Liebert
Keeping Business in Business™

Deluxe System 3
SM Control

Model Number Designations

FH	245.000	A	—	A	AM
FH = Downflow UH = Upflow FE = Downflow with Econ-o-coil UE = Upflow with Econ-o-coil	Nominal capacity in thousand BTU/H	A = Air Cooled W = Water Cooled G = Glycol Cooled C = Chilled Water	— = 2 Step DX or Std. CW U = 4 Step DX V = VSD CW (Variable Speed Drive)	A = 460/3/60 B = 575/3/60 C = 208/3/60 D = 230/3/60 F = 380/3/50 G = 415/3/50 H = 230/3/50 J = 200/3/50 U = 400/3/50	00 = Standard Microprocessor SM = Standard Microprocessor AM = Advanced Microprocessor AG=Advanced Graphics Microprocessor

LIEBERT DELUXE SYSTEM/3
OPERATION AND MAINTENANCE MANUAL
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SECTION 1 INTRODUCTION

1.1 SYSTEM DESCRIPTIONS

Liebert Deluxe environmental control systems are available in several configurations. Each configuration can operate with either Standard Microprocessor Controls (SM), Advanced Microprocessor Controls (AM), or Advanced Microprocessor Controls with Graphics (AG). A brief description of each, including operational differences, are listed below. Check model numbers to see what is supplied with your unit.

1.1.1 Compressorized Two-Step Systems

These systems may be air, water, or glycol cooled - depending on the heat rejection method selected.

Cooling

Two stages of mechanical refrigeration

Heating

Three stages of electric reheat standard; steam/hot water, hot gas on water and glycol cooled systems optional

Humidification

Infrared standard; steam generating optional

Dehumidification

Utilizes the lag compressor

1.1.2 Compressorized Four-Step Systems

The 4-stage systems have all the features of a compressorized 2-stage system plus cylinder unloaders on one head of each compressor. This permits the compressors to operate at a reduced level and increases energy efficiency during low-load conditions. The system responds to an increasing room load with either a two step or a four step process of increasing the unit's cooling.

Cooling

Four stages of mechanical refrigeration:

1. Lead compressor at reduced capacity.
2. Lead and lag compressors at reduced capacity.
3. Lead compressor at full capacity; lag compressor at reduced capacity.
4. Lead and lag compressors at full capacity.

Heating

Three stages of electric reheat standard; hot water/steam optional

Humidification

Infrared standard; steam generating optional

Dehumidification

Utilizes the lag compressor

1.1.3 Chilled Water Systems

These systems utilize a central chiller and control cooling by modulating a control valve in the chilled water line.

Cooling

Modulating output water valve

Heating

Three stages of electric reheat standard; steam/hot water optional

Humidification

Infrared standard; steam generating optional

Dehumidification

Chilled water valve opens proportionally in response to room needs

1.1.4 GLYCOOL (chilled glycol cooling) Systems

GLYCOOL systems have all of the features of a compressorized water or glycol system, plus a second cooling coil that is connected into the water circuit. When fluid temperature is sufficiently low (below room temperature), cooling is provided by circulating the fluid through the second cooling coil (flow is controlled by a motorized valve.) This is then the primary cooling source and it greatly reduces the compressor operation.

Cooling

Modulated cooling valve opens proportionally to match room needs (primary), two or four stages of mechanical refrigeration (secondary)

Heating

Three stages of electric reheat standard

Humidification

Infrared standard; steam generating optional

Dehumidification

Utilizes the lag compressor

1.1.5 Dual Source Cooling Systems

This system has all the features of a compressorized system but adds a second cooling coil that is connected to a source of chilled water. This second coil is controlled by a modulating control valve. It is the primary source of cooling and dehumidification so compressor operation is reduced.

Cooling

Second coil opens proportionally in response to the room needs (primary), two or four stages of mechanical refrigeration (secondary)

Heating

Three stages of electric reheat standard

Humidification

Infrared standard; steam generating optional

Dehumidification

Standard Controls use the lag compressor. Advanced Controls use the chilled water valve, and then the lag compressor if required by the load.

1.2 START-UP PROCEDURE

Before beginning start-up, make certain that unit was installed according to the instructions in the Installation Manual. All exterior panels must be in place with the three front panels open.

Locate the Start-Up form supplied with your unit documents. Complete the form during your start-up and mail it to Liebert when start-up is completed. Contact your Liebert supplier if you have any questions or problems during your unit installation, start-up, or operation.

WARNING
POTENTIALLY LETHAL VOLTAGES EXIST WITHIN THIS EQUIPMENT DURING OPERATION. OBSERVE ALL CAUTIONS AND WARNINGS ON UNIT AND IN THIS MANUAL. FAILURE TO DO SO COULD RESULT IN SERIOUS INJURY OR DEATH. ONLY QUALIFIED SERVICE AND MAINTENANCE PERSONNEL SHOULD WORK WITH THIS EQUIPMENT.

1. Disconnect all power to the environmental control unit.
2. Tighten all electrical wiring connections which may have loosened during shipping.
3. Remove all line voltage fuses except the main fan fuses at the far right of the electric panel and the Control Voltage fuses at the far left of the electric panel. For units supplied with circuit breakers, open them instead of removing fuses.
4. Turn on power and check line voltage on main unit disconnect switch. Line voltage must be within 10% of nameplate voltage.
5. Turn ON main unit disconnect switch and check secondary voltage at transformer T1. Voltage at T1 must be 24 VAC +/- 2.5 VAC (check at TB1-1 and TB1-8). T1 voltage must not exceed 28 VAC. Change primary tap if necessary.
6. Push ON button. Blower will start and ON lamp will light (lighted switch on Standard Controls only).
7. If you do not want your unit to operate at factory default settings, set temperature and humidity setpoints and sensitivity, alarms, and other control functions. Refer to Section 2 for Standard Controls, Section 3A for Advanced Controls, or Section 3B for Advanced Controls with Graphics.
8. Turn OFF main unit disconnect and main breaker. Unit ON button should be OFF.
9. Replace all fuses, which you removed above (or reset circuit breakers).
10. Restore power to unit; turn ON the main unit disconnect switch.
11. Check the current draw on all line voltage components and match with serial tag.
12. Push ON button - putting the unit into operation.
13. Check for unusual noises and vibration.
14. Check all refrigerant and water lines for leaks.
15. Test all functions of your unit for proper operation.

Return completed Start-Up form to Liebert.

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SECTION 2 — OPERATION WITH STANDARD MICROPROCESSOR CONTROLS

SECTION 2 OPERATION WITH STANDARD MICROPROCESSOR CONTROLS

The Standard Microprocessor (SM) Control front monitor panel uses LEDs to display the operating status and alarm conditions of the unit. A numeric display and control buttons are on the circuit board behind the panel. Use these to monitor and control the system. Unit status and active alarms are available on the front panel. Present room conditions and operator setpoints are shown on the numeric display. The common alarm relay will annunciate a customer supplied alarm. A communication connection to a Liebert Site Monitoring System is available.

2.1 BASICS

2.1.1 Status LEDs

The current operating mode of the unit is indicated by the LEDs in the STATUS section. Cooling, reheat, humidification and/or dehumidification are indicated.

2.1.2 Alarm LEDs

Alarm conditions activate an audible and a visual alarm. The audible alarm may be silenced by pressing the ALARMS PRESENT/SILENCE button. However, the LED indicating the problem and the ALARMS PRESENT lamp remain lit until the problem is corrected.

2.1.3 Numeric Display

The numeric display on the microprocessor board (upper left) indicates:

- current room temperature
- temperature setpoint
- temperature sensitivity
- current room humidity
- humidity setpoint
- humidity sensitivity
- humidifier water rate

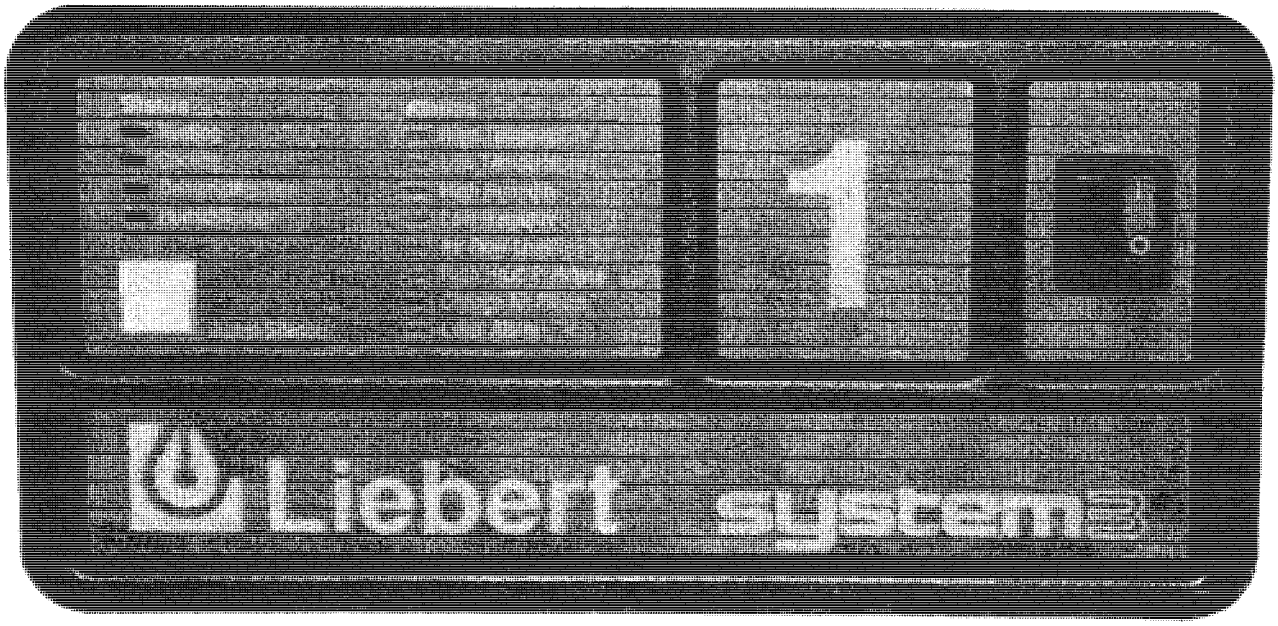

Figure 2-1. Standard Microprocessor Control Panel

The number indicated (current temperature, temperature setpoint, etc.) corresponds to the appropriate LED below the display. For example, when the Temperature Setpoint LED is lit and the numeric display shows 72, then the temperature setpoint is 72°F.

