DISCONTINUED PRODUCT

Precision Cooling
For Business-Critical Continuity

Liebert CSU 3000™ Chiller

Operation & Maintenance Manual - 2.5 - 37 Tons

Liebert

EMERSON
Network Power

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PRODUCT MODEL INFORMATION

Table 1 Model Number Designation

DS065A–A							
DS		**065**	**A**		**–**	**A**	
DS =	Single Module 5 Ton	Nominal capacity in thousand BTUH	A =	Air Cooled			Voltage/Phase/Hz
DD =	Dual Module 5 Ton		W =	Water Cooled		A =	460/3/60
CS =	Single Module 7-1/2, 10, 12, 15 Ton		G =	Glycol Cooled		B =	575/3/60
CD =	Dual Module 7-1/2, 10, 12, 15 Ton		L =	Glycool		C =	208/3/60
AS =	Alternate Water Source Module					D =	230/3/60
CT =	Triple Module 20, 30, 37 Ton					F =	380/3/50
						G =	415/3/50
						J =	200/3/50
						M =	380/415/3/50

Table 2 CSU3000 Models

Tonnage	Air Cooled	Water Cooled	Glycol Cooled	Glycool
5	DS065A/DD130A	DS072W/DD144W	DS057G/DD114G	
7-1/2	CS091A/CD182A	CS101W/CD202W	CD085G/CD170G	CD170L
10	CS109A/CD218A	CS121W/CD242W	CS102G/CD204G	CD204L
12	CS135A/CD270A	CS151W/CD302W	CS126G/CD252G	CD252L
15	CS/181A/CD362A	CS200W/CD400W	CS168G/CD336G	
20	CT327A	CT363W	CT306G	
30	CT543A	CT600W	CT504G	
37	CT663A	CT702W	CT621G	

Figure i   CSU3000 5 Ton Unit

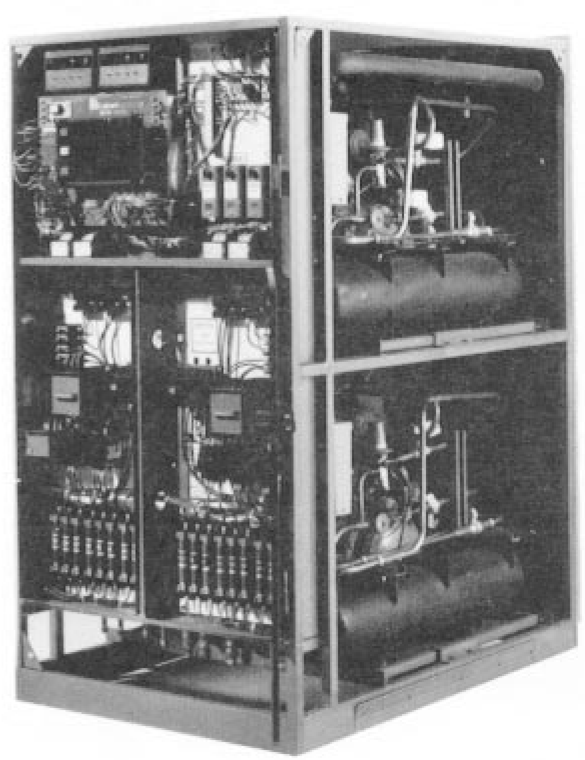


Figure ii   CSU3000 7-1/2 – 15 Ton Unit

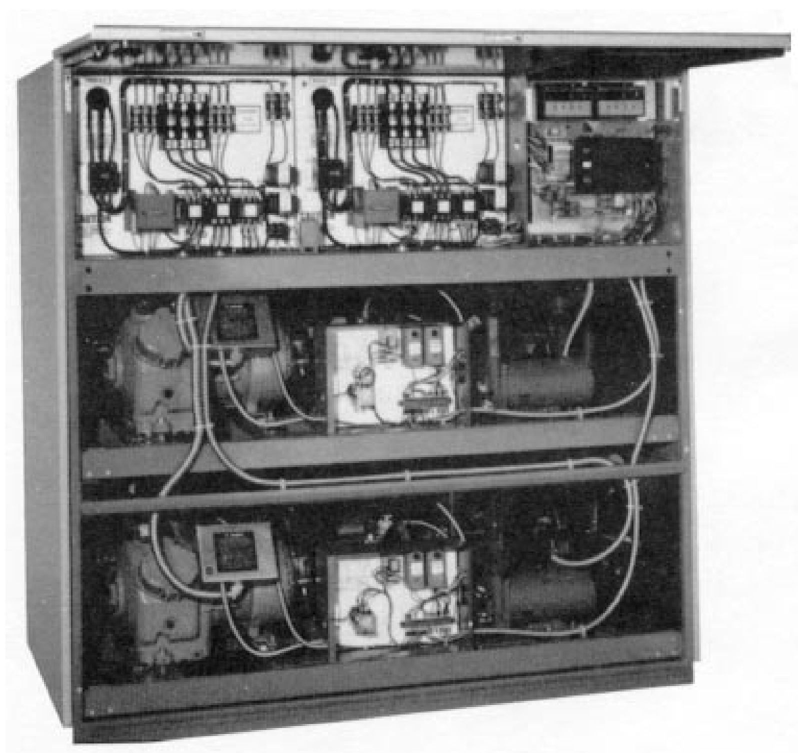
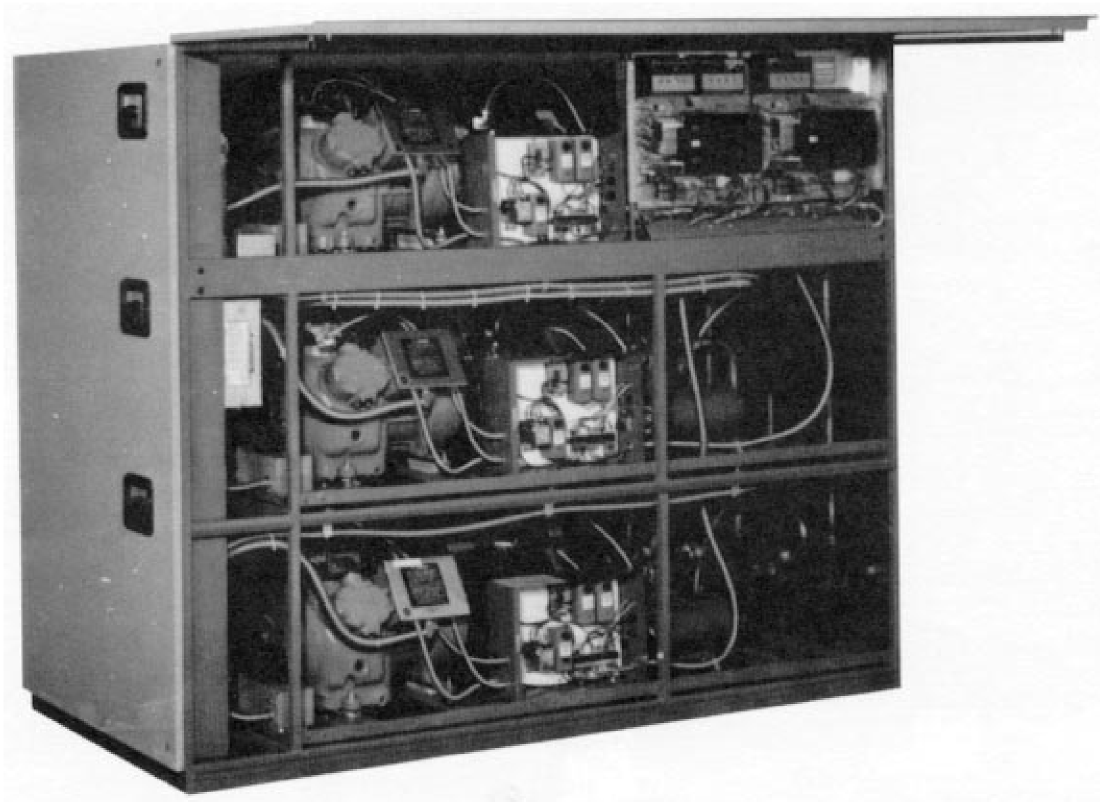


Figure iii   CSU3000 20 – 37 Ton Unit



1.0 START-UP PROCEDURE

Before start-up verify that the supply voltages are correct and that all debris has been removed from the electric panels and refrigeration modules.

Depressing the START/STOP switch will energize the chilled water pump and the temperature controller for that module. The same switch will also stop the module.

For initial start-up, or if the unit has been idle for some time, follow the procedure below:

CAUTION
For air cooled chillers, the Lee-Temp/Flood Back Head Pressure Control heater pads must be energized 24 hours before start-up.

1. Make sure that all voltage is OFF, main unit disconnect (if provided) is OFF and all electrical connections are secure.
2. Close liquid line manual shut-off valves on both modules.
3. If the unit has a capacity selector switch, set it for “High Capacity”.
4. Remove any debris from the unit that may interfere with the start up.
5. Turn ON the main power - check for proper voltage.
6. Close the unit disconnect switch.
7. Purge the compressor by manually depressing the compressor contactor or by placing jumper leads across the contacts on the low pressure switch.
8. Open the liquid line shut-off valve.
9. Start the chiller module by depressing the START button on the status panel.
10. Verify that the water pump is rotating correctly (clockwise).
11. Test Sentinel 3000/Alarm Monitor operation (see **2.2 - Sentinel 3000/Alarm Monitor** for the procedure).
12. Turn the Temperature Control adjustment knob counterclockwise until the liquid line solenoid valve and discharge bypass solenoid valve are energized.
13. Verify that compressor energizes at 65 PSIG (450 kPa) suction pressure.
14. Turn the Temperature Control adjustment knob clockwise until the liquid line solenoid valve and discharge bypass solenoid valve are deactivated.
15. Verify that the compressor pumps down and stops at 53 PSIG (365 kPa).
16. Make sure that the Temperature Control adjustment knob and the Differential Adjustment bar are set as required:

Set Point typically	52°F (11.1°C)
Differential typically	3°F (1.7°C)

NOTE
Some applications may require different setpoints and differentials. Consult factory for assistance, if required.

