locally. Also, the remote contacts may be enabled through the LID and closed to initiate a start-up.

Whenever the chiller is in LOCAL control mode, the PIC waits for the current time to coincide with an occupied time period as configured in the local time schedule (OCCPC01S) and for the remote contacts to close, if enabled. The PIC then performs a series of pre-start checks to verify that all pre-start alerts and safeties are within the limits shown in Table 3. The *RUN STATUS* line on the STATUS01 screen now reads STARTUP.

If the checks are successful, the chilled water/brine pump relay is energized. Five seconds later, the condenser pump relay is energized. One minute later the PIC monitors the chilled water and condenser water flow switches, and waits until the *WATER FLOW VERIFY TIME* (operator configured, default 5 minutes) to confirm flow. See the SERVICE1 screen or Table 2, Example 8. After flow is verified, the chilled water/brine temperature is compared to *WATER/BRINE CONTROL POINT* plus *DEADBAND.* If the temperature is less than or equal to this value, the PIC turns off the condenser pump relay and goes into a RECYCLE mode.

If the water/brine temperature is high enough, the start-up sequence continues and checks the guide vane position. If the guide vanes are more than 6% open, the start-up waits until the PIC closes the vanes. If the vanes are closed, and the oil pump pressure is less than 3 psid (21 kPad), the oil pump relay is then energized. The PIC then waits a minimum of 15 seconds (maximum 5 minutes) to verify that the compressor oil pressure (*OIL PRESSURE* on the STATUS01 screen) has reached 15 psid (103 kPad). At the same time, the PIC waits up to 30 seconds to verify that the gear oil pressure (*GEAR OIL PRESSURE* on the STATUS04 screen) has reached 24 psi (166 kPa). After the oil pressures are verified, the PIC waits 10 seconds, and then the compressor start relay (1CR) is energized to start the compressor.



LEGEND

A — START INITIATED — Prestart checks made; chilled water pump started.
B — Condenser water pump started (5 seconds after A).
C — Water flows verified (one minute to 5 minutes maximum after A). Chilled water temperature checked against control point. Guide vanes checked for closure. Oil pumps started; tower fan control enabled.
D — Oil pressure verified (for compressor, 15 seconds minimum, 300 seconds maximum, after C; for gear, within 30 seconds after C).
E — Compressor motor starts, compressor ontime and service ontime starts, 15-minute inhibit timer starts (10 seconds after D). Start-in-12 hours counter advances by one.
F — SHUTDOWN INITIATED — Compressor motor stops, guide vanes close, compressor ontime and service ontime stops, stop-to-start inhibit timer starts.
G — After the post-lube period, oil and evaporator pumps deenergized. Post-lube configurable to between one and 5 minutes after Step F.
O/A — Restart permitted (both inhibit timers expired) (minimum of 15 minutes after E; minimum of 1 minute after F).

Fig. 22 — Control Sequence

If any of these requirements are not met, the PIC aborts the start and displays the applicable pre-start mode of failure on the LID default screen. A pre-start failure does not advance the *STARTS IN 12 HOURS* counter (STATUS01 screen). Any failure after the 1CR relay has energized causes a safety shutdown, advances the *STARTS IN 12 HOURS* counter by one, and displays the applicable shutdown status on the LID display.

Shutdown Sequence — The chiller shuts down if any of the following occurs:

- the STOP button on the control panel is pressed for at least one second. The alarm light blinks once to confirm the stop command.
- a recycle condition is present (see Chilled Water Recycle Mode section).
- the *OCCUPIED ?* parameter on the STATUS01 screen reads NO; that is, the chiller is not scheduled to run at the current time and date.
- the remote contact opens.
- the *CHILLER START/STOP* status is overridden to STOP from the CCN network or the LID.

When a stop signal occurs, the shutdown sequence first stops the compressor by deactivating the start relay. A status message, SHUTDOWN IN PROGRESS, COMPRESSOR DEENERGIZED, displays. The guide vanes are then brought to the closed position. The oil pump relay and the chilled water/brine pump relay are shut down 60 seconds after the compressor stops. The condenser water pump shuts down when the condenser refrigerant temperature is less than the condenser pressure override minus 5 psi (34 kPa) or is less than or equal to the entering condenser water temperature plus 3° F (2° C). The stop-to-start timer now begins to count down. If the value of the start-to-start timer is still greater than the value of the start-to-stop timer, then the start-to-start time is displayed on the LID.

There are certain conditions during shutdown that can change this sequence:

- if the *COMPRESSOR MOTOR LOAD* (STATUS01 screen) is greater than 10% after shutdown or the starter contacts remain energized, the oil pump and chilled water pump remain energized and the alarm is displayed
- if the *ENTERING CONDENSER WATER* (STATUS01 screen) temperature is greater than 115 F (46 C) at shutdown, the condenser pump is deenergized after the 1CR compressor start relay
- if the chiller shuts down due to low refrigerant temperature, the chilled water pump keeps running until the *LEAVING CHILLED WATER* temperature is greater than the *WATER/BRINE CONTROL POINT* plus 5° F (3° C).

Automatic Soft Stop Amps Threshold — The automatic soft stop amps threshold is an operator configured value that closes the guide vanes of the compressor automatically when a non-recycle, non-alarm stop signal occurs before the compressor motor is deenergized.

If the STOP button on the control panel is pressed, the guide vanes close to a preset amperage percent or until the guide vane is less than 2% open. The compressor then shuts off.

If the chiller enters an alarm state or if the compressor enters a RECYCLE mode, the compressor is deenergized immediately.

To activate the automatic soft stop amps threshold, access the SERVICE1 screen. Set the *SOFT STOP AMPS THRESHOLD* parameter value to the percent of amps at which the motor will shut down. The default setting is 100% amps (no soft stop).

When the automatic soft stop amps threshold is being applied, a status message, SHUTDOWN IN PROGRESS, COMPRESSOR UNLOADING, displays.

Chilled Water Recycle Mode — When the compressor is running under light load conditions, the chiller may cycle off and wait until the load increases to restart again. This cycling is normal and is known as recycle. A recycle shutdown is initiated when any of the following occurs:

- when the chiller is operating under the control of the leaving chilled water temperature (that is, when the *ECW CONTROL OPTION* on the CONFIG screen is disabled), the difference between the *LEAVING CHILLED WATER* temperature and *ENTERING CHILLED WATER* temperature is less than the *RECYCLE SHUTDOWN DELTA T* (found in the SERVICE1 table) and the *LEAVING CHILLED WATER TEMP* is below the *WATER/BRINE CONTROL POINT*, and the *WATER/BRINE CONTROL POINT* has not increased in the last 5 minutes
- when the chiller is operating under the control of the entering chilled water temperature (that is, the *ECW CONTROL OPTION* is enabled), the difference between the *ENTERING CHILLED WATER* temperature and the *LEAVING CHILLED WATER* temperature is less than the *RECYCLE SHUTDOWN DELTA T* (found in the SERVICE1 table) and the *ENTERING CHILLED WATER* temperature is below the *WATER/BRINE CONTROL POINT*, and the *WATER/BRINE CONTROL POINT* has not increased in the last 5 minutes
- when the *LEAVING CHILLED WATER* temperature is within 3° F (2° C) of the *BRINE REFRIG TRIPPOINT*. (See the SERVICE1 screen.)

When the chiller is in RECYCLE mode, the chilled water pump relay remains energized so that the chilled water temperature can be monitored for increasing load. The recycle control uses the *RECYCLE RESTART DELTA T* value to check when the compressor should be restarted. This is an operator-configured value that defaults to 5° F (3° C). The value can be viewed/modified on the SERVICE1 screen. The compressor restarts when:

- the chiller is operating under leaving chilled water temperature control and the *LEAVING CHILLED WATER* temperature is greater than the *WATER/BRINE CONTROL POINT* plus the *RECYCLE RESTART DELTA T;* or
- the chiller is operating under entering chilled water temperature control and the *ENTERING CHILLED WATER* temperature is greater than the *WATER/BRINE CONTROL POINT* plus the *RECYCLE RESTART DELTA T.*

Once these conditions are met, the compressor initiates a start-up, with a normal start-up sequence.

An alert condition may be generated if 5 or more recycles occur in less than 4 hours. Because excessive recycling can reduce chiller life, compressor recycling caused by extremely low loads should be reduced. To accomplish this, use the time schedule to shut the chiller down during periods of known low load operation or increase the chiller load by running the fan systems. If the hot gas bypass is installed, adjust the values to ensure that hot gas is energized during light load conditions. Increase the *RECYCLE RESTART DELTA T* value on the SERVICE1 screen to lengthen the time between restarts.

The chiller should not be operated below design minimum load without a hot gas bypass installed on the chiller.

Safety Shutdown — A safety shutdown is identical to a manual shutdown with the exception that the LID displays the reason for the shutdown, the alarm light blinks continuously, and the spare alarm contacts are energized. A safety shutdown requires that the RESET softkey be pressed in order to clear the alarm. If the alarm continues, the alarm light continues to blink. Once the alarm is cleared, the operator must press the CCN or LOCAL softkeys to restart the chiller.

⚠ CAUTION

Do not reset starter loads or any other starter safety for 30 seconds after the compressor has stopped. Voltage output to the compressor start signal is maintained for 10 seconds to determine starter fault.

BEFORE INITIAL START-UP

Job Data Required

- list of applicable design temperatures and pressures (product data submittal)
- certified drawings of the chiller
- starting equipment details and wiring diagrams
- diagrams and instructions for special controls or options
- installation instructions
- pumpout unit instructions

Equipment Required

- mechanic's tools (refrigeration)
- digital volt-ohmmeter (DVM)
- clamp-on ammeter
- electronic leak detector
- absolute pressure manometer or wet-bulb vacuum indicator (Fig. 23)
- 500 v insulation tester (megohmmeter) for compressor motors with nameplate voltage of 600 v or less, or a 5000 v insulation tester for compressor motor rated above 600 v

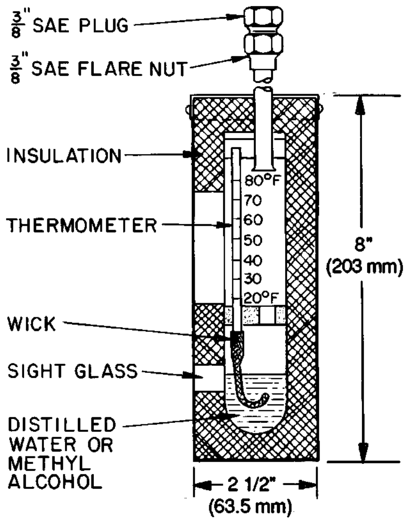


Fig. 23 — Typical Wet-Bulb Type Vacuum Indicator

Using the Economizer/Storage Vessel and Pumpout System — Refer to the Pumpout and Refrigerant Transfer Procedures section, page 63 for: pumpout system preparation, refrigerant transfer, and chiller evacuation.

Remove Shipping Packaging — Remove any packaging material from the control center, power panel, guide vane actuator, motor and bearing temperature sensor covers, and the factory-mounted starter.

MOTOR

⚠ CAUTION

The motor may be provided with a shipping brace or shipping bolt (normally painted yellow) to prevent shaft movement during transit. It must be removed prior to operation. See Fig. 24.

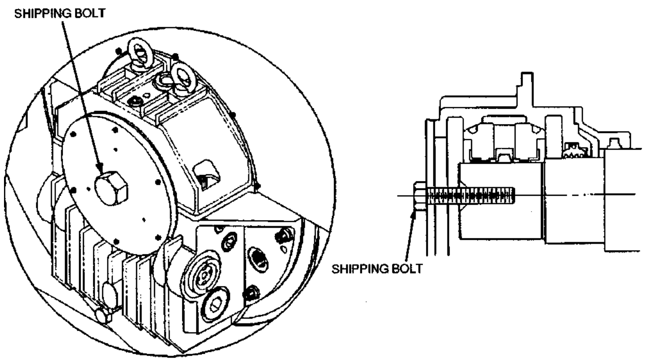


Fig. 24 — Shipping Bolt on Open Drive Motor

The motor should be inspected for any temporary, yellow caution tags with legends that convey information concerning actions necessary before the motor can be safely operated. Any slushing compound on the shaft or other parts must be removed using a petroleum type solvent. Observe proper safety precautions.

NOTE: If a shipping bolt was used to restrain the rotor, the Westinghouse logo must be installed over the hole in the endcover. The logo, the gasket, and hardware can be found with the parts that have been shipped loose. (Usually these are packed inside the main power lead box.)

EXTERNAL GEAR — Remove any packaging material that may be on the external gear. Be sure that the breather is in place and free of any obstructions.

Motor Electrical Connection — All interconnecting wiring for controls and grounding should be in strict compliance with both the (NEC) National Electrical Code and any local requirements.

The main lead box furnished with the motor has been sized to provide adequate space for making up connections between the motor lead cables and the incoming power cables. The bolted joints between the motor lead and the power cables must be made and insulated in a workman-like manner following the best trade practices.

Fabricated motors are provided with 2 stainless steel grounding pads drilled and tapped with the NEMA (National Electrical Manufacturers Association) 2-hole pattern (two ½-13 tapped holes on 1¾ in. centers). Fan cooled cast frames are provided with a special grounding bolt. The motor should be grounded by a proper connection to the electrical system ground.

The rotation direction of the motor is shown either on the motor nameplate or on the certified drawing. Information on the required phase rotation of the incoming power for this motor may also be found on the nameplate or drawing. If either is unknown, the correct sequence can be determined as follows. While the motor is uncoupled from the load, start the motor and observe the direction of rotation. Allow the motor to achieve full speed before disconnecting it from the power source. Refer to Motor Pre-Start Checks (page 51) for information concerning initial start-up. If the resulting rotation is incorrect, it can be reversed by interchanging any 2 incoming cables.

Motor Auxiliary Devices — Auxiliary devices such as resistance temperature detectors, thermocouples, thermoguards, etc., generally terminate on terminal blocks located in the auxiliary terminal box on the motor. Other devices may terminate on their own enclosures elsewhere on the motor. Such information can be obtained by referring to the certified drawing. Information regarding terminal designations and the connection of auxiliary devices can be obtained from the auxiliary drawings referenced by the outline drawing.

If the motor is provided with internal space heaters, to ensure proper heater operation, the incoming voltage supplied to them must be exactly as shown by either the nameplate on the motor or the outline drawing. Exercise caution any time contact is made with the incoming space heater circuit, because space heater voltage is often automatically applied when the motor is shut down.

Open Oil Circuit Valves — Check that the oil filter isolation valves for both the compressor and external gear are open by removing the valve cap and checking the valve stem. (See Scheduled Maintenance, Changing the Oil Filters, page 76.)

Tighten All Gasketed Joints and Guide Vane Shaft Packing — Gaskets and packings normally relax by the time the chiller arrives at the jobsite. Tighten all gasketed joints and the guide vane shaft packing to ensure a leak-tight chiller.

NOTE: Check the chiller cold alignment. Refer to Chiller Alignment in the General Maintenance section, page 71.

Check Chiller Tightness — Figure 25 outlines the proper sequence and procedures for leak testing.

17EX chillers may be shipped with the refrigerant contained in the economizer/storage vessel and the oil charge shipped in the compressor. The cooler/condenser vessels have a 15 psig (103 kPa) refrigerant charge. Units may also be ordered with the refrigerant shipped separately, along with a 15 psig (103 kPa) nitrogen-holding charge in each vessel.

To determine if there are any leaks, the chiller should be charged with refrigerant. Use an electronic leak detector to check all flanges and solder joints after the chiller is pressurized. If any leaks are detected, follow the leak test procedure.

If the chiller is spring isolated, keep all springs blocked in both directions in order to prevent possible piping stress and damage during the transfer of refrigerant from vessel to vessel during the leak test process or any time refrigerant is transferred. Adjust the springs when the refrigerant is in operating condition and when the water circuits are full.

Refrigerant Tracer — Carrier recommends using an environmentally acceptable refrigerant tracer for leak testing with an electronic detector.

Ultrasonic leak detectors also can be used if the chiller is under pressure.

> **⚠ WARNING**
>
> Do not use air or oxygen as a means of pressurizing the chiller. Some mixtures of HFC-134a and air can undergo combustion.

Leak Test the Chiller — Due to regulations regarding refrigerant emissions and the difficulties associated with separating contaminants from refrigerant, Carrier recommends the following leak test procedures. See Fig. 25 for an outline of the leak test procedures. Refer to Tables 5A and 5B for refrigerant pressure/temperature values and to the Pumpout and Refrigerant Transfer Procedures section, page 63.

1. If the pressure readings are normal for the chiller condition:
   a. Evacuate the nitrogen holding charge from the vessels, if present.
   b. Raise the chiller pressure, if necessary, by adding refrigerant until the pressure is at an equivalent saturated pressure for the surrounding temperature. Follow the pumpout procedures in the Pumpout and Refrigerant Transfer Procedures section, page 63.

> **⚠ WARNING**
>
> Never charge liquid refrigerant into the chiller if the pressure in the chiller is less than 35 psig (241 kPa). Charge as a gas only, with the cooler and condenser pumps running, until this pressure is reached, using PUMPDOWN/LOCKOUT and TERMINATE LOCKOUT mode on the PIC. Flashing of liquid refrigerant at low pressures can cause tube freeze-up and considerable damage.

> **⚠ WARNING**
>
> Run the chiller water pumps whenever transferring, removing, or charging refrigerant.

   c. Leak test chiller as outlined in Steps 3 - 9.
2. If the pressure readings are abnormal for chiller conditions:
   a. Prepare to leak test chillers shipped with refrigerant (Step 2h).
   b. Check for large leaks by connecting a nitrogen bottle and raising the pressure to 30 psig (207 kPa). Soap test all joints. If the test pressure holds for 30 minutes, prepare to test for small leaks (Steps 2g - h).
   c. Plainly mark any leaks that are found.
   d. Release the pressure in the system.
   e. Repair all leaks.
   f. Retest the joints that were repaired.
   g. After successfully completing the test for large leaks, remove as much nitrogen, air, and moisture as possible, given the fact that small leaks may be present in the system. This can be accomplished by following the dehydration procedure, outlined in the Chiller Dehydration section, page 49.
   h. Slowly raise the system pressure to the equivalent saturated pressure for the surrounding temperature but no less than 35 psig (241 kPa) by adding HFC-134a refrigerant. Proceed with the test for small leaks (Steps 3-9).
3. Check the chiller carefully with an electronic leak detector, or soap bubble solution.

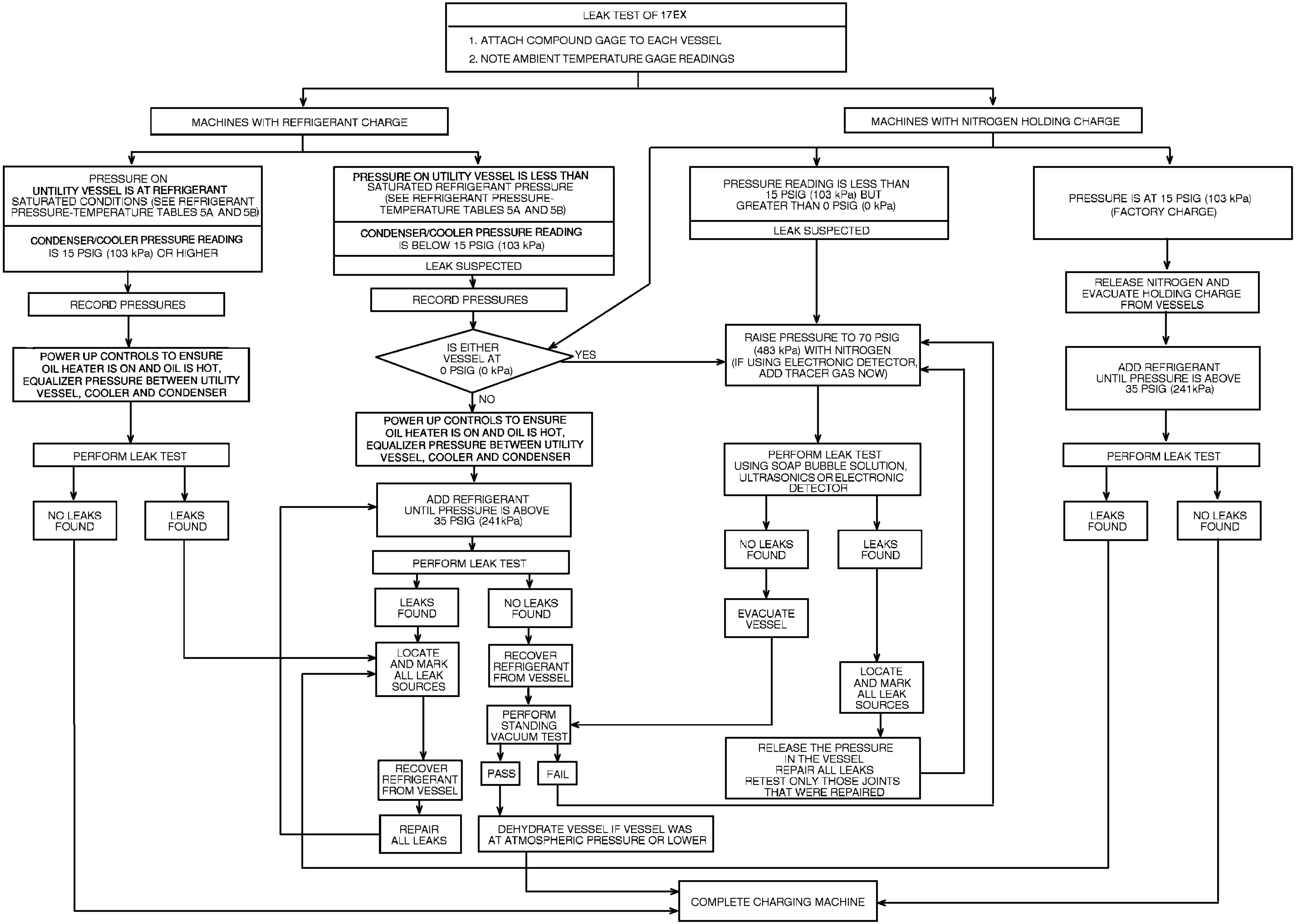


Fig. 25 — 17EX Leak Test Procedures

Table 5A — HFC-134a Pressure — Temperature (F)

TEMPERATURE (F)	PRESSURE (psi)
0	6.50
2	7.52
4	8.60
6	9.66
8	10.79
10	11.96
12	13.17
14	14.42
16	15.72
18	17.06
20	18.45
22	19.88
24	21.37
26	22.90
28	24.48
30	26.11
32	27.80
34	29.53
36	31.32
38	33.17
40	35.08
42	37.04
44	39.06
46	41.14
48	43.28
50	45.48
52	47.74
54	50.07
56	52.47
58	54.93
60	57.46
62	60.06
64	62.73
66	65.47
68	68.29
70	71.18
72	74.14
74	77.18
76	80.30
78	83.49
80	86.17
82	90.13
84	93.57
86	97.09
88	100.70
90	104.40
92	108.18
94	112.06
96	116.02
98	120.08
100	124.23
102	128.47
104	132.81
106	137.25
108	141.79
110	146.43
112	151.17
114	156.01
116	160.96
118	166.01
120	171.17
122	176.45
124	181.83
126	187.32
128	192.93
130	198.66
132	204.50
134	210.47
136	216.55
138	222.76
140	229.09

Table 5B — HFC-134a Pressure — Temperature (C)

TEMPERATURE (C)	PRESSURE (kPa)
-18.0	44.8
-16.7	51.9
-15.6	59.3
-14.4	66.6
-13.3	74.4
-12.2	82.5
-11.1	90.8
-10.0	99.4
-8.9	108.0
-7.8	118.0
-6.7	127.0
-5.6	137.0
-4.4	147.0
-3.3	158.0
-2.2	169.0
-1.1	180.0
0.0	192.0
1.1	204.0
2.2	216.0
3.3	229.0
4.4	242.0
5.0	248.0
5.6	255.0
6.1	261.0
6.7	269.0
7.2	276.0
7.8	284.0
8.3	290.0
8.9	298.0
9.4	305.0
10.0	314.0
11.1	329.0
12.2	345.0
13.3	362.0
14.4	379.0
15.6	396.0
16.7	414.0
17.8	433.0
18.9	451.0
20.0	471.0
21.1	491.0
22.2	511.0
23.3	532.0
24.4	554.0
25.6	576.0
26.7	598.0
27.8	621.0
28.9	645.0
30.0	669.0
31.1	694.0
32.2	720.0
33.3	746.0
34.4	773.0
35.6	800.0
36.7	828.0
37.8	857.0
38.9	886.0
40.0	916.0
41.1	946.0
42.2	978.0
43.3	1010.0
44.4	1042.0
45.6	1076.0
46.7	1110.0
47.8	1145.0
48.9	1180.0
50.0	1217.0
51.1	1254.0
52.2	1292.0
53.3	1330.0
54.4	1370.0
55.6	1410.0
56.7	1451.0
57.8	1493.0
58.9	1536.0
60.0	1580.0

4. Leak Determination — If an electronic leak detector indicates a leak, use a soap bubble solution, if possible, to confirm it. Total all leak rates for the entire chiller. Leakage for the entire chiller at rates greater than the EPA (Environmental Protection Agency) guidelines or local codes must be repaired. Note the total chiller leak rate on the start-up report. This leak rate repair is only for new start-ups. See page 67 in General Maintenance section for recommendations on checking leak rates and leak repairs for operating chillers.
5. If no leak is found during the initial start-up procedures, complete the transfer of refrigerant gas (see Pumpout and Refrigerant Transfer Procedures section, page 63.)
6. If no leak is found after a retest:
   a. Transfer the refrigerant to the economizer/storage vessel or other storage tank and perform a standing vacuum test as outlined in the Standing Vacuum Test section, this page.
   b. If the chiller fails this test, check for large leaks (Step 2b).
   c. Dehydrate the chiller if it passes the standing vacuum test. Follow the procedure in the Chiller Dehydration section, below. Charge chiller with refrigerant (see Pumpout and Refrigerant Transfer Procedures section, page 63).
7. If a leak is found, pump the refrigerant back into the economizer/storage vessel or other storage tank.
8. Transfer the refrigerant until the chiller pressure is 18 in. Hg (41 kPa absolute).
9. Repair the leak and repeat the procedure, beginning from Step 2g to ensure a leak-tight repair. (If chiller is opened to the atmosphere for an extended period, evacuate it before repeating the leak test.)

Standing Vacuum Test — When performing the standing vacuum test or chiller dehydration, use a manometer or a wet bulb indicator. Dial gages cannot indicate the small amount of acceptable leakage during a short period of time.

1. Attach an absolute pressure manometer or wet bulb indicator to the chiller.
2. Evacuate the vessel (see Pumpout and Refrigerant Transfer Procedures section, page 63) to at least 18 in. Hg vac, ref 30-in. bar (41 kPa), using a vacuum pump or the pumpout unit.
3. Valve off the pump to hold the vacuum and record the manometer or indicator reading.
4. a. If the leakage rate is less than 0.05 in. Hg (0.17 kPa) in 24 hours, the chiller is sufficiently tight.
   b. If the leakage rate exceeds 0.05 in. Hg (0.17 kPa) in 24 hours, repressurize the vessel and test for leaks. If refrigerant is available in the other vessel, pressurize by following Steps 2-10 of Return Chiller To Normal Operating Conditions section, page 67. If not, use nitrogen and a refrigerant tracer. Raise the vessel pressure in increments until the leak is detected. If refrigerant is used, the maximum gas pressure is approximately 70 psig (483 kPa) at normal ambient temperature.
5. Repair the leak, retest, and proceed with dehydration.

Chiller Dehydration — Dehydration is recommended if the chiller has been open for a considerable period of time, if the chiller is known to contain moisture, or if there has been a complete loss of chiller holding charge or refrigerant pressure.

⚠ WARNING

Do not start or megohm-test the compressor motor or oil pump motor, even for a rotation check, if the chiller is under dehydration vacuum. Insulation breakdown and severe damage may result.

Dehydration is readily accomplished at room temperatures. Using a cold trap (Fig. 26) may substantially reduce the time required to complete the dehydration. The higher the room temperature, the faster dehydration takes place. At low room temperatures, a very deep vacuum is required for boiling off any moisture. If low ambient temperatures are involved, contact a qualified service representative for the dehydration techniques required.

Perform dehydration as follows:

1. Connect a high capacity vacuum pump (5 cfm [0.002 m^3/s] or larger is recommended) to the refrigerant charging valve (Fig. 6). Tubing from the pump to the chiller should be as short and as large in diameter as possible to provide the least resistance to gas flow.
2. Use an absolute pressure manometer or a wet bulb vacuum indicator to measure the vacuum. Open the shutoff valve to the vacuum indicator only when taking a reading. Leave the valve open for 3 minutes to allow the indicator vacuum to equalize with the chiller vacuum.
3. Open all isolation valves (if present), if the entire chiller is to be dehydrated.
4. With the chiller ambient temperature at 60 F (15.6 C) or higher, operate the vacuum pump until the manometer reads 29.8 in. Hg vac, ref 30 in. bar. (0.1 psia)(–100.61 kPa) or a vacuum indicator reads 35 F (1.7 C). Operate the pump an additional 2 hours.

   Do not apply a greater vacuum than 29.82 in. Hg vac (757.4 mm Hg) or go below 33 F (0.56 C) on the wet bulb vacuum indicator. At this temperature/pressure, isolated pockets of moisture can turn into ice. The slow rate of evaporation (sublimation) of ice at these low temperatures/pressures greatly increases dehydration time.
5. Valve off the vacuum pump, stop the pump, and record the instrument reading.
6. After a 2-hour wait, take another instrument reading. If the reading has not changed, dehydration is complete. If the reading indicates a vacuum loss, repeat Steps 4 and 5.
7. If the reading continues to change after several attempts, perform a leak test up to the maximum 180 psig (1241 kPa) pressure. Locate and repair the leak, and repeat dehydration.

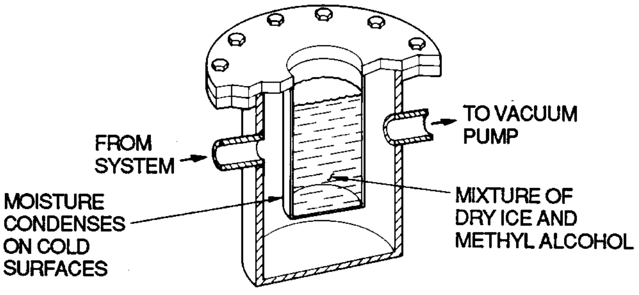


Fig. 26 — Dehydration Cold Trap

Inspect Water Piping — Refer to the piping diagrams provided in the certified drawings and the piping instructions in the 17EX Installation Instructions manual. Inspect the piping to the cooler and condenser. Be sure that flow directions are correct and that all piping specifications have been met.

Piping systems must be properly vented, with no stress on the waterbox nozzles and covers. Water flows through the cooler and condenser must meet job requirements. Measure the pressure drop across the cooler and condenser.

⚠ CAUTION

Water must be within design limits, clean, and treated to ensure proper chiller performance and reduce the potential of tube damage due to corrosion, scaling, or erosion. Carrier assumes no responsibility for chiller damage resulting from untreated or improperly treated water.

Check Optional Pumpout Compressor Water Piping — If the optional pumpout system is installed, check to ensure that the pumpout condenser water has been piped in. Check for field-supplied shutoff valves and controls as specified in the job data. Check for refrigerant leaks on field-installed piping.

Check Relief Devices — Be sure that relief devices have been piped to the outdoors in compliance with the latest edition of ANSI/ASHRAE (American National Standards Institute/American Society of Heating, Refrigeration, and Air Conditioning Engineers) Standard 15 and applicable local safety codes. Piping connections must allow for access to the valve mechanism for periodic inspection and leak testing.

Relief valves are set to relieve at the 225 psig (1551 kPa) chiller design pressure.

Inspect Wiring

⚠ WARNING

Do not check voltage supply without proper equipment and precautions. Serious injury may result. Follow power company recommendations.

⚠ CAUTION

Do not apply any kind of test voltage, including to check compressor oil pump even for a rotation check, if the chiller is under a dehydration vacuum. Insulation breakdown and serious damage may result.

1. Examine wiring for conformance to job wiring diagrams and to all applicable electrical codes.
2. Compare the ampere rating on the starter nameplate with the compressor nameplate. The overload trip amps must be 108% to 120% of the rated load amps.
3. The starter for a centrifugal compressor motor must contain the components and terminals required for PIC refrigeration control. Check the certified drawings.
4. Check the voltage to the following components and compare to the nameplate values: compressor and gear oil pump contactors, pumpout compressor starter, and power panel.
5. Be sure that fused disconnects or circuit breakers have been supplied for the compressor and gear oil pumps, power panel, and pumpout unit.
6. Check that all electrical equipment and controls are properly grounded in accordance with job drawings, certified drawings, and all applicable electrical codes.
7. Make sure that the customer's contractor has verified the proper operation of the pumps, cooling tower fans, and associated auxiliary equipment. This includes ensuring that motors are properly lubricated, have proper electrical supply, and have proper rotation.
8. Tighten all wiring connections to the plugs on the SMM, 8-input, and PSIO modules.
9. Ensure that the voltage selector switch inside the power panel is switched to the incoming voltage rating, 115 v. The 230 v alternative is not used.
10. On chillers with free-standing starters, inspect the power panel to ensure that the contractor has fed the wires into the bottom of the panel. Wiring into the top of the panel can cause debris to fall into the contactors. Clean and inspect the contactors if this has occurred.

⚠ WARNING

Voltage to terminals LL1 and LL2 comes from a control transformer in a starter built to Carrier specifications. Do not connect an outside source of control power to the compressor motor starter (terminals LL1 and LL2). 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.

CHECK INSULATION RESISTANCE — Before applying operating voltage to the motor, whether for checking rotation direction or for actual operation, measure the resistance of the stator winding insulation.

The test voltage, based on the motor operating voltage, is as follows:

Operating Voltage	DC Test Voltage
0- 900	500
901- 7000	1000
7001-14500	2500

This is particularly important if the motor may have been exposed to excessive dampness either during transit or while in storage. A ''megger'' type instrument can be used to measure the insulation resistance. The test voltage should be applied between the entire winding (all winding leads connected together) and ground for approximately one minute with the winding at ambient temperature. The recommended minimum insulation resistance is determined as follows:

RM = KV + 1

Where

RM = Recommended minimum insulation resistance in megohms at 104° F (40° C) of the entire winding.

KV = Rated motor terminal to terminal voltage in kilovolts (1000 volts = 1 KV).

On a new winding, where the contaminant-causing low insulation resistance is generally moisture, drying the winding through the proper application of heat normally increases the insulation resistance to an acceptable level. The following methods are acceptable for applying heat to a winding:

1. If the motor is equipped with space heaters, energize the heaters to heat the winding.

2. Direct current (as from a welder) can be passed through the winding. The total current should not exceed approximately 50% of the rated full load current. If the motor has only 3 leads, 2 must be connected together to form one circuit through the winding. In this case, one phase carries the full applied current and each of the others carries half of the applied current. If the motor has 6 leads (3 mains and 3 neutrals), the 3 phases should be connected into one series circuit.
3. Heated air can be blown either directly into the motor or into a temporary enclosure surrounding the motor. The source of heated air should preferably be electrical vs. fueled (such as kerosene), since a malfunction of the fuel burner could result in carbon entering the motor. Exercise caution when heating the motor with any source of heat other than self-contained space heaters. Raise the winding temperature at a gradual rate to allow any entrapped moisture to vaporize and escape without rupturing the insulation. The entire heating cycle should extend over 15 to 20 hours.

Insulation resistance measurements can be made while the winding is being heated. However, they must be corrected to 104 F (40 C) for evaluation since the actual insulation resistance decreases with increasing temperature. For a new winding, the insulation resistance approximately halves for each 18° F (10° C) increase in insulation temperature above the dew point.

Motor Pre-Start Checks — To prevent damage to the motor, the following steps must be taken before initial start-up:

1. Remove the shaft shipping brace (if supplied).
2. For sleeve bearing motors, the oil reservoir must be filled with oil to the correct level. Use a rust and oxidation inhibited, turbine grade oil. The viscosity of the oil must be 32 ISO (150 SSU) at 100 F (37.7 C). Oil capacity in each of the two bearings is 0.6 gal. (2.3 L) per bearing. Use of Carrier Oil Specification PP16-0 is approved, Carrier Part No. PP23BZ091 (Mobil DTE Light or Texaco Regal R+O32).
3. If possible, the shaft should be turned over by hand to ensure that there is free rotation. On sleeve bearing motors, the shaft should be moved to both extremes of its end play while it is being rotated, and the oil rings should be viewed through the viewing ports in the top of the bearing housing to verify free ring rotation.
4. On fan-cooled motors, the area around the external fan inlet should be checked for loose debris that could be drawn into the fan during operation.
5. All external, factory-made, bolted joints should be checked for any looseness that may have occurred in transit. Refer to Table 6 for recommended bolt torques.

Table 6 — Recommended Motor Fastener Tightening Torques

	Bolt size	¼″	5⁄16″	⅜″	½″	⅝″	¾″	⅞″	1″	1⅓″	1½″
	Grade	SAE GR 5									
Torque*	Ft-lbs	3.5	7	12	31	63	115	180	275	550	960
	N·m	4.7	9.5	16	42	85	156	244	373	746	1302

	Bolt size	M4	M6	M8	M10	M12	M10	M12	M16
	Grade	DIN 8.8					DIN 12.9		
Torque*	Ft-lbs	2	8	15	35	65	45	92	225
	N·m	2.7	11	20	47	88	61	125	305

*Torque values based upon dry friction.

External Gear Pre-Start Checks

⚠ CAUTION

There are 2 service valves on the external gear oil lines. See Fig. 27. Open both valves before starting the chiller.

⚠ CAUTION

External gears are shipped without oil. Before start-up, the gear must be filled with the proper type and amount of oil.

Before starting the external gear, check for any signs of mechanical damage, such as damaged piping or accessories. Then, follow the procedures listed below.

1. Fill the gear and auxiliary sump (if applicable) with oil to the level indicated next to the sight glass. Fill the gear to the proper level as follows. Make sure all external piping, gear oil cooler, and pumps are filled before confirming the final oil level. Fill to the oil level indicated next to the glass sight gage.

   Add oil through the gear inspection cover. The inspection cover must be removed in order to add oil. Take care to seal the cover when it is replaced.

   ⚠ CAUTION

   Never attempt to add or replace oil while the external gear is running unless a vertical sight glass is in use and the running oil level has been established and marked on the sight glass. Do not fill beyond the indicated oil level. Excess lubrication increases the churning effect and may result in overheating and subsequent thinning of oil and possible damage to the rotating components.

2. The viscosity of the oil must be 68 ISO. Use of Carrier oil, specification PP16-2 is approved (Mobil DTE Heavy Medium or Texaco Regal UR & 068; Carrier Part No. PP23BB005).
3. Check that all electrical connections have been made and are in working order. Check that all accessories are properly mounted.
4. Turn the gear shafts by hand with a spanner wrench to confirm that there are no obstructions to rotation.
5. Check that all couplings are properly aligned, mounted, and keyed on the shaft extension.
6. Check that the inspection cover is securely fastened. See Table 7 for recommended torque values.
7. For units operating in cold ambient temperatures, optional heaters must be turned on and the oil temperature must be allowed to rise to at least 60 F (16 C) before start-up.
8. Start the chiller under as light a load as possible. Check for oil leaks, unusual sounds, excessive vibration, and excessive heat. If an operating problem develops, shut down immediately and correct the problem before restarting.

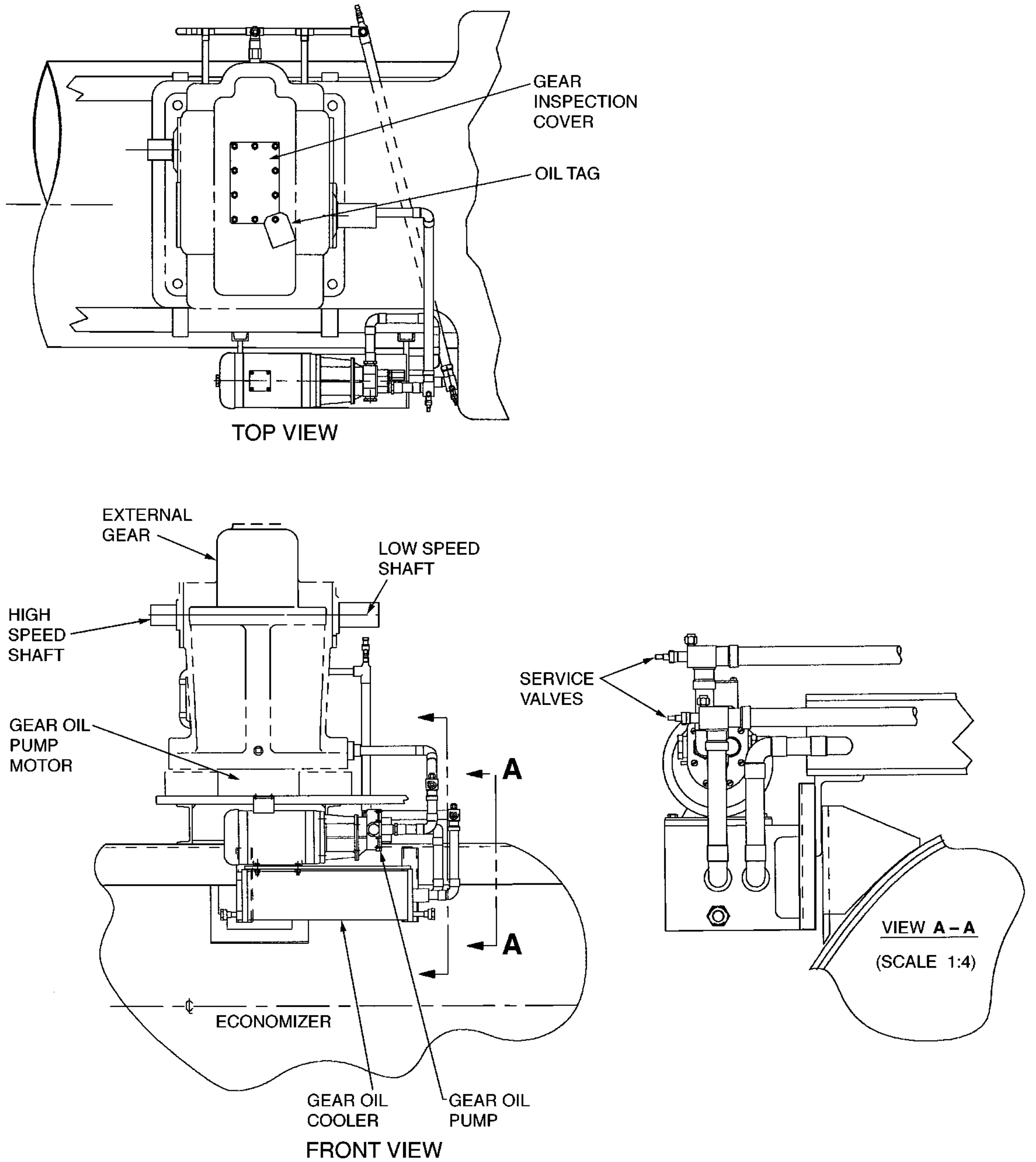


Fig. 27 — External Gear Lubrication System

Table 7 — Recommended Compressor and External Gear Fastener Tightening Torques

FASTENER DIAMETER (in.)	TORQUE* Lb.-Ft. (N·m)	
UNC	Minimum	Maximum
1⁄4	7 (9.5)	9 (12.2)
5⁄16	14 (19.0)	17 (23.1)
3⁄8	25 (33.9)	31 (42.0)
7⁄16	40 (54.2)	50 (67.8)
1⁄2	60 (81.4)	75 (101.7)
9⁄16	87 (118.0)	108 (137.0)
5⁄8	120 (162.7)	150 (203.4)
3⁄4	213 (288.8)	266 (360.7)
7⁄8	343 (465.1)	429 (581.7)
1	515 (698.3)	643 (871.9)
1 1⁄8	635 (861.1)	793 (1075.3)
1 1⁄4	896 (1215.0)	1120 (1518.7)
1 3⁄8	1175 (1593.3)	1468 (1990.6)
1 1⁄2	1560 (2115.4)	1950 (2644.2)
1 3⁄4	1828 (2478.8)	2286 (3099.8)
2	2750 (3729.0)	3437 (4660.6)
2 1⁄4	4022 (5453.8)	5027 (6816.6)
2 1⁄2	5500 (7458.6)	6875 (9322.5)
2 3⁄4	7456 (10,110.3)	9323 (12,642.0)

*Dry fastener.