Advance Button

Pressing the ADV button will step the numeric display through the seven LED indicators.

Control Buttons

Two control buttons are used to change the setpoint numbers shown in the numeric display.

The up button increases the value and the down button decreases the value.

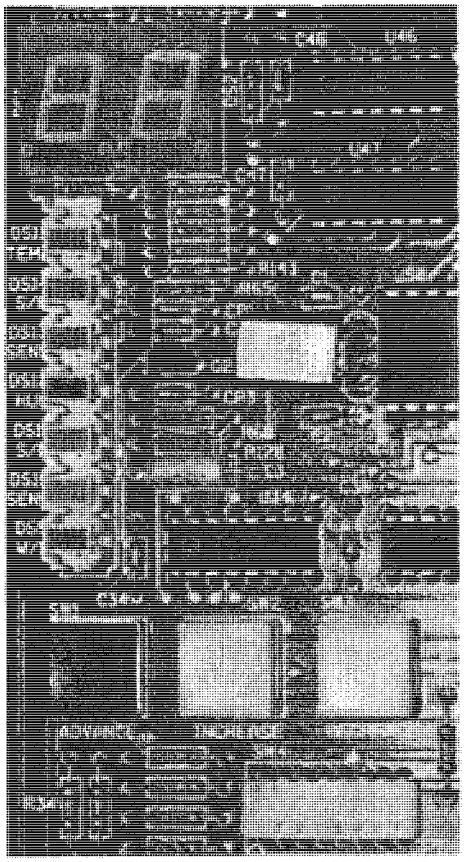

Figure 2-2. Numeric Display, LEDs, and Buttons

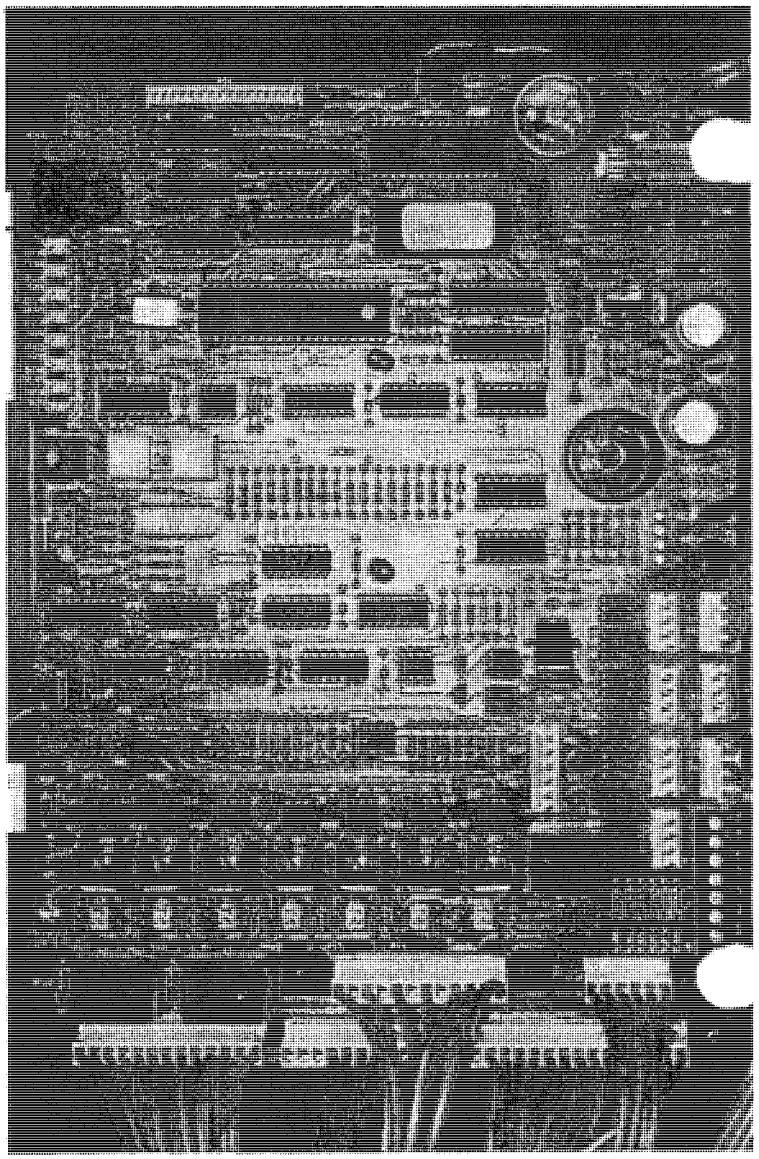

Figure 2-3. Standard Microprocessor Board

2.2 CONTROL SETPOINTS

The control buttons on the microprocessor board are used to adjust temperature and humidity setpoints and sensitivities. The board is located behind the front panel and is separated from all line voltage components.

2.2.1 Temperature Setpoint

Use the ADV button to select Temperature Setpoint. The numeric display will indicate the current setpoint. Use the up or the down button to select the desired setpoint (40-85°F/4-29°C).

2.2.2 Temperature Sensitivity

The range of temperature change that must occur before action is taken by the environmental control system is the temperature sensitivity. This range may be set from 1° to 5°F / 1° to 3°C in 1° increments.

Use the ADV button to select Temperature Sensitivity. The numeric display will indicate the current sensitivity. Use the up or the down button to select the desired sensitivity.

2.2.3 Humidity Setpoint

Use the ADV button to select Humidity Setpoint. The numeric display will indicate the current setpoint. Use the up or the down button to select the desired setpoint (20-80% RH in 1% increments).

2.2.4 Humidity Sensitivity

The range of humidity change that must occur before action is taken by the environmental control system is the humidity sensitivity. This range may be set from 1% to 10% RH in 1% increments.

Use the ADV button to select Humidity Sensitivity. The numeric display will indicate the current sensitivity. Use the up or the down button to select the desired sensitivity.

NOTE
The selection of temperature and humidity control setpoints and sensitivities will automatically determine some of the alarm setpoints. Refer to section 2.4 ALARM SYSTEM.

NOTE
Temperature and humidity sensors are factory calibrated to an accuracy of +/- 1°F/ 3% RH.

2.3 SYSTEM PERFORMANCE WITH FOUR STAGE/MULTIPLE STAGE COOLING

On units equipped with the multiple stage cooling system, the unit will respond to changing load conditions in the room by energizing the two compressors in 4 steps. This is accomplished by cylinder unloaders on one head of each compressor that reduce its cooling capacity. These four steps are (in order):

1. Compressor #1 unloaded,
2. Compressor #1 and #2 both unloaded,
3. Compressor #1 fully loaded and Compressor #2 unloaded,
4. Compressor #1 and #2 fully loaded.

Drycooler and Pump operate when either compressor is energized.

If a Glycool coil is provided, it is activated prior to any compressor steps. Dehumidification is accomplished by energizing the lag compressor, fully loaded. Drycooler and Glycol Pump operate continuously.

2.4 ALARM SYSTEM

2.4.1 Temperature and Humidity Alarms

Temperature and humidity sensors, located in the return air section of the system, constantly monitor room conditions. If room conditions ever exceed the selected parameters, an audible and visual alarm is activated and the common alarm relay closes. The audible alarm may be silenced by pressing the ALARMS PRESENT/SILENCE button on the front monitor, but the LED indicating the alarm remains lit and the common alarm relay remains closed until the problem is corrected.

2.4.2 Programming Temperature and Humidity Alarms

The temperature and humidity alarms are programmable using the ADVANCE and CONTROL buttons on the microprocessor board.

At the unit, the first step is to access SET MODE 2. This adds a second level of functions to the LED indicators on the microprocessor board (below the numeric display).

To access SET MODE 2:

1. Use the ADVANCE button to select TEMPERATURE.
2. Simultaneously press and hold the up and down buttons for 5 seconds. The TEMPERATURE LED will blink, indicating SET MODE 2 functions. Release the up and down buttons.

Normal Functions	SET MODE 2 Functions
TEMPERATURE	TEMPERATURE SENSOR CALIBRATION ±5°F
TEMPERATURE SET POINT	HIGH TEMPERATURE ALARM (from 1° above setpoint to maximum of 90°F/32°C)
TEMPERATURE SENSITIVITY	LOW TEMPERATURE ALARM (from 1° below setpoint to minimum of 35°F/2°C)
HUMIDITY	HUMIDITY SENSOR CALIBRATION ±5% RH
HUMIDITY SET POINT	HIGH HUMIDITY ALARM (from 1% above setpoint to a maximum of 85%)
HUMIDITY SENSITIVITY	LOW HUMIDITY ALARM (from 1% below setpoint to a minimum of 15%)
HUMIDIFIER WATER RATE	LEAD COMPRESSOR 1 or 2

To set Temperature and Humidity alarms:

1. Use the ADVANCE button to select the desired function.
2. Use the up and the down button to increase or decrease the value shown on the numeric display.

To return to Normal Set Mode:

The microprocessor automatically returns to Normal Set Mode 30 seconds after last activity.

2.4.3 Alarm Indications

Change Filters

The filter change switch senses a pressure drop across the air filters and activates the Change Filter and audible alarm when the pressure drop reaches a customer preset level. Instructions for adjusting the switch are on a label near the switch.

Loss of Air Flow

On Deluxe units, the fan safety switch is located on the low voltage panel and consists of a diaphragm switch and interconnecting tubing to the blower scroll. The normally open contacts of the switch will close at a factory preset air velocity and energize the control voltage circuits (see schematic on unit). Upon loss of airflow, the normally closed contacts on the switch will activate the Loss of Air Flow and audible alarm.

High Head Pressure - Compressor 1 (& 2)

The high head pressure cut-out switch activates the HIGH HEAD PRESSURE LED and the audible alarm at the cut-out setting of the compressor pressure switches.

Water Under Floor

The Liqui-tect/Water Detection Sensor (optional) consists of a solid-state switch that closes when water (or other conductive liquid) is detected by two sensor probes. The sensor may be mounted wherever water problems may occur. When water is detected, a visual and an audible alarm are activated.