The cover of the Temperature Controller must be removed to set the differential. The Differential Adjustment bar is on the right hand side of the switch.

1.1 Overview of Operation

If there is an increase in leaving chilled water temperature beyond the setpoint (typically 52°F, 11.1°C), the temperature controller will energize the liquid line solenoid valve and the discharge bypass solenoid valve. Refrigerant will flow through the evaporator to the compressor. The compressor is activated when the low pressure switch senses sufficient pressure (65 PSIG, 450 kPa).

When chilled water temperature drops below the temperature controller differential setting (typically 3°F, 1.70°C) the liquid line solenoid valve is deenergized and the compressor pumps down (53 PSIG, 365 kPa).

Outdoor heat rejection equipment is regulated by the compressor operation.

The Sentinel 3000/Alarm Monitor continuously checks compressor head pressure, leaving water temperature (LWT), and water flow. It will activate a light and audible alarm in the event of any malfunction.

2.0 ELECTRICAL PANEL COMPONENTS

Figure 1 PCR Readout

2.1 PCR 3000/Status Panel

The PCR 3000/Status Panel contains three buttons. The upper and lower buttons activate the individual chiller modules. Each button starts and stops its respective module. On 20, 30 and 37 ton models a second display is provided for the third module. On this second display only the top START/STOP button and the silence button are used. It is recommended that operation modules be alternated periodically to provide even wear of each.

The center button silences the audible alarm should a system related problem occur (see **2.2 - Sentinel 3000/Alarm Monitor**). If there is a failure of one module, the standby module will be activated automatically. The cause of the module failure is displayed on the PCR 3000/Status Panel Readout and remains lit after changeover to aid in troubleshooting.

If a failure of the lead module is the result of a power failure, changeover to the standby module will only take place if the standby module is powered from a different source.

Table 3 Status Panel Parts

Description	Model	Part No.
Lamps	ALL	G-139A
Start-stop Switch CSU1	1SS	G02-0190
Start-stop Switch CSU2	2SS	G02-0200
Start-stop Switch CSU3	3SS	G02-0190
Silence Switch	SL	G02-0180

2.1.1 Remote Monitoring Devices

To monitor the unit operation from a remote location, a remote monitor panel can be provided.

The Panel will duplicate the PCR 3000/Status Panel display. Although start lights will be activated on the panel, the unit can not be started or stopped from this repeater panel.

If the unit contains an Information Gathering Module (IGM) connection (optional), it can communicate with a local status monitor such as Sitemaster “200 or SiteScan”.

2.1.2 Replacing Lights

Lights under the START/STOP buttons can be replaced by grasping the individual cover and pulling straight out. The plug-in bulb will come out with the cover. To replace other lights in the readout panel, open the accent panel using a panel wrench. Remove the plastic clips surrounding the backlighted panel and pull the panel cover straight out exposing the plug-in type bulbs. The switches S1 and S2 are soldered to the printed circuit board.

2.2 Sentinel 3000/Alarm Monitor

The Sentinel 3000/Alarm Monitor monitors system operation and activates for four standard malfunctions: High Water Temperature, Low Temperature, Loss of Water Flow and High Compressor Head Pressure. An optional alarm (i.e. Water Under Floor) may be customer specified.

Figure 2 Sentinel 3000/Alarm Monitor

If there is a malfunction, the Sentinel 3000/Alarm Monitor de-energizes the refrigeration module, activates the audible alarm and lights the appropriate message on the PCR 3000 display screen. Automatically and simultaneously the standby refrigeration module is activated. A common alarm message such as “CALL SERVICE” may be customer specified and will light whenever any malfunction occurs. Depressing the SILENCE button on the panel will quiet the audible alarm but the message will remain lit. Even if the malfunction corrects itself, the message and alarm (if not manually silenced) remains activated.

When the malfunction in the lead module is corrected and the reset button is depressed, the switchover is reversed and the lead unit restarts.

2.2.1 Testing

All tests are to be conducted with lead module(s) on, standby module off.

1. Lamp test button

   Lights all lamps except PUMP ON and activates the audible alarm. The alarm is silenced by pressing the SILENCE button.
2. Low Temperature — push to test*

   Hold the button in for 30 seconds. Changeover to the standby module will take place. Release the button and push reset. The lead module will restart.
3. High Water Temperature -— push to test*

   Hold the button in for three minutes. Changeover to the standby module should take place. Release the button and push reset. The lead module will then restart. If the unit is equipped with unloaders for multiple steps of cooling, the standby module is designed to come on at full capacity; however, the standby module is not energized at full capacity when the high temperature sentinel alarm is tested. To energize the standby module for testing at full capacity, lower the setting on the high water temperature stat to create a high temperature alarm. Make sure to reset the stat when testing is finished.

4. No Water Flow — push to test*

   Hold the button in for 10 seconds. Within that time operation will switch to the standby module. The lead module will restart when the button is released.

5. High (Compressor) Head Pressure — push to test*

   Push the button (no time delay). Changeover to standby module will immediately take place. The lead module will restart when the button is released.

*Each test is accompanied by a lighted message and an audible alarm.

2.3 Transformers

Transformers are line voltage fused primary with 24 volt 75VA secondary. These transformers are used to operate various relays and contacts in the control circuit. Only 37 ton units have a 120V 75VA transformer to operate the compressor low oil pressure switch and compressor high temperature switch.

2.3.1 Transformers Circuit Breaker Module

Description

The control voltage circuit is protected by manual reset circuit breakers for each 24 volt transformer secondary. Circuit breakers are mounted on a module and plugged into socket F. The (4) 3.2 amp breakers each protect a 75VA transformer.

Test

If the reset button is in the up or extended position, eliminate all possible shorts in that circuit then depress the reset button.

Replacement

The entire module may be pulled straight out. The 3.2 amp breakers can be individually replaced by removing cover plate and disconnecting wires. The (1) amp breaker wires must be unsoldered to replace them.

Figure 3 Transformer Circuit Breaker Module

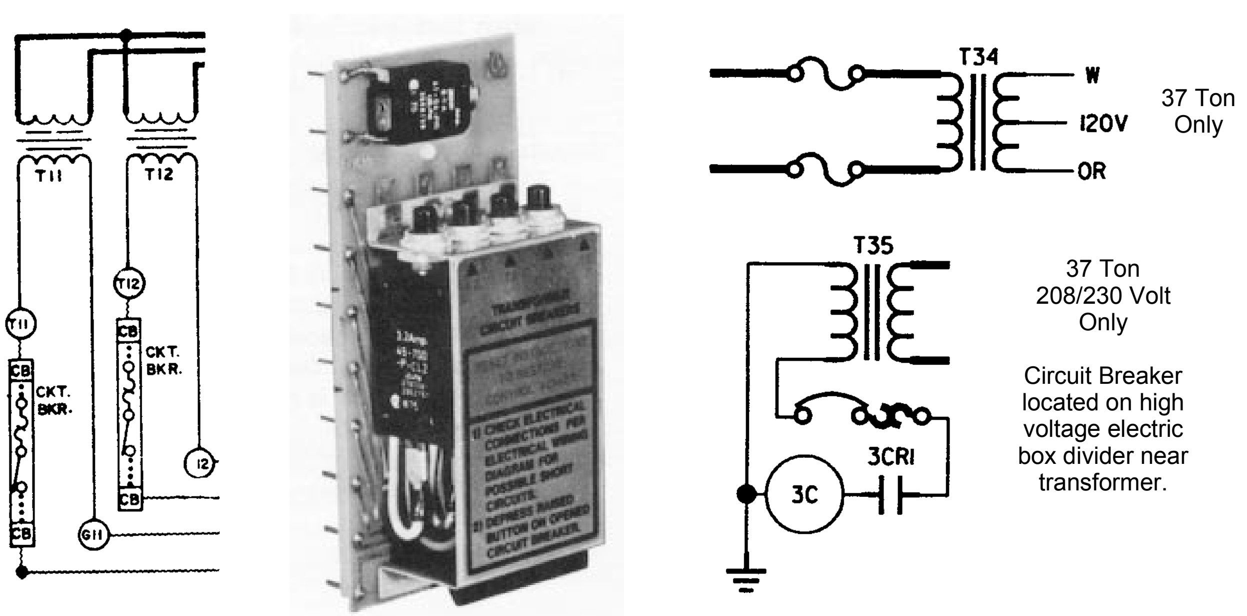


Figure 4   Circuit Breaker Location

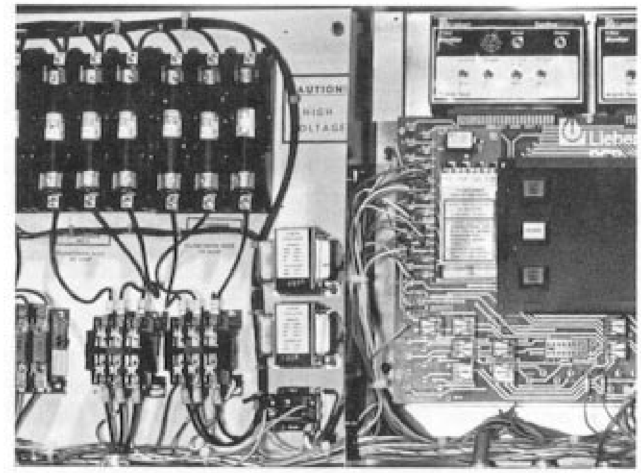
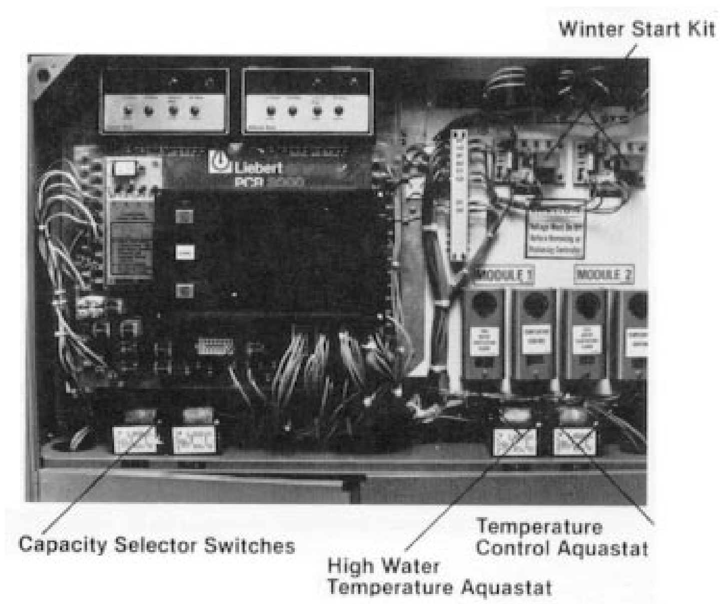


Figure 5   Low Voltage Panel (5-Ton)



2.4 Socket Identification

These descriptions refer to systems which have 2 modules. For 3 module CT systems, a second PCR 3000 board is mounted in the unit. All references here to module 1 would apply to module 3 on the second board.

