



Deluxe System 3 Level 1-2-3 Controls

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System Description

Liebert manufactures 5 families of Deluxe System/3 environmental control systems. Each can operate on any of the three levels of control processors (except FOUR STEP systems). A brief overview of each describes the operational differences of the systems.

1. Compressorized Systems

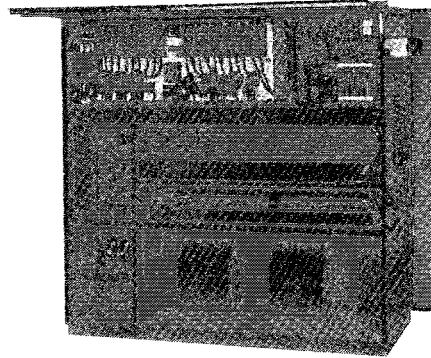
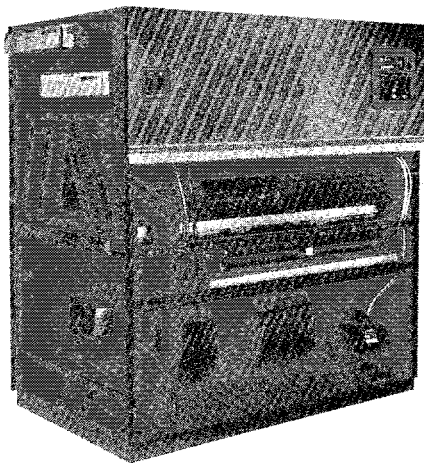
These systems may be air, water or glycol cooled depending upon the heat rejection method selected.

COOLING Two stages of mechanical refrigeration

HEATING Three stages of electric reheat standard; Steam/Hot Water optional Hot Gas on water and glycol cooled systems

HUMIDIFICATION Infrared humidification standard; Steam optional

DEHUMIDIFICATION Utilizes the lag compressor



3. Chilled Water Systems

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

COOLING Proportional in response to room needs

HEATING Three stages of electric reheat standard; Steam/Hot Water optional

HUMIDIFICATION Infrared humidification standard; Steam optional

DEHUMIDIFICATION Chilled Water valve opens proportionally in response to room needs

2. FOUR STEP systems

The FOUR STEP system has all the features of a compressorized or GLYCOOL system plus cylinder unloaders on one head of each of the compressors. This permits the compressors to operate at reduced capacity and increases energy efficiency during low-load conditions. The system responds to increasing room load with 4 steps of cooling.

COOLING (If provided) GLYCOOL or FE proportional cooling.

(Step 1) Lead compressor at reduced capacity

(Step 2) Lead and lag compressor at reduced capacity

(Step 3) Lead compressor at full capacity, lag compressor at reduced capacity

(Step 4) Lead and lag compressor at full capacity

HEATING Three stages of electric reheat standard; Hot water/steam optional

HUMIDIFICATION Infrared humidification standard; steam optional

DEHUMIDIFICATION Utilizes the lag compressor at full capacity

FOUR STEP systems operate with the standard control processor only.

4. GLYCOOL Systems

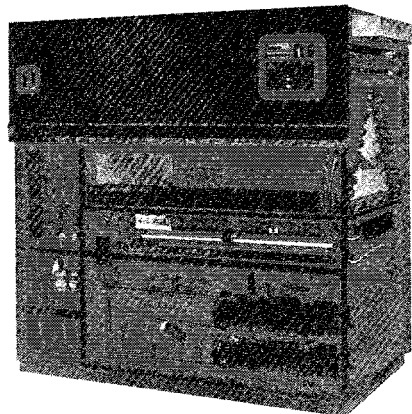
GLYCOOL systems have all the features of a compressorized water or glycol system, plus a second cooling coil that is connected into the glycol or water circuit. When fluid temperature is sufficiently low (below room temperature), cooling is provided by circuiting the fluid through the econ-o-coil. Flow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

COOLING Econ-o-coil valve opens proportionally to match room needs (primary). Two stages of mechanical refrigeration (secondary)

HEATING Three stages of electric reheat standard

HUMIDIFICATION Infrared humidification standard

DEHUMIDIFICATION Utilizes the lag compressor



5. Series FE Dual Source Cooling

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 and is the primary source of cooling and dehumidification so compressor operation is reduced.

COOLING FE coil opens proportionally in response to room needs (primary). Two stages of mechanical refrigeration (secondary)

HEATING Three stages of electric reheat standard

HUMIDIFICATION Infrared humidification standard

DEHUMIDIFICATION (Level 0 & 1)

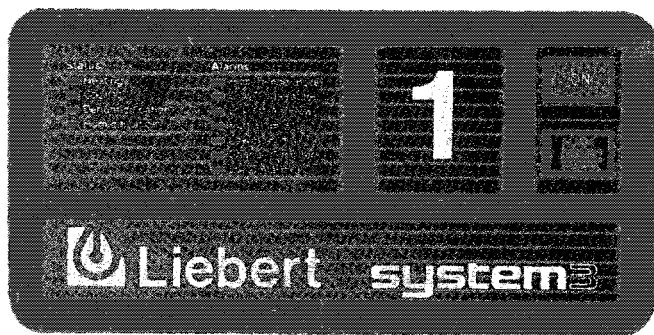
Utilizes the lag compressor

(Level 2 & 3) FE coil opens proportionally to match room needs

Start-Up Procedure

Before beginning start-up, make certain that unit has been installed according to the instructions in the Installation Manual. All exterior panels must be properly in place with the main accent panel and the dead front panel opened.

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 Main Fan and Control Voltage Transformer fuses at the far right of the electrical panel.
4. Install temperature and humidity sensors in mating sockets on top of electrical panel compartment (humidity sensor toward front).
5. Turn on main breaker and check line voltage on main unit disconnect switch. **Line voltage must be within 10% of nameplate voltage.**
6. Turn ON main unit disconnect switch and check secondary voltage at transformers T5 and T115. **Voltage at T5 must be $24v \pm 2.5v$; T115 must be $115v \pm 12v$.**
7. Push ON button. Blower will start and ON lamp will light.
8. Air movement will cause Fan Safety Switch to energize relay R1 and power transformers T2, T3 & T4. Check secondary voltage at each transformer. **Voltage should be $24v \pm 2.5v$.**
9. Set temperature and humidity setpoints and sensitivity, alarm parameters and other control functions.
10. Turn OFF main unit disconnect and main breaker. Unit ON button should be OFF.
11. Replace all fuses.
12. Restore power to unit; Turn ON main unit disconnect switch.
13. Push ON button putting unit into operation.



Monitoring and Control Options

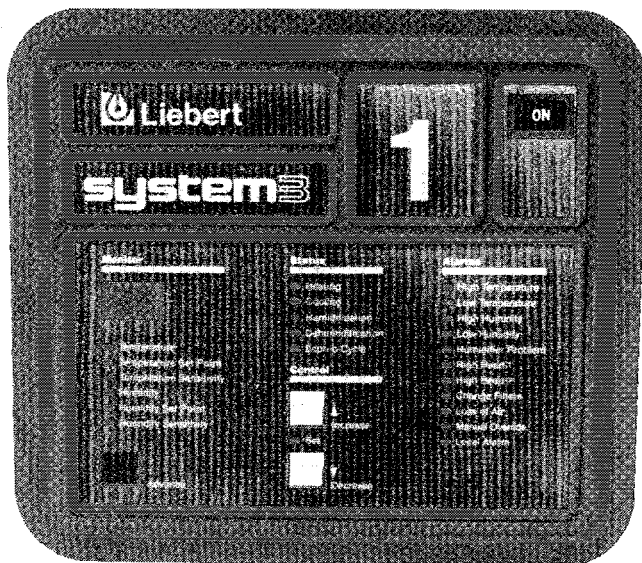
Standard Control Processor (Level 00)

- Monitoring, Alarms at Front Panel
- Control on Circuit Board
- Communication with Sitemaster Monitor



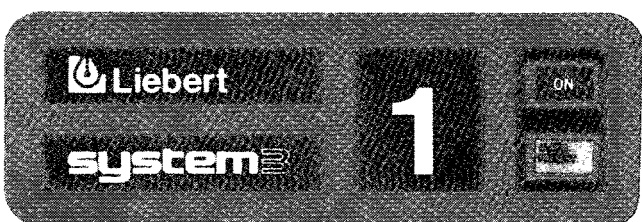
Optional Control Processor (Level 01)

- Monitoring, Control and Alarms at Local Monitor
- Communication with Sitemaster Monitor



Extended Control Processor (Level 03) with Local Monitor

- Energy Saving Enhancements
- Control, Monitoring and Alarms at Local Monitor, Sitemaster and Service Terminal



Extended Control Processor (Level 02)

- Monitoring, Control and Alarms at Liebert Sitemaster and Service Terminal
- Energy Saving Enhancements

| | |
|--|-----------|
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Controls Operation-Standard Control Processor

FRONT MONITOR PANEL

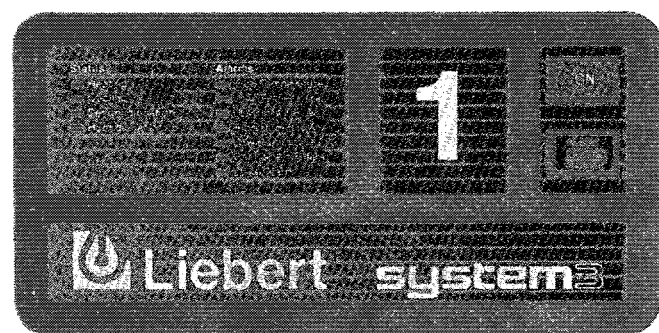
The front monitor of the Standard Control Processor displays operating status and alarm conditions of the Deluxe System/3. The panel is located on the front of the unit on the accent panel. Behind the accent panel, is the numerical display and control buttons. This provides monitoring and control of the system.

STATUS LEDS

The current operating mode of the Deluxe System/3 is indicated by LED's in the STATUS section. Cooling, reheat, humidification and/or dehumidification are indicated.

ALARM LEDS

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



NUMERICAL DISPLAY

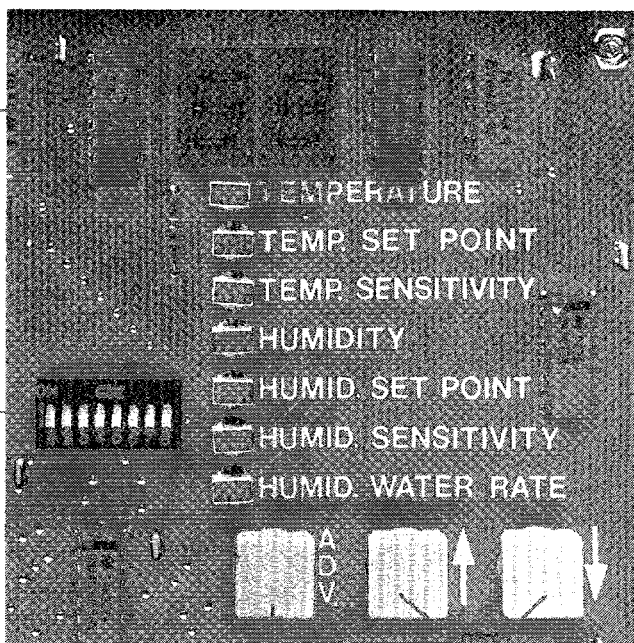
The numerical display on the microprocessor board will indicate: Current Temperature, Temperature Setpoint, Temperature Sensitivity, Current Humidity, Humidity Setpoint, Humidity Sensitivity and Humidifier Water Rate. The value being displayed is indicated by LED's below the display.

Advance Button

Pressing the ADV button will step the Numerical Display through the seven LED indicators.

Control Buttons

Two control buttons are used to change the setpoints displayed in the Numerical Display. The ▲ button will increase the value displayed and the ▼ button will decrease the value.

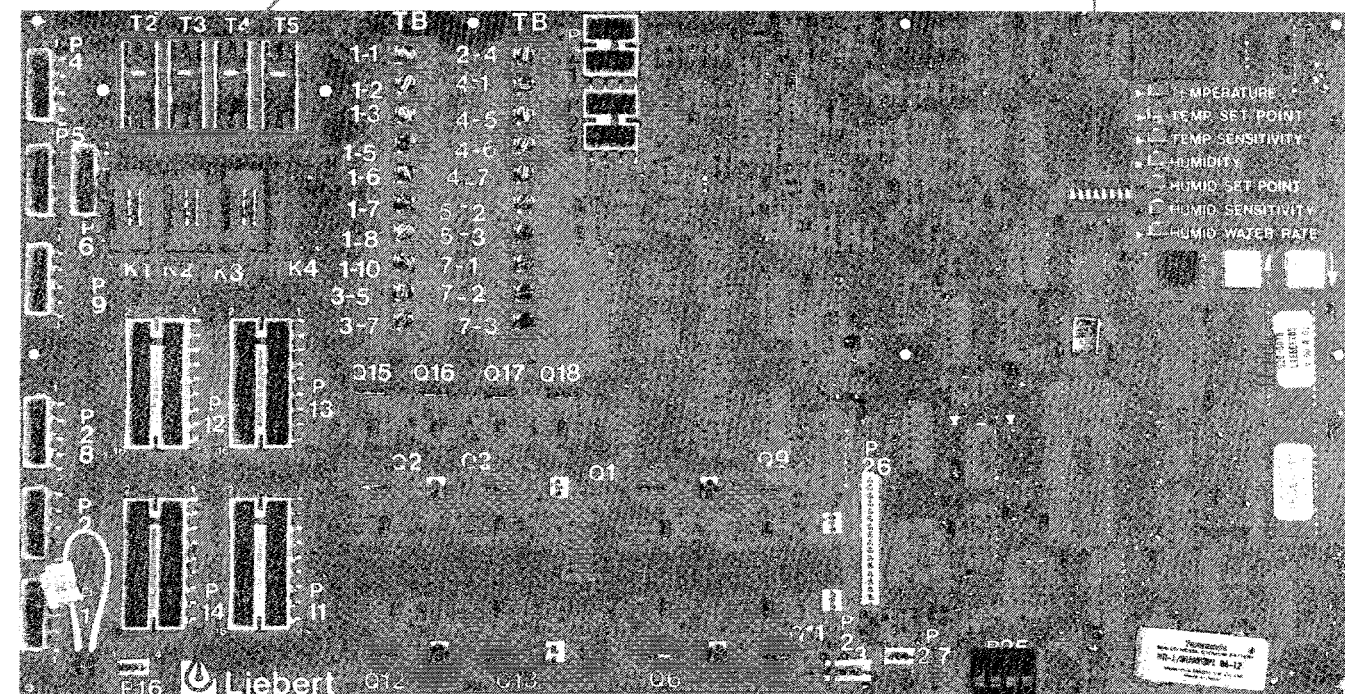


NUMERICAL DISPLAY

CONTROL SWITCHES

CONTROL BUTTONS
ADVANCE BUTTONS

CIRCUIT BREAKERS



MANUAL OVERRIDE

TEMPERATURE/HUMIDITY SETPOINTS AND SENSITIVITY

The Control buttons on the Microprocessor board are used to adjust temperature and humidity setpoints and sensitivities. The board is located behind the accent panel and is separated from all high voltage components.