NOTE: The torque values listed are to be used for end covers, seal cages, shaft guards, inspection covers, and housing split line bolts, unless otherwise specified on the drawing or assembly instructions.

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 signal ground pins.

To attach the CCN communication bus wiring, refer to the certified drawings and wiring diagrams. The wire is inserted into the CCN communications plug (COMM1) on the PSIO module. This plug also is referred to as J5.

NOTE: Conductors and drain wire must be 20 AWG (American Wire Gage) minimum stranded, tinned copper. Individual conductors must be insulated with PVC, PVC/nylon, vinyl, Teflon, 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 –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	PSIO MODULE COMM 1 PLUG (J5) PIN NO.
+	RED	1
Ground	WHITE	2
–	BLACK	3

Check Starter

⚠ CAUTION

BE AWARE that certain automatic start arrangements *can engage the starter*. Open the disconnect *ahead* of the starter in addition to shutting off the chiller and pump.

Use the instruction and service manual supplied by the starter manufacturer to verify that the starter has been installed correctly.

⚠ CAUTION

The main disconnect on the starter front panel may not deenergize all internal circuits. Open all internal and remote disconnects before servicing the starter.

Whenever a starter safety trip device activates, wait at least 30 seconds before resetting the safety. The microprocessor maintains its output to the 1CR relay for 10 seconds after starter safety shutdown to determine the fault mode of failure.

MECHANICAL STARTERS

1. Check all field wiring connections for tightness, clearance from moving parts, and correct connection.
2. Check the contactor(s) to be sure they move freely. Check the mechanical interlock between contactors to ensure that the 1S and 2M contactors cannot be closed at the same time. Check all other electro-mechanical devices, such as relays and timers, for free movement. If the devices do not move freely, contact the starter manufacturer for replacement components.
3. Some dashpot-type magnetic overload relays must be filled with oil at the jobsite. If the starter is equipped with devices of this type, remove the fluid cups from these magnetic overload relays. Add dashpot oil to the cups per instructions supplied with the starter. The oil is usually shipped in a small container attached to the starter frame near the relays. Use only dashpot oil supplied with the starter. Do not substitute.

   Factory-filled dashpot overload relays need no oil at start-up, and solid-state overload relays do not have oil.
4. Reapply starter control power *(not main chiller power*) to check the electrical functions. When using a reduced-voltage starter (such as a wye-delta starter) check the transition timer for proper setting. The factory setting is 30 seconds (±5 seconds), timed closing. The timer is adjustable in a range between 0 and 60 seconds, and settings other than the nominal 30 seconds may be chosen as needed (typically 20 to 30 seconds).

   When the timer has been set, check that the starter (with relay 1CR closed) goes through a complete and proper start cycle.

SOLID-STATE STARTERS

⚠ WARNING

The solid-state starter is at line voltage when AC power is connected. Pressing the Stop button does not remove voltage. Use caution when adjusting the potentiometers on the equipment.

1. Check that all wiring connections are properly terminated to the starter.
2. Verify that the ground wire to the starter is installed properly and is of sufficient size.
3. Verify that the motors are properly grounded to the starter.
4. Check that all the relays are properly seated in their sockets.
5. Verify that the proper AC input voltage is brought into the starter per the certified drawings.
6. Verify that the initial factory settings (i.e., starting torque, ramp potentiometers, etc.) are set per the manufacturer's instructions.

Compressor Oil Charge — If oil is added, it must meet Carrier's specification for centrifugal compressor use as described in the Scheduled Maintenance, Oil Specifications section (page 77).

Oil may be added through the compressor oil drain and charging valve (Fig. 2, Item 22) using a pump. The pump must be able to lift from 0 to 150 psig (0 to 1034 kPa), or above chiller pressure. However, an oil charging elbow on the seal-oil return chamber (Fig. 4, Item 3) allows oil to be added without pumping. The seal oil return pump automatically transfers the oil to the main oil reservoir.

Oil should only be charged or removed when the chiller is shut down. Maximum oil level is the middle of the upper sight glass.

Power Up the Controls and Check the Compressor Oil Heater — Be sure that an oil level is visible in the compressor before energizing the controls. A separate disconnect energizes the oil heater and the control circuit. When first powered, the LID should display the default screen within a short period of time.

The oil heater is energized by powering the control circuit. This should be done several hours before start-up to minimize oil-refrigerant dilution. The oil heater is controlled by the PIC and is powered through a contactor in the power panel. Starters contain a separate circuit breaker to power the heater and the control circuit. This arrangement allows the heater to energize when the main motor circuit breaker is off for service work or extended shutdowns. The oil heater relay status can be viewed on the STATUS02 screen on the LID. Oil sump temperature can be viewed on the LID default screen.

SOFTWARE VERSION — The software version is always labeled on the PSIO module and on the back side of the LID module. The software number also appears on both the CONTROLLER IDENTIFICATION and LID CONFIGURATION tables. See Fig. 15.

Set Up Chiller Control Configuration

⚠ WARNING

Do not operate the chiller before the control configurations have been checked and a Control Test has been satisfactorily completed. Protection by safety controls cannot be assumed until all control configurations have been confirmed.

As you configure the 17EX chiller, write down all configuration settings. A log, such as the one shown on pages CL-1 to CL-12, is a convenient way to list configuration values.

Input the Design Set Points — To modify the set points, access the SETPOINT menu. (Press the MENU and SETPOINT softkeys.) From this menu, you can modify the base demand limit and the leaving chilled water, entering chilled water, and ice build set points. See Fig. 15 for the SETPOINT menu structure.

The PIC can control a set point according to ether the leaving or entering chilled water temperature. To change the type of control, access the CONFIG screen. Scroll down to highlight *ECW CONTROL OPTION*. To control the set point according to the leaving chilled water, press the DISABLE softkey; to control the set point according to the entering chilled water, press the ENABLE softkey.

Input the Local Occupied Schedule (OCCPC01S) — To set up the occupied time schedule according to the site requirements, access the SCHEDULE screen on the LID. (Press the MENU and SCHEDULE softkeys.) The default, factory-set schedule is 24 hours, occupied 7 days per week including holidays. For more information about how to set up a time schedule, see the Controls section, page 11.

If the ice build option is being used, configure the ice build schedule (OCCPC02S).

If a CCN system is being installed or if a secondary time schedule is required, configure the CCN occupancy schedule (OCCPC03S to OCCPC99S). This task is normally done using a CCN Building Supervisor terminal, but it can also be done at the LID. For more information on CCN functions, see 17EX CCN supplement. Also, in this manual, see the section on Occupancy Schedule, page 32.

Input Service Configurations — The following configurations are done from the SERVICE menu:

- password
- input time and date
- LID configuration
- controller identification
- service parameters
- equipment configuration
- automated control test

PASSWORD — You must enter a password whenever you access the SERVICE screens. The default, factory-set password is 1 - 1 - 1 - 1. The password may be changed from the LID CONFIGURATION screen. To change the password:

1. Press the MENU and SERVICE softkeys. Enter your password and highlight LID CONFIGURATION. Press the SELECT softkey. Only the last 5 entries on the LID CONFIGURATION screen can be changed: *BUS #, ADDRESS #, BAUD RATE, US IMP/METRIC*, and *PASSWORD*.
2. Use the ENTER softkey to scroll to *PASSWORD*. The first digit of the password is highlighted on the LID screen.
3. To change the digit, press the INCREASE or DECREASE softkey. When you see the digit you want, press the ENTER softkey.
4. The next digit is highlighted. Change it and the third and fourth digits in the same way you changed the first.

5. After the last digit is changed, the LID goes to the *BUS #* parameter. Press the EXIT softkey to leave the screen, record your password change, and return to the SERVICE menu.

⚠ CAUTION

BE SURE TO REMEMBER YOUR PASSWORD. Retain a copy of the password for future reference. If you forget your password, you will not be able to access the SERVICE menu unless you install and download a new PSIO module.

INPUT TIME AND DATE — Access the Time and Date table on the SERVICE menu. Input the present time of day, date, and day of the week. *HOLIDAY TODAY* should only be configured to YES if the present day is a holiday.

CHANGE THE LID CONFIGURATION IF NECESSARY — From the LID CONFIGURATION screen, the LID CCN address, units (English or SI), and password can be changed. If there is more than one chiller at the jobsite, change the LID address on each chiller so that each chiller has its own address. Note and record the new address. Change the screen to SI units as required, and change the password if desired.

<u>To Change the LID Display From English to Metric Units</u> — By default, the LID displays information in English units. To change to metric units:

1. Press the MENU and SERVICE softkeys. Enter your password and highlight LID CONFIGURATION. Press the SELECT softkey.
2. Use the ENTER softkey to scroll to *US IMP/METRIC*.
3. Press the softkeys that correspond to the units you want displayed on the LID (e.g., US or METRIC).

MODIFY CONTROLLER IDENTIFICATION IF NECESSARY — The PSIO module address can be changed from the CONTROLLER IDENTIFICATION screen. If there is more than one chiller at the site, change the controller address for each chiller. Write the new address on the PSIO module for future reference.

INPUT EQUIPMENT SERVICE PARAMETERS IF NECESSARY — The EQUIPMENT SERVICE table has 3 screens: SERVICE1, SERVICE2, and SERVICE3.

<u>Configure SERVICE1 Table</u> — Access the SERVICE1 table to modify or view the following:

Chilled Medium	Water or Brine?
Brine Refrigerant Trippoint	Usually 3° F (1.7° C) below design refrigerant temperature
Surge Limiting or Hot Gas Bypass Option	Is HGBP installed?
Minimum Load Points (T1/P1)	Per job data — See Modify Load Points section
Full Load Points (T2/P2)	Per job data — See Modify Load Points section
Motor Rated Load Amps	Per job data
Motor Rated Line Voltage	Per job data
Motor Rated Line kW	Per job data (if kW meter installed)
Line Frequency	50 or 60 Hz
Compressor Starter Type	Reduced voltage or full?
Stop-to-Start Timer	Follow motor vendor recommendation for time between starts. See certified prints for correct value.

NOTE: Other values are left at the default values. These may be changed by the operator as required. SERVICE2 and SERVICE3 tables can be modified by the owner/operator as required.

<u>Modify Minimum and Maximum Load Points (ΔT1/P1; Δ T2/P2) If Necessary</u> —These pairs of chiller load points, located on the SERVICE1 table, determine when to limit guide vane travel or to open the hot gas bypass valve when surge prevention is needed. These points should be set based on individual chiller operating conditions.

If, after configuring a value for these points, surge prevention is operating too soon or too late for conditions, these parameters should be changed by the operator.

Example of configuration:

Chiller operating parameters:
Refrigerant used: HFC-134a

Estimated Minimum Load Conditions:

44 F (6.7 C) LCW
45.5 F (7.5 C) ECW
43 F (6.1 C) Suction Temperature
70 F (21.1 C) Condensing Temperature

Estimated Maximum Load Conditions:

44 F (6.7 C) LCW
54 F (12.2 C) ECW
42 F (5.6 C) Suction Temperature
98 F (36.7 C) Condensing Temperature

<u>Calculate Maximum Load</u> — To calculate the maximum load points, use the design load condition data. If the chiller full load cooler temperature difference is more than 15° F (8.3° C), estimate the refrigerant suction and condensing temperatures at this difference. Use the proper saturated pressure and temperature for the particular refrigerant used.

Suction Temperature:
42 F (5.6 C) = 37 psig (255 kPa) saturated refrigerant pressure (HFC-134a)

Condensing Temperature:
98 F (36.7 C) = 120 psig (1827 kPa) saturated refrigerant pressure (HFC-134a)

Maximum Load ΔT2:
54 – 44 = 10° F (12.2 – 6.7 = 5.5° C)

Maximum Load ΔP2:
120 – 37 = 83 psid (827 – 255 = 572 kPad)

To avoid unnecessary surge prevention, add about 10 psid (70 kPad) to ΔP2 from these conditions:

ΔT2 = 10° F (5.5° C)
ΔP2 = 93 psid (642 kPad)

<u>Calculate Minimum Load</u> — To calculate the minimum load conditions, estimate the temperature difference that the cooler will have at 20% load, then estimate what the suction and condensing temperatures will be at this point. Use the proper saturated pressure and temperature for the particular refrigerant used.

Suction Temperature:
43 F (6.1 C) = 38 psig (262 kPa) saturated refrigerant pressure (HFC-134a)

Condensing Temperature:
70 F (21.1 C) = 71 psig (490 kPa) saturated refrigerant pressure (HFC-134a)

Minimum Load ΔT1 (at 20% Load):
2° F (1.1° C)

Minimum Load ΔP1:
71 – 38 = 33 psid (490 – 262 = 228 kPad)

Again, to avoid unnecessary surge prevention, add 20 psid (140 kPad) at ΔP1 from these conditions:

ΔT1 = 2° F (1.1° C)
ΔP1 = 53 psid (368 kPad)

If surge prevention occurs too soon or too late, make the following adjustments:

LOAD	SURGE PREVENTION OCCURS TOO SOON	SURGE PREVENTION OCCURS TOO LATE
At low loads (<50%)	Increase P1 by 10 psid (70 kPad)	Decrease P1 by 10 psid (70 kPad)
At high loads (>50%)	Increase P2 by 10 psid (70 kPad)	Decrease P2 by 10 psid (70 kPad)

MODIFY EQUIPMENT CONFIGURATION IF NECESSARY — The EQUIPMENT CONFIGURATION table has a number of screens to select, view, and/or modify. See Fig. 16 for the menu structure of this table. Carrier provides certified drawings that have the configuration values required for specific jobsites. Modify these values only if requested.

CONFIG Screen Modifications — Change the values on this screen according to your job data. See certified drawings for the correct values. Modifications can include:

- chilled water reset
- entering chilled water control (Enable/Disable)
- 4 to 20 mA demand limit
- auto. restart option (Enable/Disable)
- remote contact option (Enable/Disable)

LEAD/LAG Screen Modifications — Change the values on this screen according to your job data. See certified drawings for specific values. Modifications can include:

- lead/lag selection
- load balance option
- common sensor option
- lag start/stop timers
- standby chiller option

Owner-Modified CCN Tables— The following tables are described for reference only. For detailed information on CCN operations, consult the CCN supplement for your chiller.

- OCCDEFCS Screen Modifications — This table contains the local and CCN time schedules, which can be modified here, or on the SCHEDULE screen as described previously.
- HOLIDEF Screen Modifications — This table configures the days of the year that holidays are in effect. See the holiday paragraphs in the Controls section for more details.
- BRODEF Screen Modifications — This table defines the outside-air temperature sensor and humidity sensor if one is to be installed. It also defines the start and end of daylight savings time. Enter the dates for the start and end of daylight savings, if required for your location. BRODEF also activates the Broadcast function, which enables the holiday periods defined on the LID to take effect.
- Other Tables — The ALARMDEF, CONS-DEF, RUNTDEF, and WSMALMDF screens contain information for use with a CCN system. See the applicable CCN manual for more information on these screens. These screens can only be changed from a CCN Building Supervisor terminal.

CHECK VOLTAGE SUPPLY — Access the STATUS 01 screen and read the *LINE VOLTAGE: ACTUAL* value. This reading should be equal to the incoming power to the starter. Use a voltmeter to check incoming power at the starter power leads. If the readings are not equal, an adjustment can be made by selecting the *LINE VOLTAGE: ACTUAL* parameter and then increasing or decreasing the value so that the value appearing on the LID is calibrated to match the incoming power voltage reading. Voltage can be calibrated only between 90 and 100% of the rated line voltage.

PERFORM AN AUTOMATED CONTROL TEST — Check the safety controls status by performing an automated controls test. Access the CONTROL TEST table from the SERVICE menu. This table has the following screens:

Automated Test	As described above, a complete control test.
PSIO Thermistors	Checks all PSIO thermistors only.
Options Thermistors	Checks all options board thermistors.
Transducers	Checks all transducers.
Guide Vane Actuator	Checks the guide vane operation.
Pumps	Checks operation of pump output; either all pumps can be activated or individual pumps. Also tests the associated input such as flow or pressure.
Discrete Outputs	Activates all on/off outputs, all at once or individually.
Pumpdown/Lockout	Pumpdown prevents the low refrigerant alarm during evacuation so refrigerant can be removed from the unit, locks the compressor off. and starts the water pumps.
Terminate Lockout	Charges refrigerant and enables the chiller to run after pumpdown lockout.
FX Gear Oil Pump I/O	Activates external gear main oil pump and auxiliary oil pump (if supplied).

Automated Test — Before running this test, be sure that the compressor is in the OFF mode and the 24-v input to the SMM is in range (per line voltage percent on STATUS01 screen). Put the compressor in OFF mode by pressing the STOP pushbutton on the LID.

The automated test starts with a check of the PSIO thermistors and proceeds through the rest of the tests listed in the table below. The test not only checks readings, such as temperature and pressure readings, but also lets the operator know if certain devices, such as pumps or relays, are on or off and if all outputs and inputs are functioning. It also sets the refrigerant type.

As each test is executed, the LID display shows which test is running as well as other pertinent data. At the end of each test, the LID displays, OK TO CONTINUE? If a test indicates a problem, error, or device malfunction, the operator can choose to address the problem as the test is being done or note the problem and proceed to the next test.

NOTE: If during the control test the guide vanes do not open, check to see that the low pressure alarm is not active. (This causes the guide vanes to close.)

NOTE: The oil pump test will not energize the oil pump if cooler pressure is below –5 psig (–35 kPa).

When the test is finished, or the EXIT softkey is pressed, the test stops and the CONTROL TEST menu is displayed. If a specific automated test procedure is not completed, access that test by scrolling to it and selecting it to test the function when ready. The CONTROL TEST menu is described in more detail in Table 8.

Check Pumpout System Controls and Optional Pumpout Compressor — The pumpout system controls include an on/off switch, a 3-amp fuse, the compressor overloads, an internal thermostat, a compressor contactor, and a refrigerant high pressure cutout. The high pressure cutout is factory set to open at 161 psig (1110 kPa) and reset at 130 psig (896 kPa). Check that the water-cooled condenser has been connected. Loosen the compressor holddown bolts to allow free spring travel. Open the compressor suction and discharge service valves. Check that oil is visible in the compressor sight glass. Add oil if necessary.

Table 8 — Control Test Menu Functions

TESTS TO BE PERFORMED	DEVICES TESTED
1. **Automated Tests***	Operates the second through seventh tests
2. **PSIO Thermistors**	Entering chilled water Leaving chilled water Entering condenser water Leaving condenser water Discharge temperature Bearing temperature Motor winding temperature Oil sump temperature
3. **Options Thermistors**	Common chilled water supply sensor Common chilled water return sensor Remote reset sensor Temperature sensor — Spare 1 Spare 2 Spare 3 Spare 4 Spare 5 Spare 6 Spare 7 Spare 8 Spare 9
4. **Transducers**	Evaporator pressure Condenser pressure Oil pressure differential†
5. **Guide Vane Actuator**	Open Close
6. **Pumps**	All pumps or individual pumps may be activated: Oil pump — Confirm pressure Chilled water pump — Confirm flow Condenser water pump — Confirm flow Auxiliary oil pump — confirm pressure†
7. **Discrete Outputs**	All outputs or individual outputs may be energized: Hot gas bypass relay Oil heater relay Motor cooling relay Tower fan relay Alarm relay Shunt trip relay
8. **Pumpdown/Lockout**	When using pumpdown/lockout, observe freeze up precautions when removing charge. Instructs operator as to which valves to close and when. Starts chilled water and condenser water pumps and confirms flows. Monitors — Evaporator pressure Condenser pressure Evaporator temperature during pumpout procedures Turns pumps off after pumpdown. Locks out compressor.
9. **Terminate Lockout**	Starts pumps and monitors flows. Instructs operator as to which valves to open and when. Monitors — Evaporator pressure Condenser pressure Evaporator temperature during charging process Terminates compressor lockout.
10. **FX Gear Oil Pump I/O**	Activates gear main oil pump; confirms pressure. Activates optional gear auxiliary pump; confirms pressure.

*During any of the tests that are not automated, an out-of-range reading will have an asterisk (*) next to the reading and a message will be displayed.
†On open-drive chillers, differential pressure is the only oil pressure displayed.

See the Pumpout and Refrigerant Transfer Procedures (page 63) and Pumpout System Maintenance sections (page 83) for details on transferring refrigerant, oil specifications, etc.

High Altitude Locations — Because the chiller is initially calibrated at sea level, it is necessary to recalibrate the pressure transducers if the chiller is to be operated at a high altitude location. Please see the calibration procedure in the Troubleshooting Guide section.

Charge Refrigerant into Chiller

⚠ CAUTION

The transfer, addition, or removal of refrigerant in spring isolated chillers may place severe stress on external piping if springs have not been blocked in both up and down directions.

The 17EX chiller may have the refrigerant already charged in the economizer/storage vessels. If chiller is not shipped fully charged, refrigerant is shipped separately to conform with transportation regulations. The 17EX may be ordered with a nitrogen holding charge of 15 psig (103 kPa). Evacuate the entire chiller, and charge chiller from refrigerant cylinders.

The full refrigerant charge on the 17EX will vary with chiller components and design conditions as indicated on the job data specifications. An approximate charge may be found in Physical Data and Wiring Schematics section, page 99. The full chiller charge is printed on the chiller identification label.

⚠ WARNING

Always operate the condenser and chilled water pumps during charging operations to prevent water in heat exchanger tubes from freezing.

Use the CONTROLS TEST terminate lockout function to monitor conditions and start the pumps.

If the chiller has been shipped with a holding charge, add refrigerant through the refrigerant charging valve (Fig. 6) or to the pumpout charging connection. First evacuate the nitrogen holding charge from the vessels. Charge the refrigerant as a gas until the system pressure exceeds 35 psig (141 kPa). After the chiller is beyond this pressure, the refrigerant should be charged as a liquid until all the recommended refrigerant charge has been added.

TRIMMING REFRIGERANT CHARGE — The 17EX is shipped with the correct charge for the design duty of the chiller. Trimming the charge can best be accomplished when the chiller is operating at design load. To trim, check the temperature difference between the leaving chilled water temperature and the cooler refrigerant temperature at full load design conditions. If necessary, add or remove refrigerant to bring the temperature difference to design conditions or a minimum differential.

INITIAL START-UP

Preparation — Before starting the chiller, check that the:

1. Power is on to the main starter, oil pump relay (which energizes both the compressor and gear oil pumps), tower fan starter, oil heater relay, and the chiller control center.
2. Cooling tower water is at proper level and at or below design entering temperature.

3. Chiller is charged with refrigerant and all refrigerant and all oil valves are in their proper operating position.
4. Gear oil, compressor oil, and motor bearing oil are at the proper levels in the reservoir sight glasses.
5. Compressor oil reservoir temperature is above 140 F (60 C) or refrigerant temperature plus 50° F (28° C).
6. Valves in the evaporator and condenser water circuits are open.

   NOTE: If the water pumps are not automatic, make sure water is circulating properly.
7. Check the starter to be sure it is ready to start and that all safety circuits have been reset. Be sure to keep the starter door closed.

⚠ WARNING

Do not permit water or brine that is warmer than 110 F (43 C) to flow through the cooler or condenser. Refrigerant overpressure may discharge through the relief devices and result in the loss of refrigerant charge.

8. To prevent accidental start-ups, the *CHILLER START/STOP* parameter is set to STOP at the factory. Access the STATUS01 screen and scroll to the *CHILLER START/STOP* parameter. Press the RELEASE softkey to enable the chiller to start.

Manual Operation of the Guide Vanes — Manual operation of the guide vanes helps to establish a steady motor current when calibrating the motor amps value.

To manually operate the guide vanes, override the target guide vane position (*TARGET GUIDE VANE POS* parameter on the STATUS01 screen). Manual control is also indicated on the default screen on the run status line.

1. Access the STATUS01 screen and look at the *TARGET GUIDE VANE POS* parameter. (Refer to Fig. 13). If the compressor is off, the value reads zero.
2. Move the highlight bar to the *TARGET GUIDE VANE POS* parameter and press the SELECT softkey.
3. Press ENTER to override the automatic target. The screen reads a value of zero. The word SUPVSR! flashes to indicate that manual control is in effect. The default screen also indicates that the guide vanes are in manual control.
4. To return the guide vanes to automatic mode, press the SELECT softkey; then press the RELEASE softkey. After a few seconds, the word SUPVSR! disappears.

Dry Run to Test Start-Up Sequence

1. Disengage the main motor disconnect on the starter front panel. This should only disconnect the motor power. Power to the controls, oil pumps, and starter control circuit should still be energized.
2. Look at the default screen on the LID. The status message in the upper left corner should read, MANUALLY STOPPED. Press the CCN or LOCAL softkey to start. If MANUALLY STOPPED is not on the default screen access the SCHEDULE screen and override the schedule or change the occupied time. Then, press the LOCAL softkey to begin the start-up sequence.
3. Check that the chilled water and condenser water pumps have energized.
4. Check that the oil pumps have started and have pressurized the lubrication system. After the oil pumps have run about 15 seconds, the starter energizes and goes through its start-up sequence.
5. Check the main contactor for proper operation.
6. The PIC will activate an alarm for motor amps not sensed. Reset this alarm and continue with the initial start-up.

Check Motor Rotation

INITIAL MOTOR START-UP

Initial Uncoupled Start-Up — The initial start-up of the motor should be made with the motor uncoupled. Verify that oil has been added to each bearing housing to the correct level.

1. If the motor is equipped with unidirectional fans (refer to the certified drawing) and verification of rotation direction is required, do the following:
   a. Start the motor and observe the rotation direction. See Fig. 28.
   b. Allow the motor to achieve full speed before disconnecting it from the power source.
   c. If the rotation direction must be changed, refer to the Before Initial Start-Up, Motor Electrical Connection section, page 45. Otherwise, the motor can be restarted immediately after it has coasted to a stop.

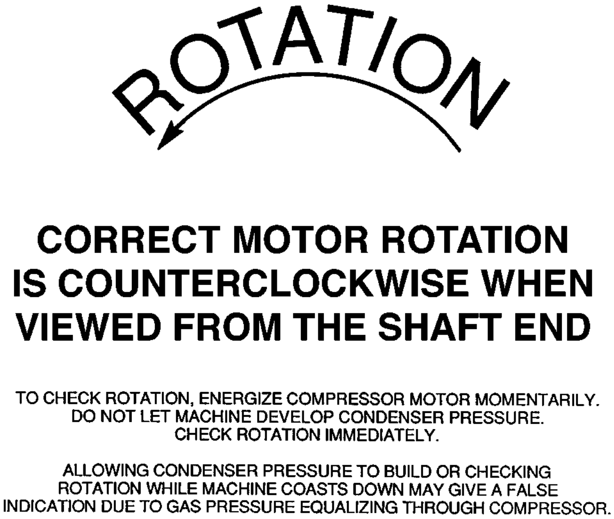


Fig. 28 — Correct Motor Rotation

2. After the initial start-up, monitor the bearing temperatures closely. Verify the free rotation of the oil rings on the sleeve bearings by observing them through the viewing port in the top of the housing. The rate of rise in bearing temperature is more indicative of impending trouble than the actual temperature. If the rate of rise in temperature is excessive or if the motor exhibits excessive vibration or noise, shut it down immediately and conduct a thorough investigation to find the cause before operating the motor again. If the bearing temperatures rise and motor operation appears to be normal, continue operating the motor until the bearing temperatures stabilize.

   The recommended limits on bearing temperature rise over ambient temperature are listed below:

Sleeve Bearing Temperature As Measured By	Temperature Rise Over Ambient Temperature
A permanently installed detector	72° F (40° C)
A temporary detector on top of the bearing sleeve near the oil ring	63° F (35° C)

NOTE: When operating flood-lubricated sleeve bearings, the bearing temperature must not be allowed to exceed 185 F (85 C) total temperature.

⚠ CAUTION

Under normal conditions, for the self-lubricating bearing, the rate of temperature rise should be from 20° to 25° F (11° to 14° C) during the first 10 minutes after starting up and approximately 40° F (22° C) over 30 minutes. The rate of bearing temperature rise is a function of the natural ventilation and operating conditions.

⚠ CAUTION

When the rate of bearing temperature rise is less than 2° F (1.1° C) per half-hour, the bearing temperature is considered to be stabilized.

⚠ CAUTION

If the total bearing temperature exceeds 195 F (91 C), the motor should be shut down immediately.

3. Any abnormal noise or vibration should be immediately investigated and corrected. Increased vibration (with the motor uncoupled from its load) can indicate a change in balance due to a mechanical failure or loose rotor part, a stator winding problem, a foundation problem, or a change in motor alignment.
4. Verify that the magnetic center indicator aligns with the shaft.

Initial Coupled Start-Up — After initial uncoupled start-up, take the following steps to ensure safe coupled operation:

1. Follow the procedure stated in the General Maintenance, Chiller Alignment section to align the motor to the driven chiller.
2. Prepare the coupling for operation according to the Disc Coupling Installation and Alignment instructions, this page. Note any match marks on the couplings and assemble accordingly. For sleeve bearing motors, verify that the correct limited end float coupling has been installed. The end float limits can be found on the certified drawing.
3. Ensure that all personnel are at a safe distance from rotating parts. Start the motor in accordance with instructions supplied with the motor control.
4. If the motor rotor fails to start turning in a second or two, shut off the power supply immediately. This can result from:
   a. too low a voltage at the motor terminals
   b. the load is too much for the rotor to accelerate
   c. the load is frozen up mechanically
   d. all required electrical connections are not made
   e. single-phase power has been applied
   f. any combination of the above.

   Investigate thoroughly and take corrective action before attempting a restart.
5. Carefully observe the vibration of the bearing housing and any abnormal noise generator. Note that coupled motor vibration may not be the same as uncoupled vibration amounts. If coupled vibration is excessive, recheck the mounting and alignment.
6. Carefully observe the bearing temperature rise and the movement of the oil ring.

   If the bearing temperatures rise and motor operation appears normal, operation should continue until the bearing temperatures stabilize.
7. If possible, check the motor line currents for balance.

Note that each start time an induction motor starts, it is subjected to the full inrush of current along with heating of the stator and rotor windings. Each acceleration and repeated start can produce more heat than is produced and dissipated by the motor under full load. The starting duty for which the motor is designed is shown on a nameplate mounted on the motor. Do not exceed this amount if long motor life is expected.

Abnormally low terminal voltage, excessive load torque, and/or excessive load inertia during motor start-up can cause lengthened acceleration times during which rotor ventilation is reduced. This can cause rotor damage or can lead to shortened rotor life.

The temperature rating of the motor is shown on the main nameplate as a temperature rise above an ambient temperature. If there is a service factor, it is also shown. If the motor temperature switch opens, investigate the situation before attempting to continue operation.

If the motor is a TEWAC (Totally Enclosed Water-to-Air Cooled) design, the maximum inlet water temperature and the water flow rate or gpm (gallons per minute) at the air cooler must be as shown on the certified drawing. Otherwise, the discharge air temperature from the cooler (actually the ambient air for the motor as shown by the main nameplate) could be too high for the motor to properly cool.

Disc Coupling Installation and Alignment — Before installing the disc coupling, inspect it for any signs of damage during shipment. Check that all parts are available, as ordered. Cradle or support the coupling components during handling to avoid damage. Wrap the components for protection. Keep flanges free of nicks and burrs. Read all the instructions and review this procedure before beginning the actual installation. Some steps apply only to certain types of couplings (e.g., high speed coupling).

⚠ WARNING

Use only the bolts and nuts supplied by the coupling manufacturer.

1. Installing the Coupling Hubs (Keyed Mounting).
   a. Check the hub bore and shaft for nicks and burrs; dress if necessary.
   b. For taper bores, check the fit of the bore to the shaft.
   c. Fit keys precisely to the keyways in the shaft and hub. Each key should have a tight fit on the sides with a slight clearance on top. To maintain dynamic balance, the keys should fill the keyways exactly and not be too short or too long.
   d. Clean the hub bore and shaft.
   e. Heat the hub to expand the bore. DO NOT allow the hub temperature to exceed 600 F (300 C). DO NOT apply an open flame to any part of the coupling. Carrier recommends using an oven to heat the hub.

   ⚠ WARNING

   To avoid the risk of explosion, fire, or damage to the coupling and equipment and/or injury to personnel, do not use an open flame or oil bath to expand the hub. If heat is used at anytime for installation, DO NOT ALLOW the hub temperature to exceed 600 F (300 C).

   f. Place the hub in the proper position on the shaft. Hold the hub in place as it cools. For tapered bores, verify the hub advance and install the shaft retaining nut.

2. Offset and Angular Alignment — Reverse dial indication or optical methods of alignment (such as lasers) are recommended. A cold alignment and a hot check (with corrections, if necessary) are required. The hub flange OD can be used to mount the alignment equipment and is machined to be concentric to the coupling bore. It can be used as the reference diameter.
3. Final Assembly — The terminology used to identify parts and the order of assembly may differ from one coupling style to another. Follow the instructions that apply to the coupling you are installing.

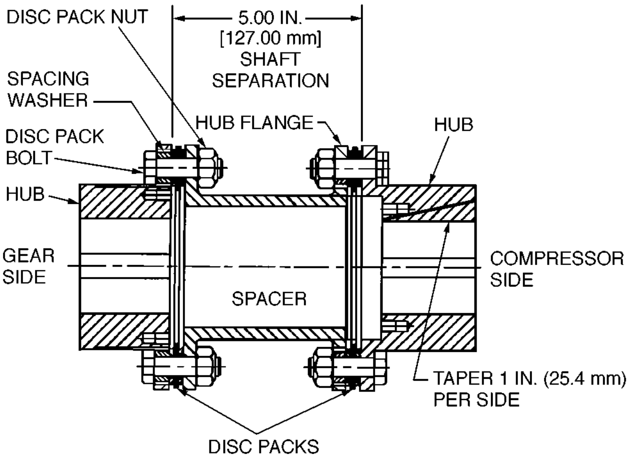
High Speed Coupling (Spacer Style):

a. Place the spacer in position between the hub flanges. Place the disc packs between the flanges on both ends of the coupling.

b. Insert the disc pack bolt into the reamed hole of the hub and through the disc pack bushing. See Fig. 29 (compressor side). The flat of the bolt head acts as a bolt lock with the hub body. Make sure the spacer is properly indexed for the large flange holes to receive the bolt ends. Tap the bolts lightly for full engagement until the heads rest on the hub flange surface. Repeat for the other bolts.

c. Place the spacing washers and disc pack nuts on the bolts. Tighten all nuts evenly and in an alternating fashion to the torque specified in Table 9.

d. Place a spacing washer over a disc pack bolt. Insert the bolt through the large hub flange hole and the disc pack bushing. See Fig. 29 (gear side). Tap the bolts lightly for full engagement. Repeat for the other bolts.



NOTES:
1. Compressor shaft should be in the thrust position and gear shaft should be on geometric center when coupling is positioned as shown.
2. The taper is 1 inch per side for the driven unit bore (compressor side).

Fig. 29 — Typical High Speed Coupling for 17FX Compressor/External Gear (Spacer Style)

Table 9 — Disc Pack Nut Tightening Torques

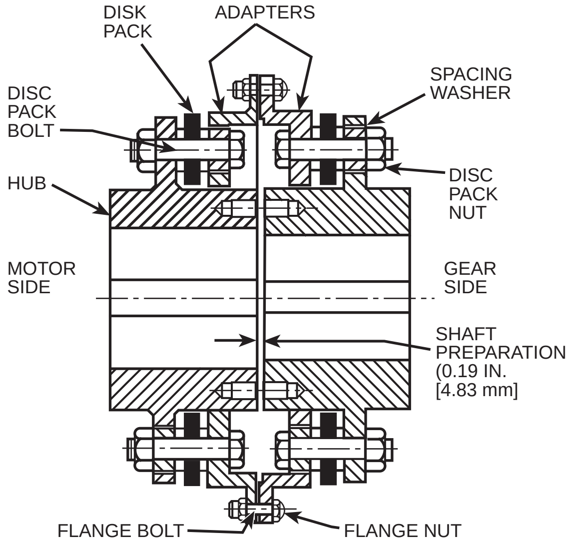
Coupling Size	Nut Size	Tightening ft-lb	Torque (dry) N-m	Tightening ft-lb	Torque (lubed)* N-M
204	1/2-20	55	75	45	60
304	5/8-18	115	155	90	120

*Light machine oil.

e. Place the disc pack nuts on the bolts. Tighten all nuts evenly and in an alternating fashion to the torque specified in Table 9.

Low Speed Coupling (Close-Coupled Style):

a. Place the disc pack and adapter in position over the hub body diameter. The reamed holes in the adapter should be aligned with the large clearance holes in the hub as in the upper portion of Fig. 30. The large clearance holes in the adapter should be aligned with the reamed holes in the hub as shown in the lower portion of Fig. 30.



NOTE: Motor rotor should be positioned on the mechanical center and gear shaft should be on geometric center when coupling is positioned as shown.

Fig. 30 — Typical Low Speed Coupling for 17FX Compressor/External Gear (Close Coupled)

b. Loosely assemble the disc pack bolts, nuts, and spacing washers. Half of the bolts attach the adapter to the disc pack. Refer to Fig. 30. These bolts are interspersed by bolts that attach the disc pack to the hub.

c. Tighten all nuts evenly and in an alternating fashion to the torque specified in Table 9.

d. Bring the driving and driven equipment together until the flanges of the adapters just begin to touch. If there is a gap between the flanges at any point, adjust the axial position of the equipment until the amount of gap is cut in half to minimize the amount of axial misalignment.

e. Rotate the equipment shafts until the flange holes are aligned.

f. Bolt the flanges together using the flange bolts and nuts. See Fig. 30. Tighten all flange nuts evenly and in a alternating fashion to the torque specified in Table 10.

Table 10 — Flange Nut Tightening Torques (Low Speed Couplings Only)

Coupling Size	Nut Size	Tightening ft-lb	Torque (dry) N-m	Tightening ft-lb	Torque (lubed)* N-M
304	5/16-24	20	27	18	24

*Light machine oil.

4. General Recommendations
   a. Both disc couplings are designed to operate for extended periods without the need for lubrication or maintenance. Visual inspection of the disc packs is enough to assess the operational condition of the coupling.
   b. All machinery should be monitored to detect unusual or changing vibration levels. Both couplings, under normal operating conditions, have no wearing parts and retain their original balance quality. Any change in vibration levels should be investigated, and remedial action should be taken immediately.
5. Removal
   a. Disassemble the coupling in the reverse order of the applicable assembly procedure.
   b. Keyed couplings — Install a puller on the hub using the tapped holes provided in the hub face. Pull the hub off the shaft.

IMPORTANT INFORMATION:

⚠ WARNING

Coupling guards protect personnel. ALL COUPLINGS MUST BE COVERED WITH A GUARD ACCORDING TO OSHA (Occupational Safety and Health Administration) REQUIREMENTS. Safety guards are included with this product and must be installed at all times.

1. Recheck alignment after all foundation bolts and mechanical connections are tightened.
2. Make sure all fasteners are properly installed and tightened.
3. Take the time to double check your work.
4. Only authorized disc coupling manufacturer replacement parts are to be used.
5. Call the disc coupling manufacturer for any clarifications or questions.

⚠ CAUTION

The self-locking nuts on the disc pack bolts should be replaced after they have been assembled and removed from the bolts 5 times.

Check Oil Pressure and Compressor Stop

1. When the motor is up to full speed, note the differential compressor oil pressure reading on the LID default screen. It should be between 18 and 30 psid (124 to 206 kPad).
2. Press the Stop button and listen for any unusual sounds from the compressor as it coasts to a stop.