2.4.1 Sockets A and B

Socket A provides an earth ground connection for the control circuitry of Module 2.

Socket B provides the earth ground connection for Module 1.

2.4.2 Sockets C and D

Socket C provides electrical connections for the components of the first slide-in refrigeration module.

Socket D provides connections for the second refrigeration module.

The temperature sensor, the liquid line and hot gas bypass solenoid valves, the low and high pressure switches and all Sentinel 3000/Alarm Monitor stats plug into these sockets.

2.4.3 Sockets E and F

Socket E provides the electrical connections for the components of the number one contactor panel.

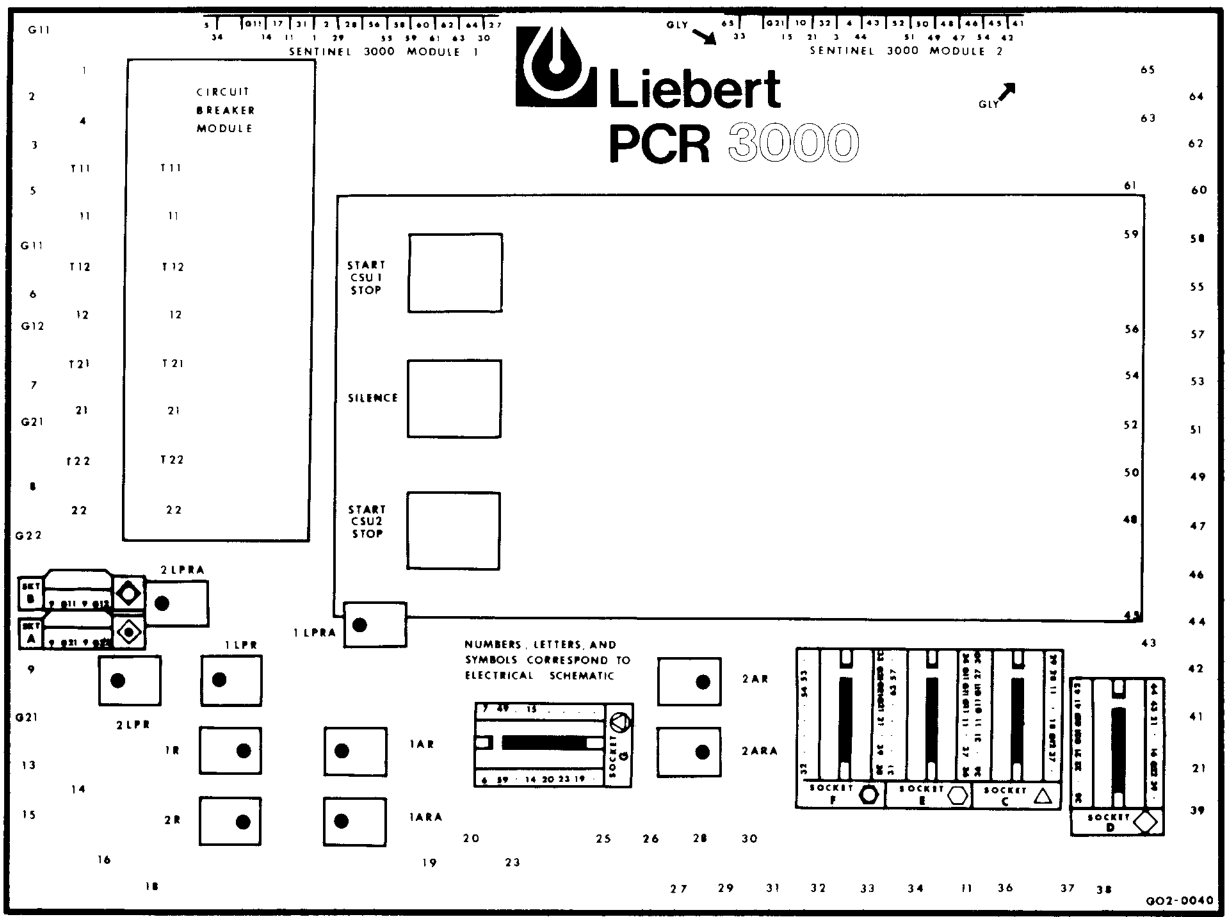
Socket F provides connections for the number two contactor panel.

The circulating pump contactor, overloads, side switch and the compressor contactor wiring plug into these sockets.

2.4.4 Socket G

Socket G provides the interface connection for a third module in another cabinet (except on 20, 30 and 37 ton models - in these units the third module is in the same cabinet). If any operating module should fail, the standby module would be automatically activated. All connections to the PCR 3000/Status Panel are 24 VAC.

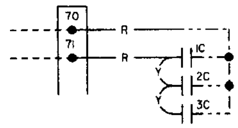
Figure 6 Socket Identification



2.5 Remote Electrical Connections

70 and 71 are non-powered, normally open contacts for connection to a remote condenser, cooling tower or glycol pump. The six-inch pigtails are located at the right end of the unit in the 2 x 4 handi-box. These connections are normally supplied on water cooled models (back of electric box - 20, 30 and 37 ton).

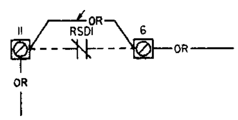
Figure 7 Connections 70 and 71



C1, C2 and C3* are side switches mounted on the compressor contacts. When the compressor contactor is pulled in, the side switch closes energizing the heat rejection equipment.

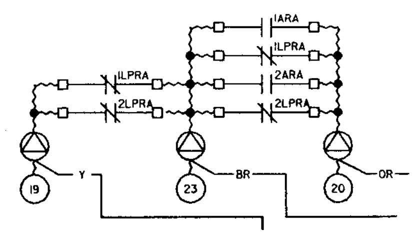
11 and 6 (21 and 7 module 2) (31 and 8 module 3)* are the emergency remote shut down connections. They are located on the terminal strip at the right end of the unit. The factory installed jumper wire must be removed if remote shutdown equipment is connected to the module (back of electric box - 20, 30 and 37 ton).

Figure 8 Emergency Shut Down Connections 6 and 11



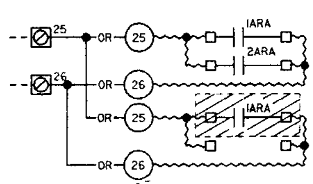
19, 20, 23 are the automatic switch- over connections for a third module. They are located on the PCR 3000/Status Panel. These connections have been prewired on 20, 30 and 37 ton 3 module units.

Figure 9 Automatic Switch-over Connections 19, 20 and 23



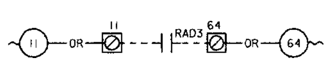
25 and 26 are the connections for an automatic switchover alarm. They are non-powered normally open contacts that will close whenever a module switch-over occurs, energizing a remote alarm. 25 and 26 are located on the terminal strip at the right end of the unit.

Figure 10 Switch-over Alarm Connections 25 and 26



11 and 64 (21 and 45 module 2) (31 and 83 module 3)* are connections for a customer specified sentinel stat/alarm monitor stat such as a Liqui-Tect/Water Detection Sensor.

Figure 11 Remote Sentinel/Detector Connections



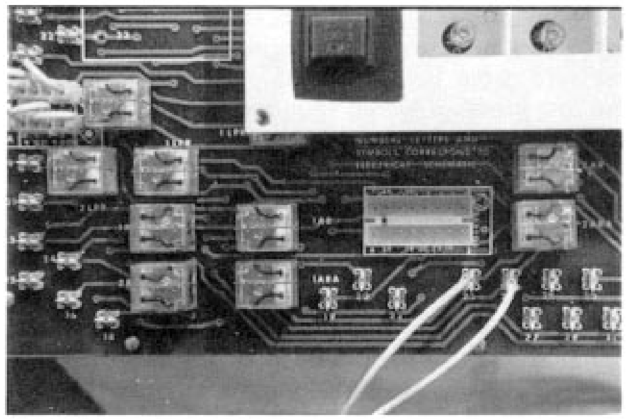
1CA, 2CA and 3CA* are non-powered, normally open contacts that will close if a malfunction should occur. The six-inch pigtails are located in the 2 x 4 handi-box at the right end of the unit, and may be connected to a remote alarm system.

*20, 30 and 37 ton models only.

2.6 Control Relays

Ten precision controls are located on the lower left corner of the printed circuit board (PCR 3000/ Status Panel).

Figure 12 Control Relays



2.6.1 1LPR and 2LPR

1LPR transfers control voltage power from module one to module two in event of power failure.

2LPR transfers power from module two to module one.

NOTE
Switchover will only occur if the standby module is powered by a second power source.