TEMPERATURE SETPOINT

Use the ADV button to select Temperature Setpoint. The Numerical Display will indicate the current setpoint. Use the ▲ or the ▼ to select the desired setpoint (65–85°F/18–29°C).

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 $\pm 5^\circ\text{F}$ / ± 1 to $\pm 3^\circ\text{C}$ in 1° increments. Use the ADV button to select Temperature Sensitivity. The Numerical Display will indicate the current sensitivity. Use the ▲ or the ▼ button to select the desired sensitivity.

HUMIDITY SETPOINT

Use the ADV button to select Humidity Setpoint. The Numerical Display will indicate the current setpoint. Use the ▲ or the ▼ to select the desired setpoint (40–60% RH in 1% increments).

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 $\pm 1\%$ to $\pm 10\%$ RH in 1% increments.

Use the ADV button to select Humidity Sensitivity. The Numerical Display will indicate the current sensitivity. Use the ▲ or the ▼ button to select the desired sensitivity.

NOTE: The selection of Temperature and Humidity setpoints and sensitivities will determine high and low temperature and humidity alarm parameters. Refer to ALARM section.

HUMIDIFIER WATER RATE

See Autoflush section for description and programming instructions.

FOUR-STEP COOLING SYSTEM

On units equipped with the four-step cooling system, the Deluxe System/3 will respond to changing load conditions in the computer room by energizing the two compressors in 4 steps. This is accomplished by cylinder unloaders on one head of each compressor that reduces 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 an econ-o-coil is provided (GLYCOOL), it is activated prior to any compressor steps. Dehumidification is accomplished by energizing the lag compressor, fully loaded. Drycooler and Glycol Pump operate continuously.

ALARM SYSTEM

TEMPERATURE AND HUMIDITY ALARMS

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

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 NUMERICAL DISPLAY).

To access SET MODE 2:

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

| Normal Functions | SET MODE 2 Functions |
|--------------------|--|
| TEMPERATURE | COMPRESSOR SEQUENCE SELECTION |
| TEMP. SET POINT | HIGH TEMPERATURE ALARM (setpoint + sensitivity + 4°F min to 90°F/32°C max) |
| TEMP. SENSITIVITY | LOW TEMPERATURE ALARM (setpoint - sensitivity - 5°F min to 35°F/2°C max) |
| HUMIDITY | NOT USED |
| HUMID. SET POINT | HIGH HUMIDITY ALARM (setpoint + sensitivity + 5% min to 65% RH max) |
| HUMID. SENSITIVITY | LOW HUMIDITY ALARM (setpoint - sensitivity - 5% min to 35% RH max) |
| HUMID. WATER RATE | NOT USED |

To set Temperature and Humidity alarms:

1. Use the ADVANCE button to select the desired function.
2. Use the ▲ and the ▼ button to increase or decrease the value shown on the NUMERICAL DISPLAY.

To return to Normal Set Mode:

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

SYSTEM ALARMS

Change Filters

The Filter Change Switch senses the pressure drop across the air filters and activates the Change Filter and audible alarm when the pressure drop reaches a customer pre-set level. (See Page 30 for setting instructions)

Loss of Air Flow

The Fan Safety switch is located on the high voltage panel and consists of a diaphragm switch and inter-connecting tubing to the blower scroll. The normally-open contacts of the switch will close at a factory pre-set air velocity and energize the Control Voltage Relay (See Page 30). 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 pressure cut-out switch will activate the ALARMS PRESENT light and the audible alarm at the cut-out setting of the compressor pressure switches.

Water Under Floor

The Liebert Liqui-Tect sensor (optional) consists of a solid-state switch that closes when water (or other conductive liquid) is detected by the twin sensor probes. The sensor may be mounted wherever water problems may occur. When water is detected, the ALARMS PRESENT light and the audible alarm will be activated. (See Page 28 for details)

Local Alarm

This is a customer accessible alarm indication. The remote alarm must be a normally open/non-powered contact, field connected at the terminal strip (on the wire raceway in the compressor compartment of the Deluxe System/3) at terminals 24 and 50.

COMMON ALARM RELAY

On any alarm indication, the common alarm relay is energized closing the non-powered contacts to a remote customer supplied alarm. This relay remains energized until all alarm conditions are corrected. See electrical schematic for connection information.

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

ACTION TAKEN: Control system will activate 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

ACTION TAKEN: Control system will deactivate humidification and dehumidification.

CONTROL FEATURES

COMPRESSOR POSITIVE START FEATURE

All compressorized models are equipped with a positive start feature. This electronically bypasses 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. Both stages of cooling have this feature.

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

MANUAL OVERRIDE

It is possible to manually override the microprocessor and manually activate Cooling 1 & 2, Reheat 1, 2 & 3, Humidification and Dehumidification. This is accomplished by jumpering the desired set of contacts with a factory-supplied jumper. Use the photo below 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 |
|------------------|--|
| Q1 | Reheat 3 |
| Q2 | Reheat 2 |
| Q3 | Reheat 1 |
| Q6 | Liquid Line Solenoid Valve 1 (DX Only) |
| Q9 | Liquid Line Solenoid Valve 2 (DX Only) |
| Q11 | Humidification |
| Q12 | Humidifier Water Valve |
| Q13 | Common Alarm Relay |

COMPRESSOR SEQUENCE

The lead/lag sequence of the compressors may be changed to equalize the run time of each. This is accomplished using the NUMERICAL DISPLAY located on the printed circuit board behind the main unit accent panel.

Use the ADV. button to step the display to the TEMPERATURE LED. Press the ▲ and ▼ buttons simultaneously. 1 on the display readout indicates that compressor no. 1 is the lead compressor; 2 indicates that no. 2 is the lead compressor. Use the ▲ or the ▼ to select either compressor no. 1 or no. 2 as the lead compressor.

CONTROL SWITCHES

A set of 8 control switches is provided on the microprocessor board near the Numerical Display. These allow the operator to select options and operating modes.

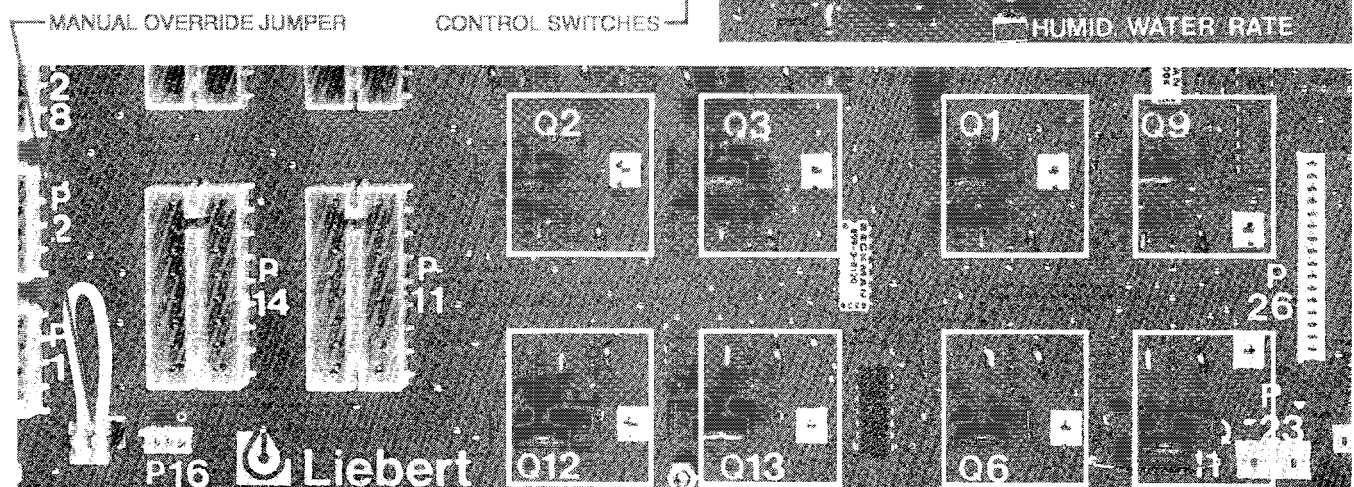
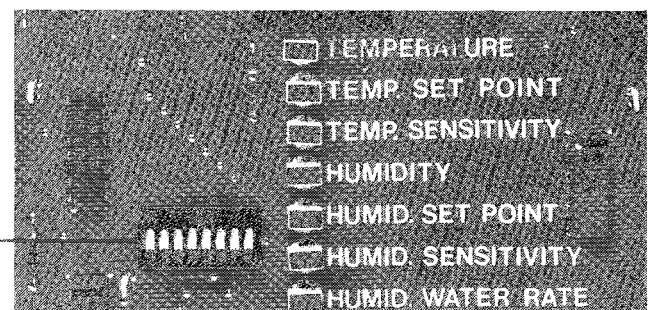
NOTE: The control switches are shipped from the factory in the correct position for each specific model. It is recommended that they not be changed without consulting the factory.

| Switch Number | ON Position | OFF Position |
|---------------|-------------------------------------|--------------------------------------|
| 1 | Staged Reheat | Proportional Reheat |
| 2 | Reheat Available | No Reheat |
| 3* | 2-Step Cooling | 4-Step Cooling |
| 4 | Humidification Available | No Humidification† |
| 5 | Low & High Humidity Alarm Available | Low & High Humidity Alarm Locked Out |
| 6 | Dehumidification Available | No Dehumidification‡ |
| 7 | Sitemaster | Sitemaster Model 200 |
| 8 | Fahrenheit Readout | Celsius Readout |

*With No Humidification Option Selected – Numerical Display will cycle through the top 6 LEDs, skipping the last one.

†With No Humidification and No Dehumidification Options Selected – Numerical Display will cycle through the top 3 LEDs, skipping the last 4.

‡Not used on Chilled Water Models.



MANUAL OVERRIDE CONNECTION POINTS

NOTE: On 4 step cooling models, manual override of cooling will not activate cylinder unloader.

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 pre-set values.

| | |
|-------------------------|----------------------|
| Temperature Setpoint | 75°F |
| Temperature Sensitivity | 3°F |
| Humidity Setpoint | 50% RH |
| Humidity Sensitivity | 3% RH |
| Humidifier Water Rate | 15 (150% water fill) |
| Humidifier Pan Size | Large (2)* |

*If unit is a chilled water model UH/FH 147C, 200C, or 248C or if the unit is 50 Hz model of a UH/FH 75A, 86W or 72G the microprocessor will have to be reprogrammed for the small humidifier pan. This is done by using the Numerical 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 ▲ and the ▼ buttons and hold for 5 seconds.
- 3) The Numerical Display will show "2" (large pan).
- 4) Use the ▼ to decrease from 2 to 1.
- 5) After 15 seconds, the control will revert to the normal operating mode.

SEQUENTIAL AUTO RESTART RELAY

The Sequential Auto Restart Relay will delay the start-up of Deluxe System/3 units after a power failure. The time delay is field adjustable so that multiple units may be restarted at different time intervals to reduce total inrush current to the room.

The relay is located on the high voltage electric panel behind the main accent and the dead front panels.

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



SEQUENTIAL AUTO RESTART RELAY

ADJUSTMENT WHEEL

AUTOFLUSH HUMIDIFIER CLEANING SYSTEM

The Autoflush will periodically flush the humidifier pan with water to prevent the buildup of water minerals due to water saturation. As 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. Operation of the flushing system is then automatic and no further adjustments need to be made.

Operation

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

1. **IF HUMIDIFIER HAS NOT BEEN ACTIVATED FOR OVER 30 HOURS**, the autoflush will flow water into the pan for 30 or 60 seconds (based on size of 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 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 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 allowed to operate for a maximum of 8 to 10 minutes (based on size of pan).
4. After the 8 to 10 minute time delay, the autoflush adds water to the pan to a) replenish the water used in humidification and b) flush the pan of mineral solids. **THIS PERIOD IS ADJUSTABLE** from 110% to 250% in increments of 10%. At the end of this period, the make-up valve is closed. Steps 3 and 4 repeat as long as humidification is required.

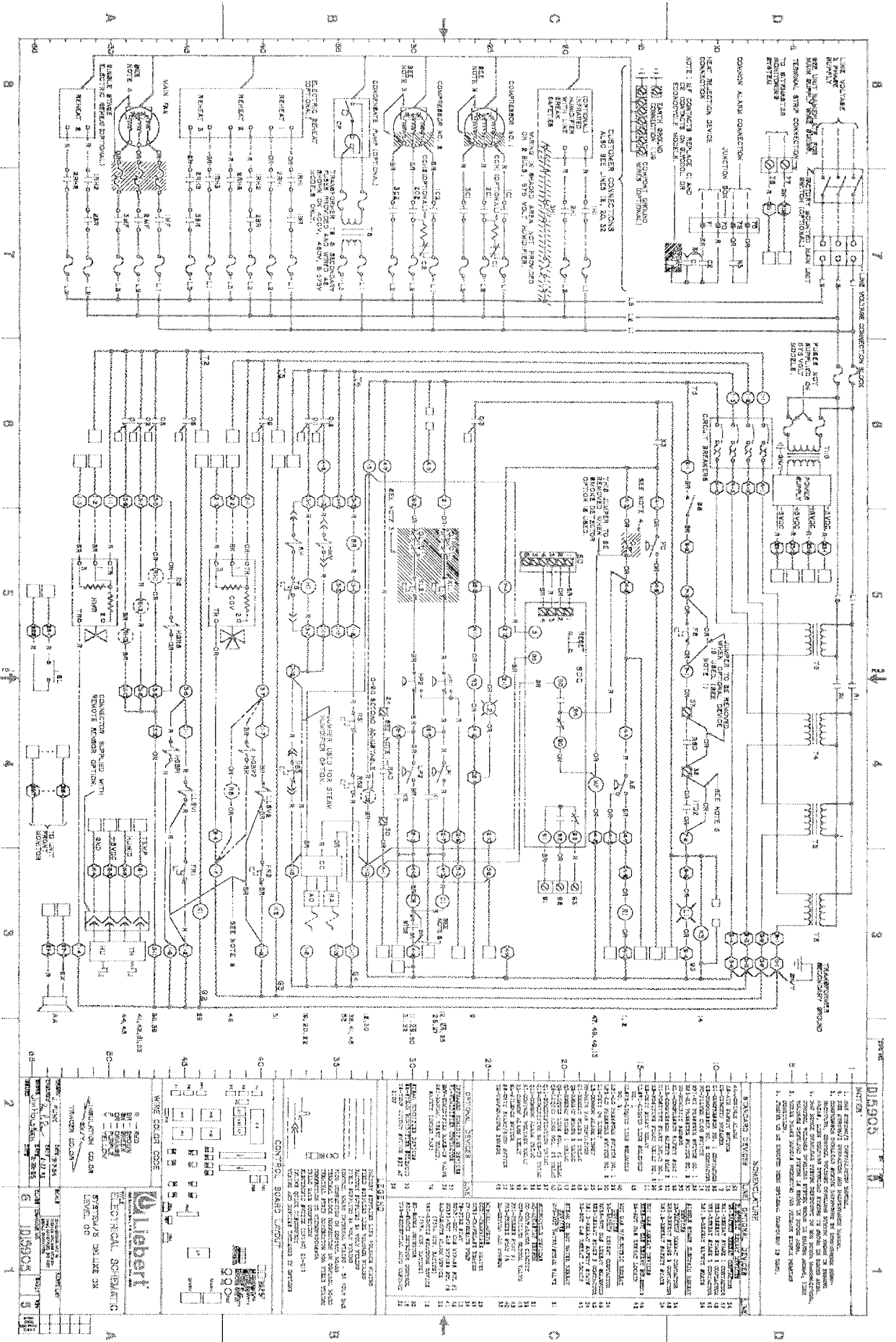
Programming the Autoflush

The Autoflush is programmed using the numerical display and the control buttons just as temperature and humidity setpoints are programmed.