Calibrate Motor Current Demand Setting

1. Make sure that the *MOTOR RATED LOAD AMPS* parameter on the SERVICE1 screen has been configured. Place an ammeter on the line that passes through the motor load current transfer on the motor side of the power factor correction capacitors (if provided).
2. Start the compressor and establish a steady motor current value between 70% and 100% RLA by manually overriding the guide vane target value (*TARGET GUIDE VANE POS* parameter on the STATUS01 screen) and setting the chilled water set point (*WATER/BRINE SETPOINT* on the STATUS01 screen) to a low value. Do not exceed 105% of the nameplate RLA (rated load amps).
3. When a steady motor current value in the desired range is reached, compare the *MOTOR RATED LOAD AMPS* value on the STATUS01 screen to the actual amps shown on the ammeter on the starter. Adjust the amps value on the STATUS01 screen to match the actual value on the starter ammeter, if there is a difference. Highlight the amps value; then, press the [SELECT] softkey. Press the [INCREASE] or [DECREASE] softkey to bring the value to that indicated on the ammeter. Press [ENTER] when the values are equal.
4. Release the target guide vane position to automatic mode. See the section on Manual Operation of the Guide Vanes, page 58, for instructions on how to do this.

To Prevent Accidental Start-Up — The PIC can be configured so that starting the unit is more difficult than just pressing the [LOCAL] or [CCN] softkeys during chiller service or whenever necessary. Access the STATUS01 screen, and highlight the *CHILLER START/STOP* parameter. Override the value by pressing [SELECT] and then the [STOP] and [ENTER] softkeys. The word SUPVSR appears. When attempting to restart the chiller, remember to release the override. Access the STATUS01 screen and highlight *CHILLER START/STOP*. The 3 softkeys represent 3 choices:

- START - forces the chiller ON.
- STOP - forces the chiller OFF
- RELEASE - puts the chiller under remote or schedule control.

To return the chiller to normal control, press the [RELEASE] softkey; then, press the [ENTER] softkey. For additional information, see Local Start-Up, page 43.

The default LID screen message indicates which command is in effect.

Hot Alignment Check — The operating temperatures of various chiller components can affect the alignment of the compressor with the heat exchangers, gear, and driver. When all the chiller components have reached operating temperature (after running at nearly full load for 4 to 8 hours), make a hot alignment check.

Using proper equipment and procedures, make the hot alignment check with either assembled or disassembled couplings. The procedures are detailed in the General Maintenance section, page 67.

A clamping tool, Part No. TS-170, is available for checking alignment without disassembling the couplings. Check with your local Carrier representative.

⚠ WARNING

Never operate the compressor or drive with the coupling guards removed. Serious injury can result from contact with rotating equipment.

Doweling — The size, quantity, and location of dowels vary considerably with type and arrangement of gear and drive. Check your job data for specific doweling instructions. Typical doweling practices are described in the General Maintenance section.

Check Chiller Operating Condition — Check to be sure that chiller temperatures, pressures, water flows, and oil and refrigerant levels indicate that the system is functioning properly.

Instruct the Operator — Check to be sure that the operator(s) understands all operating and maintenance procedures. Point out the various chiller parts and explain their function as part of the complete system.

COOLER-CONDENSER — Relief devices, temperature sensor locations, pressure transducer locations, Schrader fittings, waterboxes and tubes, and vents and drains.

ECONOMIZER/STORAGE VESSEL — Float chambers, relief valves, charging valve.

PUMPOUT SYSTEM — Transfer valves and pumpout system, refrigerant charging and pumpdown procedure, lubrication, and relief devices.

COMPRESSOR ASSEMBLY — Guide vane actuator, transmission, oil cooling system, temperature and pressure sensors, oil sight glasses, integral oil pump, isolatable oil filter, extra oil and motor temperature sensors, synthetic oil, and compressor serviceability.

COMPRESSOR LUBRICATION SYSTEM — Oil pump, cooler filter, oil heater, oil charge and specification, operating and shutdown oil level, temperature and pressure, oil charging connections, and seal oil chambers.

EXTERNAL GEAR LUBRICATION SYSTEM — Oil pump, cooler/filter, oil charge and specification, operating and shutdown oil level, temperature and pressure, and oil charging procedures.

CONTROL SYSTEM — CCN and local start, reset, menu, softkey functions, LID operation, occupancy schedule, set points, safety controls, and auxiliary and optional controls.

AUXILIARY EQUIPMENT — Starters and disconnects, separate electrical sources, pumps, and cooling tower.

CHILLER CYCLES — Refrigerant, motor cooling, lubrication, and oil reclaim cycles.

MAINTENANCE — Scheduled, routine, and extended shutdowns; importance of a log sheet, water treatment, tube cleaning, and maintaining a leak-free chiller.

SAFETY DEVICES AND PROCEDURES — Electrical disconnects, relief device inspection, and handling refrigerant.

CHECK OPERATOR KNOWLEDGE — Start, stop, and shutdown procedures, safety and operating controls, refrigerant and oil charging, and job safety.

THIS MANUAL — Be sure that the operator is familiar with the contents of this manual.

OPERATING INSTRUCTIONS

Operator Duties

1. Become familiar with chiller refrigeration and related equipment before operating the chiller.
2. Prepare the system for start-up, start and stop the chiller, and place the system in a shutdown condition.
3. Maintain a log of operating conditions and document any abnormal readings.
4. Inspect the equipment, make routine adjustments, and perform a controls test. Maintain the proper oil and refrigerant levels.
5. Protect the system from damage during shutdown periods.
6. Maintain the set point, time schedules, and other PIC functions.

Prepare the Chiller for Start-Up — Follow the steps described in the Initial Start-Up section, page 57.

Starting the Chiller

1. Start the water pumps if they are not automatic.
2. On the LID default screen, press the LOCAL or CCN softkey to start the system. If the schedule indicates that the current time and date have been established as a run time and date (a condition referred to as ‘‘occupied’’) and the 3- and 15-minute start timers have expired, the start sequence will start. Follow the procedure described in the Start-Up/Shutdown/Recycle Sequence section, page 43.

Check the Running System — After the compressor starts, monitor the LID display and observe the parameters for normal operating conditions:

1. The oil reservoir temperature should be above 150 F (66 C) or refrigerant temperature plus 70° F (38° C) during shutdown and above 125 F (52 C) during compressor operation.
2. The bearing oil temperature (*BEARING TEMPERATURE* on the STATUS01 screen) should be 150 to 200 F (65 to 93 C). If the bearing oil temperature reads more than 210 F (99 C) with the oil pump running, stop the chiller and determine the cause of the high temperature. *Do not restart* the chiller until corrected.
3. The oil level should be visible in the lower sight glass when the compressor is running. At shutdown, oil level should be halfway in the lower sight glass.
4. The oil pressure should be between 18 and 30 psid (124 to 207 kPad) differential, as seen on the LID default screen. Typically the reading will be 18 to 25 psid (124 to 172 kPad) at initial start-up.
5. The condenser pressure and temperature vary with the chiller design conditions. Typically the pressure ranges between 57 and 135 psig (393 and 930 kPa) with a corresponding temperature range of 60 to 105 F (15 to 41 C) for R-134a. The condenser entering water temperature should be controlled to remain below the specified design entering water temperature to save on compressor kilowatt requirements. The leaving condenser water temperature should be at least 20° F (11° C) above leaving chilled water temperature.
6. Cooler pressure and temperature also vary with the design conditions. Typical cooler pressure ranges between 30 and 40 psig (206 and 275 kPa); temperature ranges between 34 and 45 F (1 and 8 C) for R-134a).
7. The compressor may operate at full capacity for a short time after the pulldown ramping has ended, even though the building load is small. The active electrical demand setting can be overridden to limit the compressor IkW, or the pulldown rate can be decreased to avoid a high demand charge for the short period of high demand operation. Pulldown rate can be based on kW rate (*LOAD PULLDOWN %/MIN*) or temperature rate (TEMP PULLDOWN DEG/MIN) These parameters may be accessed on the CONFIG screen (see Table 2, Example 6).
8. The oil pump is energized once every 12 hours during shutdown periods to ensure that the shaft seal is filled with oil.

Stopping the Chiller

1. The occupancy schedule starts and stops the chiller automatically once the time schedule is set up.
2. Pressing the Stop button on the control panel for one second causes the alarm light to blink once to confirm that the button has been pressed. Then, the compressor follows the normal shutdown sequence as described in the Controls section. The chiller is now in the OFF mode.

   The chiller will not restart until the CCN or LOCAL softkey is pressed.

NOTE: If the chiller fails to stop, in addition to action that the PIC initiates, the operator should close the guide vanes by overriding the guide vane target to zero (to reduce chiller load) and then by opening the main disconnect. Do not attempt to stop the chiller by opening an isolating knife switch. High intensity arcing may occur. *Do not restart* the chiller until the problem is diagnosed and corrected.

After Limited Shutdown — No special preparations should be necessary. Follow the regular preliminary checks and starting procedures. Control power must be maintained in order to keep the oil temperature hot and all control safeties operational. The oil pump operates occasionally to keep the contact seal filled with oil to prevent refrigerant loss.

Extended Shutdown — The refrigerant should be transferred into the economizer/storage vessel (see Pumpout and Refrigerant Transfer Procedures, this page) in order to reduce chiller pressure and the possibility of leaks. Maintain a holding charge of 5 to 10 lbs (2.27 to 4.5 kg) of refrigerant within the cooler/condenser/compressor sections, to prevent air from leaking into the chiller.

If freezing temperatures are likely to occur in the chiller area, drain the chilled water, condenser water, and the pumpout condenser water circuits to avoid freeze-up. Keep the waterbox drains open.

Leave the oil charge in the chiller with the oil heater and controls energized to maintain the minimum oil reservoir temperature.

After Extended Shutdown — Be sure that the water system drains are closed. It may be advisable to flush the water circuits to remove any soft rust which may have formed. This is a good time to brush the tubes if necessary.

Check the cooler pressure on the LID default screen, and compare it to the original holding charge that was left in the chiller. If (after adjusting for ambient temperature changes) any loss in pressure is indicated, check for refrigerant leaks. See the Check Chiller Tightness section, page 46.

Recharge the chiller by transferring refrigerant from the economizer/storage vessel. Follow the Pumpout and Refrigerant Transfer Procedures section, this page. *Observe freeze-up precautions.*

Carefully make all regular preliminary and running system checks. Perform a controls test before start-up. If the compressor oil level appears abnormally high, the oil may have absorbed refrigerant. Make sure that the oil temperature is above 150 F (66 C) or above the cooler refrigerant temperature plus 70° F (39° C).

Cold Weather Operation — When the entering condenser water temperature is very low, the PIC can automatically cycle the cooling tower fans off to keep the temperature up. Provide a way to control the condenser water temperature to the chiller either by arranging a tower bypass piping system and/or adding a tower water temperature control system.

Manual Guide Vane Operation — It is possible to operate the guide vane manually in order to check control operations or control the guide vanes in an emergency. This is done by overriding the target guide vane position. Access the STATUS01 screen on the LID and highlight *TARGET GUIDE VANE POS.* To control the position, enter the desired percentage of guide vane opening. Zero percent is fully closed; 100% is fully open. To release the guide vanes to automatic operation, press the RELEASE softkey.

NOTE: Manual guide vane control allows the operator to manipulate the guide vane position and override the pulldown rate during start-up. However, motor current above the electrical demand setting, capacity overrides, and chilled water temperature below the control point will override manual guide vane control and close the guide vanes, if necessary. For descriptions of capacity overrides and set points, see the Controls section.

Refrigeration Log — A refrigeration log, such as the one shown in Fig. 31, is a convenient way to track routine inspection and maintenance and provides a continuous record of chiller performance. It is an aid in scheduling routine maintenance and in diagnosing chiller problems.

Keep a record of the chiller pressures, temperatures, and liquid levels on a log similar to Fig. 31. It is possible to automatically record PIC data by using CCN devices such as the Data Collection module and a Building Supervisor terminal. Contact your Carrier representative for more information.

PUMPOUT AND REFRIGERANT TRANSFER PROCEDURES

Preparation — The 17EX may come equipped with an optional pumpout compressor. The refrigerant can be pumped for service work to either the cooler/condenser/compressor sections or the economizer/storage vessel by using the pumpout system. The following procedures describe how to transfer refrigerant from vessel to vessel and perform chiller evacuations.

⚠ WARNING

To prevent tube freeze-up, always be sure that the condenser and cooler water pumps are operating whenever charging, transferring, or removing refrigerant from the chiller.

If the chiller water pumps are controlled by the PIC, access the CONTROL TEST table on the LID and use the PUMPDOWN/LOCKOUT screen or TERMINATE LOCKOUT screen to perform the functions described below. If the chiller water pumps are not controlled by the PIC, they must be turned on and off manually.

⚠ CAUTION

When performing pumpout, do not leave the compressor unattended for long periods of time or loss of compressor oil may result. Periodically check oil level.

Operating the Optional Pumpout Compressor

1. Be sure that the suction and the discharge service valves on the optional pumpout compressor are open (back seated) during operation. Figure 32 shows the location of these valves (valves 2, 3, 4, 5, and 8). Rotate the valve stem fully counterclockwise to open. Front seating the valve closes the refrigerant line and opens the gage port to compressor pressure.
2. Make sure that the compressor holddown bolts have been loosened to allow free spring travel.
3. Open the refrigerant inlet valve on the pumpout compressor.
4. Oil should be visible in the compressor sight glass under all operating conditions and during shutdown. If oil is low, add oil as described under Pumpout System Maintenance section, page 83. The pumpout unit control wiring schematic is detailed in Fig. 33. The Optional Pumpout System is detailed in Fig. 34.

READING REFRIGERANT PRESSURES during pumpout or leak testing:

1. The LID display on the chiller control center is suitable for determining refrigerant-side pressures and low (soft) vacuum. To measure evacuation or dehydration pressures, use a quality vacuum indicator or manometer to ensure the desired range and accuracy. This can be placed on the Schrader connections on each vessel by removing the pressure transducer.

REFRIGERATION LOG CARRIER 17EX EXTERNALLY GEARED CENTRIFUGAL CHILLER

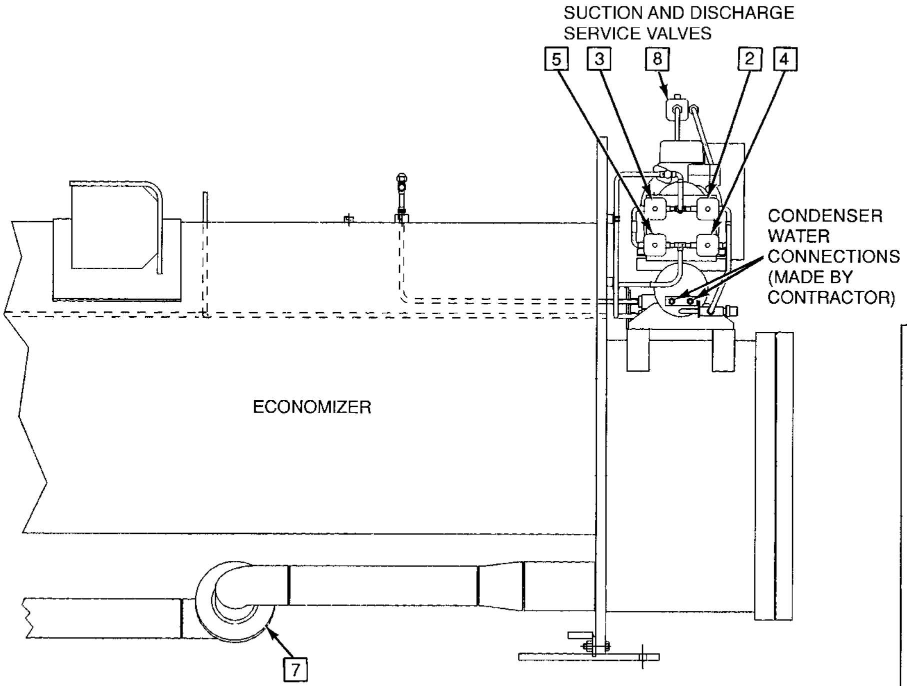
Plant____________________ **Chiller Serial No.**____________

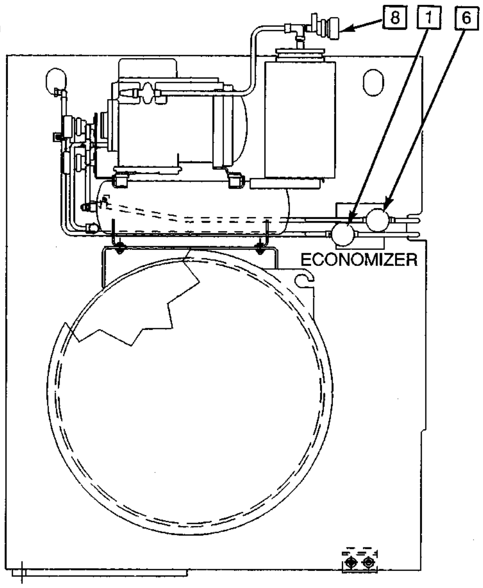
Chiller Model No.____________ **Refrigerant Type**___________

	REC. 1	REC. 2	REC. 3	REC. 4	REC. 5	REC. 6	REC. 7	REC. 8	REC. 9
TIME									
DATE									
OPERATOR INITIALS									
COOLER									
Refrigerant									
Pressure									
Temperature									
Water									
Pressure In									
Pressure Out									
Pressure GPM									
Temperature In									
Temperature Out									
CONDENSER									
Refrigerant									
Pressure									
Temperature									
Water									
Pressure In									
Pressure Out									
Pressure GPM									
Temperature In									
Temperature Out									
COMPRESSOR									
Bearing Temperature									
Oil									
Pressure Differential									
Temperature (Reservoir)									
Level									
Motor									
FLA									
Amps (or Vane Position)									
EXTERNAL GEAR									
Bearing Temperature									
Oil									
Pressure Differential									
Temperature (Reservoir)									
Level									
Motor									
FLA									
Aps (or Vane Position									

REMARKS: On an attached sheet, Indicate shutdowns on safety controls, repairs made, and oil or refrigerant added or removed. Include amounts. Include time, date, operator initials for each remark.

Fig. 31 — Refrigeration Log





NOTE: Location of pumpout compressor may vary depending on machine arrangement.

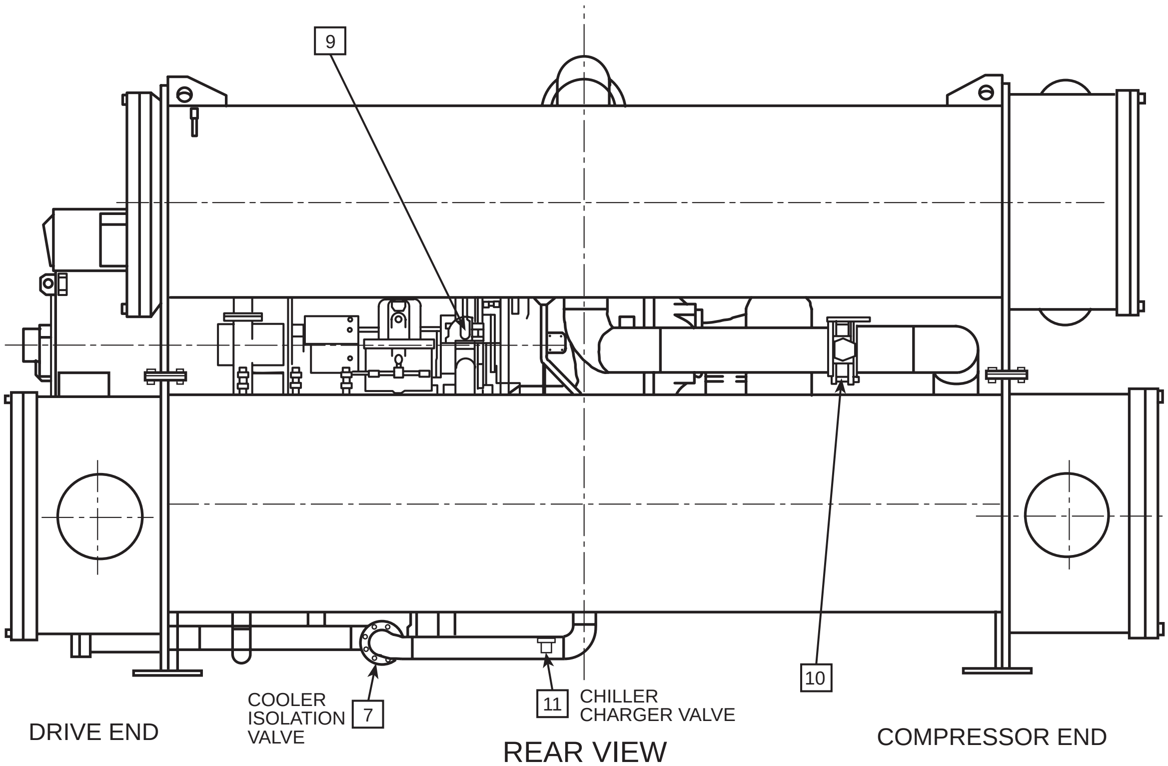
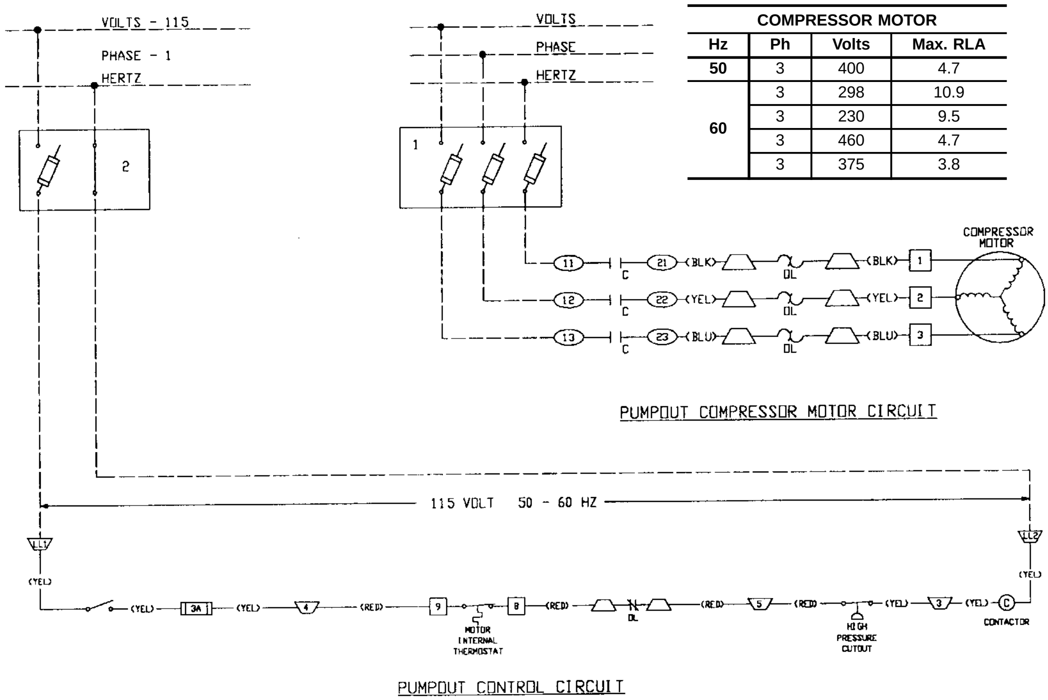


Fig. 32 — Pumpout Unit Location and Valve Number Locations



COMPRESSOR MOTOR			
Hz	**Ph**	**Volts**	**Max. RLA**
50	3	400	4.7
60	3	298	10.9
	3	230	9.5
	3	460	4.7
	3	375	3.8

LEGEND

1 — Compressor Motor Circuit Disconnect
2 — Control Circuit Disconnect
C — Contactor
OL — Compressor Overload
RLA — Rated Load Amps
T'stat — Internal Thermostat

Compressor Terminal
Contactor Terminal
Overload Terminal
Pumpout Unit Terminal

Fig. 33 — Pumpout Unit Wiring Schematic

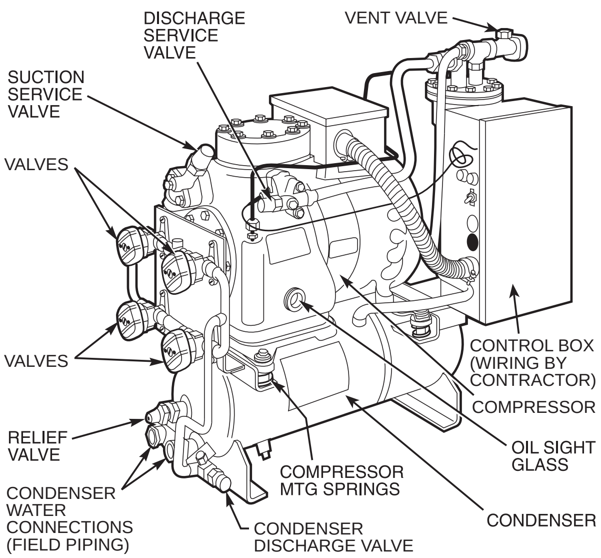


Fig. 34 — Optional Pumpout Compressor

2. To determine economizer/storage vessel pressure, attach a 30 in.-0-400 psi (-101-0-2760 kPa) gage to the vessel.
3. Refer to Fig. 32 for valve locations and numbers.

⚠ CAUTION

Transfer, addition, or removal of refrigerant in spring-isolated chillers may place severe stress on external piping if springs have not been blocked in both up and down directions.

Transferring Refrigerant into the Economizer/Storage Vessel — These steps describe the method of moving refrigerant from the cooler/condenser/compressor sections into the economizer/storage vessel. This is normally done to prepare for service work on the cooler, condenser, or the compressor components or for long-term chiller shutdown.

1. Isolate and push refrigerant into the economizer/storage vessel with the pumpout compressor.
   a. Valve positions: (Blank spaces indicate open valves).

VALVE	1	2	3	4	5	6	7	8	9	10	11
CONDITION			C	C				C	C	C	C

   b. Turn off the chiller water pumps and pumpout condenser water.
   c. Turn on pumpout compressor to push liquid out of the cooler/condenser/compressor section.
   d. When all liquid has been pushed into the economizer/storage vessel, close the cooler isolation valve 7.
   e. Access the CONTROL TEST table on the LID. Select the PUMPDOWN/LOCKOUT screen. From this screen, turn on the chiller water pumps and view the chiller pressures.
   f. Turn off pumpout compressor.
2. Evacuate refrigerant gas from the cooler/condenser/compressor vessel.
   a. Valve positions: close valves 2 and 5, open valves 3 and 4.

VALVE	1	2	3	4	5	6	7	8	9	10	11
CONDITION		C			C		C	C	C	C	C

   b. Turn on the pumpout condenser water.
   c. Run the pumpout compressor until the suction reaches 15 in. Hg (50 kPa abs). Monitor pressures on the LID and on the refrigerant gages.
   d. Close valve 1.
   e. Turn off pumpout compressor.
   f. Close valves 3, 4, and 6. (All valves are now closed.)
   g. Turn off pumpout condenser water.
   h. Use the PUMPDOWN LOCKOUT screen on the LID to turn off the chiller water pumps and to lock out the chiller compressor from operation.

Transferring Refrigerant into the Cooler/Condenser/Compressor Section — These steps describe how to transfer refrigerant from the economizer/storage vessel into the cooler/condenser/compressor section. This is normally done to prepare for service work on the economizer/storage vessel.

1. Isolate and push refrigerant into the cooler/condenser/compressor section:
   a. Valve positions:

VALVE	1	2	3	4	5	6	7	8	9	10	11
CONDITION		C			C			C	C	C	C

   b. Turn off chiller water pumps and pumpout condenser water.
   c. Turn on the pumpout compressor to push refrigerant out of the economizer/storage vessel.
   d. When all liquid refrigerant is out of the economizer/storage vessel, close the cooler isolation valve 7.
   e. Turn off the pumpout compressor.
2. Evacuate refrigerant from the economizer/storage vessel.
   a. Access the CONTROL TEST table on the LID. Select the PUMPDOWN LOCKOUT screen. From this screen, turn on the chiller water pumps and monitor vessel pressures.
   b. Valve positions: Close valves 3 and 4, open valves 2 and 5.

VALVE	1	2	3	4	5	6	7	8	9	10	11
CONDITION			C	C			C	C	C	C	C

   c. Turn on the pumpout condenser water.
   d. Run the pumpout compressor until the suction reaches 15 in. Hg (50 kPa abs). Monitor pressures on the LID and on refrigerant gages.
   e. Close valve 6.
   f. Turn off the pumpout compressor.
   g. Close valves 1, 2, and 5 (all valves are now closed).
   h. Turn off the pumpout condenser water.
   i. From the CONTROL TEST table on the LID, turn off the chiller water pumps and lock out the chiller compressor from operation.

Return Chiller to Normal Operating Conditions

1. Be sure that the vessel that was opened has been evacuated and dehydrated.
2. Access the CONTROL TEST table. From this table, select the TERMINATE LOCKOUT function to view the vessel pressures and to turn on chiller water pumps.
3. Open valves 1, 3, and 6.

VALVE	1	2	3	4	5	6	7	8	9	10	11
CONDITION		C		C	C		C	C	C	C	C

4. Slowly open valve 5, gradually increasing pressure in the evacuated vessel to 35 psig (141 kPa) for HFC-134a. Feed refrigerant slowly to prevent freeze-up.
5. Perform a leak test at 35 psig (141 kPa).
6. Open valve 5 fully. Let the vessel pressures equalize.

VALVE	1	2	3	4	5	6	7	8	9	10	11
CONDITION		C		C			C	C	C	C	C

7. Open valves 9 and 10.
8. Open valve 7 to equalize liquid refrigerant levels.
9. Close valves 1, 3, 5, and 6.

VALVE	1	2	3	4	5	6	7	8	9	10	11
CONDITION	C	C	C	C	C	C		C			C

10. Continue to use the TERMINATE/LOCKOUT function on the LID to turn off water pumps and enable the compressor to operate.

GENERAL MAINTENANCE

Refrigerant Properties — Refrigerant HFC-134a is the standard refrigerant in the 17EX. At normal atmospheric pressure, HFC-134a boils at −14 F (−25 C) and must, therefore, be kept in pressurized containers or storage tanks. The refrigerant is practically odorless when mixed with air. This refrigerant is non-combustible at atmospheric pressure. Read the Material Safety Data Sheet (MSDS) and the latest ASHRAE Safety Guide for Mechanical Refrigeration to learn more about safe handling of this refrigerant.

⚠ DANGER

Refrigerant HFC-134a will dissolve oil and some non-metallic materials, dry the skin, and, in heavy concentrations, may displace enough oxygen to cause asphyxiation. When handling this refrigerant, protect the hands and eyes and avoid breathing fumes.

Adding Refrigerant — Follow the procedures described in Charge Refrigerant into Chiller section, page 57.

⚠ WARNING

Use the PUMPDOWN LOCKOUT function on the CONTROL TEST table to turn on the chiller water pumps and lock out the compressor when transferring refrigerant. Liquid refrigerant may flash into a gas and cause possible freeze-up when the chiller pressure is below 30 psig (207 kPa) for HFC-134a. If the water pumps are not controlled by the PIC, they must be controlled manually.

Removing Refrigerant — When the optional pumpout system is used, the 17EX refrigerant charge may be transferred into the economizer/storage vessel or another storage vessel. Follow procedures in the Pumpout and Refrigerant Transfer Procedures section when removing or transferring refrigerant.

Adjusting the Refrigerant Charge — If it is necessary to add or remove refrigerant to improve chiller performance, follow the procedures under the Trimming Refrigerant Charge section.

Refrigerant Leak Testing — Because HFC-134a is above atmospheric pressure at room temperature, leak testing can be performed with refrigerant in the chiller. Use an electronic detector, soap bubble solution, or ultra-sonic leak detector. To keep false readings to a minimum, be sure that the room is well ventilated and free from concentration of refrigerant. Before making any necessary repairs to a leak, transfer all refrigerant from the leaking vessel.

Leak Rate — The ASHRAE recommendation is that chillers should be immediately taken off line and repaired if the refrigerant leak rate for the entire chiller is more than 10% of the operating refrigerant charge per year.

Additionally, Carrier recommends that leaks totalling less than the above rate but more than a rate of 1 lb (0.5 kg) per year should be repaired during annual maintenance or whenever the refrigerant is pumped over for other service work.

Test After Service, Repair, or Major Leak — If all refrigerant has been lost or if the chiller has been opened for service, the chiller or the affected vessels must be pressure and leak tested. Refer to the Leak Test Chiller section (page 46) to perform a leak test.

⚠ WARNING

Refrigerant HFC-134a MUST NOT be mixed with air or oxygen and pressurized for leak testing. In general, this refrigerant should not be allowed to be present with high concentrations of air or oxygen above atmospheric pressures, because the mixture can undergo combustion.

REFRIGERANT TRACER — Use an environmentally acceptable refrigerant as a tracer for leak test procedures.

TO PRESSURIZE WITH DRY NITROGEN — Another method of leak testing is to pressurize with nitrogen only and use a soap bubble solution or an ultrasonic leak detector to determine if leaks are present. This should only be done if all refrigerant has been evacuated from the vessel.

1. Connect a copper tube from the pressure regulator on the cylinder to the refrigerant charging valve. Never apply full cylinder pressure to the pressurizing line. Follow the listed sequence.
2. Open the charging valve fully.
3. Slowly open the cylinder regulating valve.
4. Observe the pressure gage on the chiller and close the regulating valve when the pressure reaches test level. *Do not exceed* 140 psi (965 kPa).
5. Close the charging valve on the chiller. Remove the copper tube if no longer required.

Repair the Leak, Retest, and Apply Standing Vacuum Test — After pressurizing the chiller, test for leaks with an electronic leak detector, soap bubble solution, or an ultrasonic leak detector. Bring the chiller back to atmospheric pressure, repair any leaks found, and retest.

After retesting and finding no leaks, apply a standing vacuum test, and then dehydrate the chiller. Refer to the Standing Vacuum Test and Chiller Dehydration in the Before Initial Start-Up section, page 49.

Checking Guide Vane Linkage — Refer to Fig. 35.

If slack develops in the drive chain, eliminate backlash as follows:

1. With the chiller shut down (guide vanes closed), remove the chain guard, loosen the actuator holddown bolts, and remove the chain.
2. Loosen the vane sprocket set screw and rotate the sprocket wheel until the set screw clears the existing spotting hole.
3. With the set screw still loose, replace the chain, and move the vane actuator to the left until all the chain slack is taken up.
4. Tighten the actuator holddown bolts and retighten the set screw in the new position.
5. Realign the chain guard as required to clear the chain.

Contact Seal Maintenance (Refer to Fig. 36) — During chiller operation, oil that lubricates the seal seeps through the space between the contact sleeve (Item 18) and the lock nut (Item 15). This oil slowly accumulates in an atmospheric oil chamber and is automatically returned to the system by a seal oil return pump.

Oil should never leak around the outer diameter of the contact sleeve (Item 18). If oil is found in this area, O-ring (Item 12) should be checked and replaced.

The oil passing through the shaft seal carries with it some absorbed refrigerant. As the oil reaches the atmosphere, the absorbed refrigerant is released from the oil as a vapor. For this reason, a detector will indicate the presence of a slight amount of refrigerant around the compressor shaft whenever the chiller is running.

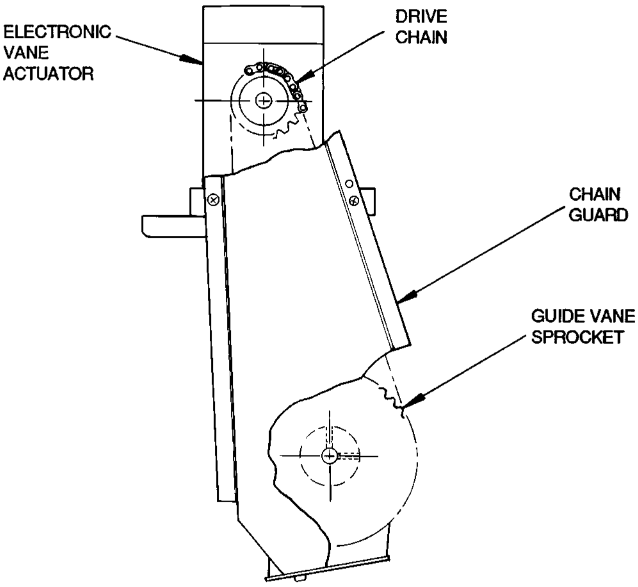


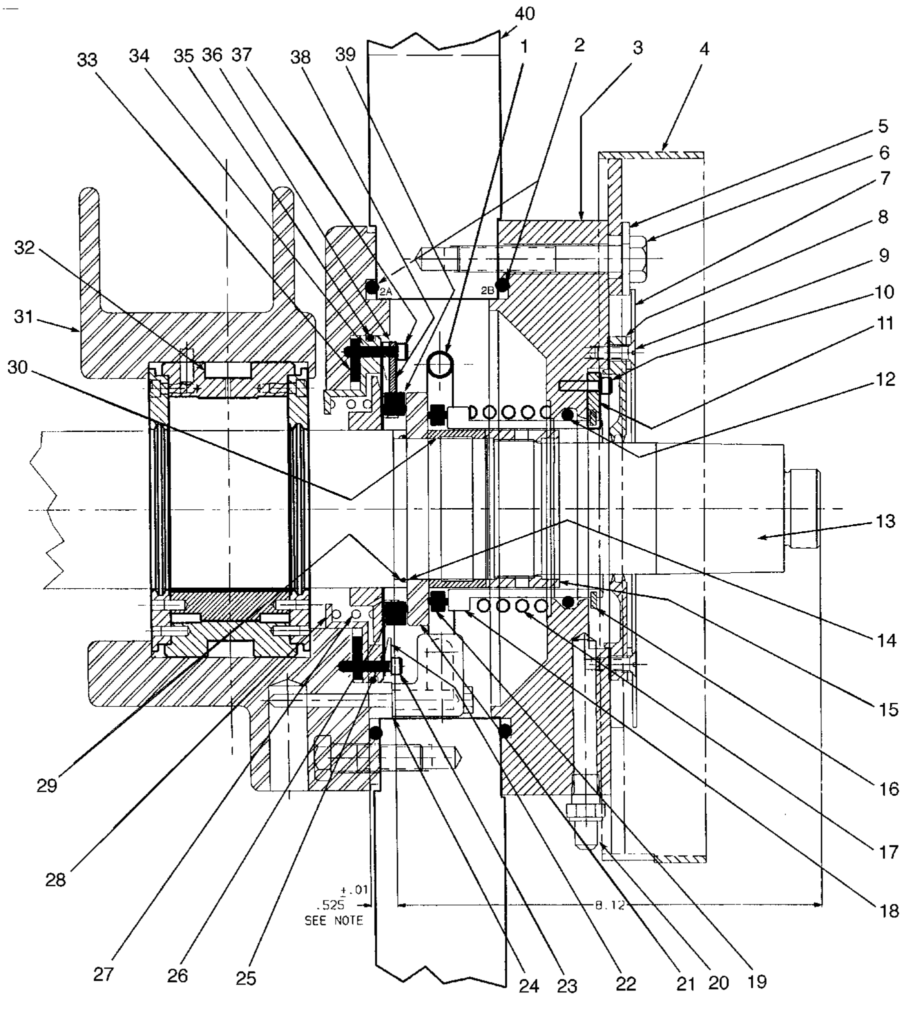
Fig. 35 — Electronic Vane Actuator Linkage

During shutdown, no refrigerant should be detected except for minute outgassing from residual oil in the seal area. There should be no oil seepage. If oil flow or the presence of refrigerant is noted while the chiller is shut down, a seal defect is indicated. Arrange for a seal assembly inspection by a qualified serviceman to determine the cause of the leakage and make the necessary repairs.

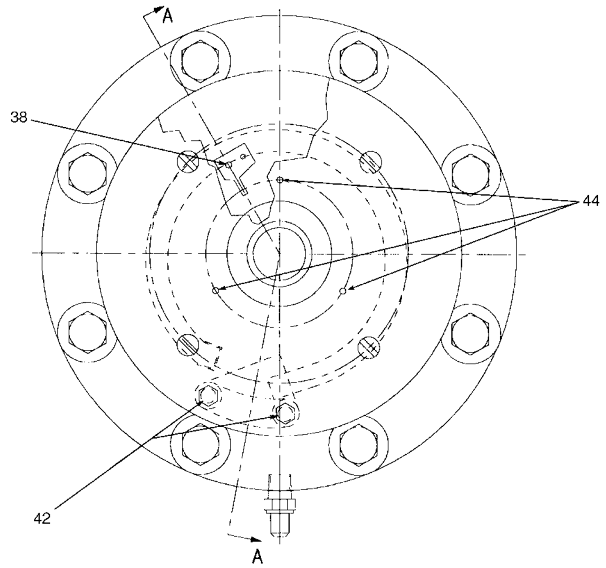
SEAL DISASSEMBLY (Fig. 36) — Contact seal disassembly and repair should be performed only by well qualified compressor maintenance personnel. These disassembly instructions are included only as a convenient reference for the authorized serviceman.

For ease of disassembly, refer to Fig. 36 while following these instructions.

1. Remove refrigerant.
2. Remove compressor shaft coupling hub and coupling spacer (if any).
3. The snap ring (Item 16) used for seal assembly/disassembly is clipped over three screws (Item 41) on the windage baffle (Item 7). Remove the snap ring and put it aside for now.
4. Remove the screws holding the windage baffle and the shaft end labyrinth (Item 8).
5. Remove the contact sleeve key (Item 11).
6. Using a snap ring tool, install the snap ring (Item 16) in the groove on the end of the contact sleeve (Item 18), as shown in Fig. 36.
7. Remove the tubing between the coupling (Item 20) and the atmospheric oil chamber. Loosen the bolts (Item 6) holding the coupling guard mounting ring (Item 4) and the seal housing (Item 3). The spring contact sleeve (Item 17) will push the housing out until the snap ring (Item 16) contacts the seal housing (Item 3). To avoid binding, loosen the bolts in a circular pattern until the spring stops pushing out on the housing. Then, remove 2 bolts that are 180 degrees apart. Replace them with a 1/2-13 all-thread rod to support the housing while the rest of the bolts are removed.
8. Remove the rest of the bolts, and remove the seal housing.



NOTE: Adjust shims (Item 33) to maintain .525 ± .01 in. (13.3 ± .3 mm) dimension with shaft thrust toward drive and check carbon for +.06 minimum travel.