2.6.2 1R and 2R (and 3R on 20, 30 and 37 Ton Units)

1R provides switching for the liquid line and hot gas bypass solenoid valves of module one.

2R provides switching for the module two liquid line and hot gas bypass solenoid valves.

2.6.3 5R and 6R (and 7R on 20, 30 and 37 Ton Units)

The high water temperature alarms energize relays 5R and 6R (and 7R on 20, 30 and 37 ton models). When these relays are energized, the normally closed contacts on the compressor unloaders (and hot gas bypass solenoid valve on 37 ton chillers) are opened and the chiller starts cooling at full capacity. After the water has cooled, the high water temperature stat will open. This de-energizes the relays and returns the chiller to normal operation (see the drawings below).

2.6.4 1AR and 2AR

1AR activates module two in the event of a module one failure (other than loss of power). 2AR provides switchover from module two to module one.

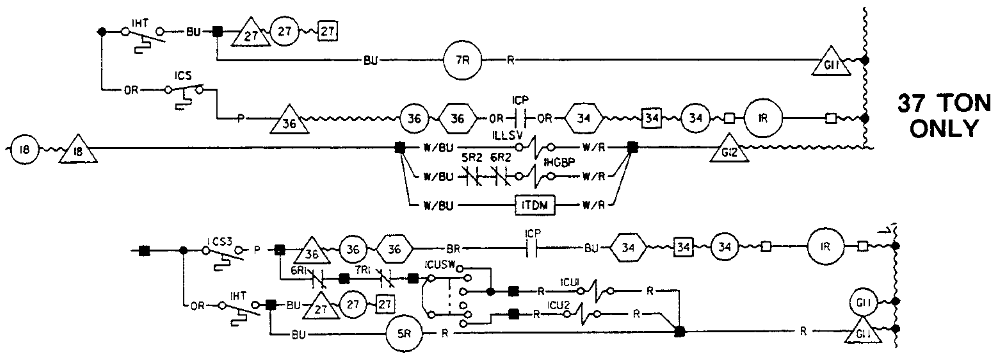
2.6.5 'A' suffix relays (LPRA; RA; ARA)

'A' suffix relays are used only with a third module. In the event of a failure of modules 1 and 2, the third module will be automatically energized.

NOTE
'A' suffix relays are not provided, unless a third module is being used.

Description	Symbol	Part No.
Control Relays	All	G-1360

Figure 13 Module 1 - Dual Unloaders



3.0 MODULE CONTROL BOX

The Module Control Box for 7-1/2 through 37 ton units is shown in **Figure 14**. Refer to **Figure 5** for controls on a 5 ton unit.

3.1 Aquastats

Two aquastats control module operation: Each aquastat may have two settings: 1) setpoint and 2) differential. The setpoint determines the point at which the switch will close. The differential sets the temperature drop required to open the switch. The setpoint adjustment knob is visible through the aquastat cover. The cover must be removed, however, to set the differential. When provided, the differential adjustment bar is located on the lower right-hand side of the switch.

The temperature control aquastat controls the refrigerant liquid line solenoid valve. The high water temp stat will activate the high water temp alarm and (if provided) can control cylinder unloader operation.

Table 4 Recommended* Aquastat Settings – °F (°C)

Description	Set Point	Differential
Temp Control	52 (11.1)	3 (1.7)
High Water Temp	60 (15.6)	3 (1.1)

*Some applications may require different setpoints and differentials. Consult factory for assistance, if required.

3.2 Pressure Switches

All models are equipped with nonadjustable high and low refrigerant pressure switches. They are located on the compressors in the refrigeration module for 5 ton models and in the control box for all other models.

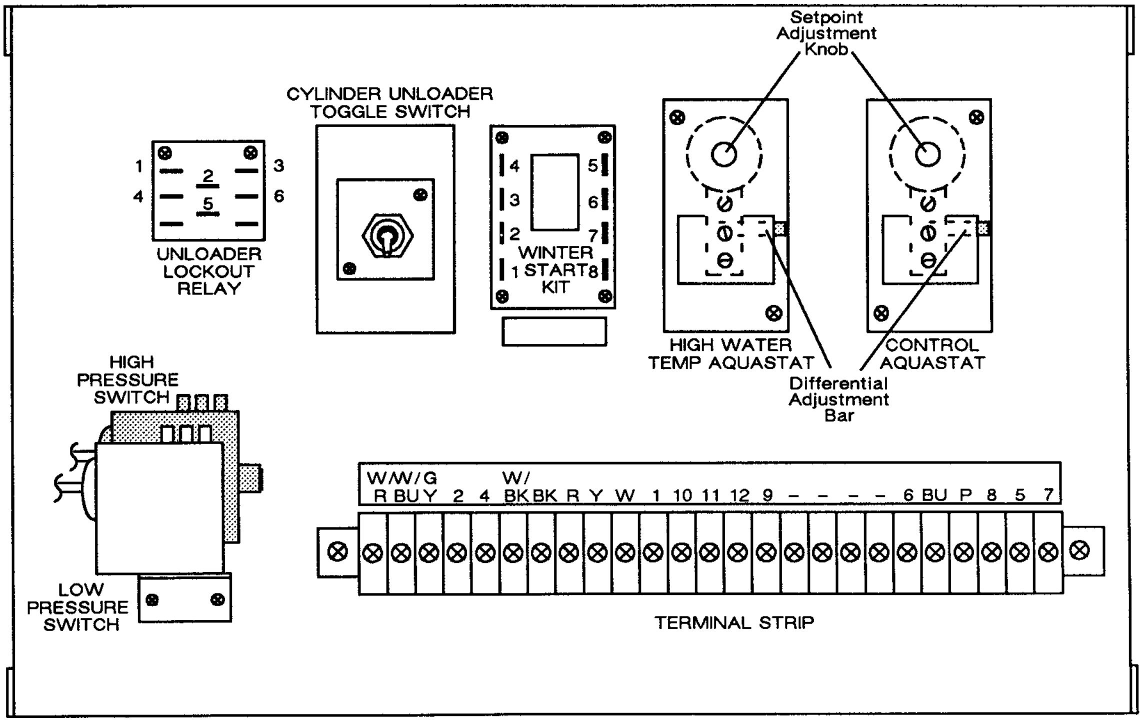
The low pressure switch sets the minimum refrigerant pressure required to start the compressor (cut-in). It will also stop the compressor if refrigerant pressure drops below the cut-out setting. Therefore, the low pressure switch requires two settings: 1) cut-in and 2) differential (cut-in minus differential = cut-out). They should be set in accordance with the chart below.

The manual reset high pressure switch sets the maximum discharge pressure of the compressor. If pressure should rise to the set point, it will simultaneously shut down the compressor and activate the Sentinel 3000/Alarm Monitor (see **2.2 - Sentinel 3000/Alarm Monitor**). The high pressure switch should be set in accordance with the chart below.

Table 5 High Pressure Settings

Switch	Set Point PSI (kPa)	Differential PSI (kPa)
Low Pressure (CS/CD/CT)	65 (450)	12 (83)
High Pressure (All)	360 (2480)	—
Low Pressure (DS/DD)	60 (415)	10 (70)

Figure 14 Module Control Box (7-1/2 – 37 ton)



3.3 Positive Start Kit

All modules have a time delay relay that bypasses the low pressure switch for three minutes. The ensures positive starting during periods of low outdoor temperature.

3.4 Capacity Selector Switch

Each module may be equipped with a dual or triple capacity toggle switch that will reduce the cooling capacity of the unit from the full rated capacity. For example, on a 5 ton unit the capacity can be transformed to 2½ tons by changing the capacity selector switch. Consult the submittal specifications to determine whether a specific unit has this feature. It is standard on 5 ton units and may be optional on others. The table below lists the various cooling capacity selections for all size units.

Table 6 Cooling Capacity Selections

Tonnage	Steps of Cooling Available
5	2
7-1/2	1 or 2
10 - 30	1, 2 or 3
37	1

On 5 ton models the switches are located on the right side of the PCR 3000 monitor panel (see **Figure 5 - Low Voltage Panel (5-Ton)**). They are marked Module 1 and Module 2. On all other units the switches are located in the module control box. On units that have one cylinder unloader per module, each toggle switch position is marked High Capacity and Low Capacity. On units that have two cylinder unloaders per module, the switch positions are marked High Capacity, Medium Capacity, and Low Capacity. The capacity of each module may be selected independently but to provide for switchover in the event of failure of the lead module(s), it is necessary to select the same capacity for each module.

4 Cylinder Compressor Models

- High capacity equals no unloading.
- Low capacity equals two (2) cylinders unloaded.

6 Cylinder Compressor Models

- High capacity equals no unloading.
- Medium capacity equals two (2) cylinders unloaded.
- Low capacity equals four (4) cylinders unloaded.

3.5 Capacity Selection Procedure

The capacity increase is accomplished by deenergizing cylinder unloader(s) on the heads of each compressor. When the cylinder unloader is activated, the effective capacity of the compressor is reduced to approximately 1/2, 1/3 or 2/3 depending on the model and selector switch settings. Deactivating the unloader(s) returns the compressor to full capacity.

1. Obtain the equipment load from the computer technical representative or the responsible engineer.
2. From the chiller specifications and cooling load requirement, determine the capacity of loading the chiller must provide. Set the capacity selector switch accordingly.

NOTE
The cylinder unloader solenoid coil is energized for unloaded cylinder operation and deenergized for full cylinder capacity operation.

See the schematic provided on the chiller.

3. Set the control thermostat dial below the required leaving water temperature (LWT) (typically 52°F, 11.1°C) to activate the compressor.
4. Start the chiller and allow the water temperature to drop to the required LWT. Measure the water temperature by strapping a thermometer to the chiller outlet header.

NOTE
Do not allow the compressor to cycle.