The Numerical Display is located behind the accent panel on the Microprocessor board.

Use the ADV button to select Humid Water Rate. The Numerical Display will indicate the current Humidifier Water rate. Use the ▲ and the ▼ buttons to select the desired flush rate.

Flush rates may be selected from 110% to 250% in increments of 10%. These are displayed as 11 to 25 in increments of 1. Selecting 15 would program the microprocessor for a 150% water flow.



WIRE COLOR CODE

| WIRE COLOR CODE | WIRE COLOR CODE |
|------------------|-----------------|
| 1. RED | 11. BROWN |
| 2. BLUE | 12. BLACK |
| 3. GREEN | 13. WHITE |
| 4. YELLOW | 14. GREY |
| 5. PURPLE | 15. SILVER |
| 6. PINK | 16. GOLD |
| 7. LIGHT BLUE | 17. COPPER |
| 8. LIGHT GREEN | 18. IRIDIUM |
| 9. LIGHT YELLOW | 19. PLATINUM |
| 10. LIGHT PURPLE | 20. RUTHENIUM |

CONTROL BOARD LAYOUT

WIRE COLOR CODE

| WIRE COLOR CODE | WIRE COLOR CODE |
|------------------|-----------------|
| 1. RED | 11. BROWN |
| 2. BLUE | 12. BLACK |
| 3. GREEN | 13. WHITE |
| 4. YELLOW | 14. GREY |
| 5. PURPLE | 15. SILVER |
| 6. PINK | 16. GOLD |
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WIRE COLOR CODE

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| 5. PURPLE | 15. SILVER |
| 6. PINK | 16. GOLD |
| 7. LIGHT BLUE | 17. COPPER |
| 8. LIGHT GREEN | 18. IRIDIUM |
| 9. LIGHT YELLOW | 19. PLATINUM |
| 10. LIGHT PURPLE | 20. RUTHENIUM |

Controls Operation-Optional Control Processor

FRONT MONITOR PANEL

The Optional Control Processor monitor panel is used to set control and alarm parameters as well as display room conditions, operational status and alarm indications.

NUMERICAL DISPLAY

The numerical display will indicate: Room Temperature, Room Humidity, Temperature Setpoint, Temperature Sensitivity, Humidity Setpoint and Humidity Sensitivity. The value being displayed is indicated by one of the six LED's below the display.

ADVANCE BUTTON

Pressing the ADVANCE button will step the numerical display through the six LED indicators. After 30 seconds, if the ADVANCE button is not pressed, the numerical display will return to the Temperature Setpoint indication.

STATUS LED

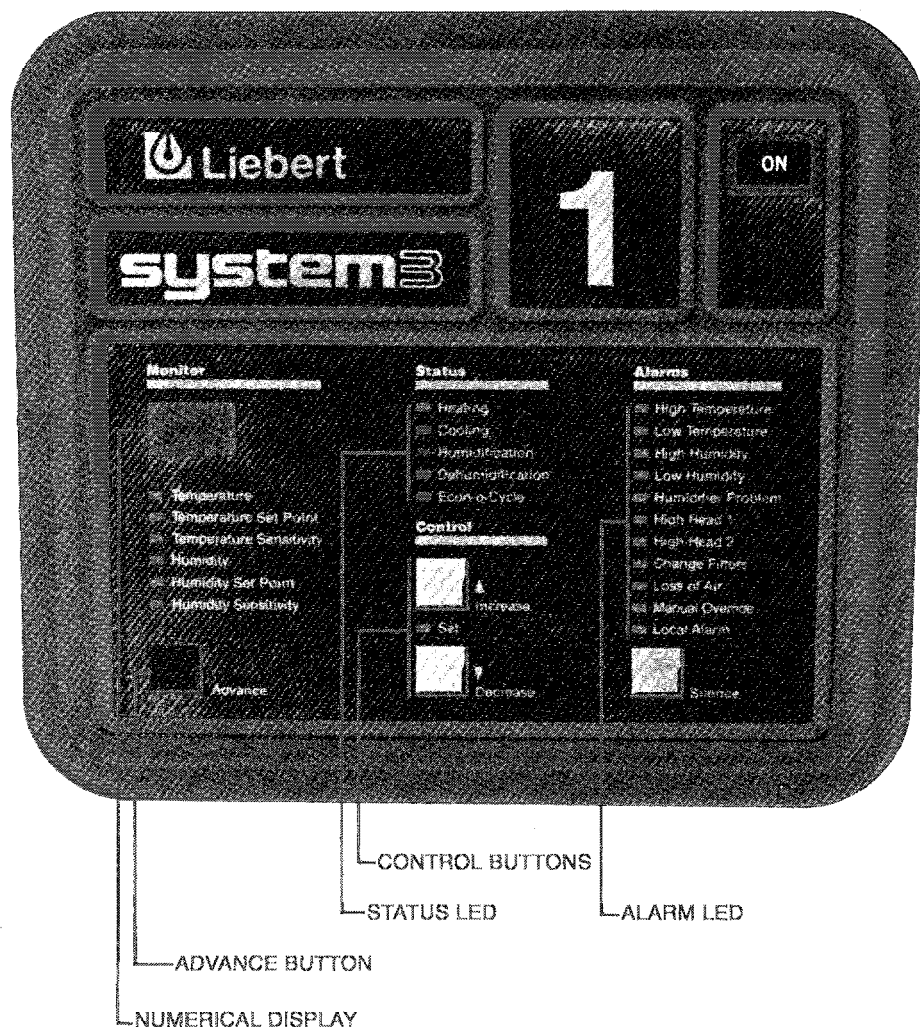
The current operating mode of the Deluxe System/3 is indicated by colored LED's in the STATUS section. Heating, Cooling, Humidification, Dehumidification and/or Econ-o-cycle may be indicated.

ALARM LED

Alarm conditions activate an audible and a visual indicator in the ALARM section. The audible alarm may be silenced by pressing the SILENCE button, but the indicator remains lit until the problem is corrected.

CONTROL BUTTONS

Two control buttons are used to change the temperature and humidity setpoints and sensitivities. The INCREASE button will raise the value selected in the NUMERICAL DISPLAY; the DECREASE button will lower the value selected. These control buttons are not functional until the SET mode has been activated. This requires access to the electronics board. Pressing the SET button on the opto-isolator board activates the SET mode and the LED indicator on the monitor panel. The SET mode will automatically de-activate 30 seconds after the last use.



TEMPERATURE/HUMIDITY SETPOINTS AND SENSITIVITY

To adjust temperature/humidity setpoints and sensitivity, the unit must first be put into the SET mode. This is done by pressing the red SET button on the Opto-Isolator board. This will activate the SET mode and the SET indicator on the monitor panel. The SET mode will automatically de-activate 30 seconds after the last use of the CONTROL buttons.

TEMPERATURE SETPOINT

Use the ADVANCE button on the monitor panel to select **Temperature Setpoint**. The numerical display will display the current setpoint. Use the INCREASE or the DECREASE button to select the desired setpoint (65–85°F/18–29°C in 1° increments).

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 $\pm 5^\circ\text{F}$ / ± 1 to $\pm 3^\circ\text{C}$.

Use the ADVANCE button on the monitor panel to select **Temperature Sensitivity**. The numerical display will display the current sensitivity. Use the INCREASE or the DECREASE button to select the desired sensitivity (1–5°F/1–3°C in 1° increments).

HUMIDITY SETPOINT

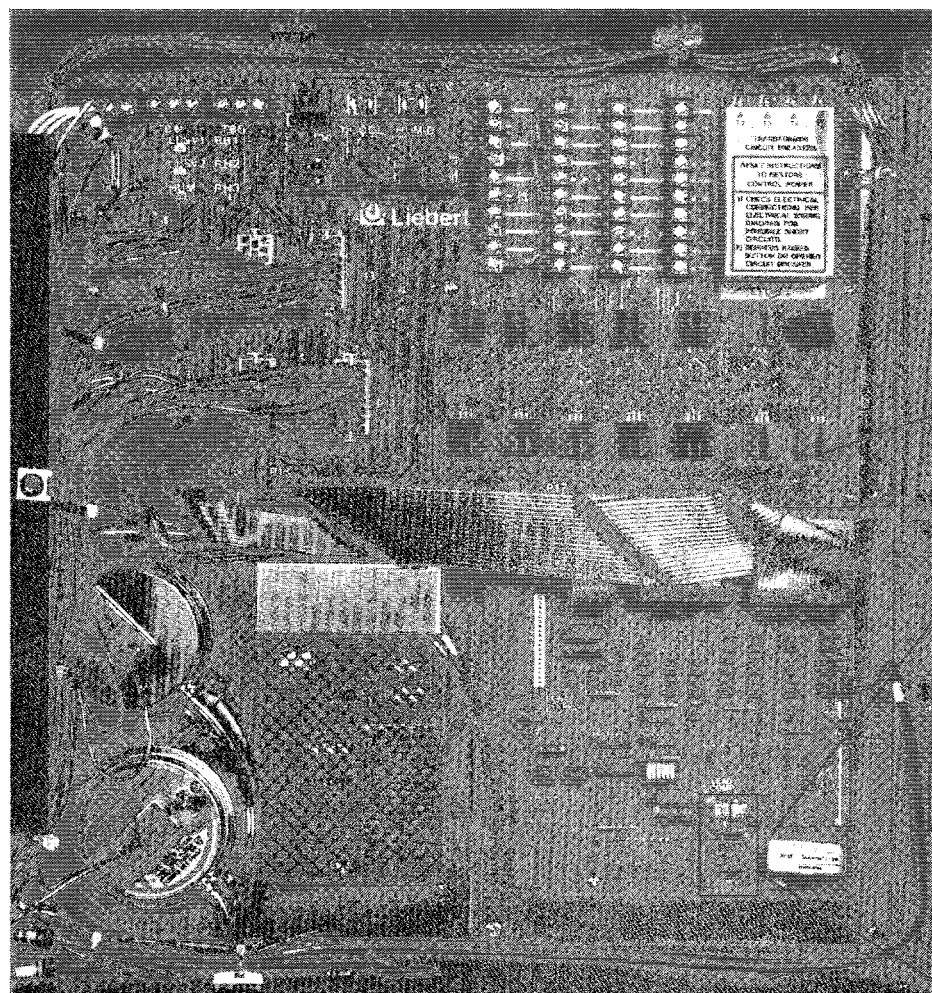
Use the ADVANCE button on the monitor panel to select **Humidity Setpoint**. The numerical display will display the current setpoint. Use the INCREASE or the DECREASE button to select the desired setpoint (40–60% RH in 1% increments).

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.

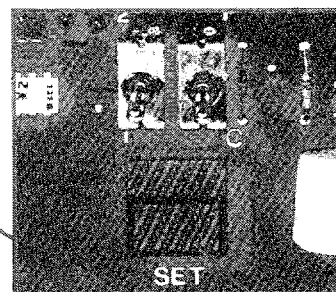
Use the ADVANCE button on the monitor panel to select **Humidity Sensitivity**. The numerical display will display the current sensitivity. Use the INCREASE or the DECREASE button to select the desired sensitivity (1–10% RH in 1% increments).

NOTE: The selection of Temperature/Humidity setpoints and sensitivity will determine high and low temperature/humidity parameters. Refer to ALARM section.



INTERFACE BOARD

OPTO-ISOLATOR BOARD



SET BUTTON

ALARM SYSTEM

TEMPERATURE AND HUMIDITY ALARMS

Temperature and humidity sensors, located in the return air section of the system, constantly monitor room conditions. Should room conditions exceed the selected parameters, a visual and audible alarm will be activated. The audible alarm may be silenced by pressing the SILENCE button, but the visual indicator remains lit and the common alarm relay remains closed until the problem is corrected.

PROGRAMMING

TEMPERATURE AND HUMIDITY ALARMS

The temperature and humidity alarms are programmable using the ADVANCE and CONTROL buttons on the Front Monitor Panel.

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 Front Monitor Panel (below the NUMERICAL DISPLAY).

To access SET MODE 2: (unit must be on)

1. Open the accent panel and press and hold the SET button on the Opto-Isolator board for 5 seconds.
2. The SET LED will begin flashing to indicate SET MODE 2 functions. Release the SET button.

| Normal Functions | SET MODE 2 Functions |
|--------------------|--|
| TEMPERATURE | NOT USED |
| TEMP. SET POINT | HIGH TEMPERATURE ALARM (setpoint + sensitivity + 4°F min to 90°F/32°C max) |
| TEMP. SENSITIVITY | LOW TEMPERATURE ALARM (setpoint - sensitivity - 5°F min to 35°F/2°C max) |
| HUMIDITY | NOT USED |
| HUMID. SET POINT | HIGH HUMIDITY ALARM (setpoint + sensitivity + 5% min to 65% RH max) |
| HUMID. SENSITIVITY | LOW HUMIDITY ALARM (setpoint - sensitivity - 5% min to 35% RH max) |
| HUMID. WATER RATE | NOT USED |

To set Temperature and Humidity alarms:

1. Use the ADVANCE button to select the desired function.
2. Use the ▲ and the ▼ button to increase or decrease the value shown on the NUMERICAL DISPLAY.

NOTE: Entering 0 for the Low Humidity Alarm Value will deactivate all Humidity Alarms.

To return to Normal Set Mode:

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

SYSTEM ALARMS

Humidifier Problem

If a high water level is detected by the two probes located in the left end of the humidifier pan, an audible and visual alarm will be activated and the system will take corrective action by shutting off the flow of water into the pan. There is a 5 second time delay to eliminate nuisance alarms.

High Head Pressure – Compressor 1 & 2

A high pressure switch will activate the High Pressure Alarm at a factory pre-set point.

Change Filters

The Filter Change Switch senses the pressure drop across the air filters and activates the alarm when the pressure drop reaches a customer-set level.

TO ADJUST: 1) Adjust to trip with clean filters
2) Turn adjusting screw clockwise 2½ turns (or to desired filter change point).

Loss of Air

The Fan Safety switch is located on the high voltage panel and consists of a diaphragm switch and interconnecting tubing to the blower scroll. The normally open contacts on the switch will close at a factory preset air velocity and energize the Control Voltage Relay which supplies power to transformers T2, T3 and T4. Upon loss of airflow, the normally closed contacts on the switch will activate the Loss of Air alarm.