LEGEND

1 — Lubricating Tube
2A — O-Ring
2B — O-Ring
3 — Seal Housing
4 — Coupling Guard Mounting Ring
5 — Plain ½-in. Washer (8 Required)
6 — Hex Head Bolt, ½-13 × 4 lg (8 Required)
7 — Windage Baffle
8 — Shaft End Labyrinth
9 — Screw ¼ - 20 × ¾ lg (4 Required)
10 — Screw, 10-24 × ½ lg
11 — Key, Contact Sleeve
12 — O-Ring
13 — Compressor Shaft
14 — O-Ring
15 — Lock Nut
16 — Snap Ring (Service tool only; must be removed for operation)
17 — Spring Contact Sleeve
18 — Contact Sleeve
19 — Outer Carbon Ring
20 — Coupling (Connection to atmospheric oil chamber)
21 — Rotating Contact Ring
22 — Diaphragm Retainer
23 — Inner Seal Retaining Screw, 10-24 × 1 lg (14 Required)
24 — Gasket
25 — Diaphragm
26 — Inner Carbon Ring
27 — Inner Seal Spring
28 — Inner Seal Retainer
29 — Seal Gland Sleeve
30 — Spacer
31 — Journal Bearing Housing
32 — Journal Bearing
33 — Inner Seal Shim
34 — Inner Carbon Guide Ring
35 — O-Ring
36 — Inner Carbon Key
37 — Screw, 10-24 × 1¼ lg (2 Required)
38 — Retaining Ring
39 — Seal Shoulder
40 — Compressor End Wall
41 — Thread Cut Screw, 8-32 × ¼ lg (3 Required)
42 — Screw, 5⁄16-18 × 1¾ lg (2 Required)

Fig. 36 — Contact Seal

9. Place a clean, lint-free cloth on a smooth, sturdy work surface. Place the seal housing assembly on the cloth with the face of the contact sleeve in contact with the cloth. While one person pushes down on the housing to compress the spring, another person must remove the snap ring. Then, slowly let the seal housing rise until the spring is fully extended.
10. Remove Items 2B and 12 (O-rings).
11. Slide the outer carbon ring (Item 19) off the shaft.
12. Remove the lubricating tube (Item 1) and gasket (Item 24).
13. Remove the inner carbon key (Item 36).
14. Remove the inner seal retaining screws (Item 23) and the diaphragm retainer (Item 22).
15. Using a spanner wrench, loosen the lock nut (Item 15). The lock nut has a right-hand thread. Remove the lock nut. The inner seal spring (Item 27) may push the contact ring part way out as the lock nut is loosened.
16. Carefully slide the rotating contact ring (Item 21) off the shaft. The ring slips onto the shaft with a very close tolerance and is prone to sticking. Slide it slowly to avoid a tight jam. To release, tap gently with a SOFT hammer.
17. Remove O-ring (Item 14). This O-ring will be crushed into a triangular shape. Since it is not an ordinary O-ring gland, this is normal. Always replace with a new O-ring.
18. The seal gland sleeve (Item 29) can be removed, but it is generally not necessary to do so. If the seal gland is removed, make sure it is reinstalled with the bevel (that contains the O-ring) facing outward.
19. The inner carbon ring (Item 26), the diaphragm (Item 25), the inner carbon guide ring (Item 34), and the inner seal spring (Item 27) can be removed as an assembly. The carbon ring is held to the guide ring by raised barbs on the guide ring. Carefully pull the carbon ring from the guide ring. The diaphragm can now be removed from the guide ring. Inspect the diaphragm for wear.
20. To remove the inner seal retainer (Item 28) and O-ring (Item 35), use 4 screws (Item 23) in the 4 threaded holes spaced evenly around the seal retainer to jack the part out of position.

If the inner seal shims are damaged, carefully measure them so that a shim package of the same thickness can be installed. The thickness of the shim package should not be changed unless the compressor shaft and/or thrust bearing are replaced. Replacing either of these items could affect the float of the inner seal. This float is adjusted by varying the thickness of the shim pack.

This completes the disassembly of the seal.

Clean all parts to be reused with solvent, coat with oil and place in a protected area until needed.

SEAL REASSEMBLY (Fig. 36) — Be sure that all gasket surfaces are clean and that all holes, including oil holes, are properly aligned between the gasket and mating flange. Coat the gasket with oil-graphite mixture to prevent sticking.

1. Install the inner seal retainer (Item 28) and O-ring (Item 35). Then, remove the bolts to allow installation of the inner seal assembly.
2. Replace the seal gland sleeve (Item 29) if it has been removed. Make sure that the plain side is against the shaft shoulder and that the beveled side is facing outward.

   NOTE: If the seal gland sleeve is oriented improperly, refrigerant will leak under the contact ring.
3. Place the diaphragm (Item 25) over the inner seal retainer (Item 28). With the best lapped sealing face of the carbon away from the diaphragm and the notch for the key centered between two of the bolt holes in the diaphragm, gently push the inner carbon ring (Item 26) into the inner carbon guide ring until it is tight against the diaphragm. Make sure that the diaphragm is not wrinkled or folded between the carbon and the retainer. Place the spring (Item 27) over the back of the guide ring. Place this assembly into the seal, and make sure that the carbon face can travel a minimum of 0.06 inches (1.5 mm) in each direction from the outside edge of the seal gland sleeve (Item 29).
4. Install the O-ring (Item 14). Slide the rotating contact ring (Item 21) into position against the seal gland sleeve. Install the lock nut (Item 15) and tighten it with a spanner.
5. Gently rotate the inner seal assembly to line up the bolt holes in the diaphragm with the bolt holes in the inner seal retainer (Item 28). Place the diaphragm retainer over the diaphragm with the beveled side toward the diaphragm. Install the 14 one-inch long screws (Item 23), leaving the top 2 holes on either side of the notch in the carbon open. Tighten to 2 ft-lb.
6. Install the inner carbon key (Item 36) using the 1-1/4-in. screws (Item 37). Tighten to 2 ft-lb.
7. Install the lubricating tube (Item 1) and gasket (Item 24).
8. Lightly coat the outer carbon ring with compressor oil. Then, slide the outer carbon ring (Item 19) into position against the rotating contact ring.
9. Install O-ring (Item 12).
10. Place the contact sleeve (Item 18) face down on a clean, lint-free cloth on a smooth, hard, work surface, and place the contact sleeve spring over the sleeve. Lightly coat the outside surface of the contact sleeve with compressor oil. While one person places the seal housing (Item 3) over the contact sleeve and presses the spring down, another person must install the snap ring (Item 16) in the groove around the small end of the contact sleeve. Once the snap ring is firmly seated in the groove, slowly let the seal housing rise until the snap ring rests against the housing. Rotate the sleeve in the seal housing until the key slot in the sleeve is in line with the bolt hole for the contact sleeve key (Item 11).
11. Install the O-ring (Item 2B) into its groove, and place the seal housing into position on the compressor. Guide rods can help accomplish this task. Place the coupling guard mounting ring (Item 4) over the seal housing, and fasten both in place with 8 hex-head bolts (Item 6). Draw in the housing against the seal spring by tightening the bolts in steps in a crisscross pattern to draw the housing evenly.
12. Once the bolts have been tightened, remove the snap ring from the contact sleeve, and set it aside.
13. Install the contact sleeve key (Item 11).
14. Install the shaft end labyrinth (Item 8) and the windage baffle using screws (Item 9). The split lines of the labyrinth and windage baffle should be located 90 degrees apart.
15. Mount the snap ring (Item 16) on the screws (Item 41) near the inside surface of the windage baffle.
16. Reconnect the tubing from the atmospheric oil chamber to the coupling (Item 20).

The reassembly of the seal is complete.

Run the oil pump to fill the seal, and rotate the shaft several times by hand before leak testing.

Chiller Alignment

ALIGNMENT METHODS — There are several established procedures for aligning shafts. The dial indicator method is presented here since it is considered to be one of the most accurate and reliable. Another faster and easier method for alignment involves using laser alignment tools and computers. Follow the laser tool manufacturer's guidelines when using the laser technique.

Where job conditions such as close-spaced shafts prohibit the use of dial indicators for coupling face readings, other instruments such as a taper gage may be used. The same procedures described for the dial indicator may be used with the taper gage.

Shafts placed in perfect alignment in the non-operating (cold) condition will always move out of alignment to some extent as the chiller warms to operating temperature. In most cases, this shaft misalignment is acceptable for the initial run-in period before hot check and alignment can be made (see Hot Alignment Check section, page 61).

NOTE: The physical configuration of the 17FX compressor makes the oil sump temperature a more significant factor in alignment than the suction and discharge temperatures. Therefore, warm the sump oil to operating temperature (approximately 140 F [60 C]), if possible, before beginning alignment procedures.

General

1. Final shaft alignment must be within .002-in. (.05-mm) TIR (Total Indicated Runout) in parallel. Angular alignment must be within 0.00033 inches per inch of traverse (0.00033 mm per mm of traverse) across the coupling face (or inch of indicator swing diameter) *at operating temperatures.* For example, if a bracket-mounted indicator moves through a 10-in. diameter circle when measuring angular misalignment, the allowable dial movement will be 10 times 0.00033 for a total of 0.0033 in. (0.0033 mm).
2. Follow the alignment sequence specified in the Near Final Alignment section.
3. All alignment work is performed on gear and drive equipment. Once the compressor is bolted in a perfectly level position and is piped to the cooler and condenser, it must not be moved prior to hot check.
4. All alignment checks must be made with the equipment hold-down bolts tightened.
5. In setting dial indicators on zero and when taking readings, both shafts should be tight against their respective thrust bearings.
6. The space between coupling hub faces must be held to the dimensions in Fig. 29 and 30.
7. Accept only repeatable readings.

High Speed Coupling Alignment

1. Move the gear with the coupling attached into alignment with the compressor coupling. The compressor must be in the thrust position and the gear must be centered between the thrust collars when determining gear position relative to the compressor. Adjust the jackscrews to reach close alignment. Follow the procedures outlined in the Correcting Angular Misalignment and Correcting Parallel Misalignment sections.
2. A 5-in. long spacer hub is supplied between the gear and compressor. Maintain the exact hub-to-hub distance specified in Fig. 29.
3. Where the shaft ends are very close, a taper gage may be used in place of the dial indicator.
4. Get the gear alignment as close as possible by using the jackscrew adjustment.

Low Speed Coupling Alignment

1. Move the motor with the coupling attached into alignment with the gear coupling. The motor must be in its mechanical center and the gear must be centered between the thrust collars when determining the motor position relative to the gear. Adjust the jackscrews to reach close alignment. Follow the procedure outlined in the Correcting Angular Misalignment and Correcting Parallel Misalignment sections.
2. Maintain the exact hub-to-hub distance as specified in Fig. 30.
3. Where the shaft ends are very close, a taper gage may be used in place of the dial indicator.
4. Get the motor alignment as close as possible by using the jackscrew adjustment.

NOTE: The drive shaft end-float at final drive position must not allow the coupling hub faces to make contact or the coupling shroud to bind.

PRELIMINARY ALIGNMENT — To get within dial indicator range, roughly align the equipment as shown in Fig. 37 and as described below.

Place a straight edge across the OD of one coupling to the OD of the other. Measure the gap between the straight edge and the OD of the second coupling with a feeler gage. Then, by adding or removing shims at each corner, raise or lower the equipment by the measured amount.

In a similar manner, measure the shaft offset from side to side and jack the equipment over as required to correct.

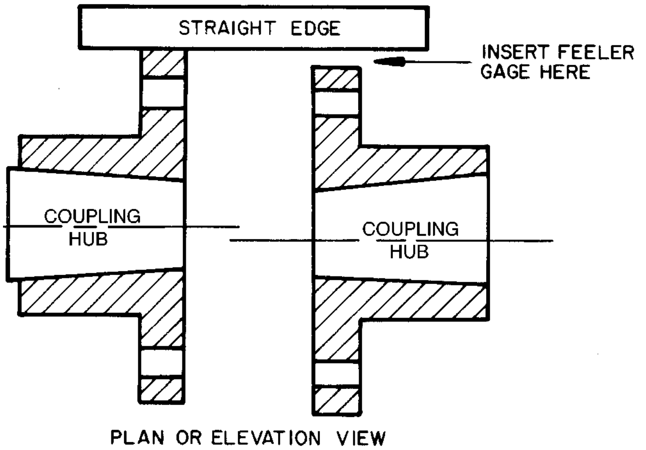
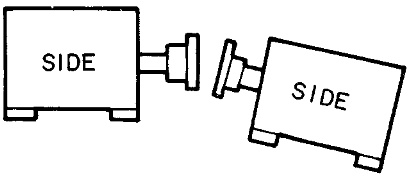


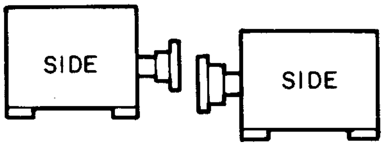
Fig. 37 — Checking Preliminary Alignment

NEAR FINAL ALIGNMENT — Once the chiller components are within dial indicator range, the adjustments for misalignment should be made in a specific sequence. The four positions of alignment described below are arranged in the recommended order.

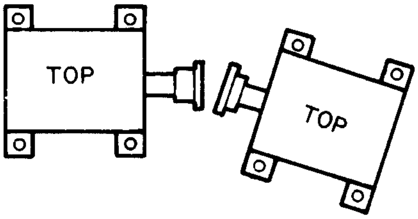
1. Angular in elevation — This alignment is adjusted with shims and is not readily lost in making the other adjustments.



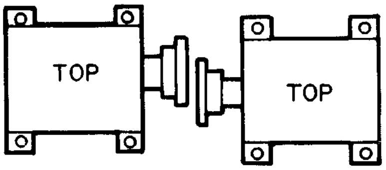
2. Parallel in elevation — This alignment is also made with shims, but it cannot be made while there is angular misalignment in elevation.



3. Angular in plan — This position can easily be lost if placed ahead of the two adjustments in elevation.



4. Parallel in plan — This adjustment cannot be made while there is still angular misalignment in plan and can easily be lost if elevation adjustments are made.

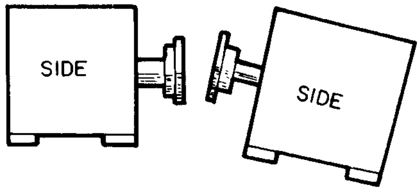


Correcting Angular Misalignment

Preparation — Shaft angular misalignment is measured on the face of the coupling hubs or on brackets attached to each shaft (see Fig. 38 and 39). Brackets are preferred since they extend the diameter of the face readings.

Attach a dial indicator to one coupling hub or shaft and place the indicator button against the face of the opposite hub. Position the indicator so that the plunger is at approximately mid-position when the dial is set to zero. Both shafts should be held tightly against their thrust bearings when the dial is set and when readings are taken.

To be sure that the indicator linkage is tight and the button is on securely, rotate the coupling exactly 360 degrees. The dial reading should return to zero. Accept only repeatable readings.



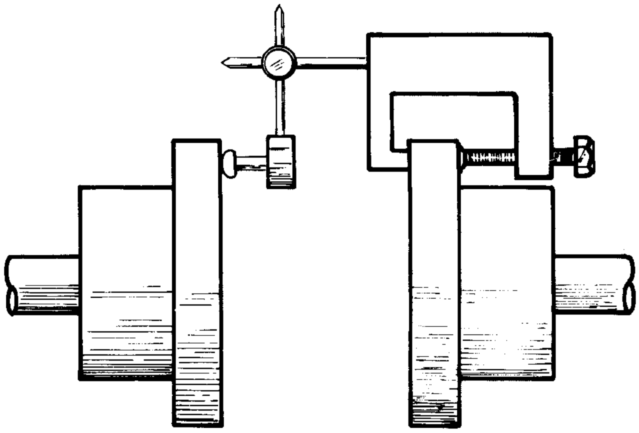


Fig. 38 — Measuring Angular Misalignment in Elevation

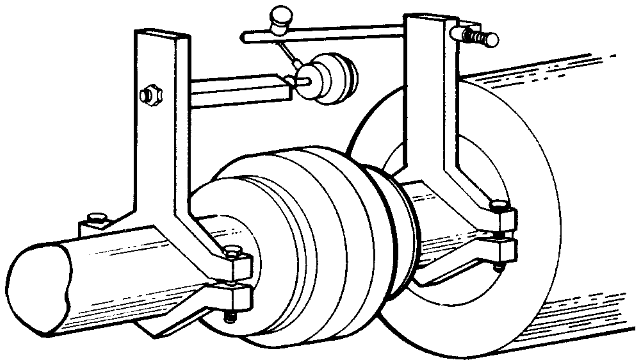
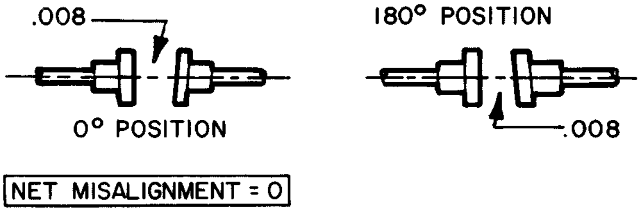


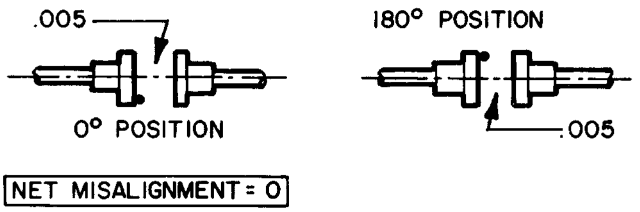
Fig. 39 — Measuring Angular Misalignment in Elevation Using Brackets

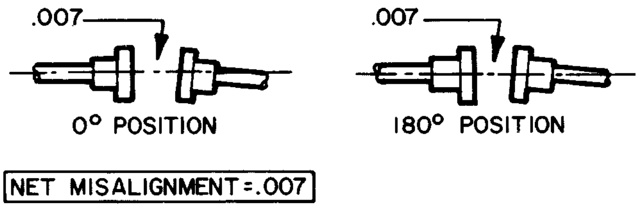
Measurement — Occasionally, coupling faces may not be perfectly true or may have been damaged in handling. To compensate for any such runout, determine the actual or “net” shaft misalignment as follows:

Check the opening at the top and at the bottom of the coupling faces (or at each side when making plan adjustment). Rotate *both* shafts exactly 180 degrees and recheck the openings. Record the difference. (Example below is in inches.)

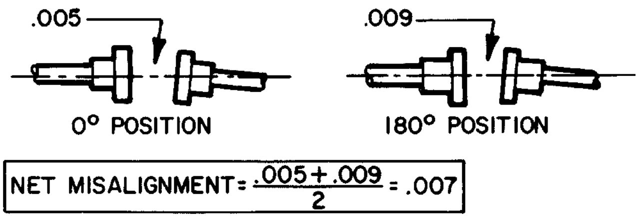


If the larger opening remains the same but changes from side to side, the shafts are in perfect alignment. The change in opening is due entirely to coupling runout, as above, or to a burr or other damage to the coupling face.

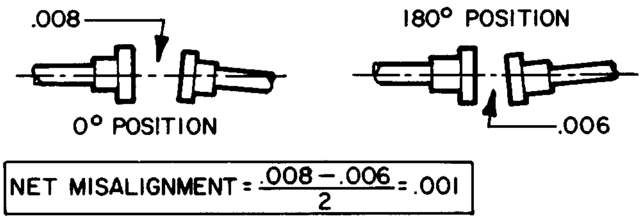




If the larger opening remains the same, and remains on the same side, the amount is entirely shaft (net) misalignment.



If the larger opening remains on the same side but changes amount, misalignment *and* runout are present. Add the two amounts and then divide by two to get the actual or net misalignment.



If the larger opening changes amount and also changes from side to side, subtract the smaller amount from the larger and divide by two to obtain the net misalignment.

Adjustment — Having obtained the net misalignment, the amount by which the equipment must be moved can now be calculated.

To determine:

S — amount of movement (in plan) or the thickness of shim (in elevation) required.

Obtain:

D — coupling face diameter in inches (or indicator button circle)

L — distance between front and rear holddown bolts (inches)

M — net misalignment in inches

And:

Divide L, the bolt distance, by D, the coupling diameter. Multiply the result by M, the net misalignment.

$$S = \frac{L}{D} \times M$$

Example: Face diameter 5 in. (D). Distance between front and rear holddown bolts 30 in. (L). Net misalignment in elevation .012 in. (M).

30 divided by 5 is 6

6 multiplied by .012 is .072 in.

S = .072 in.

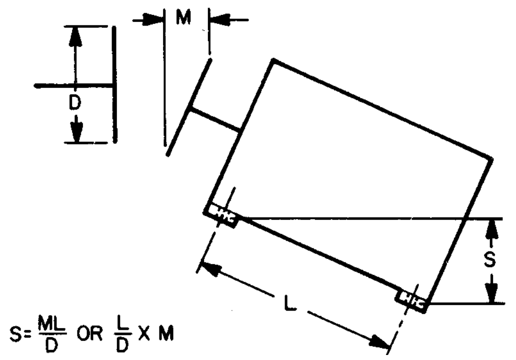
If the larger opening between coupling faces is at the top, place .072 in. of shim under each rear foot or remove .072 in. from the front footings to bring the couplings into angular alignment in elevation.

Tighten the holddown bolts and recheck the net misalignment.

The height of the shaft above the footings and the distance the shaft extends beyond the equipment will not affect the calculations.

Determine the angular adjustment in plan by the same method of calculation. At this point, however, the procedure should include a correction for the change in coupling gap which always occurs in adjusting angular alignment (Fig. 40). By selecting the proper pivot point (see Fig. 41), the coupling gap can be kept at the dimension specified in the job data.

1. Pivot on the front bolt at the closed side of the couplings to shorten the gap; pivot on the front bolt at the open side to lengthen it. It may sometimes be advantageous to pivot half the required amount on one front footing and half on the other.
2. Place a dial indicator against the rear foot as indicated in Fig. 41.
3. Place a screw jack on the other rear foot to move the equipment towards the indicator.



S — Thickness of Shim Required
L — Distance Between Front and Rear Holddown Bolt in Inches
D — Diameter of Coupling in Inches
M — Net Misalignment in Inches

Fig. 40 — Alignment Formula

4. Loosen all holddown bolts except the pivot bolt. Turn the screw jack until the rear end of the equipment moves against the indicator by the desired amount.
5. Tighten the holddown bolts and recheck the indicator. If the reading has changed, loosen the three bolts and readjust. It may be necessary to over or undershoot the desired reading to allow for the effect of bolt tightening.

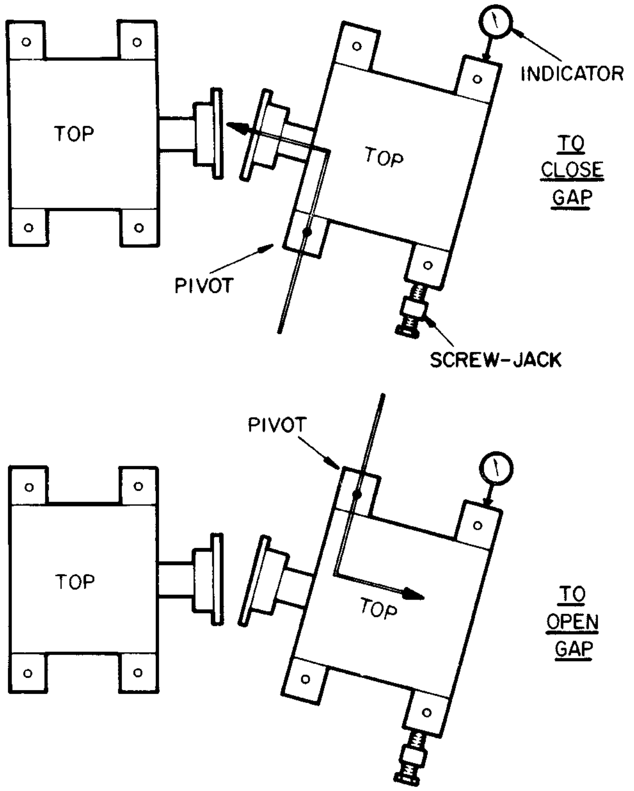


Fig. 41 — Adjusting Angular Misalignment in Plan

Correcting Parallel Misalignment

Preparation — Attach the dial indicator to one shaft or coupling hub and place the indicator button on the outside diameter of the other hub. The reach of the dial from one hub to the other should be parallel to the shafts, and the dial button shaft should point directly through the center of the shaft on which it rests. Compress the plunger to about mid-position and set the dial at zero.

Check the tightness of the dial button and the indicator linkage by rotating the shaft to which the indicator is attached 360 degrees. The dial should return to zero. Check for repeatability.

Check for runout by rotating the hub on which the dial button rests 180 degrees. If the runout exceeds .001 total indicator reading, the hub should be removed and the shaft checked. Shaft runout must not exceed .001 TIR.

The effect of hub runout can be eliminated by locating a position on the half coupling where two readings 180 degrees apart read zero. Rotate the coupling so that one zero point is at the top and the other at the bottom when checking for misalignment in elevation. Place the zero points side to side in a similar manner when checking for misalignment in plan.

Measurement — With dial set at zero in the top position, rotate the shaft to which the indicator is attached 180 degrees. If the dial reading is plus, the shaft on which the button rests is low. If the reading is minus, the shaft on which the button rests is high.

Never accept a single reading. Look for repeatability. Rotate the shaft several times to see if the reading remains the same. It is good practice to reverse the procedure and read from zero at the bottom.

Always rotate the shafts in the same direction when taking readings. Backlash in the coupling teeth could cause some differences.

Adjustment — Divide the total indicator reading by two to obtain the exact amount of shaft offset. As illustrated in Fig. 42, the indicator will read the total of A plus B but the required shaft adjustment is only half of this as indicated by C.

Add or remove identical amounts of shims at all footings to bring the shaft to the proper elevation. Tighten all the holddown bolts and recheck the readings. Parallel alignment must be within .002 TIR.

To correct parallel misalignment in plan, use a screw jack and dial indicator as shown in Fig. 42. With a front holddown bolt as the pivot, move the rear of the equipment over. Then, with the rear holddown bolt *on the same side* acting as the pivot, move the front end of the equipment over by the same amount.

FINAL ALIGNMENT — The procedures and tolerance requirements for final alignment are the same as those described in the Near Final Alignment section. Final alignment is performed just prior to grouting and chiller hot check. All piping, including water and steam, must be completed, but the water and refrigerant charges need not be in place.

HOT ALIGNMENT CHECK

General — When all chiller components have reached operating temperature (after running near full load for from 4 to 8 hours), a hot alignment check must be made. Hot alignment check may be made with couplings assembled or disassembled.

Disassembled Couplings

1. Shut down chiller.
2. With chiller hot, quickly disassemble couplings.
3. Check angular and parallel alignment in plan and elevation as described in the Near Final Adjustment section. Record the indicator readings (see page CL-12) and make necessary adjustments to bring alignment within .002 in. TIR and .00033 inches per in. of coupling face traverse (or in. of indicator swing). Follow procedures described in the Near Final Alignment section.
4. Reinstall couplings and run chiller until it again reaches operating temperature.
5. Repeat steps 1 through 4 until alignment remains within specified tolerances.

Assembled Couplings — If there is room on the shaft between coupling and component to clamp a sturdy bracket, the arrangement illustrated in Fig. 43 may be used. The clamps must have room to rotate with the shaft.

This method is quicker because the couplings do not have to be disassembled. In addition, eccentricity or coupling face runout are not problems since both shafts rotate together.

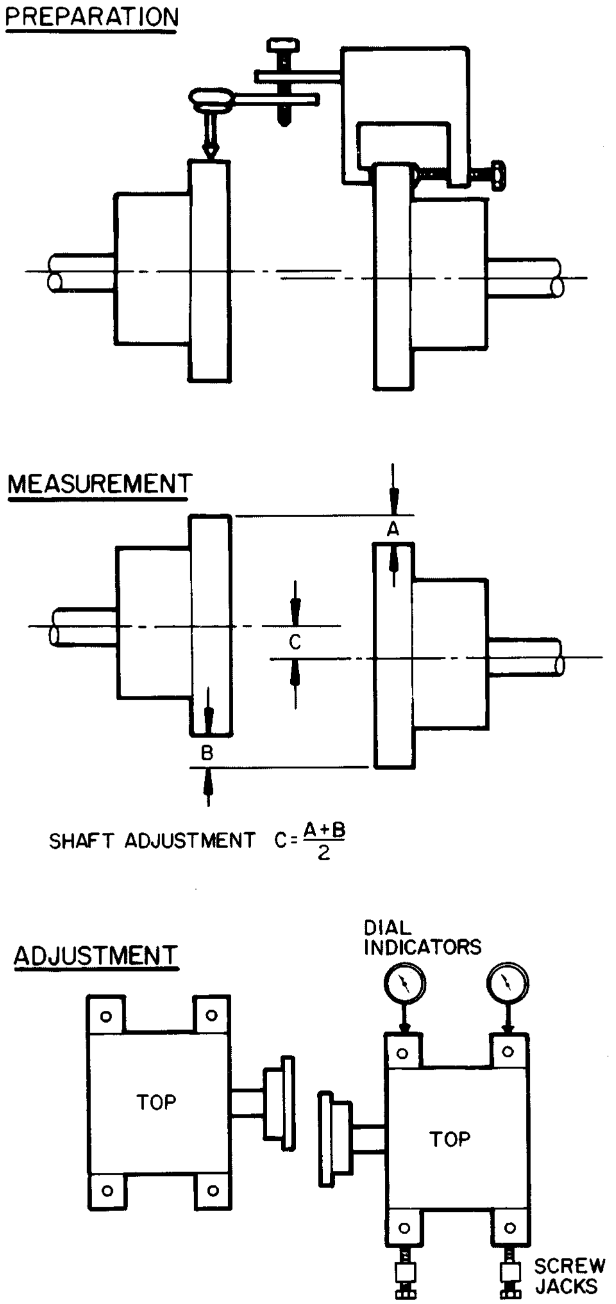


Fig. 42 — Correcting Parallel Misalignment

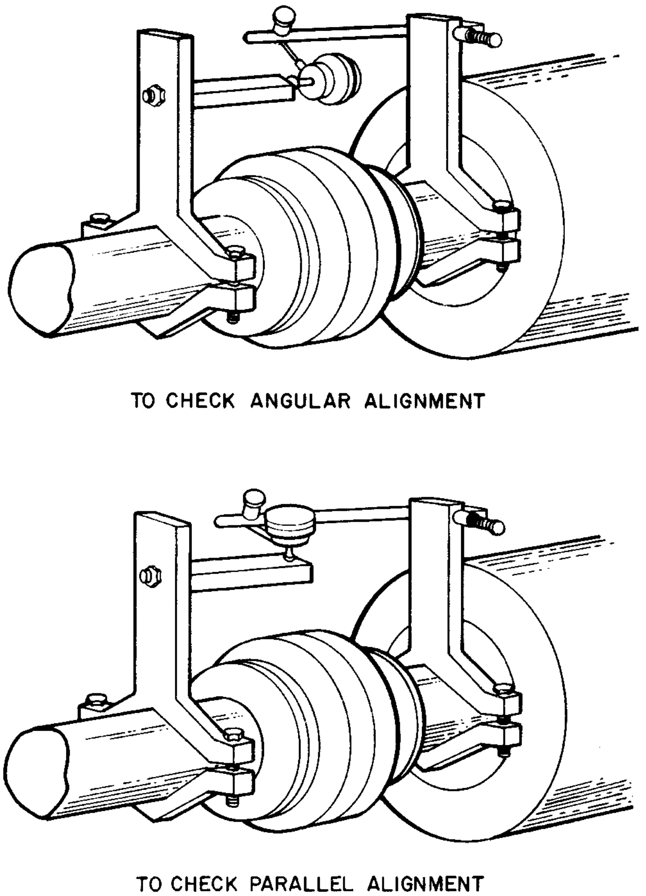


Fig. 43 — Alignment Check — Assembled Coupling

When using brackets, the diameter in the alignment formula (see Near Final Alignment, Connecting Angular Misalignment section) will be that of the circle through which the dial indicator rotates.

1. Shut down the chiller.
2. With chiller at operating temperature, quickly install brackets.
3. Check that alignment is within .002 in. TIR and .00033 in. per in. of traverse (0.00033 mm per mm of traverse) across the diameter of measurement. Adjust alignment as required. (Refer to Near Final Alignment section.)
4. Remove brackets and run chiller until operating temperature is again reached.
5. Recheck the alignment per steps 1 through 4 until it remains within the specified tolerances.

Be sure that coupling guards are replaced after these checks.

DOWELING

Techniques — After a hot alignment check has been completed, the compressor, gear and drive must be doweled to their sole plates. Doweling permits exact repositioning of components if they have to be moved.

1. Doweling must be completed with equipment at maximum operating temperature (full load).
2. Use No. 8 taper dowels to dowel the compressor, gear, and drive to the base. Use a $^{13}/_{32}$-in. drill and No. 8 taper reamer with straight flutes. Drill pilot hole and then expand the pilot hole to final dimension.
3. Fit dowel so that $^{1}/_{16}$-in. of taper is left above the equipment foot. If dowel holes are re-reamed as a result of realignment, be sure dowels are tight and do not bottom.
4. Place dowels as nearly vertical as possible.
5. Coat the dowels with white lead or other lubricant to prevent rusting.
6. Tap dowel lightly into position with a small machinist's hammer. A ringing sound will indicate proper seating.

Dowel the suction end of the compressor base, the two feet at the high speed end of the gear, and the drive feet in accordance with the drive manufacturer's instructions. The number of dowels used in the drive is usually four, but some manufacturers require more.

WEEKLY MAINTENANCE

Check the Lubrication System — Mark the oil level on the compressor reservoir sight glass, and observe the level each week while the chiller is shut down.

If the level goes below the lower sight glass, the oil reclaim system will need to be checked for proper operation. If additional oil is required, add oil as follows:

Oil may be added through the oil drain and charging valve (Fig. 2, Item 22) using a pump. However, an oil charging elbow on the seal-oil return chamber (Fig. 4) allows oil to be added without pumping. The seal oil return pump automatically transfers the oil to the main oil reservoir. A pump is required for adding oil against refrigerant pressure. The oil charge is approximately 20 gallons (76 L) for FX (size 531-599) style compressors. The added oil *must* meet Carrier's specifications. Refer to Changing the Oil Filters and Oil Changes sections. Any additional oil that is added should be logged by noting the amount and date. Any oil that is added due to oil loss that is not related to service will eventually return to the sump, and must be removed when the level is high.

An oil heater is controlled by the PIC to maintain oil temperature above 150 F (65.5 C) or refrigerant temperature plus 70° F (38.9° C) (see the Controls section) when the compressor is off. The LID STATUS02 screen displays whether the heater is energized or not (*OIL HEATER RELAY*). If the PIC shows that the heater is ON, but the sump is not heating up, the power to the oil heater may be off or the oil level may be too low. Check the oil level, the oil heater contactor voltage, and oil heater resistance.

The PIC does not permit compressor start-up if the oil temperature is too low. The PIC continues with start-up only after the temperature is within limits.

After the initial start or a 3-hour power failure, the PIC allows the chiller to start once the oil is up to proper temperature, but uses a slow ramp load rate of 2° F (1.6° C) per minute.

Be sure that the isolation valves on the oil line near the filter(s) (Fig. 44) are fully open before operating the compressor.

There are no lubrication requirements for the FX disc coupling.

Check the oil level in the gear reservoir and observe the level each week. If additional oil is required, add oil as described in the Oil Changes section on page 77. The added oil must meet Carrier specifications. (See Table 11.) Do not overfill the reservoir. Any additional oil added or removed should be logged by noting the amount and date.

Check the oil level in the motor bearings and observe the level each week. If additional oil is required, add oil as described in the Oil Changes section on page 77. The added oil must meet Carrier specifications. (See Table 11.) Any additional oil added or removed should be logged by noting the amount and date.

SCHEDULED MAINTENANCE

Establish a regular maintenance schedule based on the actual chiller requirements such as chiller load, run hours, and water quality. The time intervals listed in this section are offered as guides to service only.

Service Ontime — The LID displays a *SERVICE ONTIME* value on the STATUS01 screen. This value should be reset to zero by the service person or the operator each time major service work is completed so that time span between service can be tracked and viewed.

Inspect the Control Center — Maintenance is limited to general cleaning and tightening of connections. Vacuum the cabinet to eliminate dust build-up. If the chiller controls malfunction, refer to the Troubleshooting Guide section for control checks and adjustments.

⚠ CAUTION

Be sure power to the control center is off when cleaning and tightening connections inside the control center.

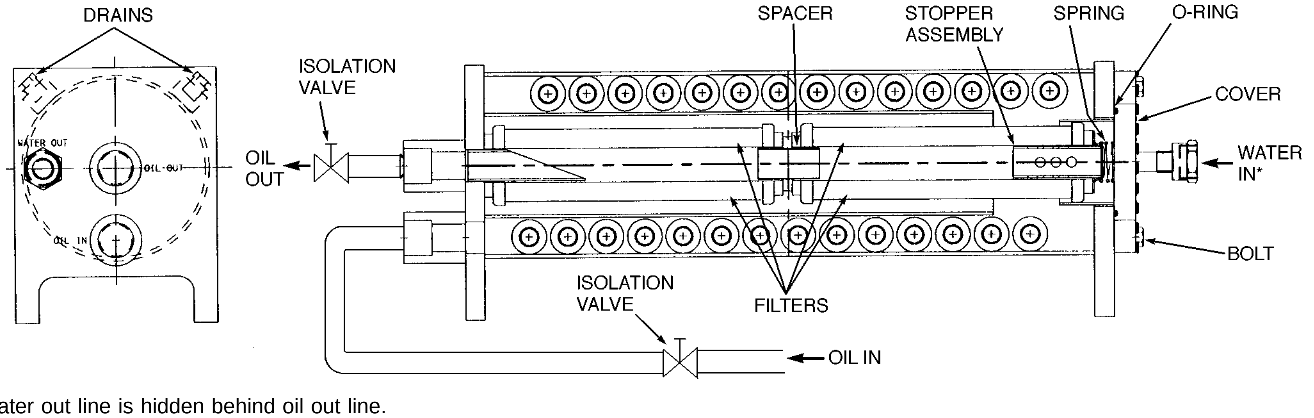
Check Safety and Operating Controls Monthly

— To ensure chiller protection, the automated control test should be done at least once per month. See Table 3 for safety control settings.

Changing the Oil Filters

COMPRESSOR OIL FILTER — Change this oil filter annually or whenever the chiller is open for repairs. The 17FX compressor has an isolatable filter so that the filter may be changed without removing refrigerant from the chiller. Use the following procedure.

1. Make sure the compressor is off and that the compressor disconnect is open.
2. Disconnect the power to the oil heater and oil pump.
3. Close the valves to the filter.
4. Relieve the pressure from within the filter by using the pressure connection on the oil feed line valve to the compressor. Run a hose from the connection to a bucket to catch the oil.



*Water out line is hidden behind oil out line.

Fig. 44 — Typical Compressor or Gear Oil Cooler/Filter

5. Open the drain located on the shell of the cooler/filter. Run a hose from the drain to a bucket to catch the oil.
6. Once the pressure has been relieved and the oil drained, loosen the bolts that hold the cover on the filter body. Remove the old filter cartridges and replace with a new filter cartridge. Assemble the filter assembly (filters, spacer, and stopper assembly), and make sure that the spring is centered against the filter assembly as shown in Fig. 44.
7. Replace the drain fitting, using standard practices to ensure a leak-tight joint. Evacuate the air from the cooler/filter assembly.
8. Once the assembly has been evacuated, open the isolation valves.
9. Connect power to the oil heater and oil pump. The oil heater should turn on and warm the oil to 140 to 150 F (60 to 66 C). Operate the oil pump for 2 minutes. Add oil, if required, to keep the level up in the lower sight glass.

Oil should be visible in the reservoir sight glass during all operating and shutdown conditions.

EXTERNAL GEAR OIL FILTER — Change the oil filter annually or whenever the chiller is open for repairs. The 17EX external gear lubrication system has an isolatable filter. Use the following procedure.

1. Make sure that the compressor is off and the compressor disconnect is open.
2. Disconnect the power to the oil heater, if equipped, and to the oil pump.
3. Close the line valves to the filter.
4. Relieve any pressure from within the filter by using the pressure connection on the oil feed line valve to the compressor. Run a hose from the connection to a bucket to catch the oil.
5. Open the drain located on the shell of the cooler/filter. Run a hose from the connection to a bucket to catch the oil.
6. Once the pressure has been removed and the oil drained, loosen the bolts that hold the cover on the filter body. Remove the oil filter cartridges and replace with new cartridges. Assemble the filter assembly (filters, spacer, and stopper assembly), and make sure that the spring is centered against the filter assembly, as shown in Fig. 44.
7. Replace the drain fitting, using standard practices to ensure a leak-tight joint.
8. Open the isolation valves.
9. Connect power to the oil heater, if equipped, and oil pump. Operate the oil pump for 2 minutes. Add oil, if required, to keep the level up in the sight glass.

Oil should be visible in the reservoir sight glass during all operating and shutdown conditions.

Oil Specifications — If oil is to be added, it must meet the Carrier specifications shown in Table 11.

Oil Changes — Carrier recommends changing the oil after the first year of operation and every three to five years thereafter as a minimum. Carrier also recommends a yearly oil analysis. However, if a continuous oil monitoring system is functioning and a yearly oil analysis is performed, the time between oil changes can be extended.

COMPRESSOR OIL

1. Open the control and oil heater circuit breaker.
2. Drain the oil reservoir by opening the oil charging valve, (Fig. 2, Item 22). Slowly open the valve against refrigerant pressure.
3. Change the oil filter at this time. See the Changing the Oil Filters section, page 76.
4. Charge the chiller with approximately 20 gallons (76 L) of oil for FX (size 531-599) style compressors in order to bring the level to the middle of the upper sight glass (Fig. 2, Item 21). Turn on the power to the oil heater and let the PIC warm it up to at least 140 F (60 C). Operate the oil pump manually, through the control test, for 2 minutes. The oil level should be between the lower sight glass and one-half full in the upper sight glass for shutdown conditions.

EXTERNAL GEAR OIL — Proper lubrication is vital to maintain gear drive performance. After 500 hours or 4 weeks of initial operation, whichever is first, the external gear drive should be thoroughly drained, flushed, and refilled with the proper lubricant. Under normal operating conditions, the lubricant should be changed every 2500 hours or 6 months, whichever comes first. This change frequency can be extended if an oil sample analysis indicates a very limited degradation or contamination.