CAUTION
The Liqui-tect/Water Detection Sensor should not be used near flammable liquids or for flammable liquid detection. During operation, the detection probes get hot and may arc.

Temperature Sensing Alarm

Indicates failure of temperature sensing function (loss of signal).

Indication: Simultaneous Hi & Lo temperature alarms, accompanied by dashes on the numeric readout for temperature.

System Response: Activates 100% cooling

Humidity Sensing Alarm

Indicates failure of humidity sensing function (loss of signal).

Indication: Simultaneous Hi & Lo humidity alarms, accompanied by dashes on the numeric readout for humidity

System Response: Deactivates humidification and dehumidification

Humidifier Problem Alarm (Optional - for Steam Generating Humidifier)

Indication: High canister water level

Action Taken: Change canister

NOTE
Contact your sales/service representative for parts and service.

2.4.4 Common Alarm Relay

On any alarm indication, the common alarm relay is energized, closing the contacts to a remote customer alarm. This relay remains energized until all alarm conditions are corrected. Refer to the electrical schematic on the unit for connection information.

2.5 CONTROL FEATURES

2.5.1 Manual Override

It is possible to manually override the microprocessor and activate cooling 1 & 2, reheat 1, 2 & 3, humidification and dehumidification. This is accomplished by placing a factory-supplied jumper across the desired set of contacts. Refer to Figure 2-4 to identify sets of jumper contacts. To return control of the unit to the microprocessor, replace the jumper on its holding contacts (these contacts are not connected to the microprocessor but only retain the jumper).

NOTE
Manual Override of cooling and dehumidification cannot be performed on chilled water units.

Connection Point	Manually Overrides
JQ1	Reheat 3
JQ2	Reheat 2
JQ3	Reheat 1
JQ6 JQ9	Liquid Line Solenoid Valve 1 Liquid Line Solenoid Valve 2
JQ11	Humidification
JQ12	Humidification Water Valve

2.5.2 Compressor Positive Start Feature

All air cooled models are equipped with a Positive Start feature (also called cold start or winter start). This circuit uses a timer to bypass the compressor low pressure switch for three minutes following the opening of the liquid line solenoid valve (a call for cooling or dehumidification). After three minutes, the bypass contacts are opened and compressor operation is controlled by the low pressure switch.

The three minute time delay is factory set and is not adjustable.

2.5.3 Compressor Sequence

The lead/lag sequence of the compressors may be changed to equalize the run time of each.

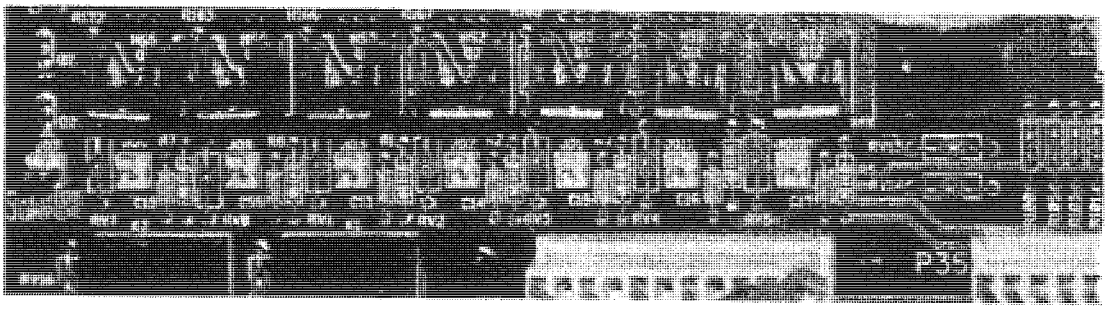

Figure 2-4. Manual Override Jumper and Connection Points

This is accomplished using the NUMERIC DISPLAY located on the printed circuit board behind the main unit accent panel.

Select SET MODE 2 as previously described in Section 2.4.2. Use the advance button to select COMPRESSOR SEQUENCING (bottom LED flashing). A1 on the display readout indicates that compressor number 1 is the lead compressor; A2 indicates that number 2 is the lead compressor. Use the up or the down button to select either compressor number 1 or number 2 as the lead compressor.

2.5.4 Sequential Auto Restart Relay

The Sequential Auto Restart Relay will delay the start-up of the unit after a power failure. The time delay is field adjustable so that multiple units may be restarted at different time intervals to reduce total rush of current to the room.

The relay is located in the low voltage compartment behind the front panel.

Turn the adjustment wheel clockwise to increase the time delay. Adjustment range: 1 to 120 seconds.

Figure 2-5. Sequential Auto Restart Relay

2.5.5 Battery Protected Setpoints

The battery back-up in the microprocessor will maintain the programmed values during power failures. If the length of the power failure exceeds the capacity of the batteries (about three months), the system will default to factory preset values listed.

- Temperature Setpoint 72°F
- Temperature Sensitivity 2°F
- Humidity Setpoint 50% RH
- Humidity Sensitivity 5% RH
- Humidifier Water Rate 15 (150% water fill)
- Humidifier Pan Size Large (2)*

*For infrared humidifiers, if a unit is a chilled water model UH/FH 147C, 200C, or 248C, or if the unit is a 50 Hz model UH/FH 75A, 86W or 72G, the microprocessor will have to be reprogrammed for the small humidifier pan. This is done by using the numeric display and the control buttons on the microprocessor board behind the unit accent panel.

1. Use the ADV button to select Humidity.
2. Simultaneously depress the up and down buttons and hold for 5 seconds.
3. The numeric display will show "2" (large pan).
4. Use the down button to decrease from 2 to 1.
5. After 15 seconds, the control will revert to the normal operating mode.

2.5.6 Control Switches

A set of 8 control DIP switches (SW4) is provided on the microprocessor board below the control buttons for the Numeric Display. Refer to Figure 2-2. These allow the operator to select options and operating modes.

NOTE
The control switches are set in the correct position for each model. Do not change them without consulting the factory.

To change control switch settings, first turn unit off at control panel. After compressor shuts off, turn off power at disconnect switch. Restore power after setting switches.

Switch Position	ON Position	OFF Position
1	Staged Reheat	Proportional Reheat
2	Reheat Available	No Reheat
3[1]	2-Step Cooling	4-Step Cooling
4	Humidification Available	No Humidification[2] Available
5	Low & High Humidity Alarm Available	No Low & High Humidity Alarm
6	Dehumidification Available	No Dehumidification[3] Available
7	Enable Common Alarm	Enable Remote ON/OFF[4]
8	Fahrenheit Readout	Celsius Readout

[1]Not used on Chilled Water Models.

[2]With switch 4 OFF: Humidifier Water Rate LED and numeric display will be disabled.

[3]With switch 6 OFF (and 4 OFF): All four Humidity LEDs and numeric displays will be disabled.

[4]Remote ON/OFF feature must be accompanied by a unit wiring change (see unit schematic) and controlled by a site monitoring product. The common alarm output **cannot** be used with this feature.

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SECTION 6 — COMPONENT OPERATION AND MAINTENANCE

SECTION 6 COMPONENT OPERATION AND MAINTENANCE

6.1 SYSTEM TESTING

6.1.1 Environmental Control Functions

The performance of all control circuits can be tested by actuating each of the main functions. This is done by temporarily changing the setpoints.

Cooling

To test the cooling function, set the setpoint for a temperature of 10°F (5°C) below room temperature. A call for cooling should be seen and the equipment should begin to cool. A high temperature alarm may come on. Disregard it. Return setpoint to the desired temperature.

Heating

Reheat may be tested by setting the setpoint for 10°F (5°C) above room temperature. A call for heating should be seen and the heating coils should begin to heat. Disregard the temperature alarm and return the setpoint to the desired temperature.

Humidification

To check humidification, set the humidity setpoint for an R.H. 10% above the room humidity reading. For infrared humidifiers, the infrared element should come on. For steam generating humidifiers, you will immediately hear the clicks as it energizes. After a short delay, the canister will fill with water. The water will heat and steam will be produced. Return the humidity setpoint to the desired humidity.

Dehumidification

Dehumidification can be checked by setting the humidity setpoint for an R.H. 10% below room relative humidity. The lag compressor should come on. Return humidity setpoint to the desired humidity.

Proportional Heating/Cooling/ Dehumidification

On Chilled Water, GLYCOOL (Econ-O-Cycle, Free Cool, GLYCOOLING cycle) models, and models with hot water reheat, the microprocessor is capable of responding to changes in room conditions. These systems utilize either a two or three-way valve activated by a proportioning motor.

For cooling and dehumidification, the microprocessor will respond by positioning the valve proportionally to match the needs of the room. Full travel of the valve takes place within the range of the sensitivity setting. During dehumidification, full travel of the valve takes place within 2% RH. On large Deluxe chilled water models, an optional variable speed drive will control blower speed proportional to cooling load.

For hot water reheat, the microprocessor will respond by positioning the hot water valve proportionally to match the needs of the room. Full travel of the valve takes place within 1°F with each 0.1°F resulting in 10% valve travel.

6.1.2 Electric Panel

The electric panel should be inspected for any loose electrical connections.

CAUTION

Be sure that power to the unit is shut down before attempting to tighten any fittings or connections.

Control Transformer and Fuses

The control system is divided into four (4) separate circuits. The control voltage circuits are individually protected by fuses located on the transformer/fuse board. If any of the fuses are blown, first eliminate shorts, then use spare fuses supplied with unit. Use only type and size of fuse specified for your unit.

The small isolation transformer on the board supplies 24 volts to the main control board. The transformer is internally protected. If the internal protector opens, the transformer/fuse board must be replaced. Also check the control voltage fuse on the main control board before replacing the transformer/fuse board.

Adjustable Overloads

Compressor overloads are optional. The overloads trip if one phase is overloaded. They can be manually reset. If an overload must be replaced, adjust the new one based on the unit nameplate.