Manual Override

This alarm indication means that the manual override mode has been activated. See Control Features, Manual Override.

Local Alarm

This is a customer accessible alarm indication. The remote alarm must be a normally open/non-powered contact, field connected at the terminal strip on the wire raceway in the compressor compartment at terminals 24 and 50.

COMMON ALARM RELAY

On any alarm indication, the common alarm relay is energized closing the non-powered contacts to a remote customer supplied alarm. This relay remains energized until all alarm conditions are corrected. See electrical schematic for connection information.

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

ACTION TAKEN: Control system will activate 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

ACTION TAKEN: Control system will deactivate humidification and dehumidification.

CONTROL FEATURES

COMPRESSOR POSITIVE-START FEATURE

All compressorized models are equipped with a positive start feature. This electronically bypasses 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. Both stages of cooling have this feature. The three minute time delay is factory preset and not field adjustable.

COMPRESSOR SEQUENCE SWITCH

To equalize compressor run times, a compressor sequence switch, located on the Opto-Isolator board, is provided on all compressorized models. With the switch in the UP position, compressor 2 (lower compressor) is the lead compressor. With the switch in the DOWN position, compressor 1 (upper compressor) is the lead compressor.

NOTE: On units with Hot Gas Reheat, the compressor sequence switch must be kept in the DOWN position.

MANUAL OVERRIDE SWITCHES

The standard microprocessor is equipped with manual override switches which enable the operator to manually activate Compressor #1, Compressors #1&2, Humidification or Dehumidification.

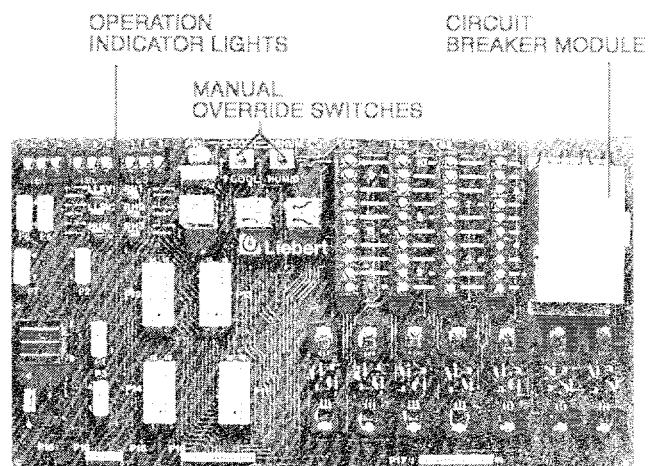
When an override mode is selected:

The Manual Override alarm is activated. The audible alarm may be silenced, but the LED remains lit until the switch is returned to the normal position.

All temperature and humidity control is discontinued, but temperature and humidity values continue to be displayed. Setpoints may be adjusted as normal.

Communication with Sitemaster continues; however, the unit operating status is not displayed.

NOTE: Manual Override of Cooling and Dehumidification cannot be performed on Chilled Water units.



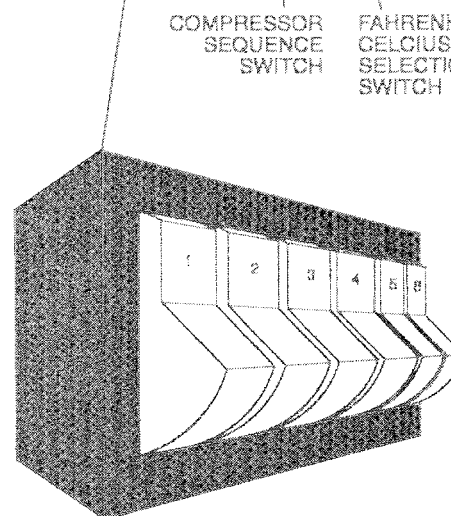
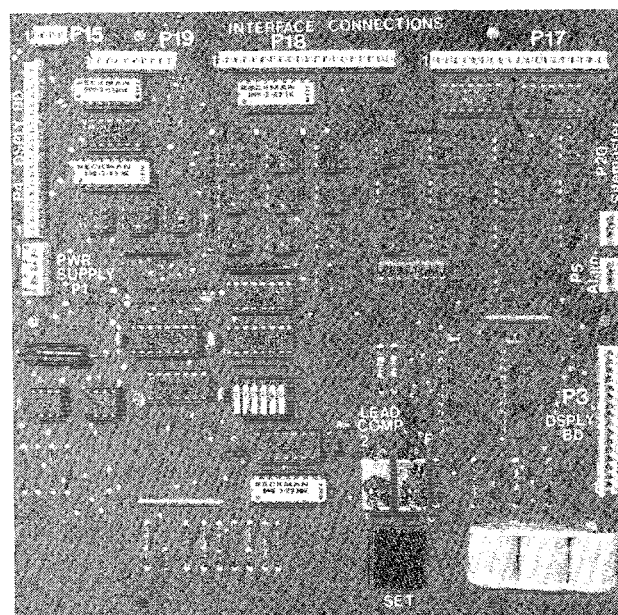
CONTROL SWITCHES

A set of 6 control switches, located on the Opto-Isolator board, allow the operator to select options and operating modes.

NOTE: The control switches are shipped from the factory in the correct position for each specific model. It is recommended that they not be changed without consulting the factory.

| Switch Number | ON Position | OFF Position |
|---------------|-----------------------------|--------------------------------------|
| 1 | Staged Reheat (Electric) | Proportional Reheat (Hot Water) |
| 2 | Reheat Available | No Reheat |
| 3 | Staged Cooling (Compressor) | Proportional Cooling (Chilled Water) |
| 4 | Humidification Available | No Humidification |
| 5 | Small Humidifier Pan | Large Humidifier Pan |
| 6 | Dehumidification Available | No Dehumidification |

OPTO-ISOLATOR BOARD



SEQUENTIAL AUTO RESTART RELAY

The Sequential Auto Restart Relay will delay the start-up of Deluxe System/3 units after a power failure. The time delay is field adjustable so that multiple units may be restarted at different time intervals to reduce total inrush current to the room.

The relay is located on the high voltage electric panel behind the main accent and the dead front panels.

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



SEQUENTIAL AUTO RESTART RELAY

ADJUSTMENT WHEEL

AUTOFLUSH HUMIDIFIER CLEANING SYSTEM

The Autoflush will periodically flush the humidifier pan with water to prevent the buildup of water minerals due to water saturation. As 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. Operation of the flushing system is then automatic and no further adjustments need to be made.

Operation

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

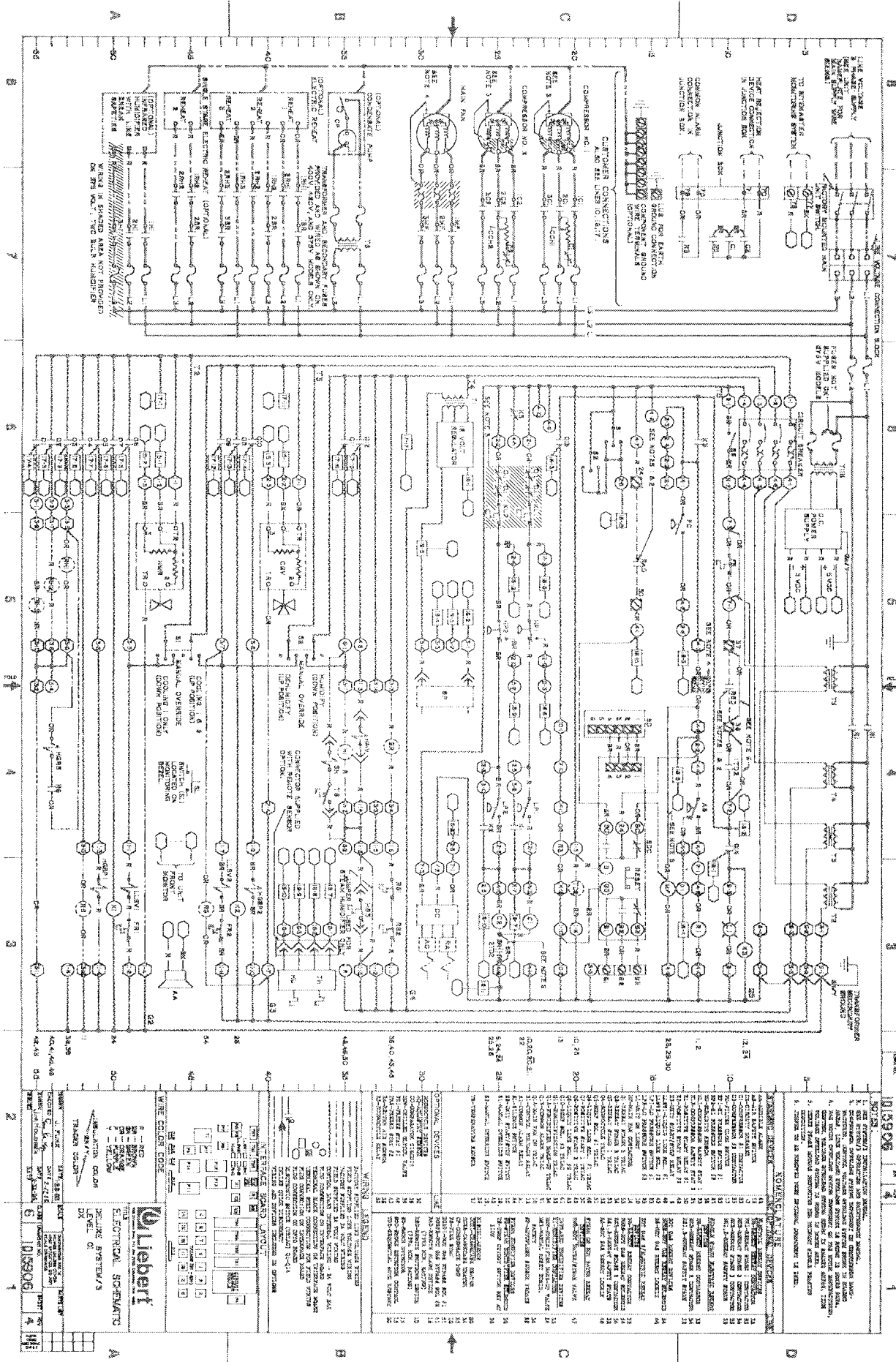
1. **IF HUMIDIFIER HAS NOT BEEN ACTIVATED FOR OVER 30 HOURS**, the autoflush will flow water into the pan for 30 or 60 seconds (based on size of pan). This will provide a minimum amount of water in the pan and prevent heat damage to the humidifier pan. Humidifier Lamps are OFF.
2. **IF HUMIDIFIER HAS 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 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 allowed to operate for a maximum of 8 to 10 minutes (based on size of pan).
4. After the 8 to 10 minute time delay, the autoflush adds water to the pan to a) replenish the water used in humidification and b) flush the pan of mineral solids. **THIS PERIOD IS ADJUSTABLE** from 110% to 250% in increments of 10%. At the end of this period, the make-up valve is closed. Steps 3 and 4 repeat as long as humidification is required.

Programming the Autoflush

The autoflush is programmed using the numerical display and the control buttons just as temperature and humidity setpoints are programmed.

To program the Autoflush:

1. Enter SET MODE 2. Press and hold the SET button located on the Opto-Isolator board behind the top accent panel (see page 13). The SET LED will flash confirming SET MODE 2.
2. Using the ADVANCE button step the LED indicator to HUMIDITY. The Numerical display will indicate the current flush rate. 11 = 110%; 25 = 250%.
3. Use the Increase or the Decrease button to select the desired flush rate. Flush rates may be selected from 110 to 250% in increments of 10% (trailing 0 is not displayed). Selecting 15 would program a 150% water flow.



Controls Operation-Extended Control Processor

FRONT MONITOR PANEL

The Front Monitor panel is used to monitor room conditions, operational status and alarm conditions.

Numerical Display

The numerical display will indicate: Room Temperature, Room Humidity, Temperature Setpoint, Temperature Sensitivity, Humidity Setpoint and Humidity Sensitivity. The value being displayed is indicated by one of the six LEDs below the display.

Advance Button

Pressing the ADVANCE button will step the numerical display through the six monitoring parameters. After 30 seconds, if the ADVANCE button is not pressed, the numerical display will return to the Temperature Setpoint indication.

Status LED

The current operating mode of the Deluxe System/3 is indicated by colored LEDs in the STATUS section. Heating, Cooling, Humidification, Dehumidification and/or Econ-o-cycle (GLYCOOL or Dual-Source Cooling Option) may be indicated.

Alarm LED

Alarm conditions activate a visual indicator in the ALARM section. This indicator will remain lit until the problem is corrected and the alarm system is reset at

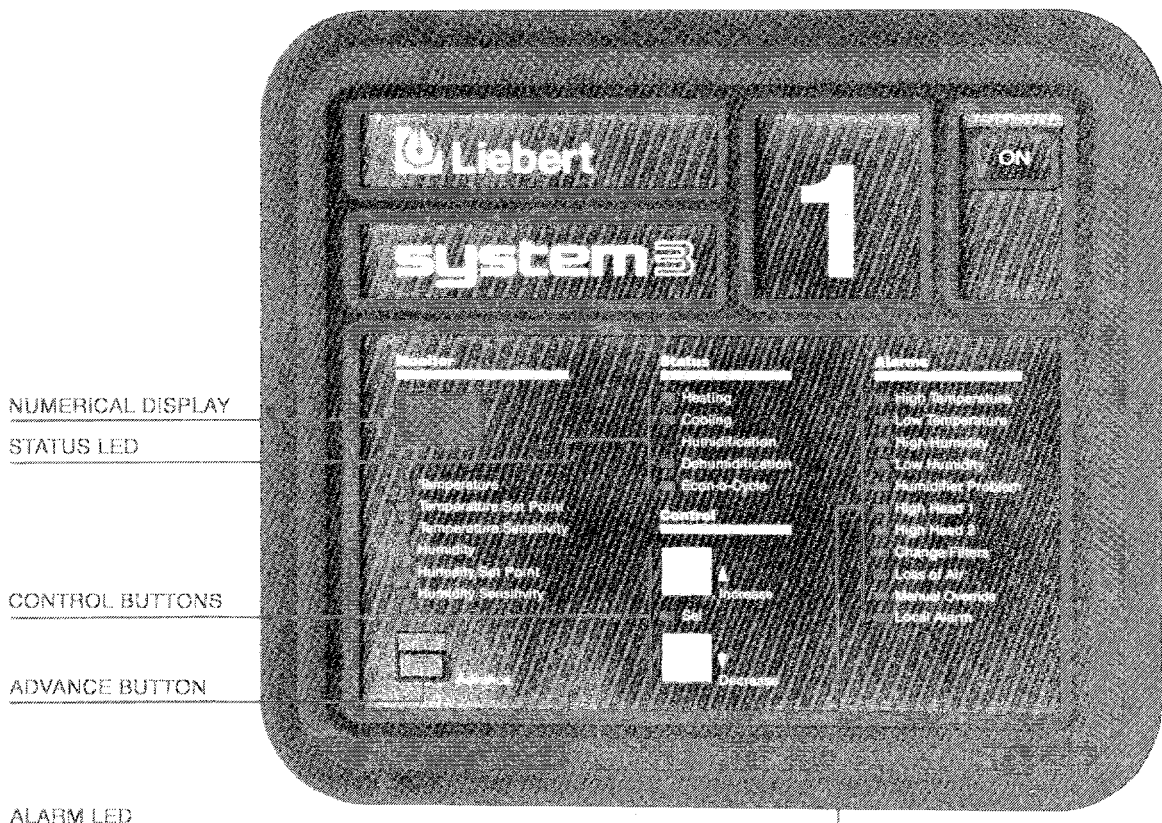
the Sitemaster or Service Terminal. The alarm system may also be reset by turning off the unit at the ON button and then restarting the unit.