Table 11 — 17EX Chiller Oil Specifications

SPECIFICATION	COMPRESSOR	MOTOR SLEEVE BEARINGS	EXTERNAL GEAR	PUMPOUT COMPRESSOR AND OIL SEPARATOR
Oil Type*	Inhitited Polyolester-Based Synthetic Compressor Oil	Mineral-Based, Rust and Oxidation Inhibited Turbine Grade Oil	Rust and Oxidation Inhibited Oil	Reciprocating Compressor Oil
Viscosity at 100 F (37 C)	ISO 68 (300 SSU)	ISO 32 (150 SSU)	ISO 68 (300 SSU)	ISO 68 (300 SSU)
Carrier Part Number	PP23BZ107	PP23BZ091	PP23BB005	PP23BZ103
Carrier Specification	PP47-12	PP16-0	PP16-2	PP47-31
Recommended Manufacturer	ICI, Emkarate RL68H	Mobil, DTE Light Texaco, Regal R & 0432 Sun Oil, Sunvis 932 Chevron, GST ISO 32	Mobil Oil, DTE Heavy Medium Texaco, Regal UR & 068 Chevron, OC #68 NOCO, Turbine T-68	Castrol Icematic SW68 ICI Emkarate RL68HP
Capacity	20 gal (76 L)	0.6 gal (2.3 L) per bearing	17 gal (41.6L)	Compressor: 4.5 pints (2.6 L) Oil Separator: 1 pint (0.6 L)

LEGEND

SSU — Saybolt Universal Seconds

*Oil type specified for chillers using HFC-134a refrigerant.

The lubricant should be drained while the gear is at operating temperature. The gear drive should be cleaned with a flushing oil. Used lubricant and flushing oil should be completely removed from the system to avoid contaminating new oil.

To change the oil in the external gear:

1. Make sure that the compressor is off and the disconnect for the compressor is open.
2. Disconnect the power to the oil heater, if equipped, and the oil pump.
3. Open the drain located on the shell of the cooler/filter. Run a hose from the drain to a bucket to catch the oil.
4. Once the pressure has been removed and the oil drained, loosen the bolts that hold the cover on the filter body. Remove the old filter cartridges. Assemble the filter assembly (filters, spacer, and stopper assembly), and make sure that the spring is centered against the filter assembly as shown in Fig. 44.
5. Replace the drain fitting, using standard practices to ensure a leak-tight joint.
6. Open the isolation valves and add new oil. Refer to Table 11 for oil specifications.
7. Connect power to the oil heater, if equipped, and the oil pump. Operate the oil pump for 2 minutes. Add oil, if required, to keep the level up in the sight glass.

MOTOR SLEEVE BEARING AND PUMPOUT COMPRESSOR OIL — For instructions on changing the motor sleeve bearing oil, refer to the section on Motor Maintenance, this page.

For instructions on changing the optional pumpout compressor and oil separator oil, refer to the section on Pumpout System Maintenance, page 83.

Inspect Refrigerant Float System — Inspect the refrigerant float system once every 5 years or when the economizer/storage vessel is opened for service. Transfer the refrigerant into the cooler vessel or into a storage tank. There are two floats on the 17EX, one on each side of the economizer/storage vessel. Remove the float access covers. Clean the chambers and valve assembly thoroughly. Be sure that the valves move freely. Make sure that all openings are free of obstructions. Examine the cover gaskets and replace if necessary. See Fig. 45 for a view of both floats.

Inspect Relief Valves and Piping — The relief valves on this chiller protect the system against the potentially dangerous effects of overpressure. To ensure against damage to the equipment and possible injury to personnel, these devices must be kept in peak operating condition.

As a minimum, the following maintenance is required.

1. At least once a year, disconnect the vent piping at the valve outlet and carefully inspect the valve body and mechanism for any evidence of internal corrosion or rust, dirt, scale, leakage, etc.
2. If corrosion or foreign material is found, do not attempt to repair or recondition. *Replace the valve.*
3. If the chiller is installed in a corrosive atmosphere or the relief valves are vented into a corrosive atmosphere, make valve inspections at more frequent intervals.

Coupling Maintenance — Proper coupling maintenance is important since the coupling supports the outboard end of the compressor high speed shaft. Clean and inspect both couplings for wear yearly. Misalignment causes undue noise and wear. Check alignment yearly, or more often if vibration or heating occur. Refer to Chiller Alignment section, page 71.

⚠ WARNING
Never operate the drive without the coupling guards in place. Contact with a rotating shaft or coupling can cause serious injury.

Motor Maintenance — A carefully planned and executed program of inspection and maintenance will do much to ensure maximum motor availability and minimum maintenance cost. If it becomes necessary to repair, recondition, or rebuild the motor, it is recommended that the nearest Westinghouse repair facility be consulted.

In addition to a daily observation of the appearance and operation of the motor, it is recommended that a general inspection procedure be established to periodically check the following items:

- cleanliness, both external and internal
- stator and rotor (squirrel-cage) windings
- bearings

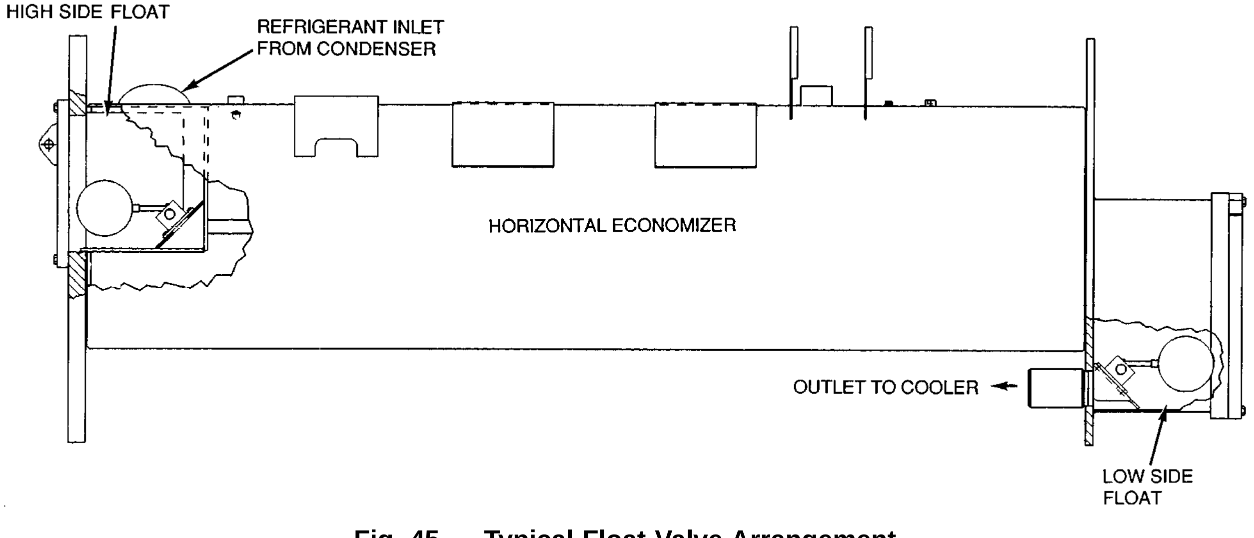


Fig. 45 — Typical Float Valve Arrangement

CLEANLINESS — On open ventilated motors, screens and louvers over the inlet air openings should not be allowed to accumulate any build-up of dirt, lint, etc., that could restrict free air movement. Screens and louvers should never be cleaned or disturbed while the motor is in operation because any dislodged dirt or debris can be drawn directly into the motor.

If the motor is equipped with air filters, they should be replaced (disposable type) or cleaned and reconditioned (permanent type) at a frequency that is dictated by conditions. It is better to replace or recondition filters too often than not often enough.

⚠ CAUTION

Washing motors using a water spray is not recommended. Manual or compressed air cleaning is preferred. If it becomes necessary to spray-wash a motor, it should be done with extreme care. Do not aim high pressure sprays directly at air inlet openings, conduit connections, shaft seals, or gasketed surfaces to prevent the possibility of forcing water inside the chiller.

The stator windings of motors with open ventilation systems can become contaminated with dirt and other substances brought into the motor by the ventilating air. Such contaminants can impair cooling of the winding by clogging the air passages in the winding end-turns and vent ducts through the stator core and by reducing heat transfer from the winding insulation surfaces to the cooling air. Conducting contaminants can change or increase electrical stresses on the insulation, and corrosive contaminants can chemically attack and degrade the insulation. This may lead to shortened insulation life and stator failure.

Several satisfactory methods of cleaning stator windings and stator cores are offered below:

<u>Compressed Air</u> — Low pressure (30 psi maximum), clean (no oil) dry air can be used to dislodge loose dust and particles in inaccessible areas such as air vent ducts in the stator core and vent passages in the winding end-turns. Excessive air pressure can damage insulation and drive contaminants into inaccessible cracks and crevices.

<u>Vacuum</u> — Vacuum cleaning can be used, both before and after other methods of cleaning, to remove loose dirt and debris. It is a very effective way to remove loose surface contamination from the winding without scattering it. Vacuum cleaning tools should be nonmetallic to avoid any damage to the winding insulation.

<u>Wiping</u> — Surface contamination on the winding can be removed by wiping, using a soft, lint-free wiping material. If the contamination is oily, the wiping material can be moistened (not dripping wet) with a safety-type petroleum solvent, such as Stoddard solvent. In hazardous locations, a solvent such as inhibited methyl chloroform may be used, but must be used sparingly and immediately removed. While this solvent is non-flammable under ordinary conditions, it is toxic. Proper health and safety precautions should be followed while using it.

Solvents of any type should never be used on windings provided with abrasion protection. Abrasion protection is a grey, rubber-like coating applied to the winding end-turns.

⚠ WARNING

Adequate ventilation must always be provided in any area where solvents are being used to avoid the danger of fire, explosion, or health hazards. In confined areas (such as pits) each operator should be provided with an air line respirator, a hose mask, or a self-contained breathing apparatus. Operators should wear goggles, aprons, and suitable gloves. Solvents and their vapors should never be exposed to open flames or sparks and should always be stored in approved safety containers.

SLEEVE BEARINGS

<u>Oil Changing</u> — The oil reservoirs of the self lubricated bearings should be drained and refilled every 6 months. More frequent changes may be needed if severe oil discoloration or contamination occurs. In conditions where contamination does occur, it may be advisable to flush the reservoir with kerosene to remove any sediment before new oil is added. Proper care must be taken to thoroughly drain the reservoir of the flushing material before refilling it with the new oil.

Refill the reservoir to the center of the oil sight glass with a rust and oxidation inhibited, turbine grade oil. The viscosity of the oil must be 32 ISO (150 SSU) at 100 F (37.7 C). Oil capacity in each of the 2 bearings is 0.6 gal. (2 l) per bearing. Use of Carrier Oil Specification PP16-0 is approved (refer to Table 11).

<u>Disassembly</u> — The bearing sleeve is spherically seated and self-aligning. The opposite drive end bearing is normally insulated for larger motors (or when specified). On some motors, the insulation is bonded to the spherical seat of the bearing housing. Use extreme care when removing the sleeve from the insulated support to avoid damaging this insulation.

Note that some bolts and tapped holes associated with the bearing housings, bearing sleeves, and seals are metric.

The following procedure is recommended for removing the bearing sleeve.

1. Remove the oil drain plug in the housing bottom and drain the oil sump.
2. Remove all instrumentation sensors that are in contact with the bearing sleeve. These include resistance temperature detectors, thermocouples, temperature relay bulbs, thermometers, etc.
3. Remove the end cover.
4. Remove the socket head bolts holding the bearing cap and the inner air seal together at the horizontal split. The front end cover plate must also be removed if the front bearing is being disassembled. Remove the bearing cap and top half of the inner air seal by lifting straight up to avoid damaging the labyrinth seals. Place them on a clean, dry surface to avoid damage to the parting surfaces.
5. Remove any split bolts that may be holding the two bearing halves together. Remove the top half of the bearing sleeve using suitable eyebolts in the tapped holes provided. Lift the bearing top straight up and avoid any contact with the shoulders of the shaft journals that might damage the thrust faces of the bearing. Place on a clean, dry surface, taking care to prevent damage to either the parting surfaces or the locating pins that are captive in the top bearing half.
6. Remove the 4 screws at the partings in the oil ring and dismantle the ring by gently tapping the dowel pin ends with a soft-faced mallet. Remove the ring halves and immediately reassemble them to avoid any mixup in parts or damage to the surfaces at the partings.

7. When removing the labyrinth seals, note the position of the anti-rotation button located on the inside of the top half of the seal. Pull up the garter spring surrounding the floating labyrinth seal and carefully slip out the top half. Rotate the garter spring until the lock is visible. Twist counterclockwise to disengage the lock, remove the garter spring, then rotate the lower half of the seal out of the groove in the bearing housing while noting the orientation of the oil drain holes. Note the condition of these floating labyrinth seals. If they are cracked or chipped, they must be replaced. Do not attempt to reuse a damaged seal.
8. To remove the bottom bearing half, the shaft must be raised a slight amount to relieve pressure on the bearing. On the rear end, this can be done by jacking or lifting on the shaft extension. (Care must be taken to protect the shaft from damage.) On the front end, jacking or lifting can be done using bolts threaded into the tapped holes provided in the shaft end.

   NOTE: Lift only enough to free the bearing; overlifting the shaft can cause difficulty in removing the bearing.
9. Roll the bottom bearing half to the top of the shaft journal and then lift it using suitable eyebolts threaded into the holes provided. Again, avoid any contact with the shaft shoulders that could damage the bearing thrust faces. Place the lower bearing half on a clean, dry surface to protect the parting surfaces.

⚠ WARNING

Use extreme care when rolling out the lower bearing half. Keep the hands and fingers well clear of any position where they might be caught by the bearing half if it were accidentally released and rotated back to its bottom position. Serious personal injury could result.

10. Protect the shaft journal by wrapping it with clean, heavy paper or cardboard.

Reassembly — Bearing reassembly is basically a reversal of the disassembly procedures outlined above, with the following additional steps.

⚠ CAUTION

Curil-T is the only approved compound for use in the assembly of the bearings on this motor. Other products may harden and impede the operation.

⚠ CAUTION

During the reassembly of the bearing parts, a thin layer of Curil-T should be applied to all gasketed and machined interface surfaces. This suggestion does not apply to the machined surfaces of the bearing liner halves.

⚠ CAUTION

When seating the bearing shell, apply a thin layer of lubricating oil at the spherical surface of the liner. Slowly roll the lower bearing liner into the bearing housing making sure that the split surfaces of the liner and the housing are flush. Gradually lower the shaft onto the bearing. The weight of the shaft will help rotate the bearing liner so that the babbitt surface of the liner will match the slope of the journal. Sometimes it is necessary to use a rubber mallet to tap lightly on the bearing housing while slowly rolling the shaft to help this seating operation.

1. The interior of the bearing housing should be cleaned and then flushed with clean oil or kerosene.
2. The bearing halves and the shaft journal should be wiped clean using lint-free cloth soaked with clean oil.
3. All parts should be carefully inspected for nicks, scratches, etc., in any contact surfaces. Such imperfections should be removed by an appropriate method such as stoning, scraping, filing, etc., followed by thorough cleaning.
4. Apply a few drops of oil to the journal and bearing saddles.
5. Roll the bottom half of the bearing into place and lower the shaft.
6. Before installing the floating labyrinth seal halves, observe their condition. Do not attempt to use a cracked or chipped seal. The bottom half seal has a set of drilled holes in its side face. These must be placed at the bottom toward the inside of the bearing so that accumulating oil may drain back into the housing.
7. Put a small bead of Curil-T around the bottom seal half outside diameters on both sides adjacent to the garter spring groove. This prevents oil from bypassing the seal around its outside.
8. Place the bottom seal half on top of the shaft (ensuring that the proper orientation of the drain holes is provided) and roll it into position. Install the top half of the seal making sure that the anti-rotation button is located in the proper position on the inboard side of the bearing. Insert the garter spring pulling up on both ends to permit engaging the lock. Run a small bead of Curil-T around the outside diameters on both sides adjacent to the garter spring groove on this half also.
9. Carefully reassemble the two oil ring halves. Inspect the dowel pins for burrs and straightness and make any corrections required. Do not force the ring halves together. Excessive force may alter the roundness or flatness of the ring which can change its oil delivery performance. Apply locking compound to the oil ring screws prior to reassembly.
10. Assemble the top half of the bearing liner making sure that the match marks on the liner halves align with one another. Failure to ensure alignment of match marks can cause misalignment and possible damage to bearings and journal surfaces. Reinstall any split bolts, if supplied, between the bearing halves.
11. Some of the pipe plugs in the housing are metric thread type and have a copper, lead, or similar material washer. If these plugs are removed, be careful not to lose the washers. Before reassembly, inspect the washers and replace them if required.
12. Before installing the bearing cap, observe the position of the floating labyrinth seal. The "tab" must be on top to engage the pocket. Failure to position the seal properly will result in damage when the cap is assembled.
13. Carefully lower the bearing housing cap over the floating seals. Keep the bearing cap level to avoid binding and possibly damaging the seals. The bearing cap should seat evenly on the bearing housing base.

⚠ CAUTION

Do not force the bearing cap down. Damage could occur to the labyrinth seals.

If the bearing cap does not seat completely, remove and reset the floating labyrinth seal position. When installing upper bearing cap, the floating labyrinth seals sometimes rotate and the anti-rotation "tab" does not seat in its holder, thus preventing the bearing housing from seating properly. This procedure should be repeated until the bearing cap seats properly.

14. Reinstall the bearing housing split bolts. Before torquing bearing housing cap bolts, rotate the shaft by hand while bumping the bearing housing with a rubber or rawhide mallet in the horizontal and axial planes to allow the bearings to align themselves to the shaft journals.
15. Torque the bearing housing cap bolts by following the torque values as provided in Table 6 on page 51.

Motor Handling/Rigging — Each motor is provided with lifting lugs, welded to the four corners of the motor frame, for lifting the assembled chiller. The motor should always be lifted by using the lifting lugs located on all four corners of the motor frame. (See Fig. 46.)

⚠ CAUTION

Spreader bars of adequate capacity and number must be used to avoid applying any pressure against the top air housing with the lifting plugs.

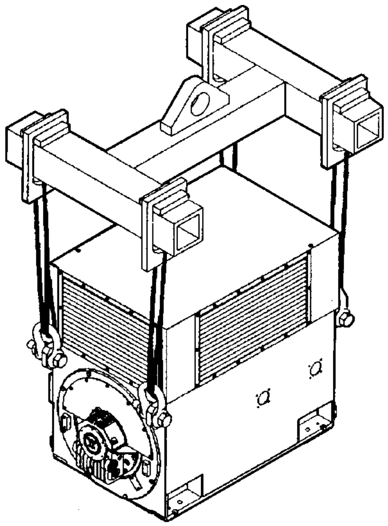


Fig. 46 — Motor Riggings

If the motor is lifted with the top air housing removed, the angle of the lifting slings with the horizontal should never be less than 45 degrees.

With the exclusion of the TEWAC cooler, the top air housing is provided with ¾-10 tapped holes for lifting devices to be installed in order to remove the air housing from the motor. The top air housing can be detached by removing the enclosure holddown bolts, located in the inside corners of the enclosure. These enclosure holddown bolts are accessed through the louver/screens located on the front and rear end of the chiller or through access panels bolted to the sides of the enclosure.

⚠ CAUTION

Uneven lifting must always be avoided. When single point lifting is to be used, slings of equal lengths must always be used to avoid uneven lifting.

⚠ CAUTION

Under no circumstances should the motor be lifted using the shaft as an attachment point.

NOTE: Refer to weights specified on certified drawing to determine proper lifting equipment required for specific components or assemblies.

Motor Storage — If the chiller is to be placed in extended shutdown, certain precautions must be taken to provide proper protection while the motor is being stored. The motor should be stored under cover in a clean, dry location and should be protected from rapid temperature changes.

Since moisture can be very detrimental to electrical components, the motor temperature should be maintained at approximately 5° F (3° C) above the dew point temperature by providing either external or internal heat. If the motor is equipped with space heaters, they should be energized at the voltage shown by the space heater nameplate attached to the motor. Incandescent light bulbs can be placed within the motor to provide heat. However, if used, they must not be allowed to come in contact with any parts of the motor because of the concentrated hot spot that could result.

This motor has been provided with a shaft shipping brace or shipping bolt (normally painted yellow) to prevent shaft movement during transit, it must be removed to allow shaft rotation (refer to Before Initial Start-Up, Remove Shipping Packaging section, page 45). It is very important that this brace be reinstalled exactly as it was originally, before the motor is moved from storage or any time when the motor is being transported. This prevents axial rotor movement that might damage the bearings.

Motors equipped with sleeve bearings are shipped from the factory with the bearing oil reservoirs drained. In storage, the oil reservoirs should be properly filled to the center of the oil level gage with a good grade of rust inhibiting oil (refer to the certified drawing for oil viscosity and any special requirements). To keep the bearing journals well oiled and to prevent rusting, the motor shaft should be rotated several revolutions every 2 weeks. While the shaft is rotating it should be pushed to both extremes of the endplay to allow for oil flow over the entire length of the journals.

External Gear Storage — All internal and unpainted external surfaces of the gear drives have been treated with a rust preventative at the factory before shipment. The protective life of the rust preventative varies with temperature fluctuations, atmospheric moisture content, degree of exposure to the elements during storage, and degree of contact with other objects.

Inspect all machined surfaces, and spray or add rust inhibitor to exposed metal surfaces that may have had the protective coating removed during shipping and handling.

To be sure that the gear drive operates satisfactorily at start-up, take certain precautions when you receive it. The expected length of storage and the storage atmosphere dictate the maintenance schedule to be followed. The gear must always be stored in its operating position, level on its mounting feet, and free of loads or weights on input and output shafts.

SHORT-TERM STORAGE (Indoors) — If the units are to be stored for 30 days or less, observe the following precautions.

- Store the unit in a clean, dry location with the factory packing intact and with as nearly a constant temperature as possible.
- Elevate the unit a minimum of 6 in. above the floor level.
- Avoid areas that are subject to extremes in temperature, vibration, and humidity.

LONG-TERM STORAGE (Indoors) — If the unit is to be stored for more than 30 days, observe the following precautions. Store in a clean, dry location. Elevate the unit at a minimum of 6 in. above the ground floor level. Avoid areas that are subject to extremes in temperature, vibration, and humidity. In addition, do *one* of the following:

- Remove the breather and replace it with pipe plugs. Pack the entire seal area with grease to form a vapor barrier and seal with tape.

Fill the gear drive to the recommended oil level with heated Shell VSI grade 68 oil or its equivalent, heated between 110 and 120 F (43 and 49 C). Do not overfill. Immediately close the openings to keep the vapors in the housing.

Inspect the unit every 30 days and spray or add rust inhibitor suitable for anticipated storage conditions, as required.

Drain and replace the oil with the recommended oil type prior to start-up.

- Remove the breather and replace it with a pipe plug. Pack the entire seal area with grease to form a vapor barrier and seal it with tape.
  A vapor-phase rust inhibitor, such as Daubert Chemical, Non-Rust Motorstor VCi-10 or its equivalent, may be added to the recommended oil type in the amount of 2% of the total sump capacity. Fill the unit to the recommended level. Do not overfill.

  Inspect the unit every 30 days and spray or add rust inhibitor suitable for anticipated storage conditions, as required.

  The unit may run without changing this oil mixture.

EXTENDED DOWNTIME — Consider the length of downtime the unit will undergo. The lubricating oil used in the unit should protect the interior parts for up to 30 days of shutdown. If the unit will be shut down longer than 30 days, it must be operated a minimum of 30 minutes every 30 days to distribute the lubricant to all interior parts.

If it is impractical to operate the unit every 30 days, the long-term storage instructions described above must be followed. All seals applied for this storage condition must be removed before operating the unit.

Compressor Bearing Maintenance — The key to good bearing maintenance is proper lubrication. Use the proper grade of oil, maintained at recommended level, temperature, and pressure. Inspect the lubrication system regularly and thoroughly.

Only a trained service technician should remove and examine the bearings. The bearings should be examined on a scheduled basis for signs of wear. The frequency of examination is determined by the hours of chiller operation, load conditions during operation, and the condition of the oil and the lubrication system. Excessive bearing wear can sometimes be detected through increased vibration or increased bearing temperature. If either symptom appears, contact an experienced and responsible service organization for assistance.

External Gear Maintenance — Perform the required maintenance and recommended intervals. Good preventive maintenance prolongs the life of the unit.

Daily

- Inspect for leaks and loose connections.
- Check the oil level.
- Check the oil temperature and pressure.
- Check for unusual noise and/or vibration.

Weekly — Check the oil filter.

Monthly

- Obtain oil sample analysis.
- Clean or replace oil filters.
- Check the foundation mounting bolts for tightness.
- Clean the air filter.
- Check the operation of all auxiliary equipment.

Semi-Annually

- Check gear tooth wear.
- Check the oil and replace it if necessary.
- Check the coupling alignment.

Annually

- Check the heat exchanger for corrosion and clogged tubes.
- Check the bearing clearance and end play.

Disassembly and Assembly Instructions — The following instructions apply to standard high speed gear units.

- Required Equipment: In addition to standard mechanic's tools, have the following equipment on hand: hoist, sling, torque wrench, feeler gages, and dial indicator.
- General Instructions: Clean external surfaces of the gear unit before removing the cover to prevent contaminants from falling into it. Record the mounting dimensions and the location of accessories for reference when reassembling. To remove the gear from its operating area, disconnect all connected equipment and lift the gear from its foundation using 4 lifting lugs.

Inspect the Heat Exchanger Tubes

COOLER — Inspect and clean the cooler tubes at the end of the first operating season. Because these tubes have internal ridges, a rotary-type tube cleaning system is necessary to fully clean the tubes. Upon inspection, the tube condition determines the scheduled frequency for cleaning and indicates whether water treatment is adequate in the chilled water/brine circuit. Inspect the entering and leaving chilled water temperature sensors for signs of slime, corrosion, or scale. Replace the sensor if corroded or remove any scale if found.

CONDENSER — Since this water circuit is usually an open-type system, the tubes may be subject to contamination and scale. Clean the condenser tubes with a rotary tube cleaning system at least once per year and more often if the water is contaminated. Inspect the entering and leaving condenser water sensors for signs of slime, corrosion, or scale. Replace the sensor if corroded or remove any scale if found.

Higher than normal condenser pressures, together with the inability to reach full refrigeration load, usually indicate dirty tubes or air in the chiller. If the refrigeration log indicates a rise above normal condenser pressures, check the condenser refrigerant temperature against the leaving condenser water temperature. If this reading is more than what the design difference is supposed to be, then the condenser tubes may be dirty, or water flow may be incorrect. Because HFC 134a is a high-pressure refrigerant, air usually does not enter the chiller; rather, the refrigerant leaks out.

During the tube cleaning process, use brushes especially designed to avoid scraping and scratching the tube wall. Contact your Carrier representative to obtain these brushes. *Do not use wire brushes.*

⚠ CAUTION

Hard scale may require chemical treatment for its prevention or removal. Consult a water treatment specialist for proper treatment.

Water Leaks — Water in the refrigerant is indicated during chiller operation by the refrigerant moisture indicator on the refrigerant motor cooling line. Water leaks should be repaired immediately.

⚠ CAUTION

The chiller must be dehydrated after repair of water leaks. See Chiller Dehydration section, page 49.

Water Treatment — Untreated or improperly treated water may result in corrosion, scaling, erosion, or algae. The services of a qualified water treatment specialist should be obtained to develop and monitor a treatment program.

⚠ CAUTION

Water must be within design flow limits, clean, and treated to ensure proper chiller performance and reduce the potential of tube damage due to corrosion, scaling, erosion, and algae. Carrier assumes no responsibility for chiller damage resulting from untreated or improperly treated water.

Inspect the Starting Equipment — Before working on any starter, shut off the chiller, and open all disconnects supplying power to the starter.

⚠ WARNING

The disconnect on the starter front panel does not deenergize all internal circuits. Open all internal and remote disconnects before servicing the starter.

⚠ WARNING

Never open isolating knife switches while equipment is operating. Electrical arcing can cause serious injury.

Inspect the starter contact surfaces for wear or pitting on mechanical-type starters. Do not sandpaper or file silver-plated contacts. Follow the starter manufacturer's instructions for contact replacement, lubrication, spare parts ordering, and other maintenance requirements.

Periodically vacuum or blow off accumulated debris on the internal parts with a high-velocity, low-pressure blower.

Power connections on newly installed starters may relax and loosen after a month of operation. Turn power off and retighten. Recheck annually thereafter.

⚠ CAUTION

Loose power connections can cause voltage spikes, overheating, malfunctioning, or failures.

Check Pressure Transducers — Prior to start-up and once a year, the pressure transducers should be checked against a pressure gage reading. Check all three transducers: oil pressure, condenser pressure, and cooler pressure.

Note the evaporator and condenser pressure readings on the STATUS01 screen on the LID. Attach an accurate set of refrigeration gages to the cooler and condenser Schrader fittings. Compare the two readings. If there is a difference in readings, the transducer can be calibrated, as described in the Troubleshooting Guide section.

Pumpout System Maintenance — For compressor maintenance details, refer to the 06D, 07D Installation, Start-Up, and Service Instructions.

OPTIONAL PUMPOUT COMPRESSOR OIL CHARGE — Use oil conforming to Carrier specifications for reciprocating compressor usage. See Table 11.

Oil should be visible in the compressor sight glass both during operation and at shutdown. Always check the oil level before operating the compressor. Before adding or changing oil, relieve the refrigerant pressure as follows:

1. Attach a pressure gage to the gage port of either compressor service valve (Fig. 34).
2. Close the suction service valve and open the discharge line to the storage tank or the chiller.
3. Operate the compressor until the crankcase pressure drops to 2 psig (13 kPa).
4. Stop the compressor and isolate the system by closing the discharge service valve.
5. Slowly remove the oil return line connection. Add oil as required.
6. Replace the connection and reopen the compressor service valves.

PUMPOUT SAFETY CONTROL SETTINGS (Fig. 47) — The pumpout system high-pressure switch should open at 161 psig (1110 kPa) and close at 130 psig (896 kPa). Check the switch setting by operating the pumpout compressor and slowly throttling the pumpout condenser water.

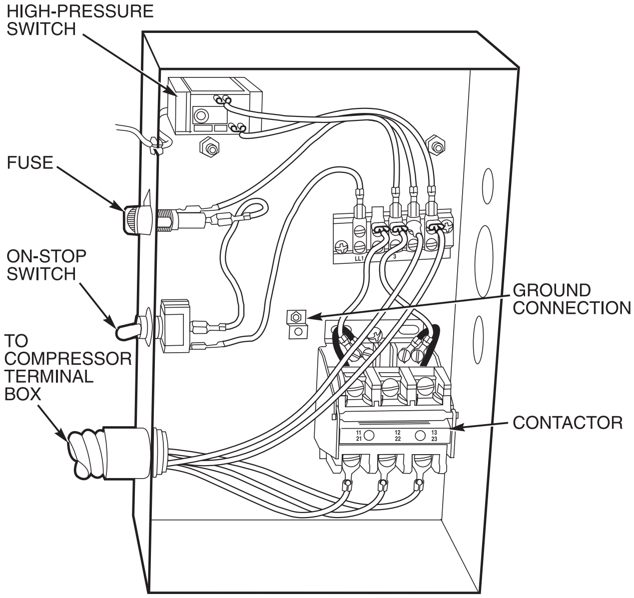


Fig. 47 — Controls for Optional Pumpout Compressor

Ordering Replacement Chiller Parts — When ordering Carrier specified parts, the following information must accompany an order:

- chiller model number and serial number
- name, quantity, and part number of the part required
- delivery address and method of shipment

MOTOR REPLACEMENT PARTS — Replacement or renewal parts information for the motor and any auxiliary devices can be obtained from the nearest Westinghouse Motor Company sales office. A complete description of the needed part(s) is necessary, together with the complete motor nameplate reading for positive motor identification.

EXTERNAL GEAR REPLACEMENT PARTS — Replacement or renewal parts information for the external gear and any auxiliary devices can be obtained from the nearest Nuttall or Lufkin sales office. A complete description of the needed part(s) is necessary, together with the complete gear nameplate reading for positive identification.

TROUBLESHOOTING GUIDE

Overview — The PIC has many features to help the operator and the technician troubleshoot a 17EX chiller.

- By using the LID display, the actual operating conditions of the chiller can be viewed while the unit is running.
- The CONTROL ALGORITHM STATUS table includes screens with information that can be used to diagnose problems with chilled water temperature control, chilled water

temperature control overrides, hot gas bypass, surge algorithm status, and time schedule operation. Refer to Fig. 14 and Table 2, Examples 11-14.

- The control test feature checks for proper operation and tests the temperature sensors, pressure transducers, the guide vane actuator, oil pumps, water pumps, tower control, and other on/off outputs while the compressor is stopped. It also has the ability to lock off the compressor and turn on water pumps for pumpout operation. The LID display shows the required temperatures and pressures during these operations. Refer to Fig. 16 for the CONTROL TEST menu structure and to the Control Test section, page 85, for more information on this feature.
- Other SERVICE menu tables can access configured items, such as chilled water resets, override set points, etc.
- If an operating fault is detected, an alarm message is generated and displayed on the LID default screen. A more detailed message, along with a diagnostic message, is also stored in the ALARM HISTORY table in the PIC.

Checking the Display Messages — The first area to check when troubleshooting the 17EX is the LID display. If the alarm light is flashing, check the primary and secondary message lines on the LID default screen (Fig. 11). These messages indicate where the fault is occurring. The ALARM HISTORY table on the SERVICE menu also carries an alarm message to further expand on this alarm. For a complete list of alarm messages, see Table 12. If the alarm light starts to flash while accessing a menu screen, depress the EXIT softkey to return to the default LID screen to read the failure message. The compressor does not run while an alarm condition exists unless the alarm type is an unauthorized start or a failure to shut down.

Checking Temperature Sensors — All temperature sensors are thermistors. This means that the resistance of the sensor varies with temperature. All sensors have the same resistance characteristics. Determine sensor temperature by measuring voltage drop if the controls are powered, or resistance if the controls are powered off. Compare the readings to the values listed in Table 14A or 14B.

RESISTANCE CHECK — Turn off the control power and disconnect the terminal plug of the sensor in question from the module. With a digital ohmmeter, measure the sensor resistance between the receptacles designated by the wiring diagram. The resistance and corresponding temperature are listed in Table 14A or 14B. Check the resistance of both wires to ground. This resistance should be infinite.

VOLTAGE DROP — Using a digital voltmeter, the voltage drop across any energized sensor can be measured while the control is energized. Table 14A or 14B lists the relationship between temperature and sensor voltage drop (volts dc measured across the energized sensor). Exercise care when measuring voltage to prevent damage to the sensor leads, connector plugs, and modules. The sensor wire should also be checked at the sensor plug connection. Check the sensor wire by removing the condenser at the sensor and measure for 5 vdc back to the module, if the control is powered.

⚠ CAUTION

Relieve all refrigerant pressure or drain the water prior to replacing the temperature sensors.

CHECK SENSOR ACCURACY — Place the sensor in a medium of a known temperature and compare that temperature to the measured reading. The thermometer used to determine the temperature of the medium should be of laboratory quality with 0.5° F (.25° C) graduations. The sensor in question should be accurate to within 2° F (1.2° C).

See Fig. 6 for sensor locations. The sensors are immersed directly in the refrigerant or water circuits. The wiring at each sensor is easily disconnected by unlatching the connector. These connectors allow only one-way connection to the sensor. When installing a new sensor, apply a pipe sealant or thread sealant to the sensor threads.

DUAL TEMPERATURE SENSORS — There are 2 sensing elements on each of the bearing temperature sensors for servicing convenience. In case one of the dual sensors is damaged, the other one can be used by moving a wire.

The number 1 terminal in the sensor terminal box is the common line. To use the second sensor, move the wire from the number 2 position to the number 3 position.

Checking Pressure Transducers — The 17EX chiller has 5 transducers. These transducers sense cooler pressure, condenser pressure, compressor oil supply pressure, oil sump, and gear oil supply pressure. The compressor oil supply pressure and the oil transmission sump pressure difference is calculated by a differential pressure power supply module. The PSIO then reads this differential. In effect, then, the PSIO reads 3 pressure inputs. The cooler and condenser transducers are used by the PIC to determine refrigerant temperatures.

All pressure inputs can be calibrated, if necessary. It is not usually necessary to calibrate at initial start-up. However, at high altitude locations, calibration of the transducer will be necessary to ensure the proper refrigerant temperature/pressure relationship. Each transducer is supplied with 5 vdc power from a power supply. If the power supply fails, a transducer voltage reference alarm occurs. If the transducer reading is suspected of being faulty, check the supply voltage. It should be 5 vdc ± .5 v. If the supply voltage is correct, the transducer should be re-calibrated or replaced.

To calibrate oil pressure differential, refer to Oil Pressure Differential Calibration at the end of this section.

Calibration can be checked by comparing the pressure readings from the transducer against an accurate refrigeration gage. These readings are all viewed or calibrated from the STATUS01 screen on the LID. The transducer can be checked and calibrated at 2 pressure points. These calibration points are 0 psig (0 kPa) and between 240 and 260 psig (1655 to 1793 kPa). To calibrate these transducers:

1. Shut down the compressor.
2. Disconnect the transducer in question from its Schrader fitting.

   NOTE: If the cooler or condenser vessels are at 0 psig (0 kPa) or are open to atmospheric pressure, the transducers can be calibrated for zero without removing the transducer from the vessel.
3. Access the STATUS01 screen, and view the particular transducer reading; it should read 0 psi (0 kPa). If the reading is not 0 psi (0 kPa), but within ± 5 psi (35 kPa), the value may be zeroed by pressing the SELECT softkey while the parameter for the transducer is highlighted. Then, press the ENTER softkey. The value will now go to zero.

   If the transducer value is not within the calibration range, the transducer returns to the original reading. If the LID pressure value is within the allowed range (noted above), check the voltage ratio of the transducer. To obtain the voltage ratio, divide the voltage (dc) input from the transducer by the supply voltage signal, measured at the PSIO terminals J7-J34 and J7-J35. For example, the condenser transducer voltage input is measured at PSIO terminals J7-1 and J7-2. The voltage ratio must be between 0.80 vdc and 0.11 vdc for the software to allow calibration. Pressurize the transducer until the ratio is within range. Then attempt calibration again.

4. A high pressure point can also be calibrated between 240 and 260 psig (1655 and 1793 kPa) by attaching a regulated 250 psig (1724 kPa) pressure (usually from a nitrogen cylinder). The high pressure point can be calibrated by accessing the appropriate transducer on the STATUS01 screen, highlighting the transducer, pressing the SELECT softkey, and then increasing or decreasing the value to the exact pressure on the refrigerant gage. Press ENTER to finish. High altitude locations must compensate the pressure so that the temperature/pressure relationship is correct.

   If the transducer reading returns to the previous value and the pressure is within the allowed range, check the voltage ratio of the transducer. Refer to Step 3 above. The voltage ratio for this high pressure calibration must be between 0.585 and 0.634 vdc to allow calibration. Change the pressure at the transducer until the ratio is within the acceptable range. Then attempt to calibrate to the new pressure input.

The PIC will not allow calibration if the transducer is too far out of calibration. A new transducer must be installed and re-calibrated.

OIL DIFFERENTIAL PRESSURE/POWER SUPPLY MODULE CALIBRATION — (See Fig. 48.) The oil reservoir in the 17EX chiller is not common to cooler pressure. Therefore, a comparison of pump output to cooler pressure can not be used to provide differential oil pressure information. A different method has been developed.

Oil transmission sump pressure and oil supply pressure are fed to a comparator circuit on a 5V power supply board. The output of this circuit, which represents differential oil pressure, is fed to the PSIO. The oil differential pressure is calibrated to 0 psid (0 kPad) by selecting the oil pressure input on the STATUS01 screen. Then, with the oil pump turned OFF and the transducers connected, press the ENTER softkey to zero the point. No high end calibration is needed or possible.

17EX OIL PRESSURE INPUT

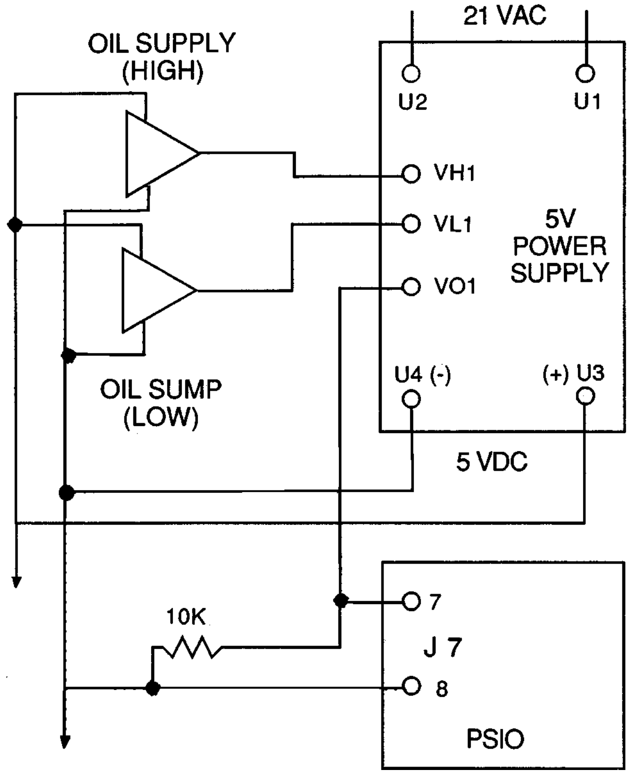


Fig. 48 — Oil Differential Pressure/Power Supply Module

TROUBLESHOOTING TRANSDUCERS — When troubleshooting transducers, keep the negative lead of your voltohmmeter on terminal U4 of the power supply (or terminal 4 on power supplies without the comparator circuit).

Voltage VO1 = (VH1-VL1) + .467 ± .1 V

For all PIC transducers:

Measured pressure = $(507.97 \times (V_{out}/V_{in})) - 47.33$

V_{out} = transducer output ref. to neg. terminal (4 or U4) i.e., VH1 to U4 or VL1 to U4

V_{in} = power supply output, i.e., U3 to U4

TRANSDUCER REPLACEMENT — Since the transducers are mounted on Schrader-type fittings, there is no need to remove refrigerant from the vessel. Disconnect the transducer wiring by pulling up on the locking tab while pulling up on the weather-tight connecting plug from the end of the transducer. *Do not pull on the transducer wires.* Unscrew the transducer from the Schrader fitting. When installing a new transducer, do not use pipe sealer, which can plug the sensor. Put the plug connector back on the sensor and snap into place. Check for refrigerant leaks.