Fan Safety Switch

For Deluxe units, the Fan Safety Switch is located in the low voltage compartment and consists of a diaphragm switch and interconnecting tubing to the blower scroll. On SM models, the normally open contacts close at a preset velocity closing relay R1 which applies power to the cooling, heating and humidifier circuits. The normally closed contacts activate the alarm system if air flow should be interrupted. In this event relay R1 would be de-energized. On AM and AG models, the Fan Safety switch is wired directly to the control circuit

Firestat

The optional firestat is a bimetal operated sensing device with a normally closed switch. This device will shut down the entire unit when the inlet air temperature exceeds a preset point. It is connected between terminals 1 and 2 at plug P39.

Smoke Detector

The optional smoke detector power supply is located in the low voltage compartment. The smoke detector is located in the room unit. It is constantly sampling return air through a tube. No adjustments are required.

Water Detection Sensor

CAUTION
Do not use near flammable liquids or for flammable liquid detection.

The optional water detection sensor contains a solid state switch that closes when water (or other conductive liquid) is detected by the twin sensor probes. The sensor is hermetically sealed in all thread PVC nipple and is to be mounted where water problems may occur.

The sensor should be located 6-8 feet (2 to 2.5 meters) from the environmental control unit in a wet trap or near a floor drain. It should not be mounted directly under the unit. Wire the sensor to unit using NEC Class 2, 24 volt wiring.

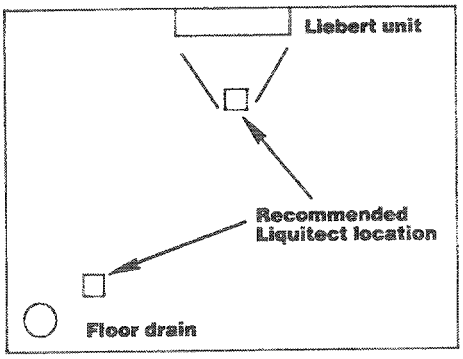

Figure 6-1. Recommended Liquid Sensor Locations

Run wires to the terminal strip on the wire raceway in the compressor compartment and connect them to terminals 24 and 50-56.

Remote Shutdown

A connection point is provided for customer supplied remote shutdown devices. This terminal strip is located in the field wiring compartment. Terminals 37 and 38 on the terminal strip are jumpered when no remote shutdown device is installed.

6.2 FILTERS

Filters are usually the most neglected item in an environmental control system. To maintain efficient operation, they should be checked monthly and changed as required. Because replacement intervals vary with environmental condition and filter type, each unit is equipped with a filter clog switch. This warns of restricted air flow through the filter compartment by activating the Change Filter alarm.

Turn power off before replacing filters.

Deluxe filters can be replaced from either end by opening the end doors. On large chilled water units, filters can be replaced from the front. Removing the middle filters will allow you to remove the end ones. Install the new end filters first, then the middle ones.

Replacement filters are commercially available in several efficiencies. For Deluxe units, refer to the Technical Data manual or other documentation for filter sizes.

After replacing the filters, test the operation of the filter clog switch. Turn the adjusting screw counter clockwise to trip the switch - this will energize the Change Filter alarm. To adjust the switch proceed as follows: With the fan running, set the switch to energize the light with clean filters. The unit panels must all be in place and closed to accurately find this point. Then turn the adjusting knob 1 turn clockwise, or to the desired filter change point.

6.3 BLOWER PACKAGE

Periodic checks of the blower package include: belts, motor mounts, fan bearings, and impellers.

On large Deluxe chilled water models an optional variable speed drive inverter is available. This packaged unit is factory set and should not require field adjustments. The variable speed drive saves power by reducing blower speed to match unit load. If you suspect a problem with the inverter, first make sure that the intelligent control method is selected at the advanced microprocessor control. Refer to the separate manual for this packaged unit for maintenance information.

6.3.1 Fan Impellers and Bearings

Fan impellers should be periodically inspected and any debris removed. Check to see if they are tightly mounted on the fan shaft. Rotate the impellers and make sure they do not rub against the fan housing.

Bearings used on the units are permanently sealed and self-lubricating. They should be inspected for signs of wear when belts are adjusted. Shake the pulley and look for movement in the fan shaft. If any excessive movement is noticed, bearings should be replaced. However, the cause of the wear must be determined and corrected before returning the unit to operation.

6.3.2 Belts

Drive belts should be checked monthly for signs of wear and proper tension. Pressing in on belts midway between the sheave and pulley should produce from 1/2" to 1" (12 to 25 mm) of movement. Belts that are too tight can cause excessive bearing wear.

Belt tension can be adjusted by raising or lowering the fan motor. If belts appear cracked or worn, they should be replaced with matched belts (identically sized). Both belts should be replaced at the same time. With proper care, belts should last several years.

NOTE
After adjusting or changing belts, always be certain that motor mounts are tight. Loose mounts will produce vibration that may damage the unit.

6.3.3 Air Distribution

All unit models are designed for constant volume air delivery. Therefore any unusual restrictions within the air circuit must be avoided. Refer to Table 6-1 for recommended free area for proper air flow.

Table 6-1. Recommended Free Area for Grilles or Perforated Panels

Unit Size (Ton)	550 FPM ft^2	(2.79 m/s) (m^2)	500 FPM ft^2	(3.05 m/s) (m^2)
6	4.6	(.43)	4.2	(.39)
8	6.3	(.59)	5.8	(.54)
10	7.7	(.72)	7.4	(.69)
15	11.5	(1.07)	10.5	(.98)
20	13.9	(1.29)	12.8	(1.19)
22	16.4	(1.52)	15	(1.39)
30	20.4	(1.90)	18.8	(1.75)

Grilles used in raised floors vary in size, the largest being 18" x 6" (46 cm x 15 cm). This type of grille has approximately 56 $in.^2$ (361 cm^2) of free area. Perforated Panels are usually 2' x 2' (61 cm x 61 cm) and have a nominal free area of approximately 108 to 144 $inches^2$ (697 to 929 cm^2).

NOTE
Absolutely avoid any underfloor restrictions such as clusters of cables or piping. Whenever possible, cables and piping should be run parallel to the air flow. Never stack cables or piping.

6.4 REFRIGERATION SYSTEM

Each month the components of the refrigeration system should be inspected for proper function and signs of wear. Since in most cases evidence of malfunction is present prior to component failure, periodic inspections can be a major factor in the prevention of most system failures.

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.

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.

6.4.1 Compressor Oil Level

There is a glass "bull's eye" provided on each compressor (clearly visible when the end door is open) that permits viewing the oil level.

Normally, the oil level should be 1/2 to 3/4 up from the bottom of the sight glass. However, this level may vary during operation due to the action of the moving parts. When idle, the oil level may be higher due to absorption of the refrigerant.

After a compressor has been idle for an extended length of time, foaming will usually be present when the compressor first starts. Wait until the compressor has been operating for at least five minutes before viewing the oil level.

Refrigeration oil does not deteriorate with normal usage and does not to be changed unless it becomes discolored or acidic. Periodically inspect the compressor compartment for signs of oil leakage. If a leak is present, it must be corrected and the oil level returned to its proper level using Sunisco 3GS refrigerant oil. Take new oil from sealed containers opened at time of use. Oil exposed to the air will absorb moisture.

6.4.2 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 and can result in compressor damage. Minimum (pressure switch cut-out setting) and maximum (design operating) suction pressures are in Table 6-2.

Table 6-2. Suction Pressures

System	Minimum PSIG (kPa) R-22		Maximum PSIG (kPa) R-22	
Air FSC	15	(103)	90	(620)
Flood back head pressure control	20	(137)	90	(620)
Water Cooled	20	(137)	90	(620)
Glycol Cooled	20	(137)	90	(620)

6.4.3 Discharge Pressure

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. Refer to Table 6-3.

Table 6-3. Discharge Pressures

System Design	PSIG	(kPa)
Air Cooled	260	(1795)
Water Cooled 65°F to 75°F water (18 to 24°C)	210	(1450)
85°F water (29°C)	225	(1550)
Glycol Cooled	295	(2035)
Maximum	330	(2275)
High Pressure Cut-Out	360	(2480)

6.4.4 Superheat

Superheat can be adjusted by the Thermostatic Expansion Value (TEV).

To determine superheat:

1. Measure the temperature of the suction line at the point the TEV bulb is clamped.
2. Obtain the gauge pressure at the compressor suction valve.
3. Add the estimated pressure drop between bulb location and 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.

6.4.5 Thermostatic Expansion Valve

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 15°F (5.6 and 8.3°C).

Adjustment

To adjust the superheat setting, proceed as follows:

1. Remove the valve cap at the bottom of the valve.
2. Turn the adjusting stem counter-clockwise 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.

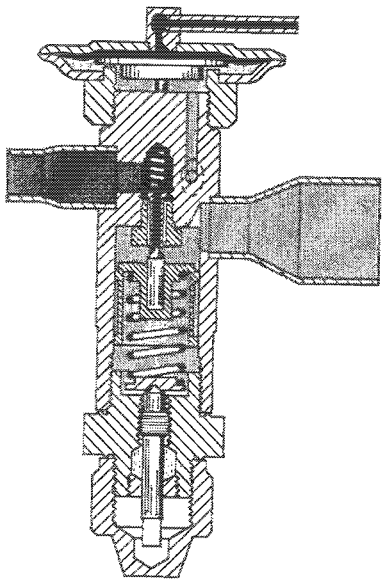

Figure 6-2. Typical Valve Cross Section

6.4.6 Hot Gas Bypass Valve

Operation

The hot gas bypass is inserted between the compressor discharge line and the leaving side of the expansion valve through the side outlet distributor (refer to Figure 6-3). The system, with normal operation when the evaporator is under full load, will maintain enough pressure on the leaving side of the hot gas valve to keep the valve port closed.

If the load on the evaporator decreases, the evaporator will get colder. When the coil is too cold, the internal pressure in the evaporator drops and allows the hot gas bypass valve to open. Hot gas then mixes with the liquid coolant on the discharge side of the expansion valve raising the temperature and pressure in the evaporator. The net result is a reduction in the cooling capacity of the unit to match the load.

Adjustment

Upon deciding what evaporator temperature is desired, the following procedure should be used to adjust the hot gas bypass valve:

1. Install the suction and discharge pressure gauge.
2. Turn thermostat to call for cooling so that the refrigeration compressor will run.

3. Remove the TOP adjusting nut from the valve.

4. Insert an Allen wrench in the brass hole at top of valve in adjusting port, and turn CLOCKWISE if a higher evaporator temperature is required.