Control Buttons

Two control buttons are used to change the temperature and humidity setpoints and sensitivities. The INCREASE button will raise the value selected in the NUMERICAL DISPLAY; the DECREASE button will lower the value. These control buttons are not functional until the SET mode has been activated by pressing the SET button on the back of the local monitor panel. This requires access to the electronics board. The SET LED will indicate that the SET mode has been activated and will automatically de-activate 30 seconds after the last use of the CONTROL BUTTONS.



EXTENDED CONTROL PROCESSOR WITHOUT LOCAL MONITORING provides ALARM PRESENT indication. All monitoring and control done at Sitemaster or Service Terminal.



EXTENDED CONTROL PROCESSOR MONITOR PANEL permits monitoring room conditions, operating status and system alarms and programming of temperature and humidity setpoints and sensitivity.

TEMPERATURE/HUMIDITY SETPOINTS AND SENSITIVITY

AT THE FRONT MONITOR PANEL

Temperature/Humidity setpoints and sensitivities may be set at the front monitor. Alarm setpoints can only be set at the Sitemaster or the Service Terminal. To set environmental parameters, the unit must first be put into the SET mode. This is done by pushing the red SET button on the back of the monitor. This will activate the SET mode and the SET indicator on the face of the monitor. The SET mode will automatically deactivate 30 seconds after the last control action.

Temperature Setpoint

Use the ADVANCE button on the monitor panel to select **Temperature Setpoint**. The numerical display will display the current setpoint. Use the INCREASE or the DECREASE button to select the desired setpoint (65–85°F/18–30°C in 1° increments).

Temperature Sensitivity

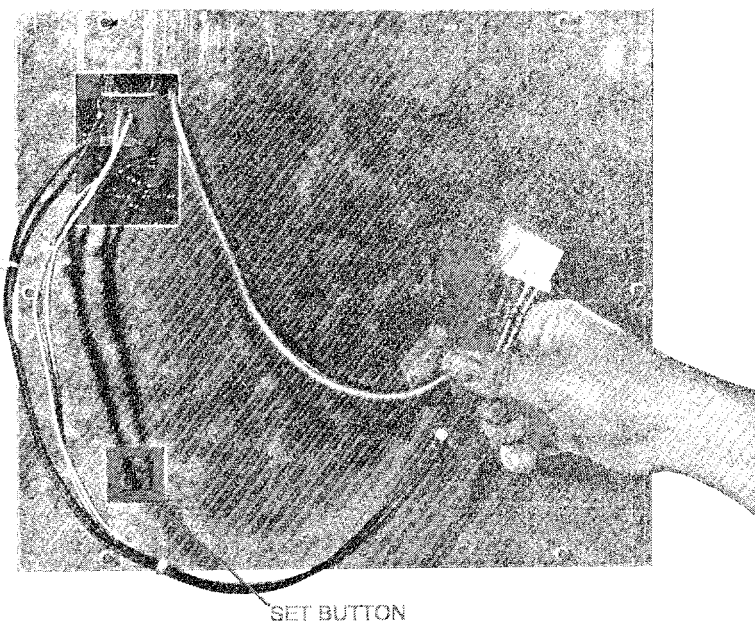
Use the ADVANCE button on the monitor panel to select **Temperature Sensitivity**. The numerical display will display the current sensitivity. Use the INCREASE or the DECREASE button to select the desired sensitivity (1–5°F/1–3°C).

Humidity Setpoint

Use the ADVANCE button on the monitor panel to select **Humidity Setpoint**. The numerical display will display the current setpoint. Use the INCREASE or the DECREASE button to select the desired setpoint (40–60% RH in 1% increments).

Humidity Sensitivity

Use the ADVANCE button on the monitor panel to select **Humidity Sensitivity**. The numerical display will display the current setpoint. Use the INCREASE or the DECREASE button to select the desired sensitivity (1–10% RH in 1% RH increments).



SYSTEM ALARMS

High Temperature
Low Temperature
High Humidity
Low Humidity

These alarms must be programmed at the Sitemaster or Service Terminal.
They are annunciated at the Front Monitor, the Service Terminal or Sitemaster.

High Humidifier Water

If water reaches the top probe, and remains there for 5 seconds, the humidifier alarm is activated and the water make-up valve is closed.

AT THE SITEMASTER

The audible alarm is activated and HI WATER HUMID PAN is displayed on the readout. The audible alarm may be silenced but the readout remains until the problem is corrected and the alarm system reset by pressing the RESET button.

AT THE SERVICE TERMINAL

HI WATER HUMID PAN is displayed at the SERVICE TERMINAL. When the problem is corrected, the alarm system may be reset at the Sitemaster.

AT THE FRONT MONITOR

HUMIDIFIER PROBLEM is indicated by the LED in the Alarms section. The alarm system must be reset at the Sitemaster.

High Head Pressure-Compressor 1&2

The high pressure switch will activate the High Pressure Alarm at a factory preset point. This indicates that high pressure exists in the discharge head of the indicated compressor.

AT THE SITEMASTER

The audible alarm is activated and HIGH HEAD PRESS COMP 1 or 2 is displayed on the readout. The audible alarm may be silenced but the readout remains until the problem is corrected and the alarm system is reset. This is done by pressing the RESET key.

AT THE SERVICE TERMINAL

HI HEAD PRESS COMP 1 or 2 is displayed at the SERVICE TERMINAL. When the problem is corrected, the alarm system may be reset by pressing the RESET key at the Sitemaster.

AT THE FRONT MONITOR

HIGH HEAD 1 or 2 is indicated by the LED in the alarms section. The alarm system must be reset at the Sitemaster.

Loss of Air

The Fan Safety Switch is located on the high voltage panel and consists of a diaphragm switch and interconnecting tubing to the blower scroll. The normally open contacts on the switch will close at a factory preset air velocity and energize the control voltage relay which energizes transformers T2, T3, and T4. Upon loss of airflow, the control voltage relay is de-energized and the normally closed contacts on the switch will activate the Loss of Air Alarm.

AT THE SITEMASTER

The audible alarm is activated and LOSS OF AIR FLOW is displayed on the readout. The audible alarm may be silenced but the readout remains until the problem is corrected and the alarm system is reset. This is done by pressing the RESET key.

AT THE SERVICE TERMINAL

LOSS OF AIR FLOW is displayed at the SERVICE TERMINAL. When the problem is corrected, the alarm system may be reset at the Sitemaster.

AT THE FRONT MONITOR

LOSS OF AIR is indicated by the LED in the Alarms section. The alarm must be reset at the Sitemaster.

Change Filters

The Filter Change Switch senses the pressure drop across the air filters and activates the alarm when the pressure drop reaches a customer-set level.

TO ADJUST: 1) Adjust to trip with clean filters
2) Turn adjusting screw clockwise 2½ turns (or to desired filter change point).

AT THE SITEMASTER

The audible alarm is activated and CHANGE FILTERS is displayed on the readout. The audible alarm may be silenced but the readout remains until the problem is corrected and the alarm system is reset. This is done by pressing the RESET key.

AT THE SERVICE TERMINAL

CHANGE FILTERS is displayed at the SERVICE TERMINAL. When the problem is corrected, the alarm system may be reset by pressing the RESET key at the Sitemaster.

AT THE FRONT MONITOR

CHANGE FILTERS is indicated by the LED in the Alarms section. The alarm system must be reset at the Sitemaster.

Manual Override

This alarm indicates that the manual override mode has been activated. Refer to Control Features, Manual Override.

Local Alarm

This is a customer accessible alarm indication. The remote alarm must be a normally open/non-powered contact, field connected at the terminal strip on the wire raceway in the compressor compartment at terminals 24 and 50 to 54.

OPTIONAL ALARMS

These alarm conditions are only displayed at the Sitemaster or Service Terminal. The Local Alarm on the monitor panel (if provided) will be lit. These alarms are customer specified. Check equipment for the alarms supplied with individual units.

Stand-by Glycol Pump On

Indicates that the primary glycol pump has failed and the stand-by pump has been activated. Glycol cooled units only.

Water Under Floor

Water has been detected by the optional Liebert Liqui-Tect sensor.

Smoke Detected

The presence of smoke has been detected by the optional Liebert Smoke Detector.

Loss of Water Flow

No water flow is detected in the Chilled Water supply line. Chilled Water units only.

Stand-by Unit On

Indicates that the primary environmental control system has failed and the stand-by system has been activated.

Low Suction Pressure

A pressure switch monitors the suction pressure at the compressor inlet and will indicate when pressure drops below a factory pre-set point.

Short Cycle Alarm

The compressor has run through a cycle of on/off/on in a three minute period.

Loss of Power

The Sitemaster will indicate Loss of Power if a unit was operating at the time of the power loss.

Main Fan Overload

The tri-block overload replaces the internal motor overload and is located next to the main fan contactor in the high voltage section. The alarm is activated when the overload is tripped.

Compressor Overload

On compressor models with low-voltage safeties, the alarm is activated when the overload is tripped.

CONTROL FEATURES

COMPRESSOR POSITIVE-START FEATURE

All compressorized models are equipped with a positive-start feature. This electronically bypasses the compressor low pressure switch for a programmable period of time (0-9) minutes following the opening of the liquid line solenoid valve (a call for cooling or dehumidification). After the programmed time delay the bypass contacts are opened and compressor operation is controlled by the low pressure switch. Both stages of compressors have this feature.
Programmed at Sitemaster or Service Terminal.

AUTO-RESTART TIME DELAY

If power to the unit is interrupted and restored, the System/3 is designed to automatically restart. To prevent current surge, especially in multiple unit installations, a time delay can be programmed into the control system to stage the restart of the units (1-99 minutes).
Programmed at Sitemaster or Service Terminal.

AUTOMATIC CHILLED WATER COIL FLUSH

The control system will initiate an automatic 1 minute flush of the chilled water coil if there has been no water flow (cooling or dehumidification) for a customer programmed period of time. This will prevent the build up of mineral scale on the inside of the coil and extend service life.

REHEAT SEQUENCE

The electric reheat in the System/3 is divided into three equal stages.

Each stage of reheat is activated sequentially to balance run-time and even wear on the elements.

This is a pre-set function and may not be changed at the installation.

SEQUENTIAL LOAD ACTIVATION

On initial start-up of the System/3, loads (compressors, fan motor, reheat and humidifier) are activated sequentially to reduce initial current surge.

This is a factory pre-set function and may not be changed at the installation.

TEMPERATURE ANTICIPATION

Temperature Anticipation is a control feature that is designed to reduce energy consumption by anticipating a rapid rise in room temperature or delaying the mechanical refrigeration process during gradual increases in temperature.

If the rate of temperature rise is faster than a pre-determined setting reheat elements will turn off early and compressors will turn on early to prevent a wide fluctuation in temperature.

If the rate of rise is small, the control system will delay activating the compressors to eliminate unnecessary runtimes due to temporary loads or minimal temperature fluctuations.

Temperature Anticipation is a factory programmed function and may not be altered at the installation. It may however be disabled by using the **control switches** on the input card.

Switch No. 8 ON – No Anticipation Control

Switch No. 8 OFF – Anticipation Control Activated

COMPRESSOR SEQUENCE

When the difference between compressor run-times is 100 hours, the lead/lag sequence of the compressors is reversed to balance run times and extend compressor life. This is a factory pre-set time interval and may not be changed at the installation. Automatic compressor sequence may be disabled and either compressor 1 or compressor 2 designated as the lead compressor by using the **Control Switches** located on the Input Card.

Switch No. 4&5 OFF

Auto Sequence mode

Switch 4 ON; Switch 5 OFF Compressor 1 is lead

Switch 5 ON; Switch 4 OFF Compressor 2 is lead

Switch No. 4&5 ON

Dual Cooling Option
Selected

AUTOMATIC HUMIDIFICATION ADJUSTMENT

Automatic Humidification Adjust is a control feature that is designed to reduce humidifier energy consumption by reducing humidification and dehumidification run time. Its operation is based on the run times over the previous 16 hours of unit operation. The humidity sensitivity will be adjusted according to the percentage of humidifier runtime over the floating 16 hour history. Total adjustment of sensitivity will never exceed $\pm 10\%$ RH, and maximum fluctuation of humidity will be 5% inside the customer selected Alarm Setpoint.

Automatic Humidification Adjust is a factory programmed function and may not be altered at the installation. It may however be disabled by using the **control switches** on the input card.

Switch No. 8 ON – No Auto Humidification Adjust

Switch No. 8 OFF – Auto Humidification Adjust
Activated

CONTROL SWITCHES

Two sets of Control Switches are used to select the control features of the microprocessor. One set of eight switches is located on the input card. Their functions are listed below.

| Switch No. | ON Position | OFF Position |
|------------|--|--|
| 1 | No Humidification | Humidification Available |
| 2 | No Dehumidification | Dehumidification Available |
| 3 | No Reheat | Reheat Available |
| 4* | #1 Compressor/Lead | Auto Sequence (If 5 is OFF) |
| 5* | #2 Compressor/Lead | Auto Sequence (If 4 is OFF) |
| 6 | 2-stage Dehumidification | 1-stage Dehumidification |
| 7 | Large Humidifier Pan | Small Humidifier Pan |
| 8 | No Auto Humidification/No Anticipation | Auto Humidification/Anticipation Control |

*If 4 & 5 are ON, Dual Cooling Source is activated.

The second set consists of two switches and is located on the Output Card.

| | | |
|---|------------------|------------------------|
| 1 | Hot Water Reheat | Electric Reheat |
| 2 | Chilled Water | Compressorized Systems |

Important: When operating control switches, it is recommended that the cards remain in the card cage and the cables attached. If the card is removed, an anti-static wrist strap must be worn.

MANUAL OVERRIDE SWITCHES

The microprocessor is equipped with manual override switches which enable the operator to manually activate Compressor #1, Compressors #1&2, Humidification or Dehumidification.