5. Adjust the hot gas bypass valve to maintain the required LWT for a minimum of 15 minutes; longer if a ride-through storage tank is used.
6. Readjust the thermostat dial setting to turn off the compressor at 3°F (1.7°C) below the required (typically 52°F, 11.1°C) LWT.

20, 30 and 37 ton units are designed so that two of the three modules are operating at any given time. All combinations of the three modules taken two at a time must be setup, adjusted and tested (1–2, 1–3 and 2–3).

4.0 Other Components

4.1 Thermostatic Expansion Valve

4.1.1 Operation

The thermostatic expansion valve performs one function. It keeps the evaporator supplied with enough refrigerant to satisfy load conditions. It does not effect compressor operation.

Proper valve operation can be determined by measuring superheat. If too little refrigerant is being fed to the evaporator, the superheat will be high; if too much refrigerant is being supplied, the superheat will be low. The correct superheat setting is between 10 and 13°F (5.6 to 7.2°C differential).

4.1.2 Adjustment

To determine superheat:

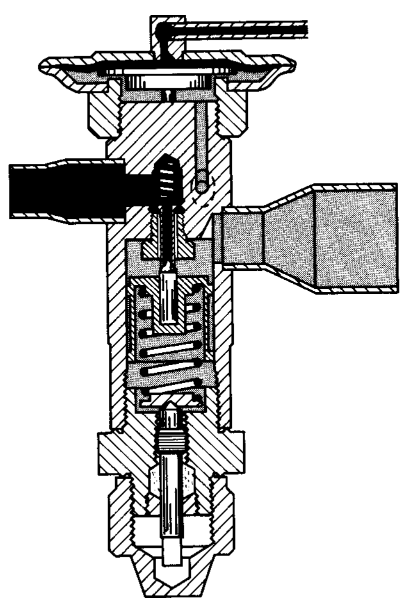
1. Measure the temperature of the suction line at the point the bulb is clamped.
2. Obtain the gauge pressure at the compressor suction valve.
3. Add the estimated pressure drop between the bulb location and the suction valve.
4. Convert the sum of the two pressures to the equivalent temperature.
5. Subtract this temperature from the actual suction line temperature. The difference is superheat.

To adjust the superheat setting, proceed as follows:

1. Remove the brass cap at the bottom of the valve.
2. Turn the adjusting stem counterclockwise to lower the superheat.
3. Turn the adjusting stem clockwise to increase the superheat.

NOTE
Make no more than one turn of the stem at a time. As long as thirty minutes may be required for the new balance to take place.

Figure 15 Typical Valve Cross Section



4.2 Hot Gas Bypass Valve

4.2.1 Operation

The hot gas bypass is inserted between the compressor discharge line and the outlet side of the expansion valve.

When the system is operating at full capacity, the valve remains closed. If the load on the evaporator decreases and evaporator temperature falls below the set temperature, the internal evaporator pressure decreases. When this happens, discharge gas pressure will overcome valve spring pressure and some hot gas will mix with the liquid discharge of the expansion valve, increasing evaporator temperature and pressure and closing the hot gas bypass valve.

The leaving water temperature requirement will determine the hot gas bypass valve setting as well as the compressor suction gauge pressure.

4.2.2 Adjustment

After calculating the desired leaving water temperature, the following procedure should be used to adjust the hot gas bypass valve:

1. Install suction and discharge pressure gauges on the compressor to monitor refrigeration.
2. Set the capacity selector switch if it is provided.
3. Set the control thermostat; labeled 1CS and 2CS (and 3CS on 20, 30 and 37 ton units) on the schematic at 3°F (1.7°C) below required leaving water temperature. Measure the leaving water temperature by strapping a thermometer to the leaving water header.

NOTE

Compressor should not cycle off and on to match the constant computer load. Each circuit should be adjusted independently.

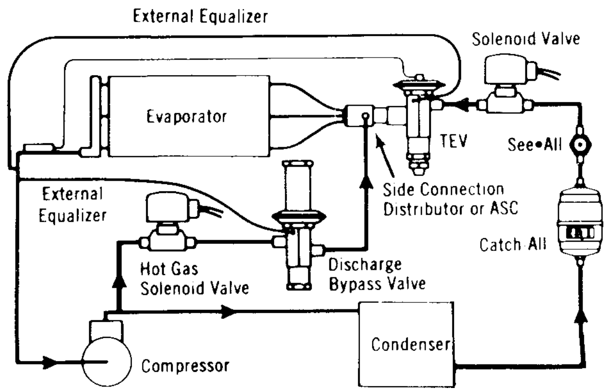
4. Adjust the hot gas solenoid valve to maintain the proper leaving water temperature.
   a. Remove the TOP brass cap from the valve.
   b. Insert an Alien wrench into the adjusting port and turn CLOCKWISE if a HIGHER leaving water temperature is required or counterclockwise if a lower leaving water temperature is required.
   c. After obtaining the leaving water temperature required, reinstall the brass cap tightly on the valve making sure that there are no leaks.
   d. Let the system operate for approximately 10 to 15 minutes to make sure that the suction pressure is within the range desired (longer if ride-through storage tank is used).

NOTE

There is a fluctuation of 3 to 6 lbs. of the suction pressure due to the differential on the hot gas bypass.

5. Readjust the control thermostat to the required leaving water temperature (typically 52°F, 11.1°C).

Figure 16 Hot Gas Bypass

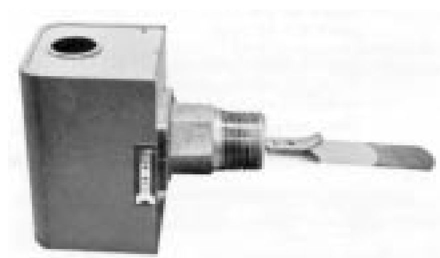


4.3 Flow Switch

Description

This device consists of a snap switch operated by a metal sail inserted into the water line. The normally open contacts close at a preset flow rate, providing power to the temperature controllers. The flow switch will deactivate the chiller module if there is an interruption of water now for at least 10 seconds, activating the alarm and energizing the backup module.

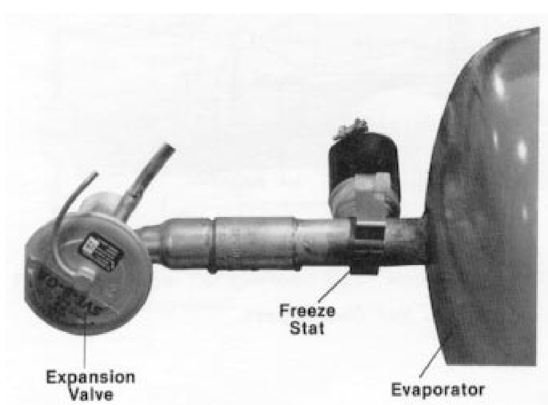
Figure 17 Flow Switch



4.4 Freeze Stat

The freeze stat monitors evaporator temperature and will shut down the refrigeration module if that temperature drops below 34°F (1°C). It is located between the evaporator and the thermostatic expansion valve and is secured to the copper line by a retaining clamp. To replace the stat, pry the retaining clamp free and remove the two connecting wires from the refrigeration module electric box.

Figure 18 Freeze Stat



DISCONTINUED PRODUCT

4.5 Liqui-Tect/Water Detection Sensor (Optional)

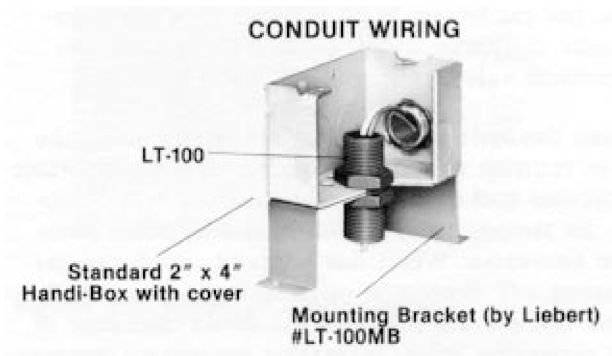
The Liqui-Tect/Water Detection Sensor may be mounted under the computer room floor or in pipe chases where water may accumulate. When water problems occur, the Liqui-Tect/Water Detection solid state switch closes the circuit, relaying the signal to an alarm system such as the LIEBERT Liqui-Tect/Water Detector Panel or PCR 3000/Status Panel.

Position the Liqui-Tect/Water Detection Sensor(s) at low spots or wherever water would be likely to collect (use plastic inserts and screws to mount the detector onto the floor).

Adjust the probes to the acceptable water level with the two adjusting nuts.

Wire the detection sensor to the unit using NEC Class 2, 24 volt wiring. Run the wires to the terminals on the wire raceway in the control compartment end panel. (This option is not available on GLYCOOL units.)

Figure 19 Liqui–Tect/Water Detection Sensor



4.6 Low Oil Pressure (37 Ton Units Only)

A differential pressure switch at the compressor monitors adequate oil pressure. Low oil pressure will shut down the compressor. Once the low oil pressure switch has tripped, it must be manually reset to restore compressor operation.

5.0 Optional Modules

5.1 Alternate Water Source (7-1/2 – 12 Ton Models Only)

5.1.1 Description

The (optional) Alternate Water Source (AWS) module replaces one of the refrigeration modules and permits the use of an existing chilled water system. The Sentinel 3000/Alarm Monitor will automatically activate the refrigeration module if the building chilled water system is interrupted.

5.1.2 Operation

The AWS module control box contains three aquastats. The first is the low temperature aquastat. It will shut the module down if there is a drop in the leaving water temperature. The second is the high temperature aquastat which will shut down the module upon temperature rise. The third aquastat is the temperature controller. Upon rise in water temperature, the controller will activate the proportioning valve actuator motor and permit building chilled water to flow through the heat exchanger. As water temperature drops the valve will begin closing. Refer to **3.1 - Aquastats** for more details.

Refer to **2.2 - Sentinel 3000/Alarm Monitor** for operation of the Sentinel 3000/Alarm Monitor System.