⚠ WARNING

Make sure to use a backup wrench on the Schrader fitting whenever removing a transducer.

Control Algorithms Checkout Procedure — One of the tables in the SERVICE menu is the CONTROL ALGORITHM STATUS table. This table has 6 screens that may be viewed to see how a particular control algorithm is operating, that is, to see what parameters and values the PIC is using to control the chiller.

MAINT01	Capacity Control	The values used to calculate the chilled water/brine control point.
MAINT02	Override Status	Details of all chilled water control override values
MAINT03	Surge/ HGBP Status	The surge and hot gas bypass control algorithm status as well as the values dealing with this control.
MAINT04	LEAD/LAG Status	LEAD/LAG operation status.
OCCDEFM	Time Schedules Status	The Local and CCN occupied schedules, displayed in a way that allows the operator to quickly determine whether the schedule is in an occupied period or not.
WSMDEFME	Water System Manager Status	The status of the WSM (water system manager), a CCN module that can turn on the chiller and change the chilled water control point.

These maintenance tables are very useful in determining guide vane position, reaction from load changes, control point overrides, hot gas bypass reaction, surge prevention, etc.

Control Test — The control test feature can check all the thermistor temperature sensors, including those on the Options modules, pressure transducers, pumps and their associated flow switches, the guide vane actuator, and other control outputs, such as hot gas bypass. The tests can help to determine whether a switch is defective, or a pump relay is not operating, among other useful troubleshooting tests.

During pumpdown operations, the pumps are energized to prevent freeze-up, and the vessel pressures and temperatures are displayed. The pumpdown/lockout feature prevents the compressor from starting up when there is no refrigerant in the chiller or when the vessels are isolated. The operator then uses the terminate lockout screen to end the pumpdown lockout after the pumpdown procedure is reversed and refrigerant is added.

LEGEND FOR TABLE 12, A - N

1CR_AUX — Compressor Start Contact
CA_P — Compressor Current
CCN — Carrier Comfort Network
CDFL — Condenser Water Flow
CHIL_S_S — Chiller Start/Stop
CHW — Chilled Water
CMPD — Discharge Temperature
CRP — Condenser Pressure
ERT — Evaporator Refrigerant Temperature
EVFL — Chilled Water Flow
GV_TRG — Target Guide Vane Position
LED — Light-Emitting Diode
LID — Local Interface Device
MTRB — Bearing Temperature
MTRW — Motor Winding Temperature
OILPD — Oil Pressure
OILT — Oil Sump Temperature
PIC — Product Integrated Control
PRS_TRIP — Pressure Trip Contact
PSIO — Processor Sensor Input/Output Module
RLA — Rated Load Amps
RUN_AUX — Compressor Run Contact
SMM — Starter Management Module
SPR_PL — Spare Protective Limit Input
STR_FLT — Starter Fault
TXV — Thermostatic Expansion Valve
V_P — Line Voltage: Percent
V_REF — Voltage Reference

Table 12 — LID Primary and Secondary Messages and Custom Alarm/Alert Messages with Troubleshooting Guides

A. SHUTDOWN WITH ON/OFF/RESET-OFF

PRIMARY MESSAGE	SECONDARY MESSAGE	PROBABLE CAUSE/REMEDY
MANUALLY STOPPED — PRESS	CCN OR LOCAL TO START	PIC in OFF mode, press the CCN or local softkey to start unit.
TERMINATE PUMPDOWN MODE	TO SELECT CCN OR LOCAL	Enter the CONTROL TEST table and select *TERMINATE LOCKOUT* to unlock compressor.
SHUTDOWN IN PROGRESS	COMPRESSOR UNLOADING	Chiller unloading before shutdown due to soft/stop feature.
SHUTDOWN IN PROGRESS	COMPRESSOR DEENERGIZED	Chiller compressor is being commanded to stop. Water pumps are deenergized within one minute.
ICE BUILD	OPERATION COMPLETE	Chiller shutdown from Ice Build operation.

B. TIMING OUT OR TIMED OUT

PRIMARY MESSAGE	SECONDARY MESSAGE	PROBABLE CAUSE/REMEDY
READY TO START IN XX MIN	UNOCCUPIED MODE	Time schedule for PIC is unoccupied. Chillers will start only when occupied.
READY TO START IN XX MIN	REMOTE CONTACTS OPEN	Remote contacts have stopped chiller. Close contacts to start.
READY TO START IN XX MIN	STOP COMMAND IN EFFECT	Chiller START/STOP on STATUS01 manually forced to stop. Release value to start.
READY TO START IN XX MIN	RECYCLE RESTART PENDING	Chiller in recycle mode.
READY TO START	UNOCCUPIED MODE	Time schedule for PIC is unoccupied. Chiller will start when occupied. Make sure the time and date have been set on the SERVICE menu.
READY TO START	REMOTE CONTACTS OPEN	Remote contacts have stopped chiller. Close contacts to start.
READY TO START	STOP COMMAND IN EFFECT	Chiller START/STOP on STATUS01 manually forced to stop. Release value to start.
READY TO START IN XX MIN	REMOTE CONTACTS CLOSED	Chiller timer counting down unit. Ready for start.
READY TO START IN XX MIN	OCCUPIED MODE	Chiller timer counting down unit. Ready for start.
READY TO START	REMOTE CONTACTS CLOSED	Chiller timers complete, unit start will commence.
READY TO START	OCCUPIED MODE	Chiller timers complete, unit start will commence.
STARTUP INHIBITED	LOADSHED IN EFFECT	CCN loadshed module commanding chiller to stop.
READY TO START IN XX MIN	START COMMAND IN EFFECT	Chiller START/STOP on STATUS01 has been manually forced to start. Chiller will start regardless of time schedule or remote contact status.

C. IN RECYCLE SHUTDOWN

PRIMARY MESSAGE	SECONDARY MESSAGE	PROBABLE CAUSE/REMEDY
RECYCLE RESTART PENDING	OCCUPIED MODE	Unit in recycle mode, chilled water temperature is not high enough to start.
RECYCLE RESTART PENDING	REMOTE CONTACT CLOSED	Unit in recycle mode, chilled water temperature is not high enough to start.
RECYCLE RESTART PENDING	START COMMAND IN EFFECT	Chiller START/STOP on STATUS01 manually forced to start, chilled water temperature is not high enough to start.
RECYCLE RESTART PENDING	ICE BUILD MODE	Chiller in ICE BUILD mode. Chilled water/brine temperature is satisfied for *ICE BUILD SETPOINT* temperature.

Table 12 — LID Primary and Secondary Messages and Custom Alarm/Alert Messages with Troubleshooting Guides (cont)

D. PRE-START ALERTS: These alerts only delay start-up. When alert is corrected, the start-up will continue. No reset is necessary.

PRIMARY MESSAGE	SECONDARY MESSAGE	ALARM MESSAGE/PRIMARY CAUSE	ADDITIONAL CAUSE/REMEDY
PRESTART ALERT	STARTS LIMIT EXCEEDED	STARTS EXCESSIVE Compressor Starts (8 in 12 hours)	Depress the RESET softkey if additional start is required. Reassess start-up requirements.
PRESTART ALERT	HIGH MOTOR TEMPERATURE	MTRW [VALUE] exceeded limit of [LIMIT]*. Check motor temperature.	Check motor cooling line for proper operation. Check for excessive starts within a short time span.
PRESTART ALERT	HIGH BEARING TEMPERATURE	MTRB [VALUE] exceeded limit of [LIMIT]*. Check thrust bearing temperature.	Check oil heater for proper operation, check for low oil level, partially closed oil supply valves, etc. Check sensor accuracy.
PRESTART ALERT	HIGH DISCHARGE TEMP	CMPD [VALUE] exceeded limit of [LIMIT]*. Check discharge temperature.	Check sensor accuracy. Allow discharge temperature to cool. Check for excessive starts.
PRESTART ALERT	LOW REFRIGERANT TEMP	ERT [VALUE] exceeded limit of [LIMIT]*. Check refrigerant temperature.	Check transducer accuracy. Check for low chilled water/brine supply temperature.
PRESTART ALERT	LOW OIL TEMPERATURE	OILT [VALUE] exceeded limit of [LIMIT]*. Check oil temperature.	Check oil heater power, oil heater relay. Check oil level.
PRESTART ALERT	LOW LINE VOLTAGE	V__ P [VALUE] exceeded limit of [LIMIT]*. Check voltage supply.	Check voltage supply. Check voltage transformers. Consult power utility if voltage is low. Calibrate voltage reading on STATUS01 Table.
PRESTART ALERT	HIGH LINE VOLTAGE	V__ P [VALUE] exceeded limit of [LIMIT]*. Check voltage supply.	Check voltage supply. Check voltage transformers. Consult power utility if voltage is low. Calibrate voltage reading on STATUS01 table.
PRESTART ALERT	HIGH CONDENSER PRESSURE	CRP [VALUE] exceeded limit of [LIMIT]*. Check condenser water and transducer.	Check for high condenser water temperature. Check transducer accuracy.
PRESTART ALERT	HIGH GEAR OIL TEMP	GEAOILT [VALUE] exceeded limit of [LIMIT].* Check gear oil cooler flow.	Check for cooler water flow. Check sensor for accuracy.

*[LIMIT] is shown on the LID as temperature, pressure, voltage, etc., set point predefined or selected by the operator as an override, alert, or alarm condition. [VALUE] is the actual pressure, temperature, voltage, etc., at which the control tripped.

E. NORMAL OR AUTO.-RESTART

PRIMARY MESSAGE	SECONDARY MESSAGE	PROBABLE CAUSE/REMEDY
STARTUP IN PROGRESS	OCCUPIED MODE	Chiller starting. Time schedule is occupied.
STARTUP IN PROGRESS	REMOTE CONTACT CLOSED	Chiller starting. Remote contacts are closed.
STARTUP IN PROGRESS	START COMMAND IN EFFECT	Chiller starting. Chiller START/STOP on STATUS01 manually forced to start.
AUTORESTART IN PROGRESS	OCCUPIED MODE	Chiller starting. Time schedule is occupied.
AUTORESTART IN PROGRESS	REMOTE CONTACT CLOSED	Chiller starting. Remote contacts are closed.
AUTORESTART IN PROGRESS	START COMMAND IN EFFECT	Chiller starting. Chiller START/STOP on STATUS01 manually forced to start.

F. SPARE SENSOR ALERT MESSAGES

PRIMARY MESSAGE	SECONDARY MESSAGE	ALARM MESSAGE/PRIMARY CAUSE	ADDITIONAL CAUSE/REMEDY
SPARE SENSOR ALERT	COMMON CHWS SENSOR	Sensor Fault: Check common CHWS sensor.	Check alert temperature set points on EQUIPMENT SERVICE table, SERVICE2 screen. Check sensor for accuracy if reading is not accurate.
SPARE SENSOR ALERT	COMMON CHWR SENSOR	Sensor Fault: Check common CHWR sensor.	
SPARE SENSOR ALERT	REMOTE RESET SENSOR	Sensor Fault: Check remote reset temperature sensor.	
SPARE SENSOR ALERT	TEMP SENSOR — SPARE 1	Sensor Fault: Check temperature sensor — Spare 1.	
SPARE SENSOR ALERT	TEMP SENSOR — SPARE 2	Sensor Fault: Check temperature sensor — Spare 2.	
SPARE SENSOR ALERT	TEMP SENSOR — SPARE 3	Sensor Fault: Check temperature sensor — Spare 3.	
SPARE SENSOR ALERT	TEMP SENSOR — SPARE 4	Sensor Fault: Check temperature sensor — Spare 4.	
SPARE SENSOR ALERT	TEMP SENSOR — SPARE 5	Sensor Fault: Check temperature sensor — Spare 5.	
SPARE SENSOR ALERT	TEMP SENSOR — SPARE 6	Sensor Fault: Check temperature sensor — Spare 6.	
SPARE SENSOR ALERT	TEMP SENSOR — SPARE 7	Sensor Fault: Check temperature sensor — Spare 7.	
SPARE SENSOR ALERT	TEMP SENSOR — SPARE 8	Sensor Fault: Check temperature sensor — Spare 8.	
SPARE SENSOR ALERT	TEMP SENSOR — SPARE 9	Sensor Fault: Check temperature sensor — Spare 9.	

Table 12 — LID Primary and Secondary Messages and Custom Alarm/Alert Messages with Troubleshooting Guides (cont)

G. START-UP FAILURES: This is an alarm condition. A manual reset is required to clear.

PRIMARY MESSAGE	SECONDARY MESSAGE	ALARM MESSAGE/PRIMARY CAUSE	ADDITIONAL CAUSE/REMEDY
FAILURE TO START	LOW OIL PRESSURE	OILPD [VALUE] exceeded limit of [LIMIT]*. Check oil pump system.	Check for closed oil supply valves. Check oil filter. Check for low oil temperature. Check transducer accuracy.
FAILURE TO START	OIL PRESS SENSOR FAULT	OILPD [VALUE] exceeded limit of [LIMIT]*. Check oil pressure sensor.	Check for excessive refrigerant in oil sump. Run oil pump manually for 5 minutes. Check calibration of oil pressure differential amplifier modules. Check wiring. Replace transducers if necessary.
FAILURE TO START	LOW CHILLED WATER FLOW	EVFL Evap Flow Fault: Check water pump/flow switch.	Check wiring to flow switch. Check through CONTROL TEST for proper switch operation.
FAILURE TO START	LOW CONDENSER WATER FLOW	CDFL Cond. Flow Fault: Check water pump/flow switch.	Check wiring to flow switch. Check through CONTROL TEST for proper switch operation.
FAILURE TO START	STARTER FAULT	STR_FLT Starter Fault: Check Starter for Fault Source.	A starter protective device has faulted. Check starter for ground fault, voltage trip, temperature trip, etc.
FAILURE TO START	STARTER OVERLOAD TRIP	STR_FLT Starter Overload Trip: Check amps calibration/reset overload.	Reset overloads, check ICR relay before restarting chiller.
FAILURE TO START	LINE VOLTAGE DROPOUT	V_P Single-Cycle Dropout Detected: Check voltage supply.	Check voltage supply. Check transformers for supply. Check with utility if voltage supply is erratic. Monitor must be installed to confirm consistent, single-cycle dropouts. Check low oil pressure switch.
FAILURE TO START	HIGH CONDENSER PRESSURE	High Condenser Pressure [LIMIT]:* Check switch 2C aux, and water temperature/flow.	Check for proper design condenser flow and temperature. Check condenser approach. Check 2C auxiliary contacts on oil sump starter. Check high pressure switch.
FAILURE TO START	EXCESS ACCELERATION TIME	CA_P Excess Acceleration: Check guide vane closure at start-up.	Check that guide vanes are closed at start-up. Check starter for proper operation. Reduce unit pressure if possible.
FAILURE TO START	STARTER TRANSITION FAULT	RUN_AUX Starter Transition Fault: Check 1CR/1M/Interlock mechanism.	Check starter for proper operation. Run contact failed to close.
FAILURE TO START	1CR AUX CONTACT FAULT	1CR_AUX Starter Contact Fault: Check 1CR/1M aux. contacts.	Check starter for proper operation. Start contact failed to close.
FAILURE TO START	MOTOR AMPS NOT SENSED	CA_P Motor Amps Not Sensed: Check motor load signal.	Check for proper motor amps signal to SMM. Check wiring from SMM to current transformer. Check main motor circuit breaker for trip.
FAILURE TO START	CHECK REFRIGERANT TYPE	Current Refrigerant Properties Abnormal — Check Selection of refrigerant type.	Pressures at transducers indicate another refrigerant type in control test. Make sure to access the ATTACH TO NETWORK DEVICE screen after specifying HFC-134a refrigerant type.
FAILURE TO START	LOW OIL PRESSURE	Low Oil Pressure [LIMIT]:* Check oil pressure switch/pump and 2C aux.	The oil pressure differential switch is open when the compressor tried to start. Check the switch for proper operation. Also, check the oil pump interlock (2C aux) in the power panel and the high condenser pressure switch.
FAILURE TO START	LOW GEAR OIL PRESSURE	GEAROILP [VALUE] exceeded limit of [LIMIT].* Check gear oil pump/filter.	Check for closed oil supply valves. Check oil filter. Check transducer accuracy.
FAILURE TO START	GEAR OIL PRESSURE SENSOR	Gear Oil Pressure Transducer Out of Range [VALUE].	Check calibration of transducer. Replace if necessary.

*[LIMIT] is shown on the LID as the temperature, pressure, voltage, etc., set point predefined or selected by the operator as an override, alert, or alarm condition. [VALUE] is the actual pressure, temperature, voltage, etc., at which the control tripped.

H. COMPRESSOR JUMPSTART AND REFRIGERANT PROTECTION

PRIMARY MESSAGE	SECONDARY MESSAGE	ALARM MESSAGE/PRIMARY CAUSE	ADDITIONAL CAUSE/REMEDY
UNAUTHORIZED OPERATION	UNIT SHOULD BE STOPPED	CA_P Emergency: Compressor running without control authorization.	Compressor is running with more than 10% RLA and control is trying to shut it down. Turn power off to compressor if unable to stop. Determine cause before re-powering.
POTENTIAL FREEZE-UP	EVAP PRESS/TEMP TOO LOW	ERT Emergency: Freeze-up prevention.	Determine cause. If pumping refrigerant out of chiller, stop operation and go over pumpout procedures.
FAILURE TO STOP	DISCONNECT POWER	RUN_AUX Emergency: DISCONNECT POWER.	Starter run and start contacts are energized while control tried to shut down. Disconnect power to starter.
LOSS OF COMMUNICATION	WITH STARTER	Loss of Communication with Starter: Check chiller.	Check wiring from PSIO to SMM. Check SMM module troubleshooting procedures.
STARTER CONTACT FAULT	ABNORMAL 1CR OR RUN AUX	1CR_AUX Starter Contact Fault: Check 1CR/1M aux. contacts.	Starter run and start contacts energized while chiller was off. Disconnect power.
POTENTIAL FREEZE UP	COND PRESS/TEMP TOO LOW	CRT [VALUE] exceeded limit of [LIMIT]* Emergency: Freeze-up prevention.	The condenser pressure transducer is reading a pressure that could freeze the water in the condenser tubes. Check for condenser refrigerant leaks, bad transducers, or transferred refrigerant. Place the unit in PUMPDOWN mode to eliminate the alarm if vessel is evacuated.

*[LIMIT] is shown on the LID as the temperature, pressure, voltage, etc., set point predefined or selected by the operator as an override, alert, or alarm condition. [VALUE] is the actual pressure, temperature, voltage, etc., at which the control tripped.

Table 12 — LID Primary and Secondary Messages and Custom Alarm/Alert Messages with Troubleshooting Guides (cont)

I. NORMAL RUN WITH RESET, TEMPERATURE, OR DEMAND

PRIMARY MESSAGE	SECONDARY MESSAGE	PROBABLE CAUSE/REMEDY
RUNNING — RESET ACTIVE	4-20MA SIGNAL	Reset program active based on CONFIG screen setup.
RUNNING — RESET ACTIVE	REMOTE SENSOR CONTROL	
RUNNING — RESET ACTIVE	CHW TEMP DIFFERENCE	
RUNNING — TEMP CONTROL	LEAVING CHILLED WATER	Default method of temperature control.
RUNNING — TEMP CONTROL	ENTERING CHILLED WATER	ECW control activated on CONFIG screen.
RUNNING — TEMP CONTROL	TEMPERATURE RAMP LOADING	Ramp loading in effect. Use SERVICE1 screen to modify.
RUNNING — DEMAND LIMITED	BY DEMAND RAMP LOADING	Ramp loading in effect. Use SERVICE1 screen to modify.
RUNNING — DEMAND LIMITED	BY LOCAL DEMAND SETPOINT	Demand limit set point is $<$ actual demand.
RUNNING — DEMAND LIMITED	BY 4-20MA SIGNAL	Demand limit is active based on CONFIG screen setup.
RUNNING — DEMAND LIMITED	BY CCN SIGNAL	
RUNNING — DEMAND LIMITED	BY LOADSHED/REDLINE	
RUNNING — TEMP CONTROL	HOT GAS BYPASS	Hot gas bypass option is energized. See surge prevention in the control section.
RUNNING — DEMAND LIMITED	BY LOCAL SIGNAL	Active demand limit manually overridden on STATUS01 table.
RUNNING — TEMP CONTROL	ICE BUILD MODE	Chiller is running under Ice Build temperature control.

J. NORMAL RUN OVERRIDES ACTIVE (ALERTS)

PRIMARY MESSAGE	SECONDARY MESSAGE	ALARM MESSAGE/PRIMARY CAUSE	ADDITIONAL CAUSE/REMEDY
RUN CAPACITY LIMITED	HIGH CONDENSER PRESSURE	CRP [VALUE] exceeded limit of [LIMIT]*. Condenser pressure override.	See Capacity Overrides, Table 4. Correct operating condition, modify set-point, or release override.
RUN CAPACITY LIMITED	HIGH MOTOR TEMPERATURE	MTRW [VALUE] exceeded limit of [LIMIT]*. Motor temperature override.	
RUN CAPACITY LIMITED	LOW EVAP REFRIG TEMP	ERT [VALUE] exceeded limit of [LIMIT]*. Check refrigerant charge level.	
RUN CAPACITY LIMITED	HIGH COMPRESSOR LIFT	Surge Prevention Override; lift too high for compressor.	
RUN CAPACITY LIMITED	MANUAL GUIDE VANE TARGET	GV_TRG Run Capacity Limited: Manual guide vane target.	

*[LIMIT] is shown on the LID as the temperature, pressure, voltage, etc., set point predefined or selected by the operator as an override, alert, or alarm condition. [VALUE] is the actual temperature, pressure, voltage, etc., at which the control tripped.

K. OUT-OF-RANGE SENSOR FAILURES

PRIMARY MESSAGE	SECONDARY MESSAGE	ALARM MESSAGE/PRIMARY CAUSE	ADDITIONAL CAUSE/REMEDY
SENSOR FAULT	LEAVING CHW TEMPERATURE	Sensor Fault: Check leaving CHW sensor.	See sensor test procedure and check sensors for proper operation and wiring.
SENSOR FAULT	ENTERING CHW TEMPERATURE	Sensor Fault: Check entering CHW sensor.	
SENSOR FAULT	CONDENSER PRESSURE	Sensor Fault: Check condenser pressure transducer.	
SENSOR FAULT	EVAPORATOR PRESSURE	Sensor Fault: Check evaporator pressure transducer.	
SENSOR FAULT	BEARING TEMPERATURE	Sensor Fault: Check bearing temperature sensor.	
SENSOR FAULT	MOTOR WINDING TEMP	Sensor Fault: Check motor temperature sensor.	
SENSOR FAULT	DISCHARGE TEMPERATURE	Sensor Fault: Check discharge temperature sensor.	
SENSOR FAULT	OIL SUMP TEMPERATURE	Sensor Fault: Check oil sump temperature sensor.	
SENSOR FAULT	OIL PRESSURE TRANSDUCER	Sensor Fault: Check oil pressure transducer.	

Table 12 — LID Primary and Secondary Messages and Custom Alarm/Alert Messages with Troubleshooting Guides (cont)

L. CHILLER PROTECT LIMIT FAULTS

⚠ WARNING

Excessive numbers of the same fault can lead to severe chiller damage. Seek service expertise.

PRIMARY MESSAGE	SECONDARY MESSAGE	ALARM MESSAGE/PRIMARY CAUSE	ADDITIONAL CAUSE/REMEDY
PROTECTIVE LIMIT	HIGH DISCHARGE TEMP	CMPD [VALUE] exceeded limit of [LIMIT]*. Check discharge temperature.	Check discharge temperature immediately. Check sensor for accuracy; check for proper condenser flow and temperature; check oil reservoir temperature. Check condenser for fouled tubes or air in chiller. Check for proper guide vane actuator operation.
PROTECTIVE LIMIT	LOW REFRIGERANT TEMP	ERT [VALUE] exceeded limit of [LIMIT]*. Check evap pump and flow switch.	Check for proper amount of refrigerant charge; check for proper water flow and temperatures. Check for proper guide vane actuator operation.
PROTECTIVE LIMIT	HIGH MOTOR TEMPERATURE	MTRW [VALUE] exceeded limit of [LIMIT]*. Check motor cooling and solenoid.	Check motor temperature immediately. Check sensor for accuracy. Check for proper condenser flow and temperature. Check motor cooling system for restrictions. Check motor cooling solenoid for proper operation. Check refrigerant filter.
PROTECTIVE LIMIT	HIGH BEARING TEMPERATURE	MTRB [VALUE] exceeded limit of [LIMIT]*. Check oil cooling control.	Check for throttled oil supply isolation valves. Valves should be wide open. Check oil cooler thermal expansion valve. Check sensor accuracy. Check journal and thrust bearings. Check refrigerant filter. Check for excessive oil sump level.
PROTECTIVE LIMIT	LOW OIL PRESSURE	OILPD [VALUE] exceeded limit of [LIMIT]*. Check oil pump and transducer.	Check power to oil pump and oil level. Check for dirty filters or oil foaming at start-up. Check for thermal overload cutout. Reduce ramp load rate if foaming noted. NOTE: This alarm is not related to pressure switch problems.
		Low Oil Pressure [OPEN]*. Check oil pressure switch/pump and 2C aux.	Check the oil pressure switch for proper operation. Check oil pump for proper pressure. Check for excessive refrigerant in oil system.
PROTECTIVE LIMIT	NO MOTOR CURRENT	CA_P Loss of Motor Current: Check sensor.	Check wiring: Check torque setting on solid-state starter. Check for main circuit breaker trip. Check power supply to PSIO module.
PROTECTIVE LIMIT	POWER LOSS	V_P Power Loss: Check voltage supply.	Check 24-vac input on the SMM (terminals 23 and 24). Check transformers to SMM. Check power to PSIO module. Check distribution bus. Consult power company.
PROTECTIVE LIMIT	LOW LINE VOLTAGE	V_P [VALUE] exceeded limit of [LIMIT]*. Check voltage supply.	
PROTECTIVE LIMIT	HIGH LINE VOLTAGE	V_P [VALUE] exceeded limit of [LIMIT]*. Check voltage supply.	
PROTECTIVE LIMIT	LOW CHILLED WATER FLOW	EVFL Flow Fault: Check evap pump/flow switch.	Perform pumps control test (from CONTROL TEST table) and verify proper switch operation. Check all water valves and pump operation.
PROTECTIVE LIMIT	LOW CONDENSER WATER FLOW	CDFL Flow Fault: Check condenser pump/flow switch.	
PROTECTIVE LIMIT	HIGH CONDENSER PRESSURE	High Cond Pressure [OPEN]*: Check switch, oil pressure contact, and water temp/flow.	Check the high-pressure switch. Check for proper condenser pressures and condenser water flow. Check for fouled tubes. Check the 2C aux. contact and the oil pressure switch in the power panel. This alarm is not caused by the transducer.
		High Cond Pressure [VALUE]*: Check switch, water flow, and transducer.	Check water flow in condenser. Check for fouled tubes. Transducer should be checked for accuracy. This alarm is not caused by the high pressure switch.
PROTECTIVE LIMIT	HIGH CONDENSER PRESSURE	High Cond Pressure [VALUE]*: Check switch, water flow, and transducer.	Check water flow in condenser. Check for fouled tubes. Transducer should be checked for accuracy. This alarm is not caused by the high pressure switch.
PROTECTIVE LIMIT	1CR AUX CONTACT FAULT	CR_AUX Starter Contact Fault: Check 1CR/1M aux contacts.	1CR auxiliary contact opened while chiller was running. Check starter for proper operation.
PROTECTIVE LIMIT	RUN AUX CONTACT FAULT	RUN_AUX Starter Contact Fault: Check 1CR/1M aux contacts.	Run auxiliary contact opened while chiller was running. Check starter for proper operation.
PROTECTIVE LIMIT	CCN OVERRIDE STOP	CHIL_S_S CCN Override Stop while in LOCAL run mode.	CCN has signaled chiller to stop. Reset and restart when ready. If the signal was sent by the LID, release the Stop signal on STATUS01 table.
PROTECTIVE LIMIT	SPARE SAFETY DEVICE	SRP_PL Spare Safety Fault: Check contacts.	Spare safety input has tripped or factory-installed jumper not present.
PROTECTIVE LIMIT	EXCESSIVE MOTOR AMPS	CA_P [VALUE] exceeded limit of [LIMIT]*. High Amps; Check guide vane drive.	Check motor current for proper calibration. Check guide vane drive and actuator for proper operation.
PROTECTIVE LIMIT	EXCESSIVE COMPR SURGE	Compressor Surge: Check condenser water temp and flow.	Check condenser flow and temperatures. Check configuration of surge protection.
PROTECTIVE LIMIT	STARTER FAULT	STR_FLT Starter Fault: Check starter for fault source.	Check starter for possible ground fault, reverse rotation, voltage trip, etc.
PROTECTIVE LIMIT	STARTER OVERLOAD TRIP	STR_FLT Starter Overload Trip: Check amps calibration/reset overload.	Reset overloads and reset alarm. Check motor current calibration or overload calibration (do not field-calibrate overloads).

*[LIMIT] is shown on the LID as the temperature, pressure, voltage, etc., set point predefined or selected by the operator as an override, alert, or alarm condition. [VALUE] is the actual temperature, pressure, voltage, etc., at which the control tripped. [OPEN] indicates that an input circuit is open.

Table 12 — LID Primary and Secondary Messages and Custom Alarm/Alert Messages with Troubleshooting Guides (cont)

L. CHILLER PROTECT LIMIT FAULTS (cont)

WARNING

Excessive numbers of the same fault can lead to severe chiller damage. Seek service expertise.

PRIMARY MESSAGE	SECONDARY MESSAGE	ALARM MESSAGE/PRIMARY CAUSE	ADDITIONAL CAUSE/REMEDY
PROTECTIVE LIMIT	TRANSDUCER VOLTAGE FAULT	V_REF [VALUE] exceeded limit of [LIMIT]*. Check transducer power supply.	Check transformer power (5 vdc) supply to transducers. Power must be 4.5 to 5.5 vdc.
PROTECTIVE LIMIT	LOW GEAR OIL PRESSURE	GEAROILP [VALUE] exceeded imit of [LIMIT]*. Check gear oil pump filter.	Check for closed oil supply valves. Check oil filter. Check transducer accuracy.
PROTECTIVE LIMIT	HIGH GEAR OIL TEMP	GEAOILT [VALUE] exceeded limit of [LIMIT]*. Check gear oil cooler filter.	Check for cooler water flow. Check sensor for accuracy.
PROTECTIVE LIMIT	CCN OVERRIDE STOP	CHIL_S_S CCN. Override stop while in local run mode.	Machine received a command from the network to stop overriding local operating mode.

*[LIMIT] is shown on the LID as the temperature, pressure, voltage, etc., set point predefined or selected by the operator as an override, alert, or alarm condition. [VALUE] is the actual temperature, pressure, voltage, etc., at which the control tripped. [OPEN] indicates that an input circuit is open.

M. CHILLER ALERTS

PRIMARY MESSAGE	SECONDARY MESSAGE	ALARM MESSAGE/PRIMARY CAUSE	ADDITIONAL CAUSE/REMEDY
RECYCLE ALERT	HIGH AMPS AT SHUTDOWN	High Amps at Recycle: Check guide vane drive.	Check that guide vanes are closing. Check motor amps correction calibration is correct. Check actuator for proper operation.
SENSOR FAULT ALERT	LEAVING COND WATER TEMP	Sensor Fault: Check leaving condenser water sensor.	Check sensor. See sensor test procedure.
SENSOR FAULT ALERT	ENTERING COND WATER TEMP	Sensor Fault: Check entering condenser water sensor.	
LOW OIL PRESSURE ALERT	CHECK OIL FILTER	Low Oil Pressure Alert: Check oil	Check oil filter. Check for improper oil level or temperature.
AUTORESTART PENDING	POWER LOSS	V_P Power Loss: Check voltage supply.	Check power supply if there are excessive compressor starts occurring.
AUTORESTART PENDING	LOW LINE VOLTAGE	V_P [VALUE] exceeded limit of [LIMIT]*. Check voltage supply.	
AUTORESTART PENDING	HIGH LINE VOLTAGE	V_P [VALUE] exceeded limit of [LIMIT]*. Check voltage supply.	
SENSOR ALERT	HIGH DISCHARGE TEMP	CMPD [VALUE] exceeded limit of [LIMIT]*. Check discharge temperature.	Discharge temperature exceeded the alert threshold. Check entering condenser water temperature.
SENSOR ALERT	HIGH BEARING TEMP	MTRB [VALUE] exceeded limit of [LIMIT]*. Check thrust bearing temperature.	Thrust bearing temperature exceeded the alert threshold. Check for closed valves, improper oil level or temperatures.
CONDENSER PRESSURE ALERT	PUMP RELAY ENERGIZED	CRP High Condenser Pressure [LIMIT]*. Pump energized to reduce pressure.	Check ambient conditions. Check condenser pressure for accuracy.
RECYCLE ALERT	EXCESSIVE RECYCLE STARTS	Excessive recycle starts.	The chiller load is too small to keep the chiller on line and there have been more than 5 restarts in 4 hours. Increase chiller load, adjust hot gas bypass, increase *RECYCLE RESTART DELTA T* from SERVICE1 screen.
SENSOR ALERT	LOW GEAR OIL PRESSURE	GEAROILP [VALUE] exceeded imit of [LIMIT]*. Check gear oil pump filter.	Check for closed oil supply valves. Check oil filter. Check transducer accuracy.
SENSOR ALERT	HIGH GEAR OIL TEMP	GEAOILT [VALUE] exceeded limit of [LIMIT]*. Check gear oil cooler filter.	Check for cooler water flow. Check sensor for accuracy.

*[LIMIT] is shown on the LID as the temperature, pressure, voltage, etc., set point predefined or selected by the operator as an override, alert, or alarm condition. [VALUE] is the actual temperature, pressure, voltage, etc., at which the control tripped.

Table 12 — LID Primary and Secondary Messages and Custom Alarm/Alert Messages with Troubleshooting Guides (cont)

N. OTHER PROBLEMS/MALFUNCTIONS

DESCRIPTION/MALFUNCTION	PROBABLE CAUSE/REMEDY
Chilled Water/Brine Temperature Too High (Chiller Running)	Chilled water set point set too high. Access set point on LID and verify. Capacity override or excessive cooling load (chiller at design capacity). Check LID status messages. Check for outside air infiltration into conditioned space. Condenser temperature too high. Check for proper flow, examine cooling tower operation, check for air or water leaks, check for fouled tubes. Refrigerant level low. Check for leaks, add refrigerant, and trim charge. Liquid bypass in waterbox. Examine division plates and gaskets for leaks. Guide vanes fail to open. Use control test to check operation. Chilled water control point too high. Access CONTROL ALGORITHM STATUS table, MAINT01 screen, and check chilled water control operation. Guide vanes fail to open fully. Be sure that the guide vane target is released. Check guide vane linkage. Check limit switch in actuator. Check that sensor is in the proper terminals.
Chilled Water/Brine Temperature Too Low (Chiller Running)	Chilled water set point set too low. Access set point on LID and verify. Chilled water control point too low. Access CONTROL ALGORITHM STATUS tables, MAINT01 screen, and check chilled water control for proper resets. High discharge temperature keeps guide vanes open. Guide vanes fail to close. Be sure that guide vane target is released. Check chilled water sensor accuracy. Check guide vane linkage. Check actuator operation.
Chilled Water Temperature Fluctuates. Vanes Hunt	Deadband too narrow. Configure LID for a larger deadband (SERVICE1 screen). Proportional bands too narrow. Either *PROPORTIONAL INC BAND* or *PROPORTIONAL DEC BAND* should be increased (MAINT01 screen). Loose guide vane drive. Adjust chain drive. Defective vane actuator. Check using control test feature. Defective temperature sensor. Check sensor accuracy.
Low Oil Sump Temperature While Running (Less than 100 F [38 C])	Check for proper oil level (not enough oil).
At Power Up, Default Screen Does Not Appear, “Tables Loading” Message Continually Appears	Check for proper communications wiring on PSIO module. Check that the COMM1 communications wires from the LID are terminated to the COMM1 PSIO connection. Check for ground or short on CCN system wiring.
SMM Communications Failure	Check that PSIO communication plugs are connected correctly. Check SMM communication plug. Check for proper SMM power supply. See Control Modules section on page 96.
High Oil Temperature While Running	Check for proper oil level (too much oil). Check water supply to oil cooler.
Blank LID Screen (Minimal Contrast Visible)	Increase contrast potentiometer. See Fig. 49. Check red LED on LID for proper operation, (power supply). If LED is blinking, but green LED’s are not, replace LID module, (memory failure). Check light bulb if backlit model.
“Communications Failure” Highlighted Message At Bottom of LID Screen	LID is not properly addressed to the PSIO. Make sure that, on ATTACH TO NETWORK DEVICE screen,. *LOCAL DEVICE* is set to read the PSIO address. Check LEDs on PSIO. Is red LED operating properly? Are green LEDs blinking? See Control Module troubleshooting section.
Control Test Disabled	Press the Stop pushbutton. The PIC must be in the OFF mode for the control test feature to operate. Clear all alarms. Check line voltage percent on STATUS01 screen. The percent must be within 90% to 110%. Check voltage input to SMM; calibrate starter voltage potentiometer for accuracy.
Vanes Will Not Open in Control Test	Low pressure alarm is active. Put chiller into PUMPDOWN mode or equalize pressure. Check guide vane actuator wiring.
Oil Pump Does Not Run	Check oil pump voltage supply. Cooler vessel pressure under vacuum. Pressurize vessel. Check temperature overload cutout switch.
LID Default Screen Does Not Update	This is normal operation when an alarm is present. The screen freezes the moment the alarm is activated to aid in troubleshooting. The STATUS01 screen provides current information.
Chiller Does Not Stop When the STOP Button is Pressed	The STOP button wiring connector on the LID module is not properly connected or the chiller is in soft stop mode and the guide vanes are closing.
LID Screen Dark	Light bulb burned out. Replace as needed.

Table 13 — External Gear Troubleshooting Guide

PROBLEM	POSSIBLE CAUSE — ITEM NO.s*
Excessive Operating Temperature	1,2,3,4,5,6,7,9,12,18,20,21
Oil Leakage	1,2,3,4,5,7,9,12,13,18,19,21
Gear Wear	1,2,3,4,6,7,8,9,10,11,12,13,14,15,16,18,19,21,22
Bearing Failure	1,6,7,8,9,10,11,12,15,16,19,20,21
Unusual Noise	1,2,3,4,6,7,8,9,10,11,12,13,15,16,17,20,21

*See table below for probable cause and suggested remedy.

POSSIBLE CAUSE	ACTION
1. Unit Overload	Reduce the loading.
2. Incorrect Oil Level	Verify that the oil level is correct. Too little or too much oil can cause high temperature.
3. Wrong Oil Grade	Use only the AGMA (American Gear Manufacturers Association) grade oil as specified for the unit size and ambient temperature.
4. Contaminated Oil	If oil is oxidized, dirty, or has high sludge content, change the oil.
5. Clogged Breather	Clean breather regularly.
6. Improper Bearing Clearance	Too large or too small bearing clearance. Refer to drawing or contact the gear manufacturer for correct clearance, checking technique, and tolerance. Shafts should turn freely when disconnected from the load.
7. Improper Coupling Alignment	Disconnect couplings, check spacing between shafts, and check alignment. Realign as required.
8. Incorrect Coupling	Rigid couplings can cause shaft failure. Replace with a coupling that provides flexibility and lateral float.
9. Excessive Operating Speed	Reduce the speed.
10. Torsional or Lateral Vibrations	Vibrations can occur through a particular speed range known as the critical speed. Contact the factory for specific recommendations.
11. Extreme Repetitive Shocks	Apply couplings capable of absorbing shocks.
12. Improper Lubrication of Bearings	Verify that all bearings are receiving adequate amounts of lubricating oil.
13. Improper Storage or Prolonged Shutdown	Destructive rusting of bearings and gears will be caused by storage or prolonged shutdown in moist ambient temperatures. If rust is found, unit must be disassembled, inspected, and repaired.
14. Excessive Backlash	Contact gear manufacturer.
15. Misalignment of Gears	Contact pattern to be a minimum of 80% of face.
16. Housing Twisted or Distorted	Verify proper shimming or stiffness of the foundation.
17. Gear Tooth Wear	Contact gear manufacturer.
18. Open Drains	Tighten drain plugs.
19. Loosely Bolted Covers	Check all bolted joints and tighten if necessary.
20. Motor Related	Verify that actual operating conditions are consistent with motor nameplate.
21. Excessive Ambient Temperature	Shield unit from heat source and maintain proper air flow around the gear unit.