5. After obtaining the suction pressure required, reinstall cap tightly making sure there are no leaks.

6. Let the evaporator operate for approximately 10 to 15 minutes to make sure the suction pressure is within the range desired.

7. There will be a fluctuation of approximately 3 to 6 PSIG (21 to 41 kPa) on the evaporator due to the differential on the hot gas bypass.

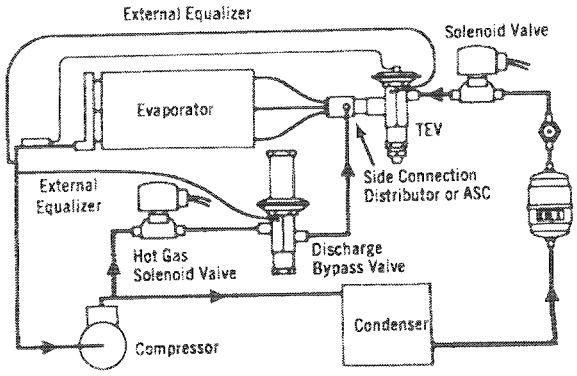

Figure 6-3. Hot Gas Bypass

6.4.7 Air Cooled Condenser

Restricted airflow through the condenser coil will reduce the operating 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.

Checking Refrigerant Charge (Lee-Temp/ Flood Back Head Pressure Control)

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 compressors will run continuously.

2. The refrigerant level is visible through two sight glasses on the receiver, and will vary with ambient temperature.

   a. 40°F (4.4°C) and lower — Midway on the bottom sight glass.

   b. 40 to 60°F (4.4 to 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.

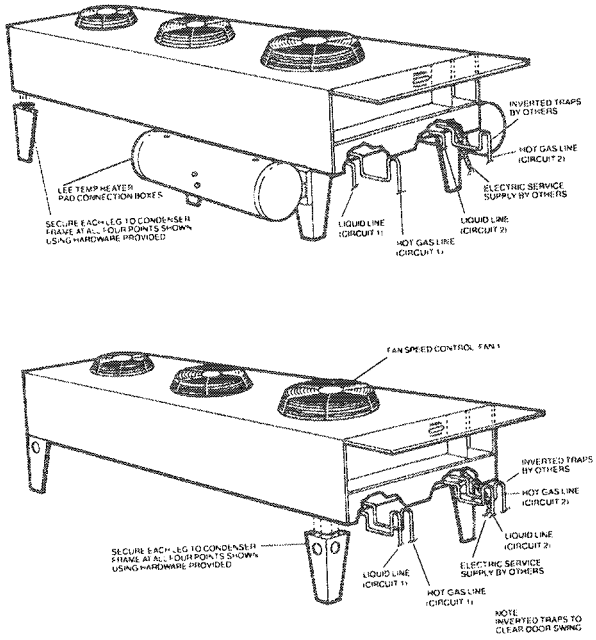

Figure 6-4. Outdoor Fan/Condenser Configuration

6.4.8 Water/Glycol Cooled Condensers

Shell and Tube Condensers

Each water or glycol cooled module has a shell and tube condenser which consists of a 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 should collect (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 unit (using start/stop switch), and allow compressor to pump down.
2. Open the disconnect switch.
3. Shut off the water supply valve to the condenser.
4. Drain the water from condensers and piping.
5. Remove the bolts securing each head and slowly pry them free.

   CAUTION
   Be careful not to damage head gaskets.
6. Swab the condenser tubes with a tube cleaning tool.
7. When the tubes are clean reinstall the gaskets and heads.
8. Reconnect piping, open water supply valve, vent the system, and check for leaks.

Regulating Valves

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

Adjustment

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

Refer to Table 6-3 for recommended refrigerant pressures.

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 counterclockwise until the desired setting is obtained.

Manual Flushing

The valve may be flushed by inserting a screw driver or similar tool under the two sides of the main spring and lifting. This action will open the valve seat and flush any dirt particles from the seat. 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 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 container to catch water below the valve).
3. Remove 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 for 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 valve is reassembled check for leaks.
7. Readjust head pressure control.

Testing Function of Valve

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

If the water continues to flow, the valve is either improperly adjusted (with head pressure too low) or the pressure sensing capillary is not connected properly to the condenser.

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 time of installation and every six (6) 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 makes it important to obtain the advice of a water treatment specialist and follow a regularly scheduled maintenance program. It is important to note that improper use of water treatment chemicals can cause problems more serious than using none.

Proper inhibitor maintenance must be performed in order to prevent corrosion of the glycol system. Consult glycol manufacturer for testing and maintenance of inhibitors. Do not mix products from different manufactures.

6.4.9 Compressor Replacement

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 far less costly to take the steps necessary to ensure proper system operation than it is to allow a compressor to fail and require replacement.

When troubleshooting a compressor, check all electrical components for proper operation.

1. Check all fuses and circuit breakers.
2. Check Hi-Lo Pressure switch operation.
3. If a compressor failure has occurred, determine whether it is an electrical or mechanical failure.

Mechanical Failure

If you have determined that only a suction or discharge valve has failed, the compressor may be repaired by replacing the valves.

A mechanical compressor failure will be indicated by no burned odor from gas released at service port. The motor will attempt to run. If you have determined that a mechanical failure has occurred, the compressor must be replaced.

If a burnout does occur, correct the problem that caused the burnout and clean the system. It is important to note that successive burnouts of the same system are usually caused by improper cleaning.

Electrical Failure

An electrical failure will be indicated by a 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.

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

CAUTION

Damage to a replacement compressor caused by improper system cleaning constitutes abuse under the terms of the warranty, and the WARRANTY WILL BE VOID.

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.

CAUTION

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

Compressor Replacement Procedure

Replacement compressors are available from your Liebert supplier. They will be shipped in a reusable crate to the job site as required 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 to the factory.

The compressor should be returned in the same container used for shipping to the job. The possible damage causes or conditions that were found should be recorded by marking the compressor return tag.

1. Disconnect power.
2. Attach suction and discharge gauges to access fittings.
3. Recover refrigerant using standard recovery procedures and equipment. Use a filter-drier when charging the system with recovered refrigerant.

   CAUTION
   Do not loosen any refrigeration or electrical connections before relieving pressure.

   NOTE
   Release of refrigerant to the atmosphere is harmful to the environment and is unlawful. Refrigerant must be recycled or discarded in accordance with federal, state, and local regulations.
4. Front seat service valves to isolate the compressor. Reclaim charge from compressor.
5. Remove service valve bolts, pressure switch capillaries, and disconnect all electrical connections.
6. Remove failed compressor.
7. Install replacement compressor and make all connections.
8. Pressurize and leak test the system at approximately 150 PSIG (1034 kPa) pressure.
9. Follow manufacturer's instructions for clean out kits.
10. Evacuate the system twice to 1500 microns, and the third time to 500 microns. Break the vacuum each time with clean, dry refrigerant to 2 PSIG (13.8 kPa).
11. Charge the system with refrigerant (R-22) based on requirements of the evaporator, condensing unit, and lines. Refer to the installation manual or the unit nameplate.
12. Apply power and operate the system. Check for proper operation. Refer to Table 6-3 for design pressures.

6.5 HUMIDIFIER

6.5.1 Infrared Humidifier

During normal humidifier operation, deposits of mineral solids will collect in the humidifier pan. This should be cleaned out periodically to ensure efficient operation. Each water supply has different characteristics, so time interval between cleanings must be determined locally. A monthly check (and cleaning if necessary) is recommended.

The humidifier pan is easily removed by draining the pan (remove the standpipe), disconnecting the drain coupling, and removing the retaining screws on each end of the pan.

NOTE
Before removing pan, be sure power to unit is disconnected and water in humidifier pan is no hotter than lukewarm.

Scale on the side and bottom can be loosened with a stiff brush. Flush with water and replace pan in humidifier.

An autoflush system can greatly increase the time between cleanings, but does not eliminate the need for periodic checks and maintenance.

Changing Humidifier Lamps

1. Open disconnect switch.
2. Remove middle front panel.
3. Remove screws securing line voltage compartment cover, then remove the cover.
4. In line voltage compartment, disconnect one end of the purple jumpers, then locate the burned out bulb with a continuity meter.
5. Remove humidifier pan.
6. Remove lamp brackets (3) under lamps.

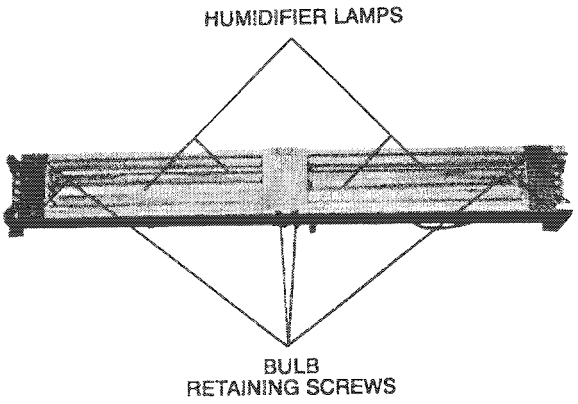

Figure 6-5. Infrared Humidifier Lamps

7. Loosen two screws securing bulb wires to junction block.
8. Pull bulb straight down.
9. Replace bulb. Wrap wires once loosely around bulb. This will support the bulb and also allow for thermal expansion. Make sure lamp wires are secure in junction block.

   CAUTION
   Do not touch the quartz lamps with your bare hands. Oily deposits such as fingerprints will severely shorten bulb life. Use clean cotton gloves at all times.

10. Reverse steps 1-6.

Autoflush Infrared Humidifier Cleaning System

NOTE
To operate properly, the Autoflush Humidifier requires a water source that can deliver at least 1 gpm (0.063 l/s) with a minimum pressure of 20 psig (138 kPa).

The autoflush system will periodically flush the humidifier pan with water to prevent the build-up of water minerals due to saturation. Because water conditions vary, the amount of water flushing through the system may be programmed to match local needs.

Water amounts between 110% and 250% of the amount needed for humidification may be selected (110% to 500% with Advanced Controls). Operation of the flushing system is then automatic and no further adjustments need to be made.

Autoflush Operation

The operation of the autoflush is divided into four steps beginning with a call for humidification.