Table 7 Recommended* Aquastat Settings – °F (°C)

Aquastat	Set Point	Differential
Low Temp	45 (7.2)	12 (6.7)
High Temp	60 (15.6)	—
Temp Controller	52 (11.1)	10 (5.6)

*Some applications may require different setpoints and differentials. Consult factory for assistance, if required.

Table 8 Standard Dual and Alternate Water Source Model Numbers

	Air	Water	Glycol
Standard Dual DX Model	CD 182A	CD 202W	CD 170G
	CD 218A	CD 242W	CD 204G
	CD 270A	CD 302W	CD 252G
Alternate Water Source Model	AS 181A	AS 201W	AS 169G
	AS 217A	AS 241W	AS 203G
	AS 269A	AS 301W	AS 251G

5.1.3 Alternate Water Source (AWS 3000) Motorized Valve

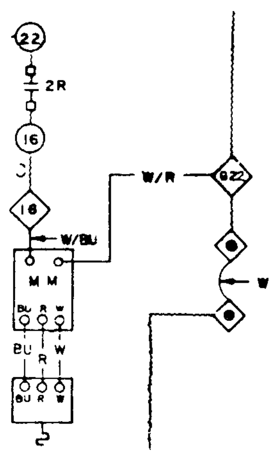
The Alternate Water Source utilizes a proportioning motorized valve to activate the water valve. The temperature controller will regulate the water valve to meet the cooling needs of the heat exchanger.

Figure 20 Motorized Valve

5.1.4 Motor Operation Check

Voltage at terminals 9 and 11 in the AWS module electric box should read 24 VAC. Turn the temperature controller counter-clockwise to open the valve. Turn the controller clockwise to close the valve.

Figure 21 Motor Operation Check



5.2 Glycool/Free Cool Modules (7-1/2 – 12 Ton Models Only)

5.2.1 Description of Operation

When outdoor temperatures exceed the useful range of the Econ-o-cycle/Free Cooling Cycle, cooling is standard mechanical refrigeration with a conventional heat rejection loop.

When outdoor temperatures drop so that glycol temperatures are a constant 45°F (7.2°C), the mechanical refrigeration will deactivate and the cold glycol solution will be circulated through the coolant distribution unit.

A three way valve operated by a proportioning motorized actuator controls the quantity of glycol circulating through the drycooler and maintains glycol temperatures within the computer manufacturer's specified limits.

The Sentinel 3000/Alarm Monitor will continue to monitor the leaving water temperature and will automatically activate the standby module if the lead module fails.

5.2.2 Control

In addition to the temperature control and high temp stat used for the mechanical refrigeration system, two more aquastats are required to operate the Econ-o-cycle/Free Cooling Cycle. They are located on top of the refrigeration module electric box. The temperature controller regulates the flow of cold glycol through the drycooler, maintaining a constant glycol temperature. The low limit stat will deactivate the module if leaving glycol temperatures fall below 36°F (2.2°C), and simultaneously energize the normal direct expansion system.

Table 9 Recommended* Aquastat Settings – °F (°C)

Aquastat	Set Point	Differential
Glycool Control Stat	52 (11.1)	3 (1.7)
Low Limit Stat	36 (2.2)	3 (1.7)

*Some applications may require different setpoints and differentials. Consult factory for assistance, it required.

See the CSU3000 Installation Manual for a general arrangement drawing of a Glycool module.

6.0 MAINTENANCE

6.1 Preventative Maintenance

The CSU3000 chiller has been designed for long life and easy service. Access to all components requiring periodic maintenance has been built into the system. In addition, the chiller incorporates many solid state electronic components that don't require maintenance.

In order to maintain efficient operation, periodic maintenance must be performed by competent service personnel familiar with the fundamentals of refrigeration and electronics. It is important that both owner and operator realize that expensive and time consuming service may result if their equipment does not receive regular scheduled maintenance.

An authorized service representative will always be in a position to provide complete maintenance, or offer service contracts to automatically provide necessary service.

Listed are some of the maintenance contracts that are available.

6.2 Service Contracts

6.2.1 Inspection Contracts

This contract automatically provides for quarterly inspection. The service firm will send a qualified service representative to make the routine inspections of the equipment. Generally, contract is arranged so that the owner will pay a flat fee per inspection, and if there is any additional material or maintenance required, the owner is notified. The service representative must have written authorization to complete the service and the work will be performed on a time and material basis using the standard rates of the service organization.

6.2.2 Service Maintenance Contract

With this contract, the owner authorizes a reputable service agent to handle all maintenance and service on all equipment. The contract will generally provide that the owner receive special consideration on emergency calls during peak seasons and receive a discount on labor costs, parts and materials used to complete any necessary repairs.

Under this contract, the number of service calls is limited. Any calls over the specified amount are performed on a time and material basis.

6.2.3 Complete Maintenance Contract

This contract provides complete coverage for calls and includes all materials and parts. Overall maintenance costs are expensive and increase as the equipment becomes older. This contract does, however, give the owner a fixed maintenance cost for the year.

6.3 Refrigeration Components

6.3.1 Periodic Inspections

Each month the components of the refrigeration module should be inspected for proper function and signs of wear. In most cases evidence of pending malfunctions is present prior to component failure, so periodic inspections can be a major factor in the preventing most system failures.

6.3.2 Compressor Oil Level

There is a glass “bull's eye” on each compressor (clearly visible when the front panels are removed) that enables viewing the oil level.

Normally, the oil level should be 1/8 to 3/8 up from the bottom of the sight glass. However, this level may vary during operation due to the action of moving parts. When idle, the oil level may be higher due to the absorption of refrigerant. After a compressor has been idle for an extended length of time, foaming will generally be viewed when the compressor first starts. In order to accurately check the oil level, it will be necessary to operate the compressor for five to ten minutes before viewing the oil level.

Note that the 37 ton models include a differential pressure switch to monitor compressor oil level.

Refrigeration oil does not deteriorate with normal use and doesn't need to be changed unless it is discolored or acidic.

Periodically, inspect the compressor compartment for signs of oil leaks. If a leak is present, it must be corrected and the oil level replaced using Sunisco 3GS refrigerant oil. It is recommended that the sealed oil containers are not opened until immediately prior to use. Oil exposed to the air absorbs moisture.

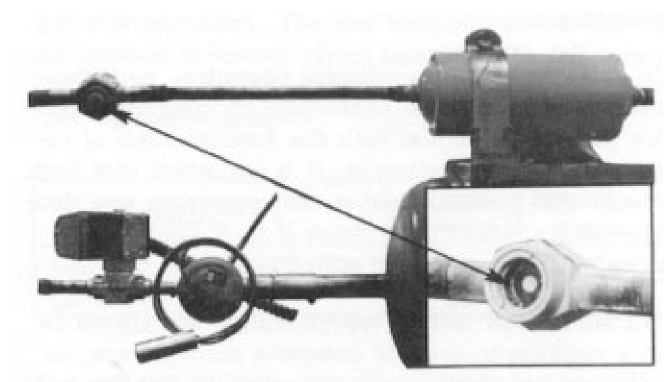
6.3.3 Refrigerant Lines

Refrigerant lines must be properly supported and not allowed to vibrate against ceilings, floors or the unit frame. Inspect all refrigerant lines every six months for signs of wear and proper support. Also inspect capillary and equalizer lines from the expansion valve and support as necessary.

6.3.4 Liquid Line Sight Glass

Each liquid line has a sight glass that indicates liquid refrigerant flow and the presence of moisture. Bubbles in the sight glass indicate a shortage of refrigerant or a restriction in the liquid line. The moisture indicator changes from green to yellow when moisture is present in the system.

Figure 22 Liquid Line Sight Glass



6.3.5 Suction and Discharge Pressure

Suction Pressure

Suction pressure will vary with load conditions. The low pressure switch will shut the compressor down if suction pressure falls below the cut-out setting. High suction pressure reduces the ability of the refrigerant to cool compressor components. Minimum and maximum pressures are in the chart below.

Table 10 Suction Pressure

Minimum Discharge Pressure psi (kPa)	Maximum Discharge Pressure psi (kPa)	Maximum Discharge Pressure psi (kPa)
53 (365)	92 (365)	360 (2480)

Discharge Pressure can be increased or decreased by load conditions or condenser efficiency. The high pressure switch will shut the compressor down at its cut-out setting.

6.4 Water/Glycol Cooled Condensers

6.4.1 Snell and Cool Condensers (7 1/2 – 37 Ton Models Only)

Each water or glycol cooled module has a shell and tube condenser which consists of shell, removable heads, gaskets and cleanable copper tubes.

It may be necessary to clean the copper tubing periodically to remove any scale or lime that has collected. (Periods between cleanings will vary with local water conditions.) As deposits build up, a cleaning tool, available at any refrigeration supply house, should be used to clean the heat exchanger tubes.

1. Stop the chiller module (using the START/STOP switch), and allow the compressor to pump down.
2. Open the disconnect switch.
3. Shut off the water supply to the condenser, by using the isolating ball valves within the unit cabinet.
4. Drain all water from the condensers and piping.
5. Remove the bolts securing each head and slowly pry them free. Do not damage head gaskets.
6. Swab the condenser tubes with the tube cleaning tool.
7. When the tubes are clean reinstall the gaskets and heads.
8. Reconnect the piping, open the water supply, vent the system and check for leaks.

6.5 Water Regulating Valves

6.5.1 Description

The water regulating valves will automatically regulate the amount of fluid necessary to remove heat from the refrigeration system, permitting more fluid to flow when load conditions are high and less fluid to flow when room conditions are low. The valve consists of a brass body, balance spring, valve seat, valve disc holders, capillary tube (to sense discharge pressure) and adjusting screw.

6.5.2 Adjustment

The valves may be adjusted with a Standard refrigeration service valve wrench or screw driver.

To lower the head pressure setting, turn the square adjusting screw clockwise until the high pressure gauge indicates the desired setting.

To raise the head pressure setting turn the adjusting screw counter clockwise until the desired setting is obtained.