Table 14A — Thermistor Temperature (F) vs Resistance/Voltage Drop

TEMPERATURE (F)	VOLTAGE DROP (V)	RESISTANCE (Ohms)
−25.0	4.821	98010
−24.0	4.818	94707
−23.0	4.814	91522
−22.0	4.806	88449
−21.0	4.800	85486
−20.0	4.793	82627
−19.0	4.786	79871
−18.0	4.779	77212
−17.0	4.772	74648
−16.0	4.764	72175
−15.0	4.757	69790
−14.0	4.749	67490
−13.0	4.740	65272
−12.0	4.734	63133
−11.0	4.724	61070
−10.0	4.715	59081
−9.0	4.705	57162
−8.0	4.696	55311
−7.0	4.688	53526
−6.0	4.676	51804
−5.0	4.666	50143
−4.0	4.657	48541
−3.0	4.648	46996
−2.0	4.636	45505
−1.0	4.624	44066
0.0	4.613	42679
1.0	4.602	41339
2.0	4.592	40047
3.0	4.579	38800
4.0	4.567	37596
5.0	4.554	36435
6.0	4.540	35313
7.0	4.527	34231
8.0	4.514	33185
9.0	4.501	32176
10.0	4.487	31202
11.0	4.472	30260
12.0	4.457	29351
13.0	4.442	28473
14.0	4.427	27624
15.0	4.413	26804
16.0	4.397	26011
17.0	4.381	25245
18.0	4.366	24505
19.0	4.348	23789
20.0	4.330	23096
21.0	4.313	22427
22.0	4.295	21779
23.0	4.278	21153
24.0	4.258	20547
25.0	4.241	19960
26.0	4.223	19393
27.0	4.202	18843
28.0	4.184	18311
29.0	4.165	17796
30.0	4.145	17297
31.0	4.125	16814
32.0	4.103	16346
33.0	4.082	15892
34.0	4.059	15453
35.0	4.037	15027
36.0	4.017	14614
37.0	3.994	14214
38.0	3.968	13826
39.0	3.948	13449
40.0	3.927	13084
41.0	3.902	12730
42.0	3.878	12387
43.0	3.854	12053
44.0	3.828	11730
45.0	3.805	11416
46.0	3.781	11112
47.0	3.757	10816
48.0	3.729	10529
49.0	3.705	10250
50.0	3.679	9979
51.0	3.653	9717
52.0	3.627	9461
53.0	3.600	9213
54.0	3.575	8973
55.0	3.547	8739
56.0	3.520	8511
57.0	3.493	8291
58.0	3.464	8076
59.0	3.437	7868
60.0	3.409	7665
61.0	3.382	7468
62.0	3.353	7277
63.0	3.323	7091
64.0	3.295	6911
65.0	3.267	6735
66.0	3.238	6564
67.0	3.210	6399
68.0	3.181	6238
69.0	3.152	6081
70.0	3.123	5929
71	3.093	5781
72	3.064	5637
73	3.034	5497
74	3.005	5361
75	2.977	5229
76	2.947	5101
77	2.917	4976
78	2.884	4855
79	2.857	4737
80	2.827	4622
81	2.797	4511
82	2.766	4403
83	2.738	4298
84	2.708	4196
85	2.679	4096
86	2.650	4000
87	2.622	3906
88	2.593	3814
89	2.563	3726
90	2.533	3640
91	2.505	3556
92	2.476	3474
93	2.447	3395
94	2.417	3318
95	2.388	3243
96	2.360	3170
97	2.332	3099
98	2.305	3031
99	2.277	2964
100	2.251	2898
101	2.217	2835
102	2.189	2773
103	2.162	2713
104	2.136	2655
105	2.107	2597
106	2.080	2542
107	2.053	2488
108	2.028	2436
109	2.001	2385
110	1.973	2335
111	1.946	2286
112	1.919	2239
113	1.897	2192
114	1.870	2147
115	1.846	2103
116	1.822	2060
117	1.792	2018
118	1.771	1977
119	1.748	1937
120	1.724	1898
121	1.702	1860
122	1.676	1822
123	1.653	1786
124	1.630	1750
125	1.607	1715
126	1.585	1680
127	1.562	1647
128	1.538	1614
129	1.517	1582
130	1.496	1550
131	1.474	1519
132	1.453	1489
133	1.431	1459
134	1.408	1430
135	1.389	1401
136	1.369	1373
137	1.348	1345
138	1.327	1318
139	1.308	1291
140	1.291	1265
141	1.289	1240
142	1.269	1214
143	1.250	1190
144	1.230	1165
145	1.211	1141
146	1.192	1118
147	1.173	1095
148	1.155	1072
149	1.136	1050
150	1.118	1029
151	1.100	1007
152	1.082	986
153	1.064	965
154	1.047	945
155	1.029	925
156	1.012	906
157	0.995	887
158	0.978	868
159	0.962	850
160	0.945	832
161	0.929	815
162	0.914	798
163	0.898	782
164	0.883	765
165	0.868	750
166	0.853	734
167	0.838	719
168	0.824	705
169	0.810	690
170	0.797	677
171	0.783	663
172	0.770	650
173	0.758	638
174	0.745	626
175	0.734	614
176	0.722	602
177	0.710	591
178	0.700	581
179	0.689	570
180	0.678	561
181	0.668	551
182	0.659	542
183	0.649	533
184	0.640	524
185	0.632	516
186	0.623	508
187	0.615	501
188	0.607	494
189	0.600	487
190	0.592	480
191	0.585	473
192	0.579	467
193	0.572	461
194	0.566	456
195	0.560	450
196	0.554	445
197	0.548	439
198	0.542	434
199	0.537	429
200	0.531	424
201	0.526	419
202	0.520	415
203	0.515	410
204	0.510	405
205	0.505	401
206	0.499	396
207	0.494	391
208	0.488	386
209	0.483	382
210	0.477	377
211	0.471	372
212	0.465	367
213	0.459	361
214	0.453	356
215	0.446	350
216	0.439	344
217	0.432	338
218	0.425	332
219	0.417	325
220	0.409	318
221	0.401	311
222	0.393	304
223	0.384	297
224	0.375	289
225	0.366	282

Table 14B — Thermistor Temperature (C) vs Resistance/Voltage Drop

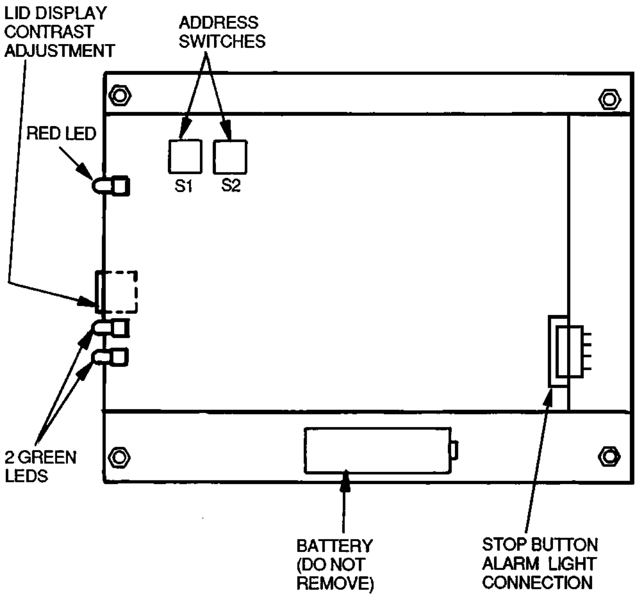
TEMPERATURE (C)	VOLTAGE DROP (V)	RESISTANCE (Ohms)
−40	4.896	168 230
−39	4.889	157 440
−38	4.882	147 410
−37	4.874	138 090
−36	4.866	129 410
−35	4.857	121 330
−34	4.848	113 810
−33	4.838	106 880
−32	4.828	100 260
−31	4.817	94 165
−30	4.806	88 480
−29	4.794	83 170
−28	4.782	78 125
−27	4.769	73 580
−26	4.755	69 250
−25	4.740	65 205
−24	4.725	61 420
−23	4.710	57 875
−22	4.693	54 555
−21	4.676	51 450
−20	4.657	48 536
−19	4.639	45 807
−18	4.619	43 247
−17	4.598	40 845
−16	4.577	38 592
−15	4.554	38 476
−14	4.531	34 489
−13	4.507	32 621
−12	4.482	30 866
−11	4.456	29 216
−10	4.428	27 633
−9	4.400	26 202
−8	4.371	24 827
−7	4.341	23 532
−6	4.310	22 313
−5	4.278	21 163
−4	4.245	20 079
−3	4.211	19 058
−2	4.176	18 094
−1	4.140	17 184
0	4.103	16 325
1	4.065	15 515
2	4.026	14 749
3	3.986	14 026
4	3.945	13 342
5	3.903	12 696
6	3.860	12 085
7	3.816	11 506
8	3.771	10 959
9	3.726	10 441
10	3.680	9 949
11	3.633	9 485
12	3.585	9 044
13	3.537	8 627
14	3.487	8 231
15	3.438	7 855
16	3.387	7 499
17	3.337	7 161
18	3.285	6 840
19	3.234	6 536
20	3.181	6 246
21	3.129	5 971
22	3.076	5 710
23	3.023	5 461
24	2.970	5 225
25	2.917	5 000
26	2.864	4 786
27	2.810	4 583
28	2.757	4 389
29	2.704	4 204
30	2.651	4 028
31	2.598	3 861
32	2.545	3 701
33	2.493	3 549
34	2.441	3 404
35	2.389	3 266
36	2.337	3 134
37	2.286	3 008
38	2.236	2 888
39	2.186	2 773
40	2.137	2 663
41	2.087	2 559
42	2.039	2 459
43	1.991	2 363
44	1.944	2 272
45	1.898	2 184
46	1.852	2 101
47	1.807	2 021
48	1.763	1 944
49	1.719	1 871
50	1.677	1 801
51	1.635	1 734
52	1.594	1 670
53	1.553	1 609
54	1.513	1 550
55	1.474	1 493
56	1.436	1 439
57	1.399	1 387
58	1.363	1 337
59	1.327	1 290
60	1.291	1 244
61	1.258	1 200
62	1.225	1 158
63	1.192	1 118
64	1.160	1 079
65	1.129	1 041
66	1.099	1 006
67	1.069	971
68	1.040	938
69	1.012	906
70	0.984	876
71	0.949	836
72	0.920	805
73	0.892	775
74	0.865	747
75	0.838	719
76	0.813	693
77	0.789	669
78	0.765	645
79	0.743	623
80	0.722	602
81	0.702	583
82	0.683	564
83	0.665	547
84	0.648	531
85	0.632	516
86	0.617	502
87	0.603	489
88	0.590	477
89	0.577	466
90	0.566	456
91	0.555	446
92	0.545	436
93	0.535	427
94	0.525	419
95	0.515	410
96	0.506	402
97	0.496	393
98	0.486	385
99	0.476	376
100	0.466	367
101	0.454	357
102	0.442	346
103	0.429	335
104	0.416	324
105	0.401	312
106	0.386	299
107	0.370	285

Control Modules

⚠ CAUTION

Turn the controller power off before servicing the controls. This ensures safety and prevents damage to the controller.

The Processor/Sensor Input/Output module (PSIO), 8-input (Options) modules, Starter Management Module (SMM), 4-in/2-out module, and the Local Interface Device (LID) module perform continuous diagnostic evaluations of the hardware to determine its condition. Proper operation of all modules is indicated by LEDs (light-emitting diodes) located on the side of the LID (Fig. 49); on the top horizontal surface of the PSIO (Fig. 50), SMM, and 8-input modules; and on the 4-in/2-out module.



NOTE: Address switches on this module can be at any position. Addresses are only changed through the LID screen for CCN.

Fig. 49 — LID Module (Rear View) and LED Locations

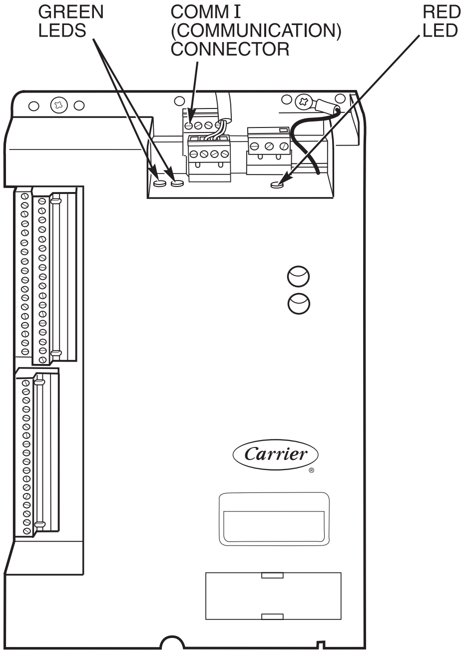


Fig. 50 — PSIO Module LED Locations

RED LEDs

PSIO Module — If the LED is blinking continuously at a 2-second rate, it is indicating proper operation. If it is lit continuously it indicates a problem requiring replacement of the module. Off continuously indicates that the power should be checked. If the red LED blinks 3 times per second, a software error has been discovered and the module must be replaced. If there is no input power, check the fuses and the circuit breaker. If the fuses are good, check for a shorted secondary of transformer, or if power is present to the module, replace the module.

4-In/2-Out Module — If the LED is blinking, this module is operating properly. A steady red light indicates a module failure. Replace the 4-In/2-Out module.

GREEN LEDs — There are 1 or 2 green LEDs on each type of module. These LEDs indicate communication status between different parts of the controller and the network modules as follows:

LID Module

Upper LED — Communication with CCN network, if present; blinks when communication occurs.

Lower LED — Communication with PSIO module; must blink every 5 to 8 seconds when the LID default screen is displayed.

PSIO Module

Green LED Closest to Communications Connection — Communication with SMM and 8-input module; must blink continuously.

Other Green LED — Communication with LID; must blink every 3 to 5 seconds.

8-Input Modules and SMM — Communication with PSIO module; blinks continuously.

4-In/2-Out Module — Communication with PSIO module; blinks continuously.

Notes on Module Operation

1. The chiller operator monitors and modifies configurations in the microprocessor through the 4 softkeys and the LID. Communication with the LID and the PSIO is accomplished through the CCN bus (COMM1). The communication between the PSIO, SMM, both 8-input modules, and the 4-in/2-out module is accomplished through the sensor bus (COMM3), which is a 3-wire cable. On the sensor bus terminal strips, Terminal 1 of the PSIO module is connected to Terminal 1 of each of the other modules. Terminals 2 and 3 are connected in the same manner, except for the connection to the 4-in/2-out module. See Fig. 51.
2. If a green LED is on continuously, check the communication wiring. If a green LED is off, check the red LED operation. If the red LED is normal, check the module address switches (Fig. 52-54). Proper addresses are set as shown below:

MODULE	ADDRESS	
	S1	S2
SMM (Starter Management Module)	3	2
8-input Options Module 1	6	4
8-input Options Module 2	7	2

MODULE	SWITCH							
	1	2	3	4	5	6	7	8
4-In/2-Out Module	O	O	O	O	C	O	C	O

O — Open
C — Closed

If all modules indicate a communications failure, check the communications plug on the PSIO module for proper seating. Also check the wiring (CCN bus — 1:red, 2:wht, 3:blk; Sensor bus — 1:red, 2:blk, 3:clr/wht). If a good connection is assured and the condition persists, replace the PSIO module.

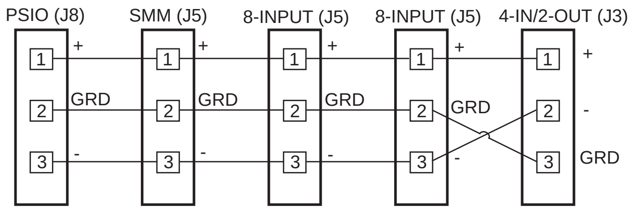
If only one 8-input module, the SMM, or the 4-in/2-out module indicates a communication failure, check the communications plug on that module. If a good connection is assured and the condition persists, replace the module.

All system operating intelligence rests in the PSIO module. Some safety shutdown logic resides in the SMM in case communications are lost between the 2 modules. The PSIO monitors conditions using input ports on the PSIO, the SMM, the 8-input modules, and the 4-in/2-out modules. Outputs are controlled by the PSIO and SMM as well.

3. Power is supplied to the modules within the control panel. The transformers are located within the power panel, with the exception of the SMM, which operates from a 24-vac power source and has its own 24-vac transformer located in the starter.

   In the power panel, T1 supplies power 21-vac to the LID, the PSIO, and the 5-vac power supply for the transducers. T3 supplies 24-vac power to the 4-in/2-out module. T4 is another 21-vac transformer, which supplies power to both 8-input modules (if present). T4 is capable of supplying power to two modules; if additional modules are added, another power supply will be required.

   Power is connected to Terminals 1 and 2 of the power input connection on each module.



LEGEND

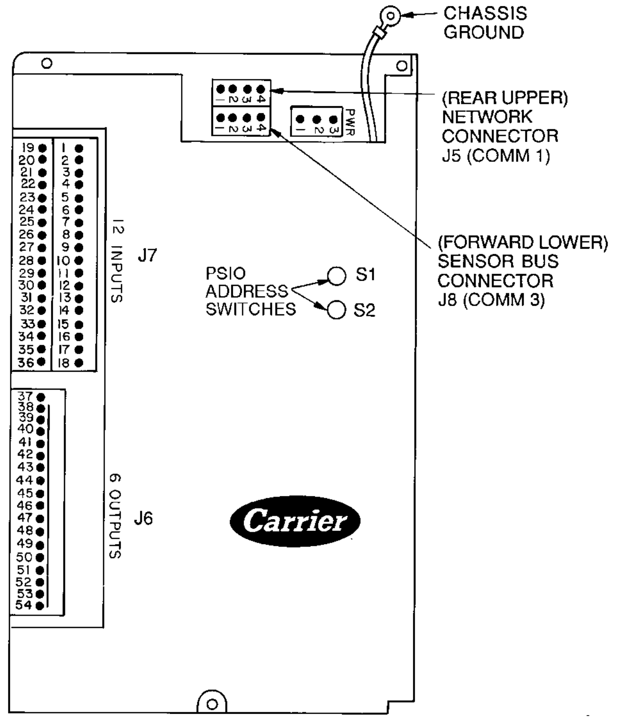
GRD	—	Ground	**PSIO**	—	Processor/Sensor Input/Output Module
J	—	Junction	☐		Pins
SMM	—	Starter Management Module			

Fig. 51 — Sensor Input/Output (SIO) Wiring Schematic for COMM3 Bus

Processor/Sensor Input/Output Module (PSIO) (Fig. 52)

INPUTS — Each input channel has 3 terminals; only 2 of the terminals are used. The chiller application determines which terminals are normally used. Always refer to individual unit wiring diagrams for terminal numbers.

OUTPUTS — Output is 20 vdc. There are 3 terminals per output, only 2 of which are used, depending on the application. Refer to the unit wiring diagram.



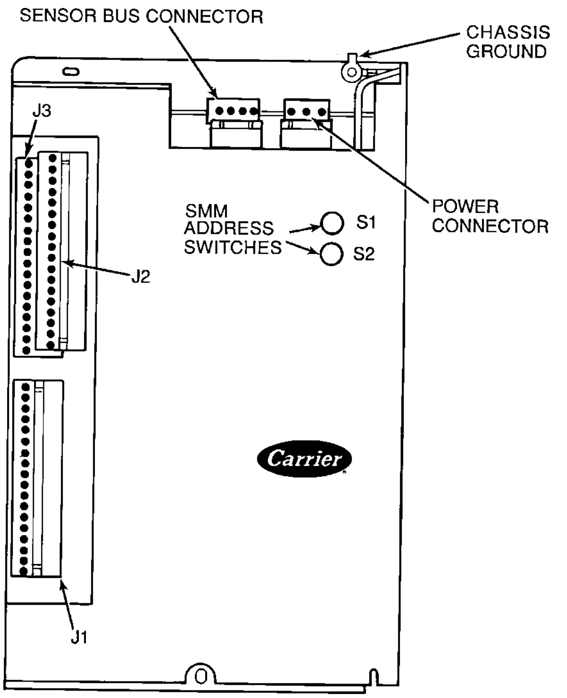
NOTE: Address switches on this module can be at any position. Addresses can only be changed through the LID or CCN.

Fig. 52 — Processor (PSIO) Module

Starter Management Module (SMM) (Fig. 53)

INPUTS — Inputs on strips J2 and J3 are a mix of analog and discrete (on/off) inputs. The chiller application determines which terminals are used. Always refer to the individual unit wiring diagram for terminal numbers.

OUTPUTS — Outputs are 24 vdc and wired to strip J1. There are 2 terminals used per output.



NOTE: SMM address switches should be set as follows: S1 set at 3; S2 set at 2.

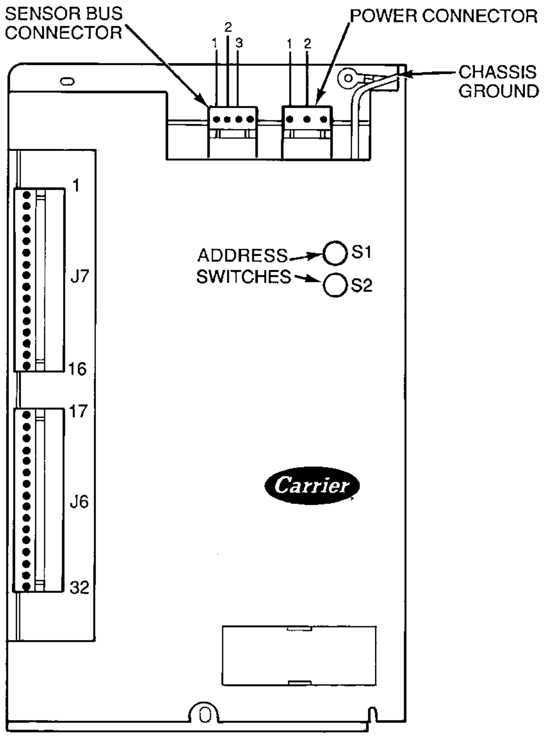
Fig. 53 — Starter Management Module (SMM)

Options Modules (8-Input) — The options modules are optional additions to the PIC, and are used to add temperature reset inputs, spare sensor inputs, and demand limit inputs. Each option module contains 8 inputs, each input meant for a specific duty. See the wiring diagram for exact module wire terminations. Inputs for each of the options modules available include the following:

OPTIONS MODULE 1
4 to 20 mA Auto. Demand Reset
4 to 20 mA Auto. Chilled Water Reset
Common Chilled Water Supply Temperature
Common Chilled Water Return Temperature
Remote Temperature Reset Sensor
Spare Temperature 1
Spare Temperature 2
Spare Temperature 3

OPTIONS MODULE 2
4 to 20 mA Spare 1
4 to 20 mA Spare 2
Spare Temperature 4
Spare Temperature 5
Spare Temperature 6
Spare Temperature 7
Spare Temperature 8
Spare Temperature 9

Terminal block connections are provided on the options modules. All sensor inputs are field wired and installed. Options module 1 can be factory or field-installed. Options module 2 is shipped separately and must be field installed. For installation, refer to the unit or field wiring diagrams. Be sure to address the module for the proper module number (Fig. 54) and to configure the chiller for each feature being used.



SWITCH SETTING	OPTIONS MODULE 1	OPTIONS MODULE 2
S1	6	7
S2	4	2

Fig. 54 — Options Module

Four-In/Two-Out Module (Fig. 55)

INPUTS — The four analog inputs each have 3 terminals and are configurable by movable on-board jumpers as thermistor (T), 4 to 20 mA (C), or 0 to 10 vdc (V) configurations. The inputs monitor the gear oil temperature and pressure. Input AI#2 should be factory-set with the jumper on (T). Inputs AI#3, and AI#4 should be factory set on (V).

OUTPUTS — The two analog outputs are each configurable by on-board jumpers as 0 to 10 vdc (maximum current: 10 mA) or 4 to 20 mA (maximum load: 600 ohms) outputs. The outputs control the relay that activates the gear oil pump starter. Outputs AO#1 and AO#2 should be factory set with the jumper on (V).

This module has a field-configurable DIP (dual in-line package) switch to designate its address. It should be factory set with the following switches open: 1, 2, 3, 4, 6, and 8. Switches 5 and 7 should be closed.

Note the SIO bus wiring for this module. Unlike the standard PIC modules, Pin 2 is negative and Pin 3 is the ground (or common). See Fig. 51.

Replacing Defective Processor Modules — The replacement part number is printed on a small label on the front of the PSIO module. The model and serial numbers are printed on the unit nameplate located on an exterior corner post. The proper software is factory-installed by Carrier in the replacement module. When ordering a replacement processor module (PSIO), specify complete replacement part number, full unit model number, and serial number. This new unit requires reconfiguration to the original chiller data by the installer. Follow the procedures described in the Set Up Chiller Control Configuration section on page 54. Electrical shock can cause personal injury. Disconnect all electrical power before servicing.

⚠ CAUTION

Electrical shock can cause personal injury. Disconnect all electrical power before servicing.

INSTALLATION OF NEW PSIO MODULE

1. Verify that the existing PSIO module is defective by using the procedure described in the Notes on Module Operation section, page 96, and the Control Modules section, page 96. Do not access the ATTACH TO NETWORK DEVICE screen if the LID displays a communication failure.
2. Data regarding the PSIO configuration should have been recorded and saved. This data must be reconfigured into the LID. If this data is not available, follow the procedures described in the Set Up Chiller Control Configuration section, page 54. Record the *TOTAL COMPRESSOR STARTS* and the *COMPRESSOR ONTIME* from the STATUS01 table on the LID.

   If a CCN Building Supervisor or Service Tool is present, the module configuration should have already been uploaded into memory; then, when the new module is installed, the configuration can be downloaded from the computer (if the software version is the same).

   Any communication wires from other chillers or CCN modules must be disconnected.
3. Check that all power to the unit is off. Carefully disconnect all wires from the defective module by unplugging the 6 connectors. It is not necessary to remove any of the individual wires from the connectors.
4. Remove the defective PSIO by removing its mounting screw with a long-shaft Phillips screwdriver and removing the module from the control box. Save the screw for later use. The green ground wire is held in place with the module mounting screw.
5. Package the defective module in the carton of the new module for return to Carrier.

6. Restore control system power (the LID displays, COMMUNICATION FAILURE at the bottom of the screen).
7. Access the SERVICE menu. Highlight and select the ATTACH TO NETWORK DEVICE screen. Press the [ATTACH] softkey. (The LID displays, UPLOADING TABLES. PLEASE WAIT; then, COMMUNICATION FAILURE.) Press the [EXIT] softkey.
8. Turn off control power.
9. Mount the new module in the unit control box using a long-shaft Phillips screwdriver and the screw saved in Step 4 on page 98. Make sure that the green grounding wire is reinstalled along with the mounting screw.
10. Connect the LID communication wires (CCN bus) and the power wires. If CCN wiring has been attached to the CCN bus, disconnect the wires. Attach the sensor bus plug and the input and output plugs.
11. Carefully check all wiring connections before restoring power.
12. Restore control power and verify that the red and green LEDs on the PSIO are functioning properly.
13. The LID should indicate AVAILABLE MEMORY and a value. This value should start to decrease. (If it does not, check the LID wiring to the PSIO; ensure connection to the proper plug.) The bottom of the screen displays, UPLOADING TABLES, PLEASE WAIT.
14. After the PSIO tables have been uploaded into the LID, access the STATUS01 screen. Move the highlight bar to the *TOTAL COMPRESSOR STARTS* line. Press the [SELECT] softkey and then, using the [INCREASE] or [DECREASE] softkeys, change the value until it is the same as the value from the old module. Press the [ENTER] softkey to save this value.
15. Move the highlight bar to the *COMPRESSOR ONTIME* line. Press the [SELECT] softkey and the, using the [INCREASE] or [DECREASE] softkeys, change this value until it matches the old module run hours. Press the [SELECT] softkey to save this value.
16. Change the address of the PSIO In the CONTROLLER IDENTIFICATION table back to its previous value. Write the address on the PSIO.
17. Use the configuration sheets (pages CL-3 to CL-11) to input set point, configuration, and schedule information into the PSIO. The TIME AND DATE table from the SERVICE menu must also be set. A Building Supervisor terminal can be used to download the old configuration into the PSIO.
18. Access the CONTROL TEST table and perform the control tests to verify all that all tested functions are working properly.

    If the software version has been updated, a CCN download of the configuration will not be allowed. Configure the PSIO by hand, and upload the PSIO into the network using the ATTACH TO NETWORK DEVICE screen.
19. Restore the chiller to normal operation; calibrate the motor amps.

PHYSICAL DATA AND WIRING SCHEMATICS

Tables 15-26 and Fig. 56-61 provide additional information regarding compressor fits and clearances, physical and electrical data, and wiring schematics for operator convenience during troubleshooting.

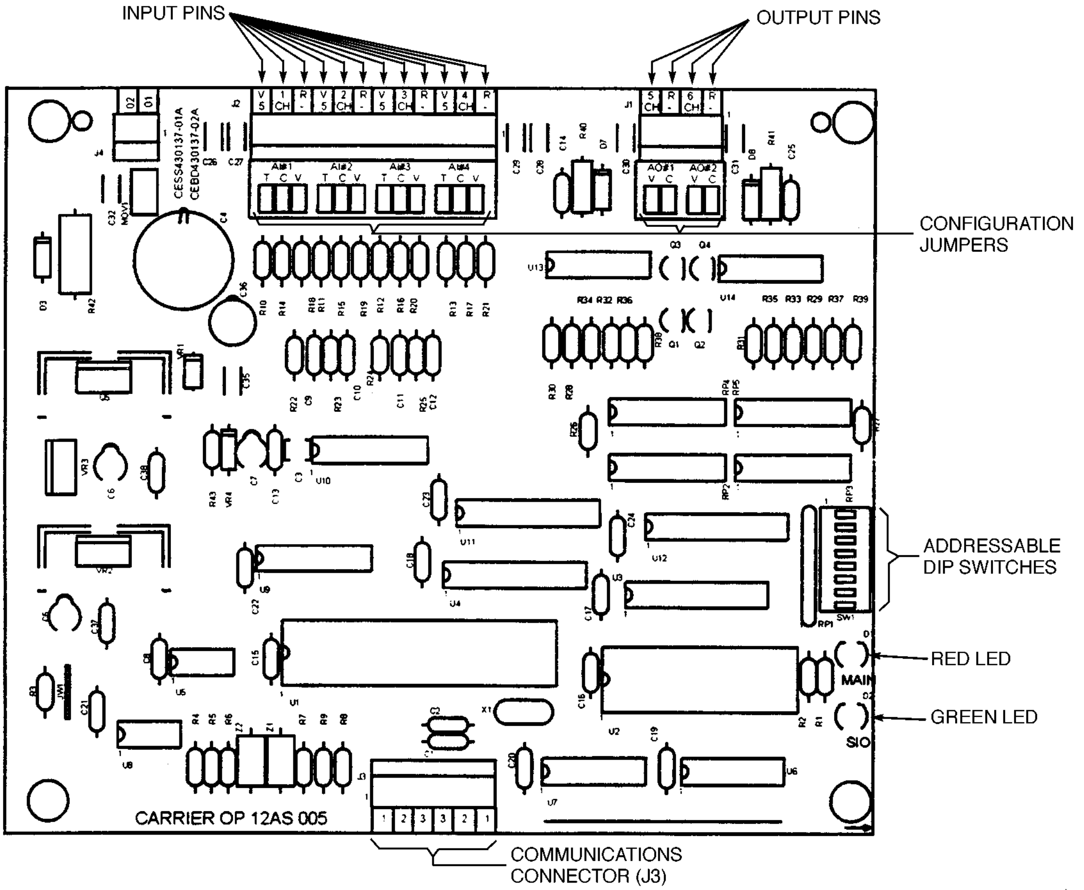


Fig. 55 — 4-In/2-Out Module

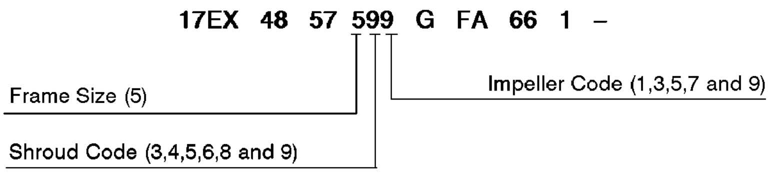


Fig. 56 — Model Number Nomenclature for Compressor Size (See Fig. 1 Also)

Table 15 — 17EX Heat Exchanger Economizer/Storage Vessel, Piping, and Pumpout Unit Weights*

COOLER SIZE†	COOLER TOTAL WEIGHT				COOLER CHARGE						ECONOMIZER/ STORAGE VESSEL		ECONOMIZER REFRIGERANT		MISCELLANEOUS PIPING		PUMPOUT UNIT	
	Dry**		Operating††		Refrigerant		Water											
	lb	kg	lb	kg	lb	kg	lb	gal	kg	L	lb	kg	lb	kg	lb	kg	lb	kg
45	25,032	11 355	30,098	13 652	2,060	934	3,006	361	1 364	1366	7,900	3 583	840	318	1,149	521	210	95
46	25,529	11 580	30,881	14 008	2,160	980	3,192	383	1 448	1450								
47	26,025	11 805	31,663	14 362	2,260	1 025	3,378	405	1 532	1533								
48	28,153	12 770	34,866	15 815	2,540	1 152	4,173	500	1 893	1893								

CONDENSER SIZE†	CONDENSER TOTAL WEIGHT				CONDENSER CHARGE			
	Dry**		Operating††		Refrigerant		Water	
	lb	kg	lb	kg	lb	kg	lb	kg
45	16,676	7 564	20,596	9 342	1,200	544	2,720	1 234
46	17,172	7 789	21,280	9 653	1,200	544	2,908	1 319
47	17,669	8 015	21,965	9 963	1,200	544	3,096	1 404
55	20,725	9 401	25,598	11 611	1,420	644	3,453	1 566
56	21,663	9 826	26,891	12 198	1,420	644	3,808	1 727
57	22,446	10 182	27,971	12 688	1,420	644	4,105	1 862

*If a chiller configuration other than 2-pass, 150 psig (1034 kPa), NIH waterbox configuration is used, refer to Tables 16 and 17 to obtain the additional dry and water weights that must be added to the values shown in this table.
†Cooler and condenser weights shown are based on 2-pass, nozzle-in-head (NIH) waterboxes with 150 psig (1034 kPa) covers. Includes components attached to cooler, but does not include suction/discharge, elbow, or other interconnecting piping.
**Dry weight includes all components attached to economizer: covers, float valves, brackets, control center (31 lb [14 kg]), and power panel (20 lb [9 kg]). Dry weight does not include compressor weight, motor weight, or pumpout condensing unit weight. The pumpout condensing unit weight is 210 lb (95 kg). For compressor and motor weights, refer to Tables 18 and 20A and 20B.
††Operating weight includes dry weight, refrigerant weight, and water weight.

Table 16 — Additional Cooler Weights*

COOLER FRAME	WATERBOX TYPE	NUMBER OF PASSES	DESIGN MAXIMUM WATER PRESSURE		ADDITIONAL DRY WEIGHT		ADDITIONAL WATER WEIGHT			
			psig	kPa	lb	kg	lb	gal	kg	L
4	NIH	1, 3	150	1034	515	234	—	—	—	—
	NIH	1, 3	300	2068	2941	1334	—	—	—	—
	NIH	2	300	2068	2085	946	—	—	—	—
	Marine	1, 3	150	1034	2100	953	5102	612	2314	2314
	Marine	2	150	1034	792	359	2551	306	1157	1157
	Marine	1, 3	300	2068	3844	1744	5102	612	2314	2314
	Marine	2	300	2068	2536	1150	2551	306	1157	1157

*When using a chiller configuration other than 2-pass, NIH waterboxes with 150 psig (1038 kPa) covers, add the weighs listed in this table to the appropriate weights in Table 15 to obtain the correct cooler weight.

Table 17 — Additional Condenser Weights*

COMPONENT	HEAT EXCHANGER SIZE	WATERBOX TYPE	NUMBER OF PASSES	DESIGN MAXIMUM WATER PRESSURE		ADDITIONAL DRY WEIGHT		ADDITIONAL WATER WEIGHT	
				psig	kPa	lb	kg	lb	kg
CONDENSER	45 - 47	NIH	1, 3	150	1034	344	156	—	—
		NIH	1, 3	300	2068	1652	749	—	—
		NIH	2	300	2068	1132	513	—	—
		Marine	1, 3	150	1034	1692	767	3 400	1 542
		Marine	2	150	1034	674	306	1 700	771
		Marine	1, 3	300	2068	2651	1 202	3 400	1 542
		Marine	2	300	2068	1630	739	1 700	771
	55 - 57	NIH	1	150	1034	†	†	—	—
		NIH	1	300	2068	1588	720	—	—
		NIH	2	300	2068	1591	721	—	—
		Marine	2	150	1034	25	11	1 734	787
		Marine	2	300	2068	1225	555	1 734	787

NIH — Nozzle-In-Head

*When using a chiller configuration other than 2-pass, NIH waterboxes with 150 psig (1034 kPa) covers, add the weights listed in this table to the appropriate weights in Table 15 to obtain the correct condenser weight.

†Subtract 228 lb (103 kg) from the weight shown in Table 15.

Table 18 — Compressor Weight and Elbow Weight

COMPONENT	WEIGHT*	
	English (lb)	SI (kg)
COMPRESSOR	5000	2270
SUCTION ELBOW	500	225

*Approximate.

Table 19 — Drive Component Weights*

BASE		GEAR		COUPLING				GUARD	
				High		Low			
lb	kg	lb	kg	lb	kg	lb	kg	lb	kg
2200	998	1500	680	32	15	75	34	50	23

*See Table 20A or 20B for motor weights.

Table 20A — Total Motor Weight, English (lb)

ENCLOSURE TYPE	HERTZ	VOLTAGE	SIZE (HP)				
			FA, FF (1250)	FB, FG (1500)	FH (1600)	FC, FJ (1750)	FD, FK (2000)
Open-Drip Proof (ODP)	60 Hz	2400	4836	5721	5900	5900	7160
		3300	4824	5832	5832	5832	7127
		4160	4836	5721	5900	5900	7160
		6900	5596	6577	8776	8776	8990
	50 Hz	3000	5518	5878	7148	7148	9048
		3300	5518	5878	7148	7148	9073
		6300	5596	6577	8875	8875	8976
			HA, HF (1250)	HB, HG (1500)	HH (1600)	HC, HJ (1750)	HD, HK (2000)
Weather Protected Type II (WPII)	60 Hz	2400	5146	6151	6330	6330	7600
		3300	5134	6262	6262	6262	7567
		4160	5146	6151	6330	6330	7600
		6900	5906	7007	9206	9206	9430
	50Hz	3000	5828	6308	7578	7578	9488
		3300	5828	6308	7578	7578	9513
		6300	5906	7007	9305	9305	9416
			JA, JF (1250)	JB, JG (1500)	JH (1600)	JC, JJ (1750)	JD, JK (2000)
Totally Enclosed Water-To-Air Cooled (TEWAC)	60 Hz	2400	5707	6746	6925	6925	8290
		3300	5694	6857	6857	6857	8257
		4160	5707	6746	6925	6925	8290
		6900	6466	7602	9801	9801	10,120
	50 Hz	3000	6388	6903	8173	8173	10,178
		3300	6388	6903	8173	8173	10,203
		6300	6466	7602	9900	9900	10,106

Table 20B — Total Motor Weight, SI (kg)

ENCLOSURE TYPE	FREQ	VOLTAGE	SIZE (kW)				
			FA, FF (932)	FB, FG (1119)	FH (1194)	FC, FJ (1305)	FD, FK (1492)
Open-Drip Proof (ODP)	60 Hz	2400	2194	2595	2676	2676	3248
		3300	2188	2645	2645	2645	3233
		4160	2194	2595	2676	2676	3248
		6900	2538	2983	3981	3981	4033
	50 Hz	3000	2503	2666	3242	3242	4104
		3300	2503	2666	3242	3242	4116
		6300	2538	2983	4026	4026	4072
			HA, HF (932)	HB, HG (1119)	HH (1194)	HC, HJ (1305)	HD, HK (1492)
Weather Protected Type II (WPII)	60 Hz	2400	2334	2790	2871	2871	3447
		3300	2329	2840	2840	2840	3432
		4160	2334	2790	2871	2871	3447
		6900	2679	3178	4175	4126	4277
	50 Hz	3000	2644	2861	3437	3437	4304
		3300	2644	2861	3437	3437	4315
		6300	2679	3178	4221	4221	4271
			JA, JF (932)	JB, JG (1119)	JH (1194)	JC, JJ (1305)	JD, JK (1492)
Totally Enclosed Water-To-Air Cooled (TEWAC)	60 Hz	2400	2587	3060	3141	3141	3760
		3300	2583	3110	3110	3110	3745
		4160	2587	3060	3141	3141	3760
		6900	2933	3448	4446	4446	4590
	50 Hz	3000	2898	3131	3707	3707	4617
		3300	2898	3131	3707	3707	4628
		6300	2933	3448	4491	4490	4584

Table 21 — Marine Waterbox Cover Weights*

HEAT EXCHANGER SIZE	DESIGN MAXIMUM WATER PRESSURE		COOLER		CONDENSER	
	psi	kPa	lb	kg	lb	kg
45 - 48	150	1034	2236	1015	1275	579
	300	2068	3060	1389	1660	754
55 - 57	150	1034	—	—	1643	746
	300	2068	—	—	2243	1018

*Heat exchangers with marine waterboxes have heavier dry and operating weights than heat exchangers with nozzle-in-head waterboxes.

Table 22 — NIH Waterbox Cover Weights*

HEAT EXCHANGER SIZE	PASSES	DESIGN MAXIMUM WATER PRESSURE		COOLER		CONDENSER	
		psi	kPa	lb	kg	lb	kg
45 - 48	1	150	1034	2997	1361	1735	788
		300	2068	4225	1918	2510	1140
	2†	150	1034	2984	1355	1885	856
		300	2068	4188	1901	2590	1176
	3	150	1034	3035	1378	1777	807
		300	2068	4244	1927	2539	1153
55 - 57	1	150	1034	—	—	2032	923
		300	2068	—	—	2940	1335
	2†	150	1034	—	—	2649	1203
		300	2068	—	—	3640	1653
	3	150	1034	—	—	—	—
		300	2068	—	—	—	—

NIH — Nozzle-in-Head

*The 150 psig (1034 kPa) waterbox cover weights are included in the dry weight shown in Table 15.
†Two different waterbox covers are present on 2-pass chillers. The weight shown in this table represents the weight of the waterbox cover that contains the nozzles. A blank waterbox cover is also present on 2-pass units. The weight of the blank waterbox cover is identical to the weight of the same size marine waterbox cover. Refer to Table 21.

Table 23 — Approximate Refrigerant (HCFC-134a) Charge*

COOLER SIZE	CONDENSER SIZE	TOTAL CHILLER CHARGE	
		lb	kg
45	45	4100	1860
	46		
	47		
	55	4320	1960
	56		
	57		
46	45	4200	1905
	46		
	47		
	55	4420	2005
	56		
	57		
47	45	4300	1950
	46		
	47		
	55	4520	2050
	56		
	57		
48	45	4580	2077
	46		
	47		
	55	4800	2177
	56		
	57		

*Total chiller refrigerant charge includes the cooler, condenser, and economizer charges.

NOTE: Regulations mandate that chiller shipping charge is limited to 7500 lb (3402 kg).