1. If the humidifier has not been activated for over 30 hours, the autoflush will flow water into the pan for 30 or 60 seconds (based on the size of the pan). This will provide a minimum amount of water in the pan and prevent heat damage to the humidifier pan. Humidifier lamps are OFF.
2. If the humidifier has been activated within the last 30 hours, Step 1 is bypassed. The autoflush will flow water into the pan for 4 or 7 minutes (based on the length of time between humidifier activations). The humidifier lamps are on and the humidifier is operational during this period. When the pan is filled (the fill cycle has timed out), the water make-up valve is closed.
3. The water make-up valve remains OFF and the humidifier lamps are on for a maximum of 8 to 10 minutes (based on the size of the pan).
4. After the 8 to 10 minute time delay, the autoflush adds water to the pan to replenish the water used in humidification and flush the pan of mineral solids. This amount of water is adjustable from 110% to 250% in increments of 10% (110% to 500% with Advanced Controls). At the end of this cycle, the make-up valve is closed. Steps 3 and 4 repeat as long as humidification is required.

Autoflush Controls

With Standard Controls the autoflush is programmed by using the numeric display and the control buttons just as the temperature and humidity setpoints are programmed.Use the ADV button to select Humid Water Rate. The numeric display will indicate the current Humidifier Water rate. Use the up and down buttons to select the desired flush rate. Flush rates are displayed as 11 to 25 in increments of 1. Selecting 15 would program the microprocessor for 150% of the amount of water needed for humidification.

For Advanced Controls, use the LCD display, menu, and keys on the front control panel.

6.5.2 Steam Generating Humidifier

Steam generating humidifiers are designed to operate in voltage ranges from 200 to 575 volts and generate either 11 or 22 pounds (5 or 10 kg) of steam per hour depending on Deluxe model. These humidifiers operate efficiently over a wide range of water quality conditions and automatically adjust to changes in the conductivity of water. The humidifiers drain and refill to maintain an amperage setpoint and alert the operator when the humidifier canister needs to be replaced.

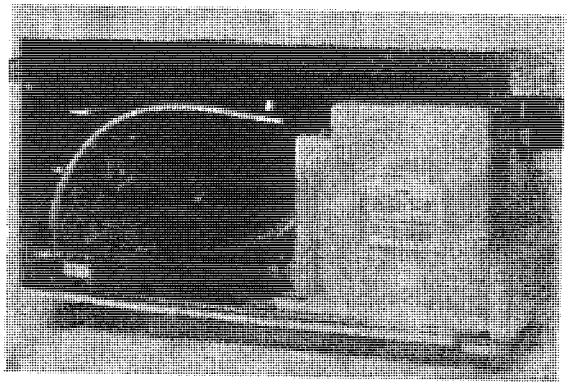

Figure 6-6. Steam Generating Humidifier

Operation

1. During start-up, when the humidity control calls for humidification, the fill valve opens and allows water to enter the canister. When the water level reaches the electrodes, current flows and the water begins to warm. The canister fills until the amperage reaches the setpoint and the fill valve closes. As the water warms, its conductivity increases and the current flow, in turn, rises. If the amperage reaches 115% of the normal operating amperage, the drain valve opens and flushes some of the water out of the canister. This reduces electrode contact with the water and lowers the current flow to the amperage setpoint. Boiling soon commences, and the canister operates normally.

2. If the conductivity of the water is low, the canister fills and the water level reaches the canister full electrode before the amperage setpoint is reached. The humidifier stops filling to prevent overflow. Boiling should commence in time. As water is boiled off, the mineral concentration in the canister increases and current flow also increases. The canister eventually reaches full output and goes to normal operation. No drain is permitted until then.

3. When full output is reached the circuit board starts a time cycle which is factory set at 60 seconds. During this repeating time cycle, the fill valve will open periodically to replenish the water being boiled off and maintain a "steady state" output at the set point. The amperage variance will depend on the conductivity of the water.

4. After a period of time, the mineral concentration in the canister becomes too high. When this occurs, the water boils too quickly. As the water quickly boils off and less of the electrode is exposed, the current flow decreases. When the current crosses the low threshold point (factory set at 70%) before the end of the time cycle, the drain valve opens, draining the mineral laden water out and replacing it with fresh water. This lowers the mineral concentration and returns the canister to "steady state" operation and prolongs canister life. The frequency of drains depends on water conductivity.

5. Over a period of time, the electrode surface will become coated with a layer of insulating material, which causes a drop in current flow. As this happens, the water level in the canister will slowly rise exposing new electrode surface to the water to maintain normal output. Eventually, the steady state water level will reach the canister full electrode and indicate so by activating the canister full alarm. At this point, all of electrode surface has been used up and the canister should be replaced.

6. After the entire electrode surface has been coated, the output will slowly begin to fall off. This usually occurs in the last several hours of electrode life and should allow enough time to schedule maintenance. During these last hours, the mineral concentration can increase. If the mineral concentration is too high, arcing can occur. If the electrodes start to arc, turn off the humidifier immediately and replace the canister with the identical part.

Controls

The humidifier RUN/DRAIN switch is located behind the front panel in the control section of the unit. This switch should be in the RUN position when the humidifier is in normal operation, and in the DRAIN position when a manual drain sequence is required. The electronic control board for the humidifier is also located in the control section of the unit. When the main unit is energized, power is available to the humidifier circuits.

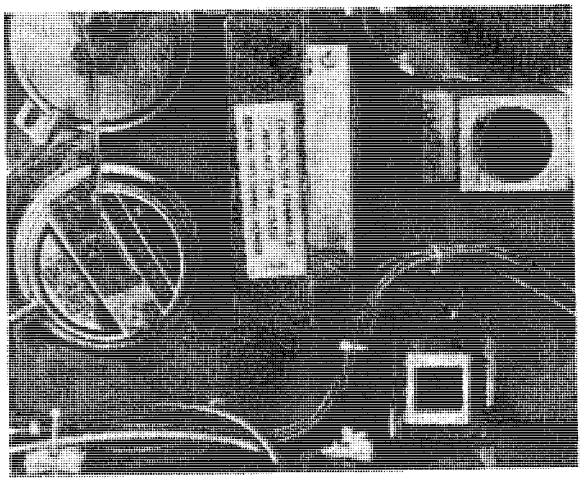

Figure 6-7. Run/Drain Switch

Replacing the Canister

Over a period of operation, the humidifier electrodes become coated with mineral solids. This coating insulates the electrodes and decreases the current flow. To maintain humidifier capacity, the water level slowly rises to expose fresh electrode. Eventually, the entire electrode becomes coated and the water level reaches the top. At this point, the canister full alarm is activated and the output begins to fail. When this happens, it is necessary to replace the full canister.

To replace the canister:

1. Turn off the humidifier by lowering the humidity setpoint below the ambient humidity level. Record the original setpoint.
2. Place the RUN/DRAIN switch in the DRAIN position to drain the water from the canister.
3. Return the RUN/DRAIN switch to the RUN position after the canister has drained.

WARNING
TO AVOID A SHOCK HAZARD, ALL POWER TO THE UNIT MUST BE DISCONNECTED BEFORE PROCEEDING WITH THE CANISTER REPLACEMENT PROCEDURE.

4. Turn OFF the power at the main unit.
5. Remove the cover from the humidifier cabinet.

CAUTION
The canister and steam hose may be hot! Allow time for the humidifier to cool before replacing parts.

6. Locate the power wires to the steam canister. They are connected to the canister with 1/4" quick connects. Make note of the wiring configuration before removing any wires. Refer to schematic on unit. Slide the rubber boot back to expose the connections. Remove the three power wires and the canister full wire at terminals 1, 2 and 3. Do not loosen the screws that secure the electrodes.
7. Use a screwdriver to remove the hose clamps that secure the drain and overflow hoses from the canister ports.
8. Loosen the fill line compression fitting and remove the tube from the input canister port.
9. Loosen the steam outlet hose clamps and slide the steam hose away from the canister fitting. Release the canister clamp along the base of the canister.

10. The canister is now ready to be removed.

    On the downflow chilled water units: Slide the humidifier cabinet bottom straight out toward you and drop the canister through the bottom of the cabinet.

    On all other units: Pull the canister straight out of the cabinet toward you.

11. Replace the canister with the part indicated in Table 6-4.

Table 6-4. Humidifier Canister Part Numbers

Part Number	Voltage	Capacity lbs/hr	Capacity (kg/hr)
121795P1	200-230	11 or 22	(5 or 10)
121795P2	380-575	11 or 22	(5 or 10)

12. Replace the canister by reversing the above procedure. Make special note of the following:

    NOTE
    When replacing the power wiring, wire #2 must be connected to the electrode closest to the steam outlet. The red canister full wire must be connected to the electrode marked with red and farthest from the steam outlet.

    NOTE
    When replacing the canister, always check the fill and drain solenoids for proper operation.

Circuit Board Adjustments

WARNING
CIRCUIT BOARD ADJUSTMENT SHOULD BE PERFORMED BY QUALIFIED PERSONNEL ONLY. HAZARDOUS VOLTAGES ARE PRESENT IN THE EQUIPMENT THROUGHOUT THE PROCEDURE. USE EXTREME CAUTION. IF DESIRED, POWER MAY BE DISCONNECTED PRIOR TO THE PROCEDURE.

Humidifier operation is governed by the humidifier control board. This board is located in the lower right area of the panel in the control section of the unit. Refer to Figure 6-8 for an illustration. There are two potentiometers

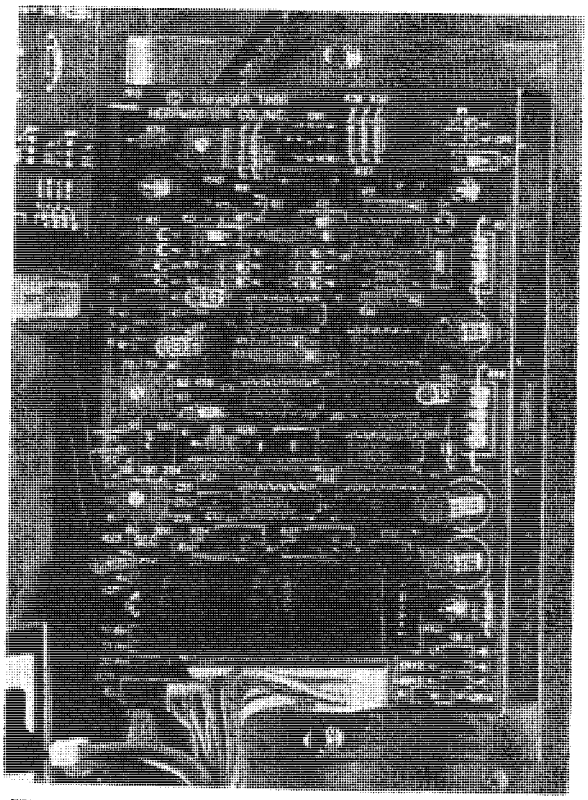

Figure 6-8. Steam Generating Humidifier Control Board

mounted on the board. These pots can be used to adjust for extreme water conductivity conditions.