If this fails, it will be necessary to dismantle the valve and clean the seat.

To dismantle the valve, proceed as follows:

1. Shut off the water supply by using the isolating ball valves within the unit cabinet.
2. Relieve the tension on the main spring by turning the adjusting screw clockwise as far as it will go. (Provide a means of catching water below the valve.)
3. Remove the four round head screws extending through the main spring housing from the end of the valve opposite the bellows.
4. Remove the center assembly screws which allow access to all internal parts.
5. Clean the seat if possible. If the seat is pitted or damaged, replace the valve rubber disc and valve seat.
6. After the valve is reassembled and reinstalled check for leaks.
7. Readjust the head pressure control.

6.5.3 Manual Flushing

The valve may be flushed by inserting a screw driver or similar tool under the two sides of the main spring and prying downward. This action will open the valve seat and flush any dirt particles from the seat.

6.5.4 Testing Function of Valve

When the refrigeration system has been off for approximately 10 to 15 minutes, the water flow should stop.

If water continues to flow, the problem is either that the valve head pressure is too low, or that the pressure sensing capillary tube is not properly connected to the condenser.

6.6 Air Cooled Condensers

Restricted airflow through the condenser coil will reduce the efficiency of the unit and can result in high compressor head pressure and loss of cooling.

Clean the condenser coil of all debris that will inhibit air flow. This can be done with compressed air or commercial coil cleaner.

Check for bent or damaged coil fins and repair as necessary. In winter, do not permit snow to accumulate around the sides or underneath the condenser.

Check all refrigerant lines and capillaries for vibration isolation. Support as necessary. Visually inspect all refrigerant lines for signs of oil leaks.

6.6.1 Checking Refrigerant Charge

The System refrigerant level must be periodically checked. This is easily done by following the procedure below.

1. Set thermostatic control in the unit so that the compressor will run continuously.
2. The refrigerant level is visible through sight glasses on the Lee Temp/Flood Back Head Pressure receiver, and will vary with ambient temperature.
   a. 40°F (4.4°C) and lower — Midway on the bottom sight glass.
   b. 40°F–60°F (4.4°C – 15.6°C) — Bottom sight glass should be clear with liquid.
   c. 60°F (15.6°C) and above — Midway on the top sight glass.

Figure 23 Lee-Temp/Flood Back Head Pressure Receiver

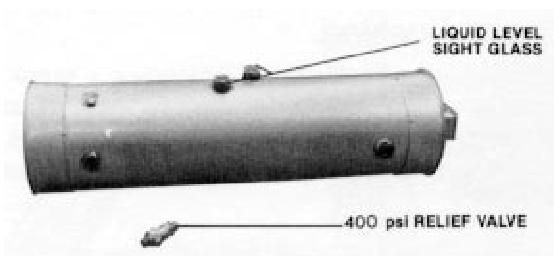
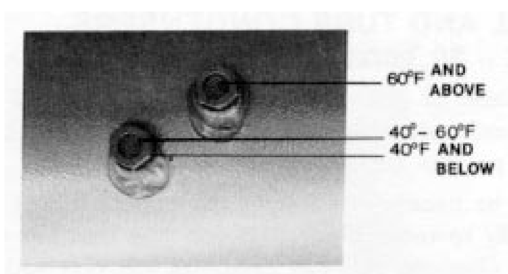


Figure 24 Receiver Sight Glasses



6.7 Glycol Solution Maintenance

It is difficult to establish a specific schedule of inhibitor maintenance since the rate of inhibitor depletion depends upon local water conditions. Analysis of water samples at the time of installation and every six months should help to establish a pattern of depletion. A visual inspection of the solution and filter residue is often helpful in judging whether or not active corrosion is occurring.

The complexity of water caused problems and their correction make it important to obtain the advice of a water treatment specialist and follow a regularly scheduled maintenance program. It is important to note that the improper use of water treatment chemicals can result in problems more serious than using no chemicals at all.

Liebert Corporation recommends consulting a glycol manufacturer for inhibitor usage requirements and instructions. See the CSU3000 System Data and Installation Manual for Glycol volumes and concentrations

6.8 Compressor Failure

Infrequently a fault in the motor insulation may result in a motor burn, but in a properly installed system burnouts rarely occur. Of those that do, most are the effects of mechanical or lubrication failures, resulting in the burnout as a secondary consequence.

If problems that can cause compressor failures are detected and corrected early, a large percentage can be prevented. Periodic maintenance inspections by alert service personnel on the lookout for abnormal operation can be a major factor in reducing maintenance costs. It is easier and less costly for all parties involved to insure proper system operation than it is to allow a compressor failure to take place and then restore the system.

Successive burnouts of the same system can usually be attributed to improper system cleaning.

CAUTION
Damage to a replacement compressor caused by improper system cleaning constitutes abuse under the terms of the warranty.

Before proceeding with a suspected burnout, a preliminary check of all electrical components should be made.

1. Check all fuses.
2. Check high and low pressure switch operation. If a compressor failure has occurred, determine whether it is an electrical or mechanical failure.

Electrical. An electrical failure will be indicated by the distinct pungent odor when some refrigerant is released through the service port. If a severe burnout has occurred, the oil will be black and acidic.

Mechanical. No burned odor from gas released at the service port. Motor attempts to run.

6.8.1 Electrical Failure

If there is an electrical failure and a complete burnout of the refrigeration compressor motor, the procedures must be performed in order, to clean the system and remove any acids that would cause a future failure.

CAUTION
Avoid touching or contacting the gas and oils with exposed skin, Severe burns will result. Use long rubber gloves when handling contaminated parts.

Clean-Up Procedure for a Compressor Motor Burnout

CAUTION
Failure to properly clean the system after a compressor motor burnout will void the compressor warranty.

There are two kits that can be used with a complete compressor burnout — Sporlan System Cleaner and Alco Dri-Kleener. Follow the manufacturer's procedure.

When system evacuation is required during the cleanup procedure, evacuate the system twice to 1500 microns, and a third time to 500 microns.

Compressor Replacement Procedure

1. Determine the cause of the burnout and make the necessary corrections so that there will not a repeat burnout with the new compressor. Check the control box for blown fuses, welded starter contacts, welded overload contacts and burned out heater elements. Check the compressor terminal plate for burned or damaged terminals or insulation and check for shorted or grounded wires. Check the unit wiring for loose power connections. Check for high and low voltages.
2. Disconnect all electrical wiring to the compressor.
3. Close the compressor and discharge service valves (isolating the compressor) and bleed all refrigerant from the compressor. Save the remaining refrigerant in the system. If you have already isolated the compressor because of a refrigerant leak, then skip this step.

   NOTE
   Release of refrigerant to the atmosphere is harmful to the environment. Refrigerant must be recycled or discarded in accordance with federal, state, and local regulations.

   Recover refrigerant using standard recovery procedures and equipment. Use a filter-drier when charging the system with recovered refrigerant.
4. Remove the suction and discharge service valve bolts and all other connections to the failed compressor. Remove the damaged compressor and replace it with a new one. For severe burnouts, be sure that the suction and discharge shut-off valves are not contaminated. They must be thoroughly cleaned or replaced before they can be reconnected.
5. Install a new liquid line filter-drier (severe burnouts require installing a suction filter drier also).
6. Evacuate and dehydrate the new compressor and check the compressor oil level.
7. Start up the compressor by putting the system in operation. After 2–4 hours check the compressor oil for any sign of discoloration or acidity with a commercial refrigerant acid test kit. If the oil is dirty, discolored, acidic or has a pungent odor, replace the oil and the filter-drier(s) and clean the compressor suction strainer.
8. Repeat step 7 as needed.
9. Check the oil daily (for about 2 weeks) for discoloration and acidity. If it stays clean and acid-free, the system is clean. Whenever the oil shows any sign of contamination, repeat step 7 until the system stays clean.

6.8.2 Mechanical Failure

If it has been determined that a mechanical failure has transpired, for anything other than suction or discharge valve plates, the compressor must be replaced using the following procedure.

1. Disconnect power.
2. Attach suction and discharge gauges to compressor service pens.
3. Front seat the service valves isolating the compressor from the rest of the refrigeration circuit, and vent all charge from the compressor (reclaim it if possible).

WARNING
DO NOT LOOSEN ANY REFRIGERATION CONNECTIONS BEFORE RELIEVING PRESSURE.

NOTE
Release of refrigerant to the atmosphere is harmful to the environment. Refrigerant must be recycled or discarded in accordance with federal, state, and local regulations.

4. Remove the service valve bolts, pressure switch capillaries and all electrical connections; then remove the compressor.
5. Put in the new compressor and attach all connections.
6. Crack the suction valve and flow refrigerant through the compressor and out the charging hose.
7. Back seat both service valves and turn on the disconnect switch.
8. Close the liquid line hand valve and pump the compressor down.
9. When the system is completely pumped down, open the liquid line hand valve and start the unit.
10. Check the refrigerant charge and leak test the system.

Compressor Replacement

Replacement compressors are available from the vendor or from Liebert Corporation in Columbus, Ohio, if the vendor is LIEBERT.

They will be shipped in a permanent type crate to the job site as requested by the service contractor.

Upon shipping a replacement compressor, the service contractor will be billed in full for the compressor until the replacement has been returned.

The compressor should be returned in the same container used for shipping to the job and should be marked where it was removed and the possible causes or conditions that were found by marking the compressor return tag.

The compressor should be returned to the vendor and if the vendor is LIEBERT return it to: Liebert Corporation, Columbus, Ohio – FREIGHT PREPAID. Contact the vendor regarding all other replacement parts.