Table 24 — Auxiliary Systems, Electrical Data

POWER SOURCE	ITEM	AVERAGE kW	DESIGN CENTER VOLTAGE	SUPPLY V-PH-Hz	FLA	LRA
1	Seal Leakage Pump	0.23	115	115-1-50/60	4.78	21.7
	Motor Space Heater	0.50	115	115-1-50/60	4.35	4.35
	Control Module and Actuator	0.40	115	115-1-60 115-1-50	3.50	—
	Oil Sump Heater	1.00	115	115-1-60 115-1-50	8.70	—
	Hot Gas* Bypass	0.20	115	115-1-50/60	2.00	4.75
2†	Compressor Oil Pump	0.66	220 430 563	200/240-3-60 380/480-3-60 507/619-3-60	4.34 2.15 2.14	24.5 13.1 25.0
			230 393	220/240-3-50 346/440-3-50	4.84 2.59	28.0 12.2
3†	Gear Oil Pump	0.7	204 220 460 575	200/208-3-60 208/230-3-60 440/480-3-60 518/632-3-60	5.7 4.2 2.1 1.7	33.5 30.6 15.3 12.3
			205 410	190/220-3-50 380/440-3-50	5.0 2.5	28.9 14.5
4	Pumpout* Compressor	3.41	204 230 460 575	200/208-3-60 220/240-3-60 440/480-3-60 550/600-3-60	10.90 9.50 4.70 3.80	63.5 57.5 28.8 23.0
			400	380/415-3-50	4.70	28.8

LEGEND

FLA — Full Load Amps
LRA — Locked Rotor Amps

*Available as an option on 17EX chillers.
†The compressor and gear oil pump contactors are wired together on the line side. Their amperage values must be added together when sizing conductors.

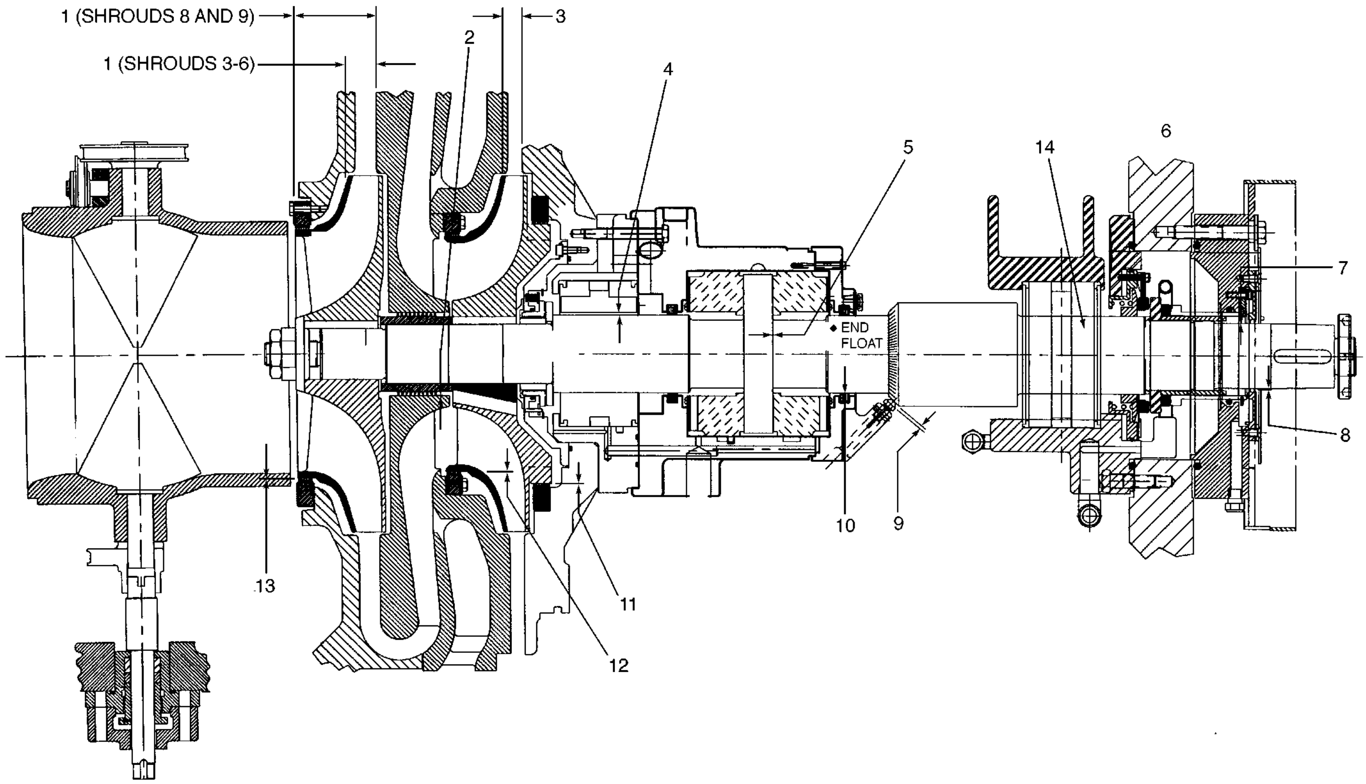
NOTE: The oil pump is powered through a field wiring terminal into the power panel. Power to the controls and oil heater via the power panel must be on circuits that can provide continuous service when the compressor starter is disconnected.

Table 25 — Relief Valve Locations and Data

RELIEF VALVE LOCATION	HEAT EXCHANGER SIZE		REQUIRED C FACTOR		NOMINAL OUTLET PIPE SIZE (in.)	NUMBER OF VALVES	RATED RELIEF PRESSURE	
	Cooler	Condenser	lb air/min.	kg air/sec.			psig	kPa
Cooler	45-47	45-47	216.3	1.64	1¼ FPT	3	225	1551
	48	55-57	228.5	1.73	1¼ NPT	3	225	1551
Economizer/Storage Vessel	ALL	ALL	84.3	0.64	1¼ FPT	2*	225	1551
Pumpout Unit Condenser	ALL	ALL	1.5	0.01	⅜ in. Male Flare MPT	1	385	2655

*To ensure relief valve serviceability, and as required in ASHRAE 15, latest edition, three-way valves and redundant relief valves are installed on the storage vessel. Only one of the ‘‘No. of Valves’’ listed are in service at any time.

NOTES:
1. The cooler relief C-factor is for both cooler and condenser vented through the cooler in accordance with ASHRAE (American Society of Heating, Refrigeration, and Air Conditioning Engineers) 15, latest edition.
2. Relief valve discharge pipe sizing is to be calculated per latest version of ASHRAE 15, using the tabulated C-factors and nominal pipe size listed above. Cooler and economizer/storage vessel rated relief valve pressure is 225 psig (1551 kPa).
3. The pumpout unit condenser contains less than 110 lb (50 kg) of HFC-134a, which is a Group A1 refrigerant. The ASHRAE 15 standard exempts small-volume vessels from the requirement to vent outside. However, Carrier recommends that the pumpout condenser be connected to the rest of the vent system.



NOTE: Refer to Table 26 for item number references.

Fig. 57 — Compressor Fits and Clearances

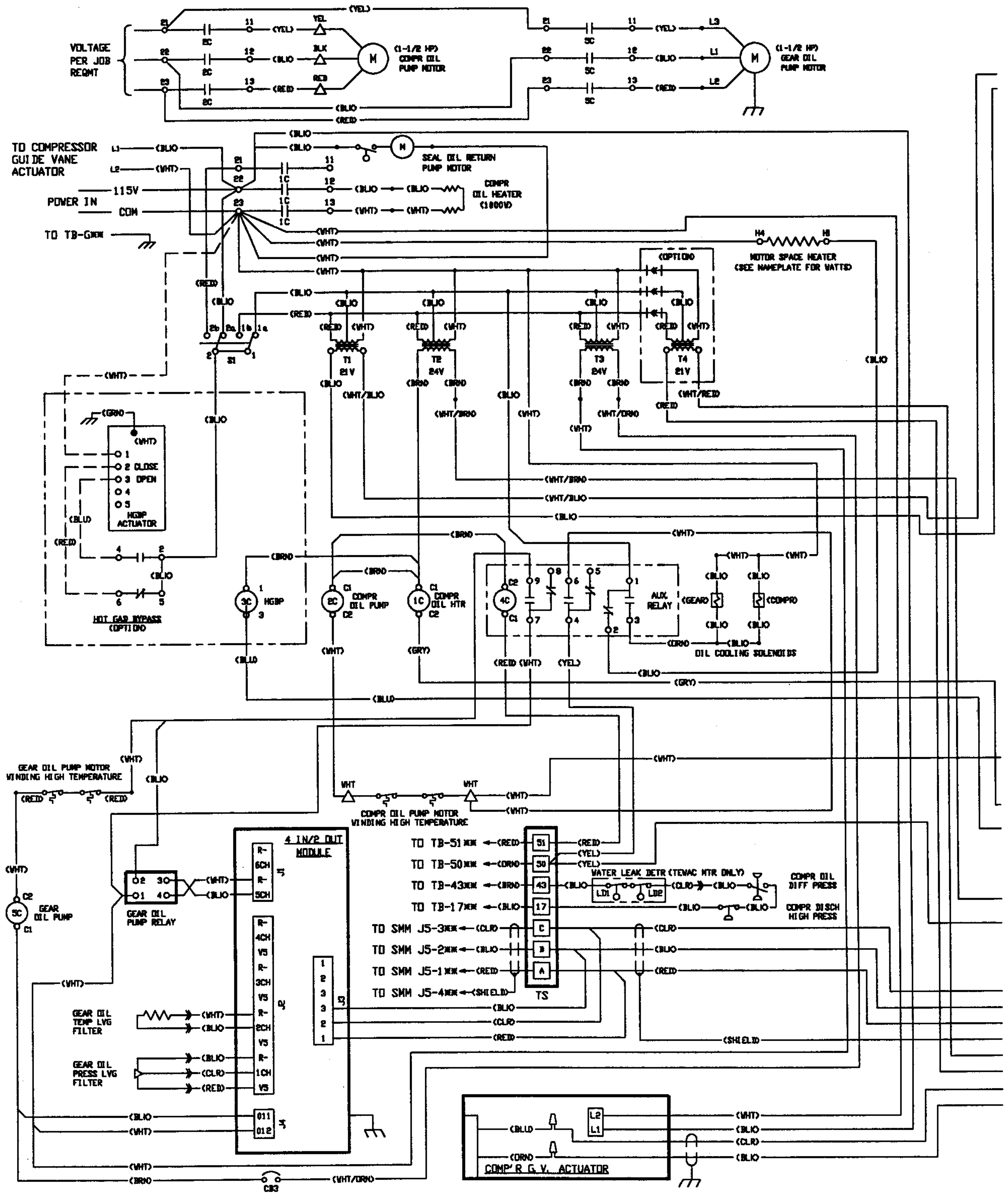
Table 26 — Compressor Fits and Clearances

ITEM	DESCRIPTION		CLEARANCE Minimum in.	Minimum mm	Maximum in.	Maximum mm	TYPE OF MEASURE
1	1st Stage Impeller to Diaphragm		See Tabulation				Axial
2	Interstage Labyrinth		0.012	0.305	0.016	0.406	Diametral
3	2nd Stage Impeller to Discharge Wall		See Tabulation				Axial
4	Thrust End Journal Bearing		0.0035	0.0889	0.0055	0.1397	Diametral
5	Thrust End Float		0.010	0.254	0.015	0.381	Axial
6	Inner Carbon Ring Travel		.06 in. (1.52 mm) minimum in each direction				Axial
7	Shaft End Labyrinth		0.001	0.025	0.005	0.127	Diametral
8	Windage Baffle to Shaft		0.092	2.337	0.095	2.413	Diametral
9	Shaft Displacement (Shrouds 3 - 6) Detector (Shrouds 8 & 9)		0.008	0.203	0.010	0.254	Axial
			0.023	0.584	0.025	0.635	
10	Counterthrust Bearing Seal Ring		0.006	0.152	0.010	0.254	Diametral
11	Balancing Piston, Labyrinth		0.008	0.203	0.012	0.305	Diametral
			0.018	0.457	0.022	0.559	
12	2nd Stage Labyrinth		0.008	0.203	0.012	0.305	Diametral
13	1st Stage Labyrinth	(Shrouds 3 - 6)	0.016	0.406	0.020	0.508	Diametral
		(Shrouds 8 & 9)	0.018	0.457	0.022	0.559	
14	Seal End Journal Bearing		0.0035	0.0889	0.0055	0.1397	Diametral

Tabulation — Impeller Clearances (Open-Drive Compressors)

<table>
<tr><th rowspan="3">COMPRESSOR SIZE</th><th rowspan="3">SHROUD</th><th rowspan="3">DIAM CODE</th><th colspan="2" rowspan="2">IMPELLER DIAMETER</th><th colspan="4">DIMENSION*</th></tr>
<tr><th colspan="2">Item 1</th><th colspan="2">Item 3</th></tr>
<tr><th>in.</th><th>mm</th><th>in.</th><th>mm</th><th>in.</th><th>mm</th></tr>
<tr><td rowspan="24">17FX</td><td rowspan="5">3</td><td>1</td><td>12.00</td><td>304.8</td><td>.837</td><td>21.26</td><td>.638</td><td>16.21</td></tr>
<tr><td>3</td><td>12.38</td><td>314.5</td><td>.797</td><td>20.24</td><td>.609</td><td>15.47</td></tr>
<tr><td>5</td><td>12.75</td><td>323.8</td><td>.757</td><td>19.23</td><td>.579</td><td>14.71</td></tr>
<tr><td>7</td><td>13.25</td><td>336.6</td><td>.717</td><td>18.21</td><td>.541</td><td>13.74</td></tr>
<tr><td>9</td><td>13.75</td><td>349.2</td><td>.690</td><td>17.53</td><td>.541</td><td>13.74</td></tr>
<tr><td rowspan="5">4</td><td>1</td><td>12.00</td><td>304.8</td><td>.977</td><td>24.82</td><td>.760</td><td>19.30</td></tr>
<tr><td>3</td><td>12.38</td><td>314.5</td><td>.937</td><td>23.80</td><td>.726</td><td>18.44</td></tr>
<tr><td>5</td><td>12.75</td><td>323.8</td><td>.897</td><td>22.78</td><td>.688</td><td>17.48</td></tr>
<tr><td>7</td><td>13.25</td><td>336.6</td><td>.837</td><td>23.62</td><td>.639</td><td>16.23</td></tr>
<tr><td>9</td><td>13.75</td><td>349.2</td><td>.810</td><td>20.57</td><td>.632</td><td>16.05</td></tr>
<tr><td rowspan="5">5</td><td>1</td><td>12.00</td><td>304.8</td><td>1.177</td><td>29.90</td><td>.895</td><td>25.02</td></tr>
<tr><td>3</td><td>12.38</td><td>314.5</td><td>1.137</td><td>28.88</td><td>.852</td><td>21.64</td></tr>
<tr><td>5</td><td>12.75</td><td>323.8</td><td>1.077</td><td>27.36</td><td>.809</td><td>20.55</td></tr>
<tr><td>7</td><td>13.25</td><td>336.6</td><td>1.017</td><td>25.83</td><td>.750</td><td>19.05</td></tr>
<tr><td>9</td><td>13.75</td><td>349.2</td><td>.970</td><td>24.64</td><td>.731</td><td>18.57</td></tr>
<tr><td rowspan="5">6</td><td>1</td><td>12.00</td><td>304.8</td><td>1.297</td><td>32.94</td><td>.972</td><td>24.69</td></tr>
<tr><td>3</td><td>12.38</td><td>314.5</td><td>1.237</td><td>31.42</td><td>.928</td><td>23.57</td></tr>
<tr><td>5</td><td>12.75</td><td>323.8</td><td>1.177</td><td>29.90</td><td>.880</td><td>22.35</td></tr>
<tr><td>7</td><td>13.25</td><td>336.6</td><td>1.097</td><td>27.86</td><td>.817</td><td>20.75</td></tr>
<tr><td>9</td><td>13.75</td><td>349.2</td><td>1.050</td><td>26.67</td><td>.796</td><td>20.22</td></tr>
<tr><td rowspan="2">8</td><td rowspan="2">1-9</td><td>13.75†</td><td>349.2†</td><td rowspan="2">4.425</td><td rowspan="2">112.39</td><td rowspan="2">.876</td><td rowspan="2">22.25</td></tr>
<tr><td>13.50**</td><td>342.9**</td></tr>
<tr><td rowspan="2">9</td><td rowspan="2">1-9</td><td>13.75†</td><td>349.2†</td><td rowspan="2">4.425</td><td rowspan="2">112.39</td><td rowspan="2">1.055</td><td rowspan="2">26.80</td></tr>
<tr><td>13.50**</td><td>342.9**</td></tr>
</table>

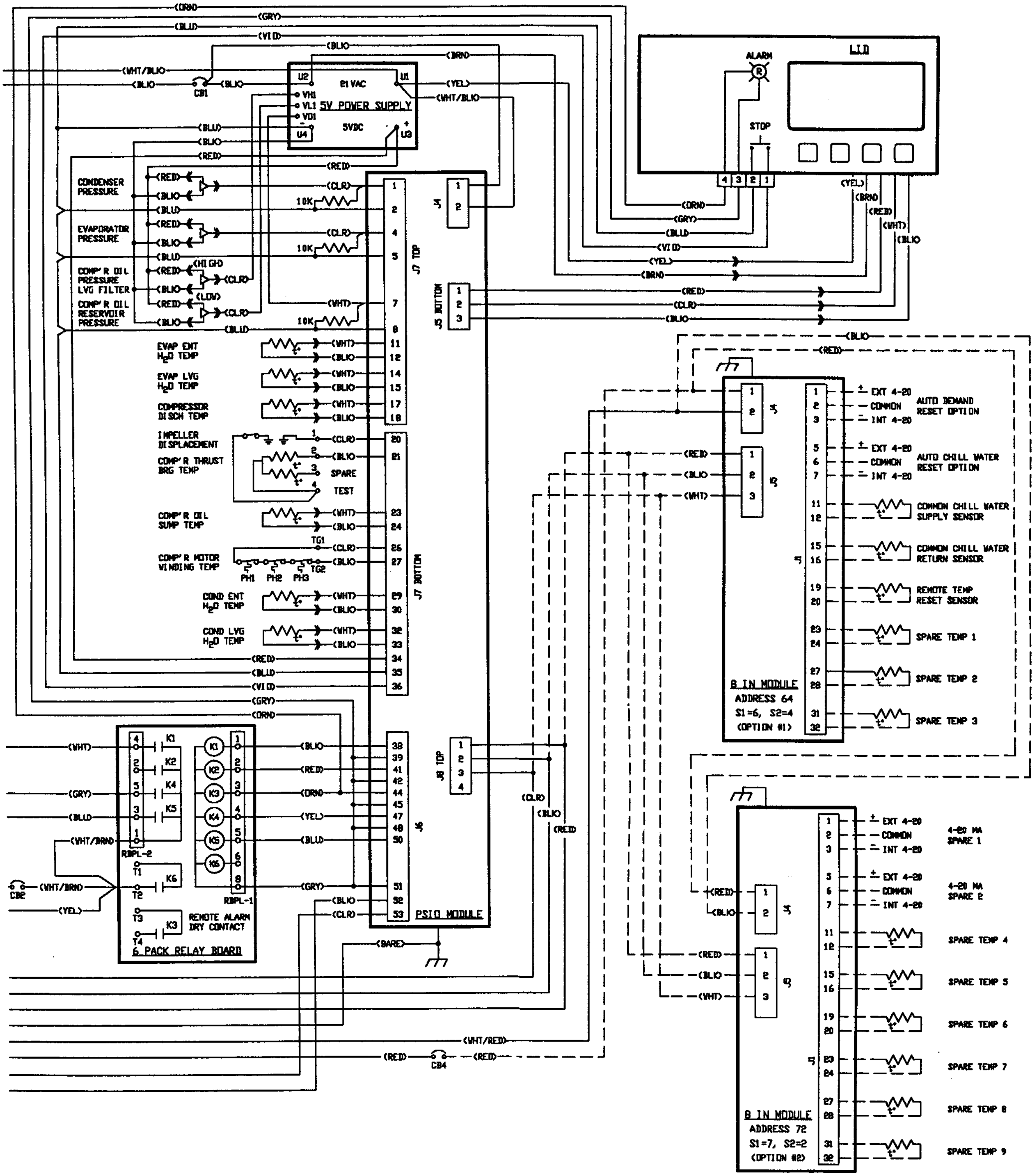
*Measured with shaft in thrust position (towards suction end); tolerance = ± .005 in. (± .127 mm).
†First-stage diameter.
**Second-stage diameter.



LEGEND

BRG	— Bearing	**DIFF**	— Differential	**INT**	— Internal
C	— Contactor	**DISCH**	— Discharge	**J**	— Junction
CB	— Circuit Breaker	**ENT**	— Entering	**K**	— Relay Designation
CH	— Channel	**EVAP**	— Evaporator	**L**	— Line Terminal
COM	— Communications	**EXT**	— External	**LD**	— Leak Detector
COMP'R	— Compressor	**G.V.**	— Guide Vane	**LID**	— Local Interface Device
COND	— Condenser	**HGBP**	— Hot Gas Bypass	**LVG**	— Leaving
DETR	— Detector	**HTR**	— Heater	**M**	— Motor

Fig. 58 — Typical 17EX Power Panel and Control Panel Wiring Schematic

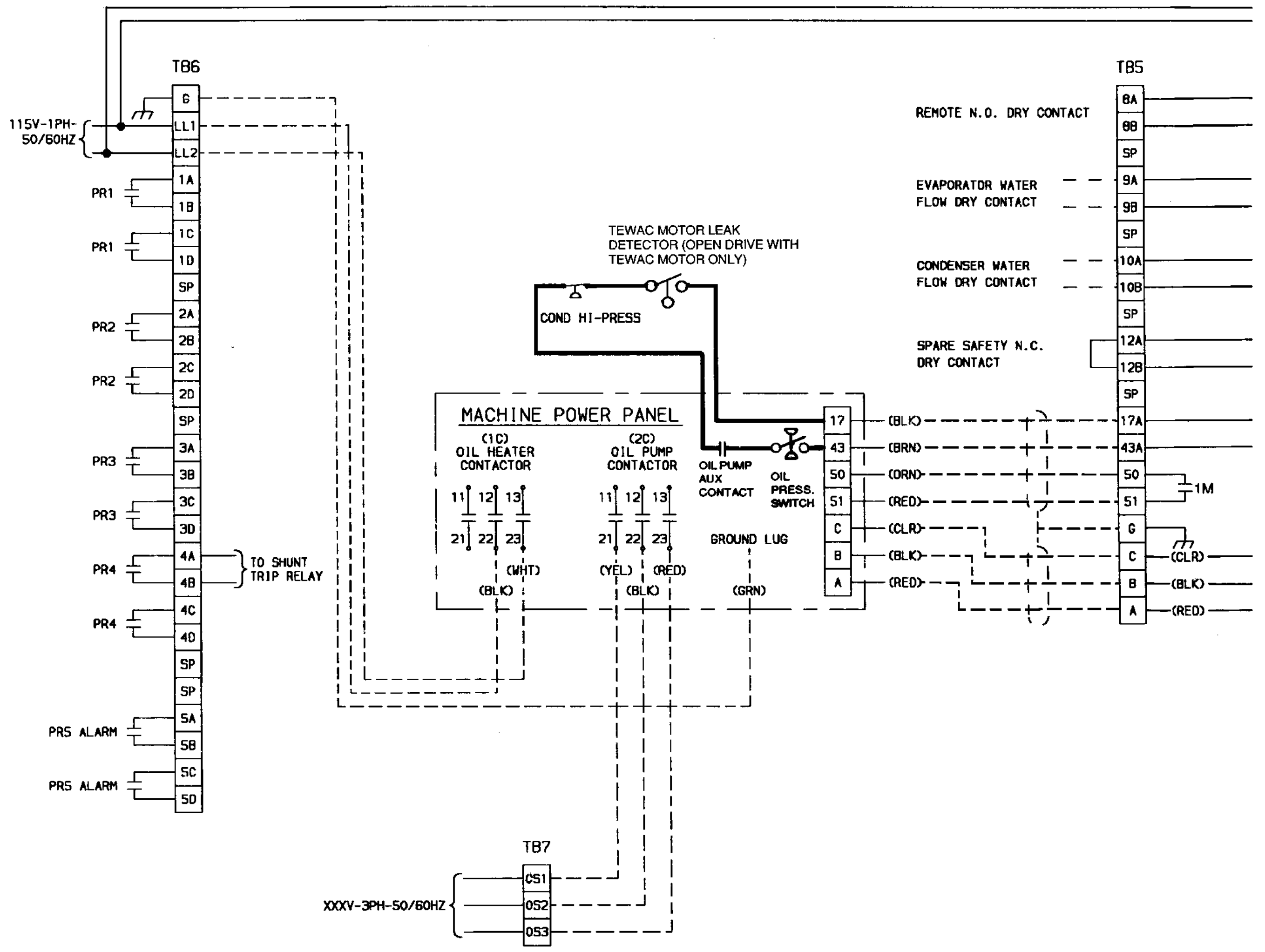


LEGEND

PH	— Phase	**TEMP**	— Temperature
PRESS.	— Pressure	**TEWAC**	— Totally Enclosed Water-to-Air Cooled
PSIO	— Processor/Sensor Input/Output Module	**TG**	— Terminal Designation
R	— Terminal Designation	**TS**	— Terminal Strip
SMM	— Starter Management Module		Required Power Wiring
T	— Terminal		Required Control Wiring
t*	— Thermistor		Options Wiring
TB	— Terminal Block		

IMPORTANT: Wiring shown is typical and not intended to show detail for a specific installation. Refer to certified field wiring diagrams.

Fig. 58 — Typical 17EX Power Panel and Control Panel Wiring Schematic (cont)



LEGEND

CB — Circuit Breaker
COMM — Communications
N.O. — Normally Open
N.C. — Normally Closed
O.L. — Overload
PR — Pilot Relay
RLA — Rated Load Amps
SMM — Starter Management Module
TB — Terminal Block
——— Starter Vendor Supplied Wiring
- - - - Field Wiring
▬▬▬ Carrier Factory Wiring

NOTE: Voltage to terminals LL1 and LL2 comes from a control transformer in a starter built to Carrier specifications. Do not connect an outside source of control power to the compressor motor starter (terminals LL1 and LL2). 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.

Fig. 59 — Elementary Wiring Diagram for Starter Management Module (SMM) and Control Interface Between Starter and Chiller Power Panel (For Low and Medium Voltage Free-Standing Starters)

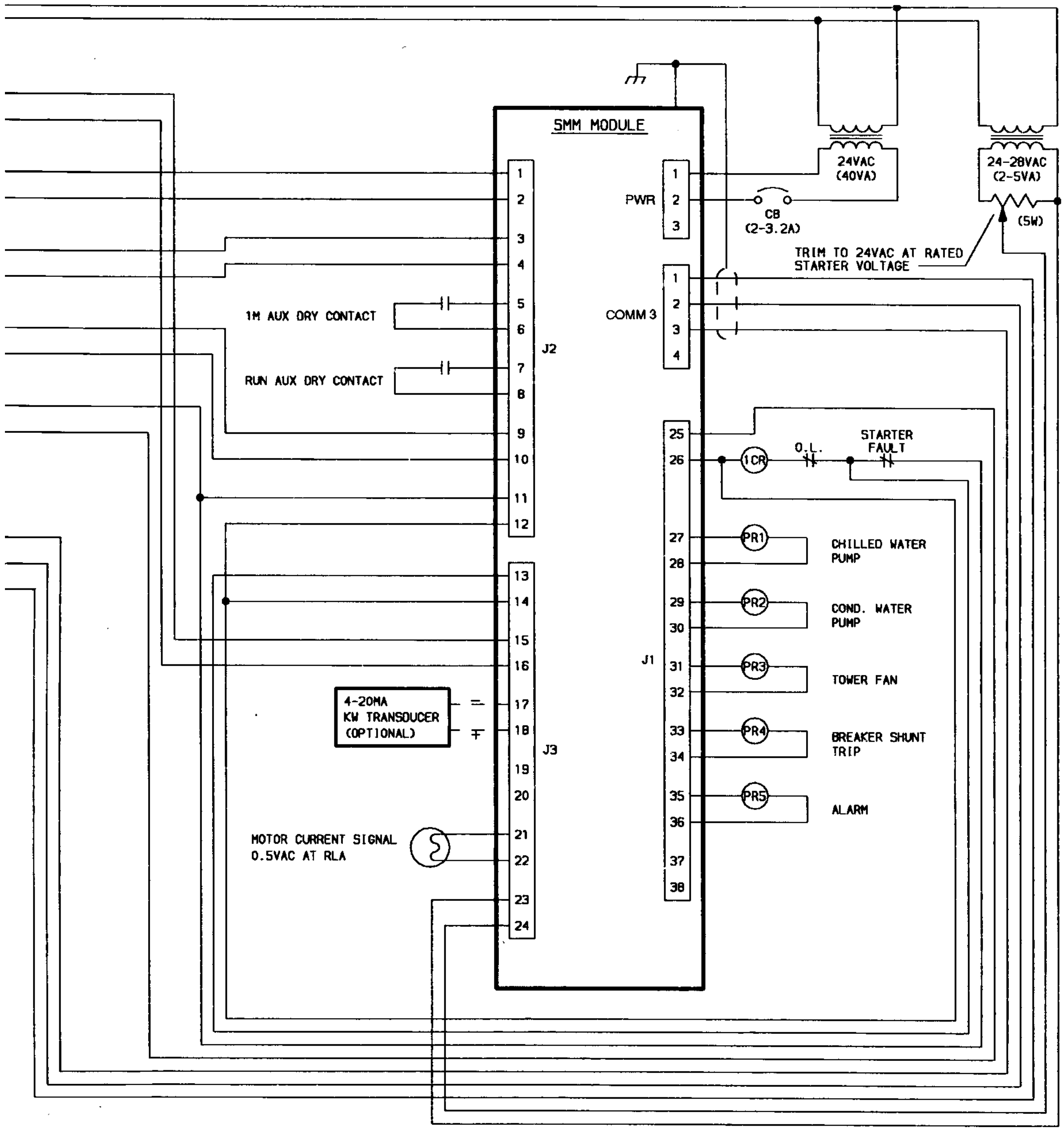
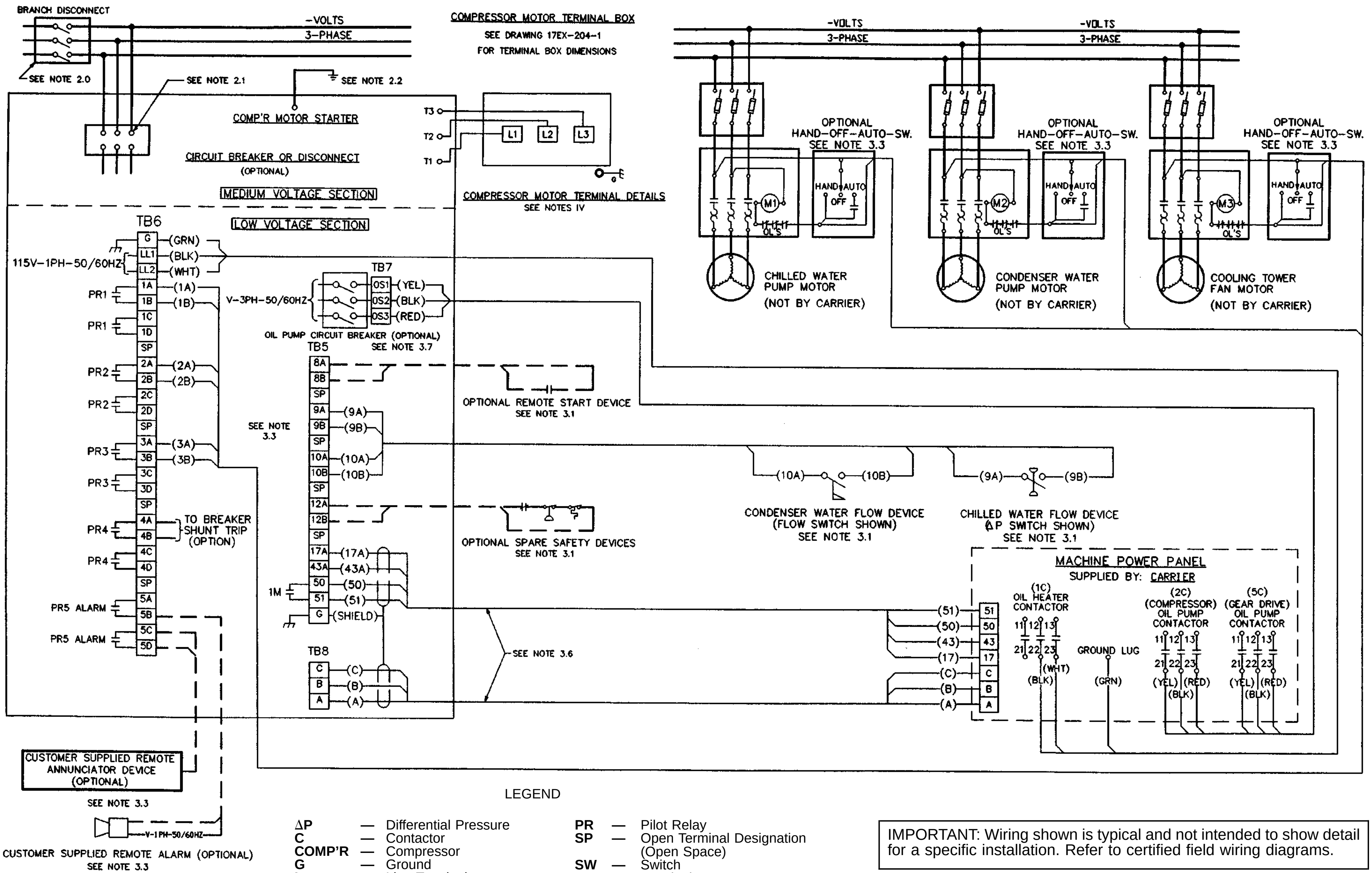


Fig. 59 — Elementary Wiring Diagram for Starter Management Module (SMM) and Control Interface Between Starter and Chiller Power Panel (For Low and Medium Voltage Free-Standing Starters) (cont)



LEGEND

ΔP	— Differential Pressure	PR	— Pilot Relay
C	— Contactor	SP	— Open Terminal Designation (Open Space)
COMP'R	— Compressor	SW	— Switch
G	— Ground	T	— Terminal
L	— Line Terminal	TB	— Terminal Board
LL	— Control Power Line Terminal		Required Power Wiring
M	— Motor		Required Control Wiring
OL's	— Overloads		Options Wiring
OS	— 3-Phase Current Power Source		

IMPORTANT: Wiring shown is typical and not intended to show detail for a specific installation. Refer to certified field wiring diagrams.

Fig. 60 — Field Wiring Diagram (Medium Voltage Motor, PIC Controls With Free-Standing Starter)

NOTES FOR FIG. 60

I GENERAL

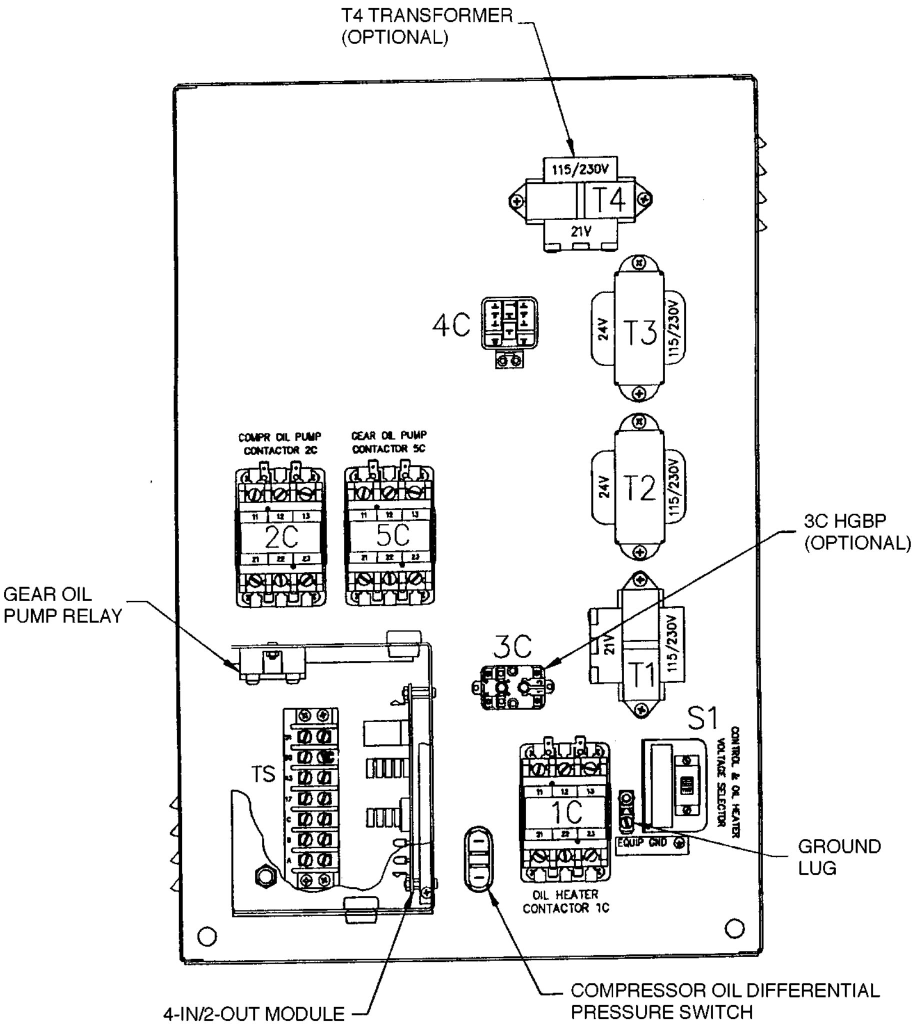
1.0 Starters shall be designed and manufactured in accordance with Carrier Engineering requirement Z-375.
1.1 All field-supplied conductors and devices, field-installation wiring, and termination of conductors and devices must be in compliance with all applicable codes and job specifications.
1.2 The routing of field-installed conduit and conductors and the location of field-installed devices must not interfere with equipment access of the reading, adjusting, or servicing of any component.
1.3 Equipment installation and all starting and control devices must comply with details in equipment submittal drawings and literature.
1.4 Contacts and switches are shown in the position they would assume with the circuit deenergized and the chiller shut down.
1.5 WARNING: Do not use aluminum conductors.
1.6 Installer is responsible for any damage caused by improper wiring between starter and chiller.

II POWER WIRING TO STARTER

2.0 Provide a means of disconnecting power to the starter.
2.1 Power conductor rating must meet minimum unit nameplate voltage and compressor motor RLA (rated load amps). When 3 conductors are used:
Minimum ampacity per conductor = 1.25 x compressor RLA.
When 6 conductors are used:
Minimum ampacity per conductor = 0.721 x compressor RLA.
2.2 Lug adapters may be required if installation conditions dictate that conductors be sized beyond the minimum ampacity required. Contact starter supplier for lug information.
2.3 Compressor motor and controls must be grounded by using equipment grounding lugs provided inside starter enclosure.

III CONTROL WIRING

3.0 Field supplied control conductors to be at least 18 AWG (American Wire Gage) or larger.
3.1 Chilled water and condenser water flow switch contacts, optional remote start device contacts, and optional spare safety device contacts must have 24 vdc rating. Maximum current is 60 mA; nominal current is 10 mA. Switches with gold plated bifurcated contacts are recommended.
3.2 Remove jumper wire between 12A and 12B before connecting auxiliary safeties between these terminals.
3.3 Pilot relays can control cooler and condenser pump and tower fan motor contactor coil loads rated up to 10 amps at 115 vac or up to 3 amps at 600 vac. Control wiring required for Carrier to start pumps and tower fan motors must be provided to assure chiller protection. If primary pump and tower motor control is by other means, also provide a parallel means for control by Carrier. Do not use starter control transformer as the power source for pilot relay loads.
3.4 Do not route control wiring carrying 30 v or less within a conduit which has wires carrying 50 v or higher or alongside wires carrying 50 v or higher.
3.5 Voltage selector switch in chiller power panel is factory set for 115 v control and oil heater power source. The 230 v position is not used. If switch is set to 230 v position, oil heater will not operate.
3.6 Control wiring cables between starter and power panel must be shielded with minimum rating of 600 v, 80 C. Ground shield at starter. Starter Management Module (SMM) communication cable must be separate.
3.7 If optional oil pump circuit breaker is not supplied within the starter enclosure as shown, it must be located within sight of the chiller with wiring routed to suit.
3.8 Voltage to terminals LL1 and LL2 comes from a control transformer in a starter built to Carrier specifications. Do not connect an outside source of control power to the compressor motor starter (terminals LL1 and LL2). 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.
4.0 Medium voltage (over 600 volts) compressor motors have 3 terminal connections (lead hooks). Use suitable splice connectors and insulation for high voltage alternating current cable terminations (these items are not supplied by Carrier). Compressor motor starter must have nameplate stamped to conform with Carrier requirement Z-375.
4.1 Power conductor rating must meet minimum unit nameplate voltage and compressor motor RLA. (Conductor as defined below may be a single lead or multiple smaller ampacity leads in parallel for the purpose of carrying the equivalent or higher current of a single larger lead.)
When (3) conductors are used:
Minimum ampacity per conductor = 1.25 × compressor RLA.
4.2 When more than one conduit is used to run conductors form starter to compressor motor terminal box, an equal number of leads from each phase (conductor) must be in each conduit to prevent excessive heating (e.g., conductors to motor terminals 1, 2 and 3 in one conduit, and those to 1, 2 and 3 in another.)
4.3 Compressor motor power connections can be made through top, top rear, or sides of compressor motor terminal box using holes cut by contractor to suit conduit. Flexible conduit should be used for the last few feet to the terminal box for unit vibration isolation. Use of stress cones may require an oversize (special) motor terminal box (not supplied by Carrier).
4.4 Compressor motor frame to be grounded in accordance with the National Electrical Code (NFPA-70) and applicable codes. Means for grounding compressor motor is 2 ground pads, 1 each located near each motor foot opposite the shaft end.
4.5 Do not allow motor terminals to support weight of wire cables. Use cable supports and strain reliefs as required.



LEGEND

EQUIP	—	Equipment
GND	—	Ground
HGBP	—	Hot Gas Bypass
S	—	Switch
T1-T4	—	Power Panel Transformers
TS	—	Terminal Strip

Fig. 61 — Oil Pump and Control Power Panel (Interior View)

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