The % pot controls the amperage at which the drain will energize. The pot is clearly marked in percentages. This adjustment is factory set at 70%, which indicates that the unit will drain when the amperage falls off to 70% of the capacity setpoint. Raising the value increases the frequency of drain cycles. Lowering the value decreases the frequency of drain cycles. The frequency should be increased for highly conductive water and decreased for less conductive water. If adjustment is necessary, and a change of three to four percent in either direction does not permit normal operation of the unit, consult your Liebert supplier.

The pot marked "sec" controls the duration of the drain cycle. The pot is clearly marked in seconds. This adjustment is factory set at 60 seconds and should not be readjusted without consulting your Liebert supplier.

Table 6-5. Steam Generating Humidifier Capacity

60 Hz Models	50 Hz Models	Capacity lbs/hr	(kg/hr)
75A, 72G, 86W 114A, 110G, 127W 125A, 116G, 138W 147C, 200C, 248C	75A, 72G, 86W 147C, 200C, 248C	11	(5)
199A, 192G, 219W 245A, 240G, 267W 290A, 265G, 315W 380A, 363G, 412W 302C, 376C 422C, 529C	115A, 111G, 128W 130A, 121G, 143W 199A, 192G, 219W 245A, 240G, 267W 290A, 265G, 315W 380A, 363G, 412W 302C, 376C 422C, 529C	22	(10)

The DIP switches are used to set the capacity of the humidifier. These are preset at the factory and should not be changed. Refer to Table 6-5 for the capacity of your unit. Find your unit voltage and capacity in Table 6-6 to determine the correct DIP switch settings for your humidifier. A potentiometer (R40) is used to regulate the capacity of the humidifier. This adjustment is factory set fully clockwise to 100%. It can be used to reduce humidifier capacity, but should never be used to raise the capacity above the capacity for your model. Turn the adjustment counterclockwise to reduce your capacity. The minimum setting is approximately 50% of the DIP switch setting.

CAUTION
The DIP switches must be set exactly as indicated in Table 6-6. Failure to correctly set the DIP switches may result in an electrical or water hazard.

Table 6-6 Notes

For DIP switches 1 to 4, 0 means Off or Open, 1 means On or Closed.

Table 6-6. DIP Switch Settings for Steam Generating Humidifier

Unit Rated Voltage	Capacity	SW1	SW2	SW3	SW4	Rated Values Voltage	AMP Set Pt
200/208	11	0	0	1	1	208	12.6
200/208	22	1	1	1	1	208	23.8
230	11	1	1	0	1	240	10.5
230	22	0	1	1	1	240	20.3
380/400/415	11	0	1	1	0	400	6.3
380/400/415	22	0	0	1	1	400	12.6
460	11	1	0	1	0	480	5.5
460	22	1	1	0	1	480	10.5
575	11	0	0	0	0	575	4.2
575	22	0	1	0	1	575	9.8

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SECTION 7 — TROUBLESHOOTING - ALL SYSTEMS

SECTION 7 TROUBLESHOOTING - ALL SYSTEMS

Use this section to assist in troubleshooting your unit. Also refer to the alarms section. Suggestions are grouped by product function for convenience.

WARNING

Only qualified personnel should perform service on these units. Lethal voltage is present in some circuits. Use caution when troubleshooting with power on. Disconnect and lock out power before replacing components. Use caution and standard procedures when working with pressurized pipes and tubes.

Caution

When using jumpers for troubleshooting, always remove jumpers when maintenance is complete. Jumpers left connected could override controls and cause equipment damage.

SYMPTOM	POSSIBLE CAUSE	CHECK OR REMEDY
7.1 BLOWER		
Blower will not start	No main power	Check L1, L2 and L3 for rated voltage.
	Blown fuse or tripped circuit breaker (CB)	Check fuses or CBs to main fan.
	Overloads tripped	Push reset button on main fan overload. Check amp draw.
	No output voltage from transformer	Check for 24 VAC between P24-2 and P24-1. If no voltage, check primary voltage.
	Control fuse blown or circuit breaker tripped	Check for 24 VAC between P4-4 and E1. If no voltage, check for short. Replace fuse or reset circuit breaker.
	Start switch S1 not making contact (SM only)	Jumper P9-1 to P9-2. Unit should start. If unit stops after jumper is removed, replace S1.
Blower runs but controls will not operate	Relay R1 not making contact (Standard Controls only)	Check for 24 VAC between P36-9 and P36-10. If voltage is not present, R1 is not receiving power.
		Check air switch. Jumper P36-4 to P36-7. If R1 closes, air switch is not closing (check for blower rotation, loose wiring, and pinched tubing). Remove jumper.

SYMPTOM	POSSIBLE CAUSE	CHECK OR REMEDY
Blower runs but controls will not operate	Relay R1 not making contact (Standard Controls only)	Check for 24 VAC between P4-1 and E1. If the voltage is present and R1 is not making contact, replace R1.
7.2 CHILLED WATER		
Chilled water or hot water-/steam valve not opening	Motor operates but valve won't open	Check linkage for adjustment and be sure that it is tight on the valve.
Modulating Motors	No 24 VAC power to motor	Check TR to TR on motor for 24 VAC.
	No signal from control	Check DC voltage on printed circuit board in motor. Terminal No. 1 is ground and No. 3 is positive. DC voltage should vary from 0.8 to 2.0 VDC or above as temperature control is varied below room temperature on cooling valve or above room temperature on heating valve.
	Motor not working	Remove wires on terminal No. 1 and No. 3 from the motor (do not short). With 24 VAC power from TR to TR, jumper terminal 1 and 2 on motor to drive open. Remove jumper to drive closed. If motor fails to work, replace it.
Actuator Motors	No 24 VAC power to motor	Check for 24 VAC between P22-3 and P22-5 (open), or P22-1 and P22-5 (closed).
7.3 COMPRESSOR AND REFRIGERATION SYSTEM		
Compressor will not start	Power off	Check main switch, fuses or CBs, and wiring.
	Current overload open	Reset manually.
	Loose electrical connections	Tighten connections.
	Compressor motor burned out	Check and replace compressor if defective.
Compressor will not operate, contactor not pulling in	No call for cooling	Check monitor status.
	Solenoid valve not energizing	Hold screwdriver over solenoid and check for magnetic field. This indicates solenoid is energized.
	Low pressure switch not making contact	Check gas pressure - manually energize low pressure switch.

SYMPTOM	POSSIBLE CAUSE	CHECK OR REMEDY
Compressor will not operate, contactor not pulling in	High pressure switch open	Reset switch. Refer to other refrigeration troubleshooting suggestions.
Compressor contactor pulled in but compressor will not operate	Blown fuse or tripped CB	Check for line voltage after fuses or CBs, and after contactors.
Compressor runs for three minutes then stops; contactor drops out	Low pressure switch not closing	Check for low gas pressure. Compressor is running on Positive Start Kit (air cooled systems only).
	Solenoid not opening	Check magnetic field to see if energized.
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.
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.
	Faulty head pressure control valve or condenser fan speed control	Replace if defective.
Low suction pressure	Insufficient refrigerant in system	Check for leaks, repair, and add refrigerant.
	Dirty air filters	Change filters.
	Plugged filter-drier	Replace filter.
	Improper superheat adjustment	Reset expansion valve for 10-15°F superheat.
	Defective expansion valve sensing element	Replace element.
	Poor air distribution	Check duct work for closed dampers. Check for underfloor restrictions at or near the unit.

SYMPTOM	POSSIBLE CAUSE	CHECK OR REMEDY
Low suction pressure	Low condensing pressure	Check head pressure control device.
	Slipping belts	Inspect and adjust.
Flooding	Defective or improperly set expansion valve	Increase superheat or replace valve.
	Evaporator fan motor or belt problem	Correct problem or replace fan motor and/or belts.
	Low condensing pressure	Check head pressure control device.
	Slipping belts	Inspect and adjust.
Blown valve plate or cylinder head gaskets	Liquid refrigerant floodback or flooded start	See Symptom: Flooding.
Low compressor capacity or inability to pull down system	Blown valve plate or cylinder head gasket	Replace gaskets. Retorque cylinder head bolts to compressor manufacturer's specs.
	Leaky valve plates or worn valve seats	Replace valve plate assembly.
	Leaky suction valves	Pump down, remove cylinder head, examine valves and valve seats. Replace if necessary.
	Broken connecting rods or pistons	Replace compressor.
	Leaking liquid line solenoid valve or dirt in valve	Replace valve if clean; clean out valve if dirty.
Compressor noisy	Slugging due to floodback of refrigerant	See Symptom: Flooding.
	Bearings wiped because of loss of oil	See Oil Pressure. Check for defective oil failure control.
	Loose compressor or piping support	Tighten clamps.
	Broken connecting rods, valves, or other running gear	Replace compressor.
Pipe rattle	Loose pipe connections	Check pipe connections.
Compressor running hot	Blown valve plate or cylinder head gasket	See Symptom: Blown Valve Plate.
	Broken suction or discharge valve	Replace valves and valve plate, if necessary.
	Compression ratio too high	Check setting of high and low pressure switches. Check condenser — is it plugged? Check that all evaporator and condenser fans are operating properly.