7.0 TROUBLE SHOOTING – ALL SYSTEMS

Table 11 Chilled Water Pump Troubleshooting

Symptom	Possible Cause	Check or Remedy
Chilled water pump will not start	No main power	Check L1, L2 and L3 for rated voltage.
	Blown fuse	Check fuses to pump. Check control voltage fuses.
	Overloads tripped	Push reset button on pump overload on the electric panel. Check amp draw.
	No output voltage from T11 or T21 transformer	Check for 24 VAC between T11 and G11 and T21 and G21. If no voltage, check primary voltage.
	Circuit breaker T11 or T21 tripped	Check for 24 VAC between T11 and G11 and T21 and G21. If no voltage, check for short and reset breaker T11 or T21.
	Start switch 1SS, 233 or 3SS not making contact	Jumper 6 to 13 and 7 to 8 momentarily. If unit stops after removing the jumpers replace the START/STOP switch.
Chilled water pump runs but controls will not operate	Relay 1CP, 2CP or 3CP not making contact	Check for 24 VAC at 1CP, 2CP or 3CP coil. If the voltage is present and 1CP, 2CP or 3CP is not pulling, replace the relay.

Table 12 AWS 3000 Valve Troubleshooting

Symptom	Possible Cause	Check or Remedy
AWS 3000 valve not opening	No. 24 VAC power to chilled glycol solenoid	Check T13 transformer for 24 VAC. If there is not 24 VAC present, replace the transformer.
		Check for 24 VAC at the chilled glycol solenoid coil. If there is no voltage, check 1ER or 2ER coil for 24 VAC.

Table 13 Compressor Troubleshooting

Symptom	Possible Cause	Check or Remedy
Compressor will not start	Power off	Check main switch, fuses and wiring.
	High pressure switch open	Reset manually.
	Loose electrical connections or faulty wiring	Tighten connections. Check wiring and rewire if necessary.
	Compressor motor burned out	Check and replace compressor if defective.
	Low oil pressure safety switch open (37 ton units)	Reset switch. Check for low oil level or failed oil pump.
Blown valve plate or cylinder head gaskets	Cylinder head bolts not properly torqued	a. Replace Gaskets b. Retorque cylinder head bolts to 30-35 lb.-ft. (41 to 47 N-m)
	Liquid refrigerant floodback or flooded start	See Flooding
Compressor cycles intermittently	Low-pressure switch erratic in operation	a. Check tubing to switch to see if clogged or crimped. b. Check setting of switch.
	Insufficient refrigerant in system	Add refrigerant.
	Suction service valve closed	Open valve.
	Insufficient water flowing through condenser or clogged condenser	Adjust water regulating valve to condenser. Clean condenser.
	Discharge service valve not fully open	Open valve.
	Air in system	Purge.

Table 13 Compressor Troubleshooting

Symptom	Possible Cause	Check or Remedy
Compressor continually cycles	Faulty pressure stats	Repair or replace.
	Dirt or restriction in tubing to pressure stat	Check and clean tubing.
	Condenser capacity reduced by refrigerant overcharge accompanied by high discharge pressure	Remove excess refrigerant.
	Plugged filter-drier	Replace filter.
Low discharge pressure	Excessive water flow through condenser	Adjust water regulating valve.
	Suction service valve partially closed	Open the valve.
	Leaky compressor suction valves	Pump down, remove the cylinder head, examine valves and valve seats; replace if necessary.
	Worn piston rings	Replace compressor.
Flooding	Improper system piping allows liquid to compressor	Correct piping.
	Defective or improperly set expansion valve	Increase superheat or replace valve.
Low Suction Pressure	Insufficient refrigerant in system	Add refrigerant.
	Plugged filter-drier	Replace filter.
Compressor Noisy	Slugging due to floodback of refrigerant	See Flooding.
	Hydraulic knock due to excess oil in circulation	a. Remove excess oil. b. Recheck oil return system.
	Bearings wiped because of loss of oil	a. Add oil. b. Check oil return system. c. See Oil Return and Oil Pressure. d. Check for defective oil failure control.
	Improper support or isolation of piping	Provide sufficient right angle bends in piping to absorb vibration and support firmly with suitable hangers.
	Compressor not firmly mounted	Check for loose mounts.
	Unit not properly isolated or vibration pad defective	Add vibration isolation or check for defective isolation pads.
	Broken connecting rods, valves or other running gear	Replace compressor.
Pipe Rattle	Inadequately supported piping or loose pipe connections	Support pipes or check pipe connections.

Table 13 Compressor Troubleshooting

Symptom	Possible Cause	Check or Remedy
Compressor motor protectors tripping or cycling	High suction pressure on low temperature compressor causes excessive amp draw	If system does not have EPR valve, throttle suction service valve until system pulls down.
	High discharge pressure on low temperature compressor causes excessive amp draw	Check for loss of condenser water or blocked condenser and/or coil.
	Incorrect overload relay or must trip amp setting too low	Replace with correct overload relay.
	Defective overload relay	Replace.
	High suction temperature	Reduce suction temperature by TEV adjustment or provide desuperheating.
	Loose power or control circuit wiring connection	Check all power and control circuit connections.
	Defective motor	Check for motor ground or short. Replace compressor, if found.
Compressor cycles on locked rotor	Low line voltage	Check line voltage and determine location of voltage drop.
	Seized compressor (remove bearing head assembly and attempt to rotate crankshaft.)	Replace compressor.
	Compressor motor defective	Check for motor winding short or ground.
	Single phasing	Check voltage across all 3 legs at contactor. Correct source of problem.
	Liquid refrigerant condensing in cylinder	Check valve plates. Replace if necessary.
Motor burnout	Check control box for welded starter contacts, welded overload contacts or burned out heater elements	Replace defective components. See Compressor Failure.
Compressor running hot	Blown valve plate or cylinder head gasket	See Blown valve plate or cylinder head gaskets.
	Broken suction or discharge valve	Replace valves and valve plate, if necessary.
	Compression ratio too high	a. Check setting of high and low pressure switches. b. Check condenser – is it plugged. c. Check that all evaporator and condenser fans are operating properly.
	High suction temperature	Reduce suction temperature by TEV adjustment or provide desuperheatings.
	Cylinder head cooling fan not operating or incorrect voltage for fan motor	Replace defective part or check that available voltage agrees with fan motor voltage.
	High oil level	Lower oil level.
	Excessive blow – by into crankcase – worn rings, valves or blown gasket	Replace gasket, valve plate or compressor.

Table 14 Glycol Pump Troubleshooting

Symptom	Possible Cause	Check or Remedy
Suddenly stops pumping	Clogged strainer or impeller	Clean out debris.
Suddenly slows pumping	Clogged impeller, diffuser or line	Clean out debris and use strainer.
Excessive leakage around the pump shaft while operating	Worn seal or packing	Replace seal or packing.
Performance poor	Worn impeller or seal	Replace with new impeller or seal.
	Suction lift too high	Relocate pump closer to supply.
	Motor not up to speed; low voltage	Larger lead wires required.
	Worn bearings	Replace.
Noisy operation	Worn motor bearings	Replace.
	Low discharge head	Throttle discharge – improve suction conditions.
	Debris logged in impeller	Remove cover and clean out.
Low Suction Pressure; High Superheat	Moisture or dirt in system	Drier – liquid indicator.
	High superheat adjustment	Reset TEV.
	Dead thermostatic adjustment element in TEV	Replace TEV sensor element.
	Restricted external equalizer	Liquid indicator.
	Low refrigerant charge	Check refrigerant level.
	Clogged drier	Check liquid indicator.
High Suction Pressure; Low Superheat	TEV seat leak	Check valve for leaks.
	Low superheat adjustment	Reset TEV.
	Moisture, dirt or wax in system	Filter Drier - liquid indicator.
	Restricted external equalizer	Liquid indicator.
Low Suction Pressure; Low Superheat	Evaporator oil logged	Check oil level
High Discharge Pressure	Dirty condenser or drycooler fins	Clean coil.
	Condenser equipment not operating	Check operation.
	High refrigerant charge	Check refrigerant charge.
	Hot gas bypass valve adjusted improperly	Adjust properly.
	Water regulating valve adjusted improperly	Adjust properly.

8.0 MONTHLY MAINTENANCE INSPECTION CHECKLIST

Date:____________________________________ Prepared By:________________________________

Model #:__________________________________ Serial #:___________________________________

Compressor

___ 1. Check for oil leaks
___ 2. Check for leaks

Air Cooled Condenser/Drycooler (if applicable)

___ 1. Condenser coil clean
___ 2. Motor mounts tight
___ 3. Bearings in good condition
___ 4. Piping properly supported

Refrigeration Cycle/Section

___ 1. Check refrigerant lines
___ 2. Check for moisture (sight glass)
___ 3. Check suction pressure
___ 4. Check head pressure
___ 5. Check discharge pressure
___ 6. Check hot gas bypass valve
___ 7. Check thermostatic exp valve
___ 8. Check superheat
___ 9. Check water regulating valve

Notes:

Signature:____

Make photocopies of this form for your records

9.0 SEMI-ANNUAL MAINTENANCE INSPECTION CHECKLIST

Date:______________________________ Prepared By:______________________________

Model #:______________________________ Serial #:______________________________

Air Cooled Condenser/Drycooler (if applicable)

___ 1. Condenser coil clean
___ 2. Motor mounts tight
___ 3. Bearings in good condition
___ 4. Piping properly supported

Water/Glycol Condenser (if applicable)

___ 1. Copper tube clean
___ 2. Water regulating valves function
___ 3. Glycol solution
___ 4. Check for water/glycol leaks

Glycol Pump (if applicable)

___ 1. Check for glycol leaks
___ 2. Check pump operation

Chilled Water Pump

___ 1. Check for leaks
___ 2. Check pump operation

Refrigeration Cycle/Section

___ 1. Check refrigerant lines
___ 2. Check for moisture (sight glass)
___ 3. Check suction pressure
___ 4. Check head pressure
___ 5. Check discharge pressure
___ 6. Check hot gas bypass valve
___ 7. Check thermostatic exp valve
___ 8. Check superheat
___ 9. Check water regulating valve

Compressor

___ 1. Check for oil leaks
___ 2. Check for leaks

Notes:

Signature:____

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