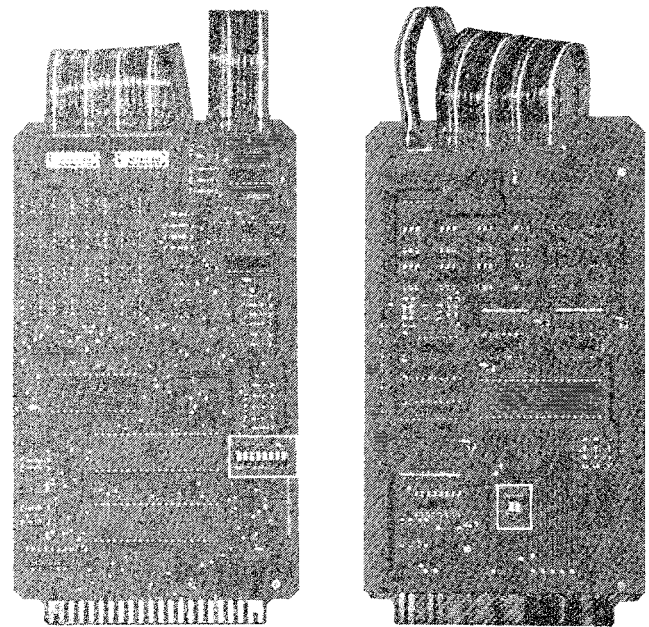
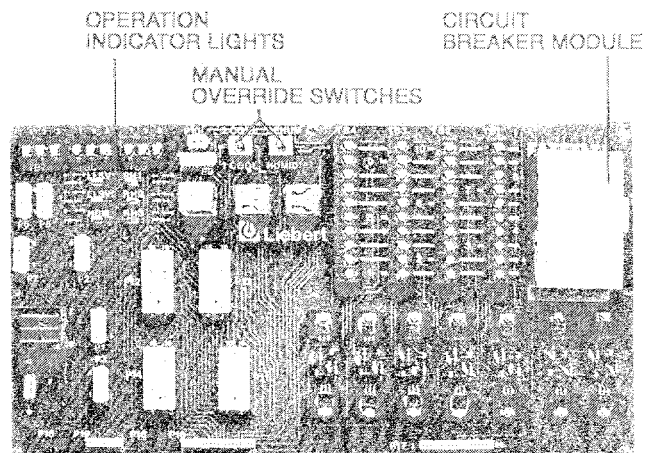
When an override mode is selected:

The Manual Override alarm is activated. The audible alarm may be silenced, but the LED remains lit until the switch is returned to the normal position.

All temperature and humidity control is discontinued, but temperature and humidity values continue to be displayed. Setpoints may be adjusted as normal.

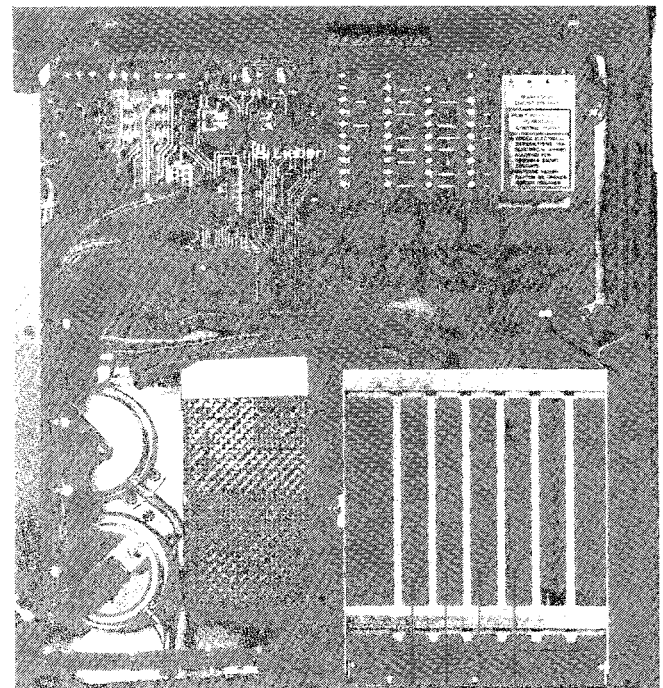
Communication with Sitemaster continues; however, the unit operating status is not displayed.

NOTE: Manual Override of Cooling and Dehumidification cannot be performed on Chilled Water units.



INPUT CARD

OUTPUT CARD



CARD CAGE

COMMUNICATION
MEMORY/
MICROPROCESSOR
OUTPUT
INPUT

AUTOFLUSH HUMIDIFIER CLEANING SYSTEM

The Autoflush will periodically flush the humidifier pan with water to prevent the buildup of water minerals due to water saturation. As 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. Operation of the flushing system is then automatic and no further adjustments need to be made.

Operation

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

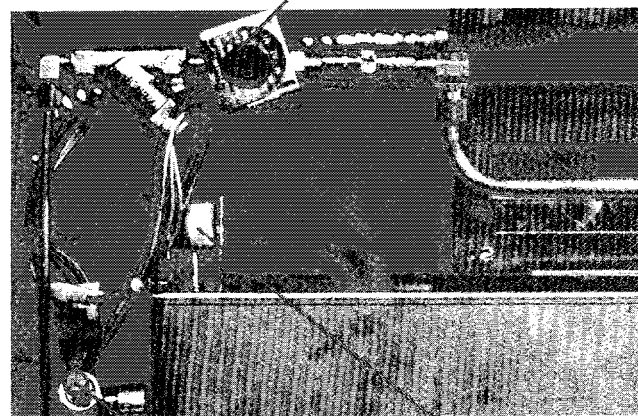
1. **IF HUMIDIFIER HAS NOT BEEN ACTIVATED FOR OVER 30 HOURS**, the autoflush will flow water into the pan for 30 or 60 seconds (based on size of pan). This will provide a minimum amount of water in the pan and prevent heat damage to the humidifier pan. Humidifier Lamps are OFF.
2. **IF HUMIDIFIER HAS 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 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 allowed to operate for a maximum of 8 to 10 minutes (based on size of pan).
4. After the 8 to 10 minute time delay, the autoflush adds water to the pan to a) replenish the water used in humidification and b) flush the pan of mineral solids. **THIS PERIOD IS ADJUSTABLE** from 110% to 250% in increments of 10%. At the end of this period, the make-up valve is closed. Steps 3 and 4 repeat as long as humidification is required.

Programming the Autoflush

The Autoflush water flush rate is programmed using either the Sitemaster (See Sitemaster User's Guide) or Service Terminal (see page 26).

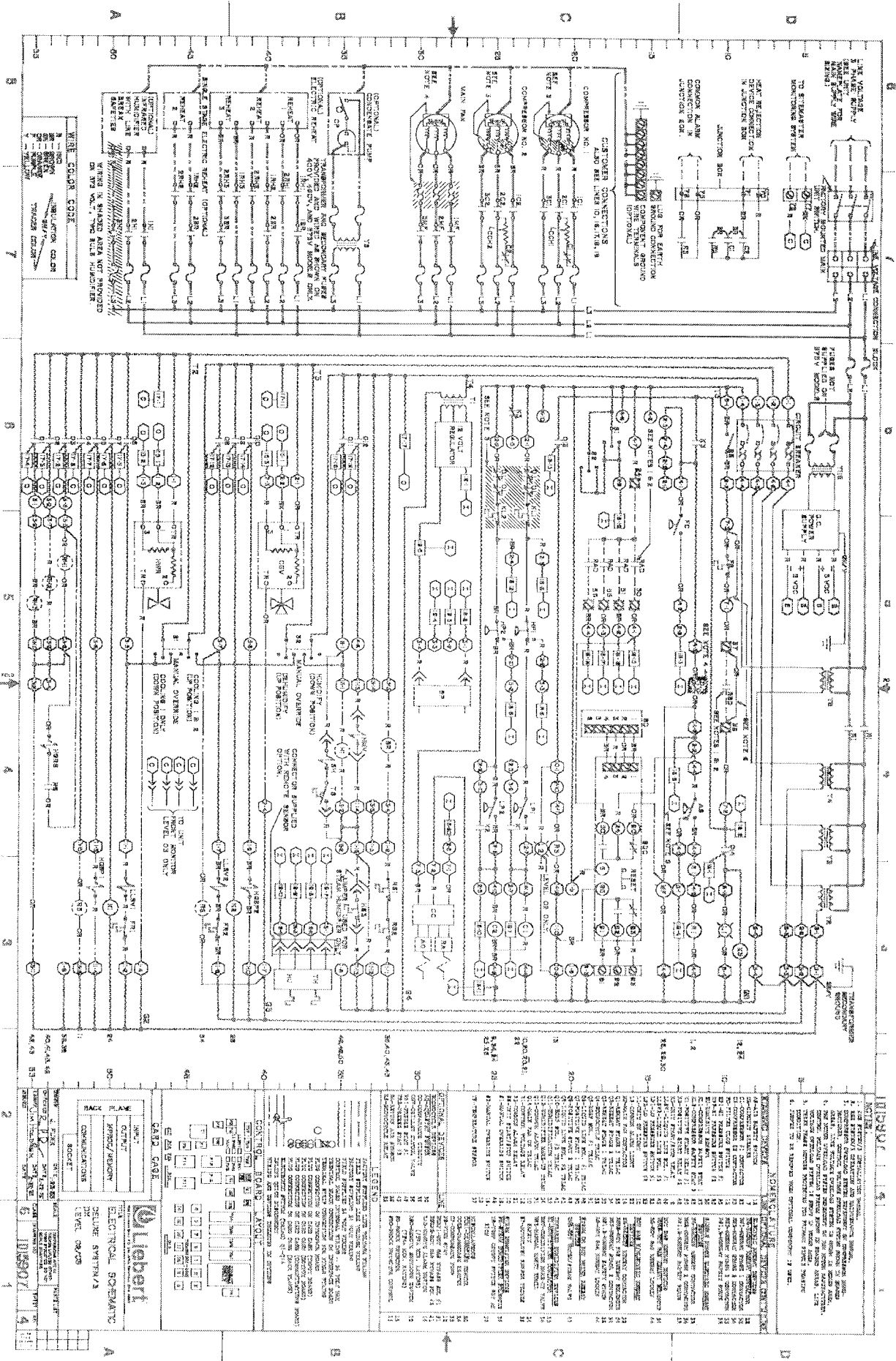
AUTOFLUSH ASSEMBLY

HUMIDIFIER WATER
MAKE UP VALVE



PAN DRAIN

WATER LEVEL
SENSING PROBES



Service Terminal-Extended Control Processor

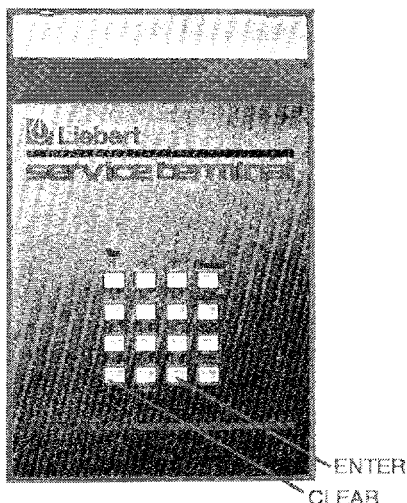
The Service Terminal may be used to monitor room conditions and unit operating mode; temperature/humidity setpoints, sensitivity and alarm parameters; and compressor and GLYCOOL operating hours.

Room Conditions and Unit Operating Mode

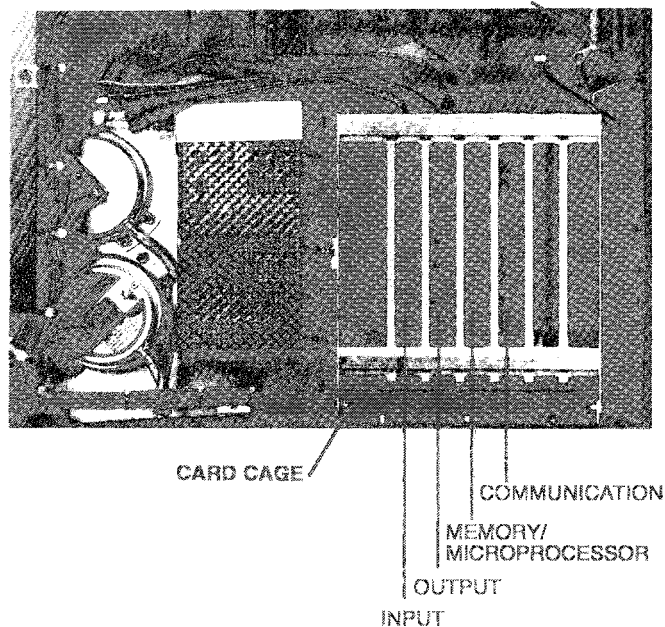
| | | | | | |
|---|---------|---|---|---|---|
| Room Temperature °F/°C, Room Humidity % RH | MONITOR | - | 1 | - | E |
| Cooling/heating Operating Mode | MONITOR | - | 2 | - | E |
| Humidification Operating Mode | MONITOR | - | 3 | - | E |

Compressor and Glycool™ Operating Hours

| | | | | | |
|--|---------|---|---|---|---|
| Compressor 1 Run Time - Total Hours | MONITOR | - | 4 | - | E |
| Compressor 2 Run Time - Total Hours | MONITOR | - | 5 | - | E |
| GLYCOOL Run Time - Total Hours | MONITOR | - | 6 | - | E |



SERVICE TERMINAL CONNECTION



AT THE SERVICE TERMINAL

Insert the SERVICE TERMINAL cable connector into the mating socket in the low voltage section of the unit. "COMMUNICATIONS OK" will appear.

Set Temperature Setpoint:

Press **CONTROL** - **0** - **E**
Enter desired setpoint (40-90°F) - **E**

Set Temperature Sensitivity:

Press **CONTROL** - **1** - **E**
Enter desired sensitivity (1.0-5.0°F) - **E**

Set Humidity Setpoint:

Press **CONTROL** - **2** - **E**
Enter desired setpoint (40-60% R.H.) - **E**

Set Humidity Sensitivity:

Press **CONTROL** - **3** - **E**
Enter desired sensitivity (01.0-10.0%) - **E**

Set High Temperature Alarm:

Press **CONTROL** - **4** - **E**
Enter desired setting (95°F max) - **E**

Set Low Temperature Alarm:

Press **CONTROL** - **5** - **E**
Enter desired setting (35°F min) - **E**

Set High Humidity Alarm:

Press **CONTROL** - **6** - **E**
Enter desired setting (65% max) - **E**

Set Low Humidity Alarm:

Press **CONTROL** - **7** - **E**
Enter desired setting (35% min) - **E**

Positive Start Time Delay

Press **CONTROL** - **8** - **E**
Enter desired time delay (00-09 minutes) - **E**

Auto Restart Time Delay

Press **CONTROL** - **9** - **E**
Enter desired time delay (01-99 minutes) - **E**
00 setting for manual restart

If no time delay is selected, the control will default to **00** (manual restart).

Automatic Humidifier Flush

Press **CONTROL** - **10** - **E**
Enter desired flush rate - **E**

Automatic Chilled Water Coil Flush

Press **CONTROL** - **11** - **E**
Enter desired flush interval (1-99 hours) - **E**

If no time delay is selected the control will default to a 3 minute time delay.

MICROPROCESSOR DIAGNOSTICS WITH THE SERVICE TERMINAL

The Service Terminal can be used to diagnose the printed circuit boards of the microprocessor control system and aid in troubleshooting the electro-mechanical components of the entire environmental control system.

With the Service Terminal, the operator can:

- 1) Diagnose all printed circuit boards in the card cage.
- 2) Check the validity of input signals to the microprocessor from other components of the system.
- 3) Manually activate individual loads (fans, valves, switches).