SYMPTOM	POSSIBLE CAUSE	CHECK OR REMEDY
Compressor running hot	Excessive blow-by into crankcase — worn rings, valves, or blown gasket	Replace gasket, valve plate, or compressor
Compressor cycles intermittently	Low-pressure switch erratic in operation	Check tubing to switch to see if clogged or crimped. Check for proper switch operation.
	Insufficient refrigerant in system	Check for leaks, fix, and add refrigerant.
	Suction service valve closed	Open valve.
	Insufficient water flowing through condenser or clogged condenser, or dirty air cooled condenser coils	Adjust water regulating valve to condenser. Clean condenser.
	Discharge service valve not fully open	Open valve.
Compressor continually cycles	Faulty low pressure switch	Repair or replace.
	Dirt or restriction in tubing to pressurestat	Check and clean tubing.
	Defective liquid line solenoid valve	Check valve and solenoid operator; replace if necessary.
	Plugged filter-drier	Replace filter.
Compressor motor protectors tripping or cycling	High discharge pressure	Check for loss of condenser water or blocked condenser fan or coil.
	Defective overload relay	Replace.
	High suction temperature	Reduce suction temperature by expansion valve 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 either condition is 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 and replace valve plates.

SYMPTOM	POSSIBLE CAUSE	CHECK OR REMEDY
Motor burnout	Check control panel for welded contactor contacts or welded overload contacts	Replace defective components.
7.4 DEHUMIDIFICATION		
No dehumidification	Control not calling for dehumidification	Check monitor status.
	Compressor contactor not pulling in	See Compressor Section.
	Compressor won't run; fuse blown or CB tripped	See Compressor Section. Check fuses or CBs and contacts. Check line voltage.
7.5 GLYCOL PUMPS		
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 may be required. Check for proper line voltage (+/- 10%).
	Worn bearings	Replace pump.
Noisy operation	Worn motor bearings	Replace pump.
	Low discharge head	Throttle discharge—improve suction conditions.
	Debris lodged in impeller	Remove cover and clean out.
	Cavitating pumps	Adjust system pressures.
7.6 HUMIDIFIER - INFRARED		
No humidification	Humidifier pan not filling	Check water supply.
		Check fill valve operation.
		Check drain stand pipe adjustment.
		Check for clogged waterline filter.
	Control not calling for humidity	Check monitor status.

SYMPTOM	POSSIBLE CAUSE	CHECK OR REMEDY
No humidification	Humidity contactor not pulling in	Check visually. If contactor is made, check line voltage after contactor and fuses or CBs.
		Check for open humidifier safety stat. Jumper between terminals P35-6 and P35-15. If contactor pulls in, replace safety. Remove jumper.
	Humidifier bulb burned out	Replace bulb. Loosen leads on old bulb. Trim excess lead length on new bulb to avoid shorts.
7.7 HUMIDIFIER - STEAM GENERATING		
False canister full indication	Foaming	Check drain valve to ensure that it drains freely. Check and replace if defective.
		Check water supply. If commercially softened, reconnect to raw water supply. If connected to hot water, reconnect to cold water.
Main 24 VAC fuse or circuit breaker trips	Shorts or loose connections	Check the wiring connections of the 24 VAC circuit.
	Faulty circuit board	Replace the circuit board.
Main fuses blow approximately 15 seconds after unit is activated	Faulty solenoid	Check for magnetic field at coil.
	Conductivity too high	Check amp draw of humidifier on start-up. If it exceeds rated amps, increase setting of the % pot on the circuit board.
	DIP switches set incorrectly	Check that DIP switches are set in accordance with table under Circuit Board Adjustments in Section 6 of this manual.
Main fuses blow when drain valve is activated	Mineral deposits obstruct drain valve	Check drain valve for obstructions and clean if necessary.
	Faulty solenoid	Check for magnetic field at coil.
	Faulty circuit board	Replace circuit board.
Unit ON, humidifier will not operate	Humidifier not receiving power	Verify that RUN/DRAIN switch is in the RUN position.
		Check fuses or CBs and replace or reset if necessary.
		Make sure molex connector is securely plugged into circuit board and that no wires are loose.

SYMPTOM	POSSIBLE CAUSE	CHECK OR REMEDY
Contactor pulled in, but no water enters canister	No water available to unit	Check external shut-off valves.
	Clogged fill line strainer	Clean or replace fill line strainer.
	Wiring breaks or loose connections	Check for faulty wiring and loose connections.
	Faulty circuit board	Replace circuit board.
Water enters canister, but canister full circuit activates at a low water level	Foaming	Check drain valve and water supply.
	Canister full interface connections incorrect	Check connection on component plate in humidifier cabinet. Terminal #1 on the square block interface device must be connected to L2 of the power terminal block. L2 must also be connected to the electrode closest to the steam outlet port. Verify that the red wire from terminal #2 on the interface connects to the red top terminal on the canister. This is the one farthest from the steam outlet port and is the high water sensor probe.
	Full isolation has broken down	Remove red canister full wire from canister. If normal operation resumes, canister must be replaced. Remove the wire from terminal #3 on the interface. If normal operation resumes, canister full interface must be replaced.
	Drain assembly not operating freely	Check and replace coil or valve if necessary.
	Faulty circuit board	Replace circuit board.
Canister fills but overflows	Canister full circuit does not activate	Check wiring of canister full interface. Replace circuit board.

SYMPTOM	POSSIBLE CAUSE	CHECK OR REMEDY
Excessive arcing in the canister	Drain valve clogged or defective	Verify that drain valve operates freely when activated. Clean valve and replace coil or valve if defective. Flush canister several times and replace if arcing persists.
	Improper water supply	If water is commercially softened, reconnect humidifier to raw water supply, drain canister, and restart. If connected to hot supply, reconnect to cold water.
	Insufficient drain rate	Increase drain rate by adjusting % pot on circuit board above the preset 70% to roughly 80%.
	Excessive iron content in water	Analyze iron content of water. If it exceeds 0.1 mg/l, install a filter to remove iron from water supply.
On cold start-up, canister fills, high water alarm activates and humidifier fails to reach full amperage	Conductivity of water too low	Drain canister and add one Alka-Seltzer tablet to canister. Refill. Turn the % pot to roughly 60%. Restart humidifier. If amperage rises rapidly, it may be necessary to dilute the water to prevent blown fuses. If it rises too slowly, add another Alka-Seltzer tablet.
	Fill solenoid not closing tightly	If humidifier returns to canister full condition, verify that the fill solenoid closes tightly.
7.8 REHEAT		
Reheat will not operate; contactor not pulling in	Control not calling for heat	Check monitor status.
	Reheat safety stat open	Jumper between terminals P34-1 and P34-2. If reheat operates, safety is open. Remove jumper. Replace safety.
Reheat not operating; contactor pulling in	Heater burned out	Turn off power and check heater continuity with Ohm meter.

MONTHLY MAINTENANCE INSPECTION CHECKLIST

DATE: _____ PREPARED BY: _____

MODEL #: _____ SERIAL #: _____

Filters

- ☐ Restricted air flow
- ☐ Check filter switch
- ☐ Wipe section clean

Blower Section

- ☐ Impellers free of debris and move freely
- ☐ Check belt tension and condition
- ☐ Bearings in good condition
- ☐ Check fan safety switch operation
- ☐ Check pulleys and motor mounts

Compressor

- ☐ Check oil levels
- ☐ Check for leaks

Air Cooled Condenser (if applicable)

- ☐ Condenser coil clean
- ☐ Motor mounts tight
- ☐ Bearings in good condition
- ☐ Refrigerant lines properly supported

Steam Generating Humidifier

- ☐ Check canister for deposits
- ☐ Check condition of steam hoses
- ☐ Check water make-up valve for leaks

Infrared Humidifier

- ☐ Check pan drain for clogs
- ☐ Check humidifier lamps
- ☐ Check pan for mineral deposits
- ☐ Check water make-up valve for leaks

Refrigeration Cycle/Section

- ☐ Check refrigerant lines
- ☐ Check for moisture (sight glass)
- ☐ Check suction pressure
- ☐ Check head pressure
- ☐ Check discharge pressure
- ☐ Check hot gas bypass valve
- ☐ Check thermostatic exp valve

Air Distribution Section

- ☐ Restriction in grille free area

Refrigerant Charge

- ☐ Check refrigerant level

NOTES: _____

_____

_____

_____

_____

SIGNATURE _____

MAKE PHOTOCOPIES OF THIS FORM FOR YOUR RECORDS

SEMI-ANNUAL MAINTENANCE INSPECTION CHECKLIST

DATE: _____ PREPARED BY: _____

MODEL #: _____ SERIAL #: _____

Filters

- ☐ Restricted air flow
- ☐ Check filter switch
- ☐ Wipe section clean

Blower Section

- ☐ Impellers free of debris and move freely
- ☐ Check belt tension and condition
- ☐ Bearings in good condition
- ☐ Check fan safety switch operation
- ☐ Check pulleys and motor mounts

Compressor

- ☐ Check oil levels
- ☐ Check for leaks

Air Cooled Condenser (if applicable)

- ☐ Condenser coil clean
- ☐ Motor mounts tight
- ☐ Bearings in good condition
- ☐ Refrigerant lines properly supported

Water/Glycol Condenser (if applicable)

- ☐ Copper tube clean
- ☐ Water regulating valves function
- ☐ Glycol solution
- ☐ Check for water/glycol leaks

Glycol Pump

- ☐ Glycol leaks
- ☐ Pump operation

Steam Generating Humidifier

- ☐ Check canister for deposits
- ☐ Check condition of steam hoses
- ☐ Check water make-up valve for leaks

Infrared Humidifier

- ☐ Check pan drain for clogs
- ☐ Check humidifier lamps
- ☐ Check pan for mineral deposits
- ☐ Check water make-up valve for leaks

Refrigeration Cycle/Section

- ☐ Check refrigerant lines
- ☐ Check for moisture (sight glass)
- ☐ Check suction pressure
- ☐ Check head pressure
- ☐ Check discharge pressure
- ☐ Check hot gas bypass valve
- ☐ Check thermostatic exp valve

Air Distribution Section

- ☐ Restriction in grille free area

Refrigerant Charge

- ☐ Check refrigerant level

Electrical Panel

- ☐ Check fuses
- ☐ Check electrical connections
- ☐ Check operation sequence

NOTES: _____

_____

_____

SIGNATURE _____

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