Diagnosing printed circuit boards

Plug the Service Terminal into the mating socket on the card cage. COMMUNICATIONS OK will appear.

Select the diagnostic mode to test the suspected printed circuit board. See Table. The Service Terminal will display OK if the board passes.

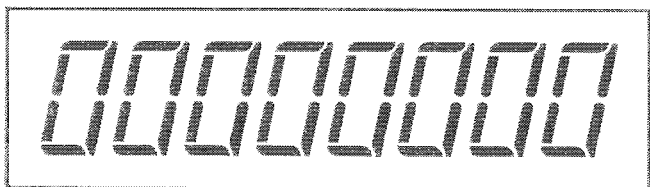
If the board does not pass, it should be replaced with a duplicate board. (Messages will appear that will pinpoint the malfunction for Liebert service personnel).

- | | | |
|----------------|----------|----------------------------|
| Diagnos | 1 | Tests all system boards |
| Diagnos | 2 | Tests Microprocessor board |
| Diagnos | 3 | Tests RAM/ROM board |
| Diagnos | 4 | Tests Input board |
| Diagnos | 5 | Tests Output board |
| Diagnos | 6 | Tests Communication board |

Validating input signals

Plug the Service Terminal into the mating socket on the card cage. COMMUNICATIONS OK will appear.

Select the diagnostic mode to test the suspected signal. See Table. The Service Terminal will display whether an on/active signal is being sent to the microprocessor or an off/inactive signal. 1 = on/active; 0 = off/inactive.



| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| BIT | BIT | BIT | BIT | BIT | BIT | BIT | BIT |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

- | | | |
|----------------|-----------|---|
| Diagnos | 10 | Input power to the microprocessor |
| Diagnos | 11 | (1st bit) Compressor #1 running (2nd bit) High Head Pressure at Compressor #1 (3rd bit) Overload at Compressor #1 |
| Diagnos | 12 | (1st bit) Compressor #2 running (2nd bit) High Head Pressure at Compressor #2 (3rd bit) Overload at Compressor #2 |
| Diagnos | 13 | Overload at Main Fan |
| Diagnos | 14 | (1st bit) Autoflush short probe in contact with water (2nd bit) Autoflush middle probe in contact with water (3rd bit) Autoflush long probe in contact with water |
| Diagnos | 15 | Manual Override Activated |

- | | | |
|----------------|-----------|--|
| Diagnos | 16 | (1st bit) Customer Alarm #4 activated (2nd bit) Customer Alarm #3 activated (3rd bit) Customer Alarm #2 activated (4th bit) Customer Alarm #1 activated |
|----------------|-----------|--|

- | | | |
|----------------|-----------|----------------------------|
| Diagnos | 17 | GLYCOOL System Operational |
|----------------|-----------|----------------------------|

- | | | |
|----------------|-----------|--|
| Diagnos | 18 | (1st bit) Control Switch #8 ON (2nd bit) Control Switch #7 ON (3rd bit) Control Switch #6 ON (4th bit) Control Switch #5 ON (5th bit) Control Switch #4 ON (6th bit) Control Switch #3 ON (7th bit) Control Switch #2 ON (8th bit) Control Switch #1 ON |
|----------------|-----------|--|

- | | | |
|----------------|-----------|---|
| Diagnos | 19 | (1st bit) Filter Clog Switch activated (2nd bit) Loss of Air Alarm activated |
|----------------|-----------|---|

Activating individual loads

Plug the Service Terminal into the mating socket on the card cage. COMMUNICATIONS OK will appear.

Select the Diagnostic mode to activate the suspected load. See Table. Diagnostic modes 25-39 may only be activated with all loads turned OFF

- | | | |
|----------------|-----------|---|
| Diagnos | 20 | Enter Load-Test mode—Turns OFF all loads |
| Diagnos | 21 | Exit Load-Test mode |
| Diagnos | 22 | INVALID ENTRY |
| Diagnos | 23 | Displays current load ON |
| Diagnos | 24 | Turns OFF all loads |
| Diagnos | 25 | Turns ON Reheat #1 and Main Fan |
| Diagnos | 26 | Turns ON Reheat #2 and Main Fan |
| Diagnos | 27 | Turns ON Reheat #3 and Main Fan |
| Diagnos | 28 | Turns ON Liquid-Line Solenoid No. 1, Main Fan and R5 (Heat Rejection) |
| Diagnos | 29 | Turns ON Liquid-Line Solenoid No. 2, Main Fan and R5 (Heat Rejection) |
| Diagnos | 30 | Turns ON Hot Gass Bypass No. 1, Main Fan and R5 (Heat Rejection) |
| Diagnos | 31 | Turns ON Hot Gass Bypass No. 2, Main Fan and R5 (Heat Rejection) |
| Diagnos | 32 | Turns ON Compressor Positive Start No. 1, Main Fan and R5 (Heat Rej.) |
| Diagnos | 33 | Turns ON Compressor Positive Start No. 2, Main Fan and R5 (Heat Rej.) |
| Diagnos | 34 | Turns ON Humidifier, Water make up valve and Main Fan |
| Diagnos | 35 | Turns ON Humidifier, Water make up valve and Main Fan |
| Diagnos | 36 | Turns ON Chilled Water Valve and Main Fan |
| Diagnos | 37 | Turns ON Hot Water Reheat Valve and Main Fan |
| Diagnos | 38 | Turns ON R5 relay (heat rejection) and Main Fan |
| Diagnos | 39 | Turns ON Common Alarm, Main Fan |
| Diagnos | 47 | Reset Alarm at Unit if Sitemaster is on line. |

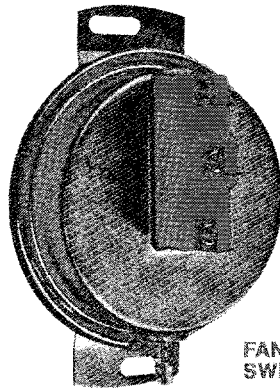
Component Identification/Operation — All Systems

TRANSFORMER CIRCUIT BREAKERS

The control voltage circuit is protected by manual reset circuit breakers for each transformer. If reset button is in the up (or extended) position, eliminate possible shorts in that circuit and depress reset button.

FAN SAFETY SWITCH

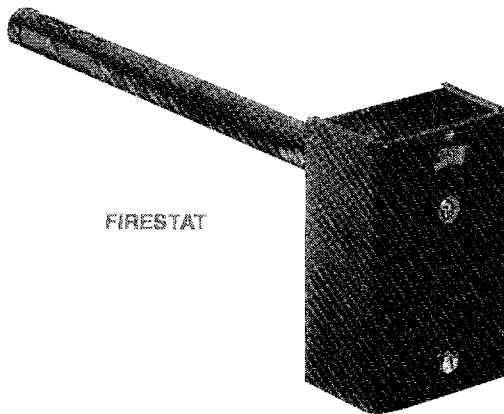
The Fan Safety Switch is located in the high voltage compartment and consists of a diaphragm switch and interconnecting tubing to the blower scroll. The normally-open contacts close at a preset velocity closing relay R1 which applies power to transformers #2, 3 & 4. The normally-closed contacts activate the alarm system if air flow should be interrupted. In this event relay R1 would be de-energized.



FAN SAFETY SWITCH

FIRESTAT

The 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 3 at terminal strip #7.



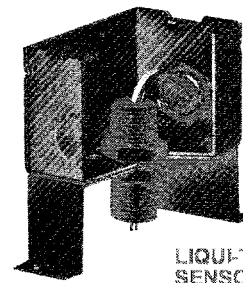
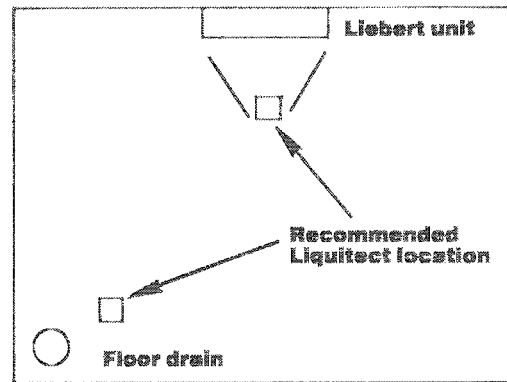
FIRESTAT

LIQUI-TECT SENSOR

The Liqui-Tect sensor consists of 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.

Installation

The sensor should be located 6-8 feet from the environmental control unit in a wet trap or near a floor drain. It should not be mounted directly under the unit. Wire sensor to unit using NEC Class 2, 24 volt wiring. Run wires to terminal strip on wire raceway in compressor compartment and connect to terminals 24 and 50-56.



LIQUI-TECT SENSOR

REMOTE SHUTDOWN

A connection point is provided for customer supplied remote shutdown devices. This terminal strip is located on the front of the unit behind the middle front panel. Terminals 37 and 38 on the terminal strip are jumpered when no remote shutdown device is installed.

PROPORTIONAL HEATING/COOLING/DEHUMIDIFICATION

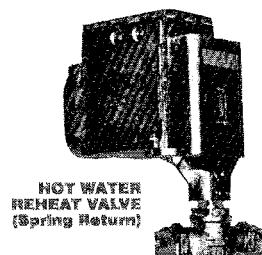
On Chilled Water, Glycool (Econ-o-cycle), models and models with hot water reheat, the microprocessor is capable of responding to changes in room conditions proportionally. These systems utilize either a two or three-way valve activated by a proportioning motor.

Chilled Water Systems

Upon an increase in room temperature or humidity the microprocessor will respond by positioning the chilled water valve proportionally to match the needs of the room. Full travel of the valve takes place within 1°F with each .1°F resulting in 10% valve travel. During dehumidification, full travel of the valve takes place within 2% RH with each .2% RH resulting in 10% valve travel.

Hot Water Reheat

Upon a decrease in room temperature, 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 .1°F resulting in 10% valve travel.



HOT WATER REHEAT VALVE (Spring Return)



CHILLED WATER VALVE (Powered Return)

TROUBLESHOOTING

| SYMPTOM | POSSIBLE CAUSE | CHECK OR REMEDY |
|--|--|---|
| Blower will not start | No main power | Check L1, L2, and L3 for rated voltage. |
| | Blown fuse | Check fuses to main fan. Check control voltage fuses. |
| | Overloads tripped | Push re-set button on main fan overload. Check amp draw. |
| | No output voltage from T5 transformer | Check for 24 vac between P4-4 and P6-4. If no voltage check primary voltage. |
| | Circuit breaker T5 tripped | Check for 24 vac between P1-4 and P6-4. If no voltage check for short and re-set breaker T5. |
| Blower runs but controls will not operate | Relay R1 not making | Jumper P9-1 to P9-2 momentarily. If unit continues to run after jumper is removed, replace S1. |
| | | Check for 24 vac between P4-3 and P6-3. If voltage is not present R1 may be open. |
| | | Check air switch. Jumper P14-4 to P14-7. If R1 makes, air switch is not closing. (Check blower rotation switch contact and loose wires). |
| | Transformer T115 bad | Check for 115 vac at R1 relay coil. If voltage is present and R1 not pulling in, replace R1. |
| Compressor contactor pulled in but compressor will not operate | Blown fuses | Check for 115 vac between G1 and T1. |
| Compressor will not operate contactor not pulled in | No call for cooling | Check to see pilot light is on. |
| | Solenoid valve not energizing | Hold screw driver over solenoid and check for magnetic field. This indicates solenoid is energized. |
| | Low pressure switch not making | Check gas pressure—manually energize low pressure switch. |
| | High pressure switch open | Reset switch—Check valves and condenser for reason. |
| | Out on overload or compressor stat | Check voltage between P12-1 and P12-3 for compressor No. 1 and between P12-2 and P12-4 for compressor No. 2. If this shows 24 vac, safety is open. |
| Compressor runs for three minutes* then stops. Contactor drops out. | Low pressure switch not closing | Check for low gas pressure. Compressor is running on winter start kit. |
| | Solenoid not opening | Check magnetic field to see if energized. |
| Reheat will not operate contactor not pulling in | Control not calling for heat | Check control to see if pilot light is lit. |
| | Reheat safety stat open | Jumper between terminals P11-8 and P11-11. If reheat operates, safety is open. |
| Reheat not operating contactor pulling in | Heater burned out | Turn off power and check heater continuity with OHM meter. |
| No humidification | Humidifier pan not filling | Check water supply. |
| | | Check auto-flush adjustment. |
| | | Check drain stand pipe adjustment. |
| | | Check for clogged waterline filter. |
| | Control not calling for humidity | Check control pilot light. |
| | Humidity contactor not pulling in | Check visually. If contactor is made, check line voltage after contactor and fuses. |
| | | Check for open humidifier safety stat. Jumper between terminals P11-18 and P11-15. |
| No dehumidification | Humidifier bulb burned out | Replace. |
| | Control not calling for dehumidification | Check control pilot light. |
| | Compressor contactor not pulling in | See compressor section. |
| Chilled water or hot water/ steam valve not opening | Compressor won't run. Fuses blown | See compressor section of trouble shooting. Check line voltage after fuses and after contacts. |
| | Motor operates but valve won't open | Check linkage for adjustment and be sure it is tight on valve. |
| | No 24 vac power to motor | Check TR to TR on Motor for 24 vac. |
| | No signal from control | Check D.C. voltage on printed circuit board in motor. Terminal No. 1 is ground and No. 3 positive D.C. voltage should vary from .8 to above 2 V.D.C. as temperature control is varied below room temperature on cooling valve or above room temperature on heating valve. |
| | Motor not working | Remove wires from terminals No. 1 and No. 3 from motor (do not short) with 24 vac power on TR to TR, jumper terminals 1 and 2 on motor to drive open. Remove jumper to drive closed. |

Maintenance Procedures — All Systems

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 Liebert System/3 is equipped with a filter clog switch. This warns of restricted airflow through the filter compartment by activating the CHANGE FILTER alarm. Replacement of air filters can be done from either end by opening the end doors. It is recommended, however, that filters be changed from left (compressor) side of the unit so that airflow will not be interrupted. Removal through the top of the unit is also possible. (Glycool and FH units only)

After replacing filters, test the operation of the filter clog switch. Turn adjusting screw counter clockwise to trip switch — This will energize the change filter alarm. To adjust switch proceed as follows: With fan running set switch to energize light with clean filters. Then turn adjusting knob 2½ turns clockwise, or to desired filter change point.

HUMIDIFIER

During the course of normal humidifier operation, deposits of mineral solids will collect on the sides and bottom of the humidifier pan. This should be cleaned out periodically to insure efficient humidifier operation. Each city and locality has different water characteristics, making it difficult to establish any definite time intervals between cleanings. However, on a monthly basis, check the buildup of deposits and if necessary clean the pan.

The humidifier pan is easily removed by disconnecting the drain coupling and removing the retaining screw at the right end of the humidifier.

CAUTION: 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.

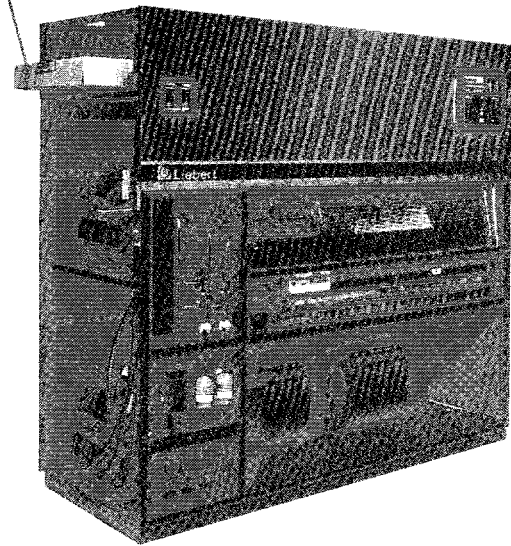
CHANGING HUMIDIFIER LAMPS

1. Open disconnect switch.
2. Remove middle front exterior panel.
3. Remove (7) screws securing humidifier high voltage access panel.
4. Remove humidifier pan.
5. Remove lamp brackets (3) under lamps.
6. Remove high voltage compartment cover.
7. In high voltage compartment, locate burned-out bulb with continuity meter.
8. Loosen two screws securing bulb wires to junction block.
9. Pull bulb straight down.
10. Replace bulb making sure lamp wires are secure in junction block.

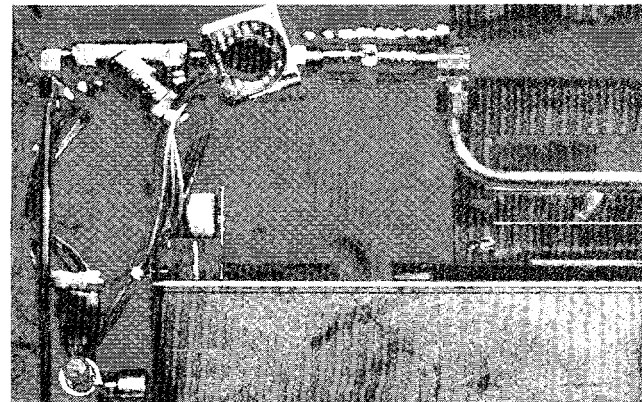
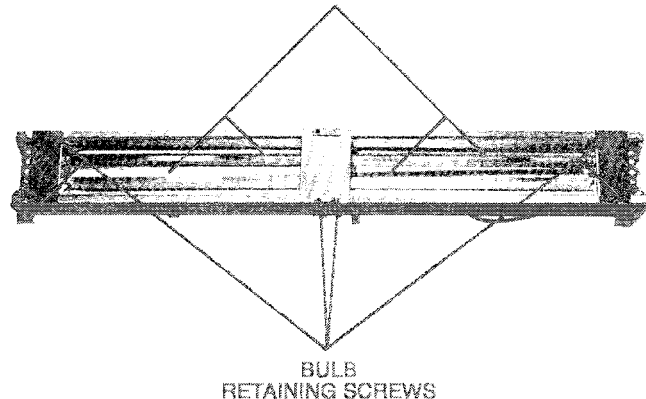
Important: Do not touch the quartz lamps with your bare hands; any oily deposits (fingerprints) will severely shorten bulb life. Use clean cotton gloves at all times.

11. Reverse steps 1-6.

FILTER



HUMIDIFIER LAMPS



BLOWER PACKAGE

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

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 Liebert 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.

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 ½" to 1" 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) which can be obtained from Liebert's parts department. 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, as loose mounts will produce vibration and may damage the unit.

AIR DISTRIBUTION

System/3 models are designed for constant volume air delivery, hence, any unusual restrictions within the air circuit must be avoided.

Recommended Free Area for Grilles
on Perforated Panels

| UNIT SIZE* | 550 F.P.M. | 600 F.P.M. |
|------------|---------------------|------------|
| 6 TON | 5.0 FT ² | 4.6 |
| 8 TON | 6.8 | 6.3 |
| 10 TON | 8.0 | 7.4 |
| 15 TON | 12.0 | 11.0 |
| 20 TON | 15.0 | 13.8 |
| 22 TON | 16.4 | 15.0 |

Grilles used in raised floors vary in size, the largest being 18"x6". This type of grille has approximately 56 sq. in. of free area.

Perforated Panels are usually 2'x2' square and have a nominal free area of approximately 108 to 144 square inches.

Absolutely avoid any under floor 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.

ELECTRIC PANEL

The electric panel should be inspected for any loose electrical connections. Note: be sure that power to the unit is shut down before attempting to tighten any fittings or connections. The functioning of all control circuits can be tested by actuating each of the main functions. This is done by setting the set points.

To test the **cooling** function, set the set points for a temperature 10°F 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 set points to room temperature.

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

To check **humidification**, set the humidification for a R.H. 10% above the room humidity reading. The infrared element should come on. Return humidity setting to room relative humidity setting.

Dehumidification is checked by setting the humidification for a level 10% below room relative humidity. The lag compressor should come on. Return humidity setting to desired humidity.

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.

COMPRESSOR OIL LEVEL

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

Normally, the oil level should be $\frac{1}{2}$ to $\frac{3}{4}$ 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 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 have the compressor operating five to ten minutes before viewing the oil level.

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

REFRIGERANT LINES

Refrigerant lines must be properly supported and not allowed to vibrate against ceilings, floors or 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.

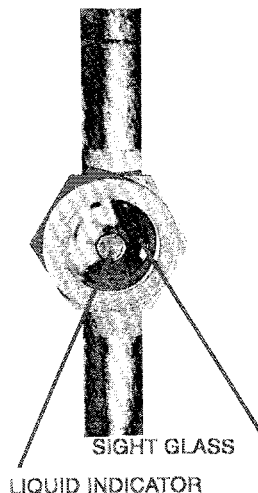
LIQUID LINE SIGHT GLASS

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.

LIQUID LINE ASSEMBLY



LIQUID LINE SIGHT GLASS



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 and maximum pressures are in the chart below.

| SYSTEM | | Minimum P.S.I.G. R-22 | Maximum P.S.I.G. R-22 |
|---------------|----------|--------------------------|--------------------------|
| AIR | FSC | 15 | 92 |
| | Lee-Temp | 20 | 92 |
| WATER COOLED | | 20 | 92 |
| GLYCOL COOLED | | 20 | 92 |

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.

NOTE: For superheat adjustment procedure see pg. 35, Thermostatic Expansion Valve.

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.

| | R-22 |
|--------|------|
| AIR | 360 |
| WATER | 360 |
| GLYCOL | 360 |

HOT GAS BYPASS VALVE

Operation

The hot gas by-pass is inserted between the compressor discharge line and the leaving side of the expansion valve through the side outlet distributor.

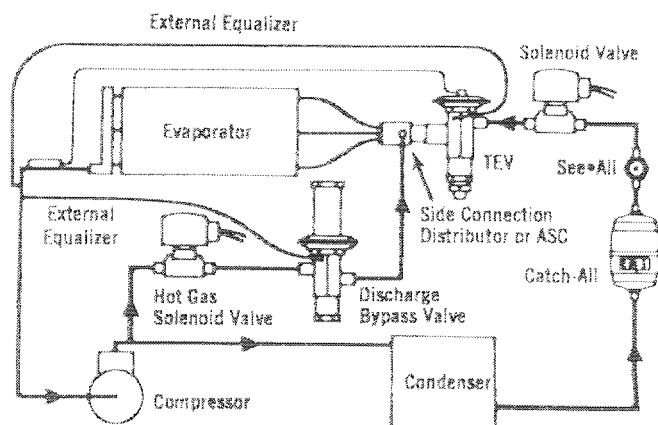
The system, with normal operation when the evaporator is under full load, will maintain enough pressure on the leaving side of the hot gas valve to keep the valve port closed.

Should the load on the evaporator decrease to the point where the coil is below the setting desired, the pressure on the discharge of the hot gas by-pass will put pressure on the diaphragm overcoming the spring pressure on the seat and allow some hot gas to mix with the normal liquid discharge of the expansion valve raising the evaporator pressure. This reduces 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 by-pass valve:

1. Install suction and discharge pressure gauge.
2. Turn thermostat to call for cooling that the refrigeration compressor will run.
3. Remove the TOP adjusting nut from 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 suction pressure required, reinstall cap tight making sure there are no leaks.
6. Let 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# on the evaporator due to the differential on the hot gas by-pass.



THERMOSTATIC EXPANSION VALVE

Operation

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

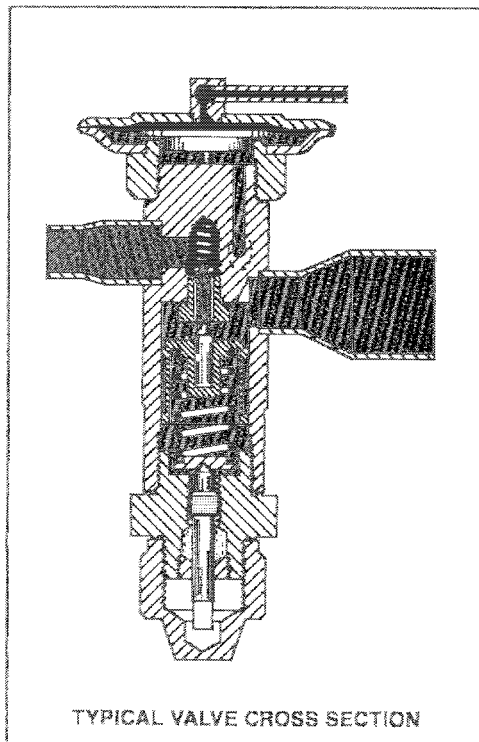
Proper valve operation can be determined by measuring superheat, (see pg. 34). If too little refrigerant is being fed to the evaporator, the superheat will be high; if too much refrigerant is being supplied, the superheat will be low. The correct superheat setting is between 8 and 10 degrees.

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.



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.

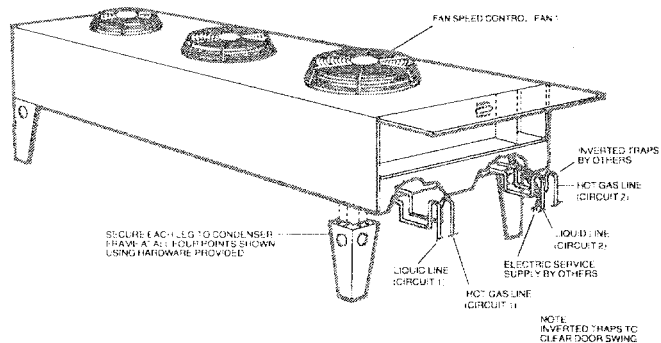
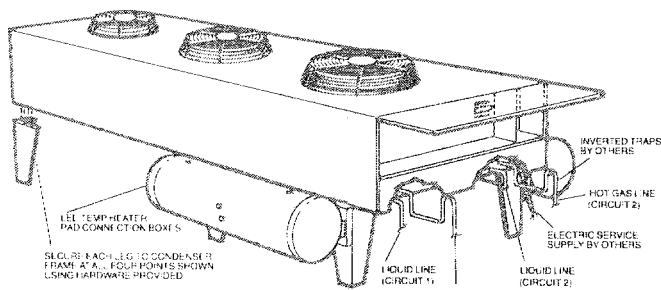
Clean the condenser coil of all debris that will inhibit air flow. This can be done with compressed air or commercial coil cleaner. Check for bent or damaged coil fins and repair as necessary. In winter, do not permit snow to accumulate around the sides or underneath the condenser.

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)

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

1. Set thermostatic control in Liebert 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 and lower — Midway on the bottom sight glass.
 - b. 40°F – 60°F — Bottom sight glass should be clear with liquid.
 - c. 60°F and above — Midway on the top sight glass.



WATER/GLYCOL COOLED CONDENSERS

Shell and Tube Condensers

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 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 unit (using start stop switch), and allow compressor to pump down.
2. Open disconnect switch.
3. Shut off water supply to the condenser.
4. Drain water from condensers and piping.
5. Remove the bolts securing each head and slowly pry them free. Do not damage head gaskets.
6. Swab condenser tubes with tube cleaning tool.
7. When tubes are clean reinstall the gaskets and heads.
8. Reconnect piping, open water supply, vent the system and check for leaks.

Regulating Valves

The water regulating valves will automatically regulate the amount of fluid necessary to remove the heat from the refrigeration system, permitting more fluid to flow when load conditions are at a high rate and less fluid to flow when room conditions are at a lower rate.

The valve consists of a brass body, balance spring, valve seat, valve disc holders, capillary tube to refrigerations discharge pressure and adjusting screw.

ADJUSTMENT

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

To Lower Head Pressure Setting:

1. Turn the square adjusting screw clockwise until the high pressure gauge indicates the desired setting.

To Raise Head Pressure Setting:

1. Turn adjusting screw counterclockwise until 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 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 means of catching 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 which allows 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 re-assembled check for leaks.
7. Re-adjust 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.

Should the water continue to flow, the valve is either improperly adjusted with too low of head pressure 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 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.

We would recommend a chemical treatment such as "Betz Inhibitor 590" or "Betz Entec" equivalent as recommended and manufactured by Betz Laboratories, Trevose, Pennsylvania.

Troubleshooting Glycol Pumps

| PROBLEM | CAUSE | REMEDY |
|--|--|--|
| Suddenly stops pumping. | Clogged strainer or impeller. | Clean out debris. |
| Slowly stops pumping. | Clogged impeller, diffuser or lines. | 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 lodged in impeller. | Remove cover and clean out. |

TROUBLESHOOTING

| PROBLEM | PROBABLE CAUSE | CHECK OR REMEDY |
|--|--|--|
| Low Suction Pressure High Superheat | Moisture, Dirt or Wax in System | Drier – liquid indicator pg. 32 |
| | High superheat adjustment | Reset TEV pg. 33 |
| | Dead thermostatic element in TEV | Replace TEV sensor element |
| | Restricted external equilizer | Liquid indicator pg. 32 |
| | Low refrigerant charge | Check refrigerant level pg. 34 |
| | Clogged drier | Check liquid indicator pg. 34 |
| High Suction Pressure Low Superheat | TEV seat leak | Check valve for leaks pg. 34 |
| | Low superheat adjustment | Reset TEV pg. 34 |
| | Moisture, Dirt or Wax in System | Filter drier – liquid indicator pg. 34 |
| | Restricted external equilizer | Liquid indicator pg. 34 |
| Low Suction Pressure Low Superheat | Dirty Filters | Check filters pg. 32 |
| | Poor air distribution | Check air distribution pg. 33 |
| | Evaporator oil logged | Check oil level pg. 34 |
| | TEV bulbs crossed | Check bulb placement pg. 35 |
| High Discharge Pressure | Dirty condenser or drycooler fins | Clean coil pg. 36 |
| | Condenser equipment not operating | Check operation pg. 36 |
| | High refrigerant charge | Check refrigerant charge |
| | Hot gas bypass valve adjusted improperly | Adjust properly pg. 35 |
| | Water regulating valve adjusted improperly | Adjust properly pg. 36 |

COMPRESSOR FAILURE

If a compressor motor burns out, the stator wiring insulation decomposes, forming carbon, water and acid. Not only must the compressor be replaced, but the entire refrigeration circuit must be cleaned of the harmful contaminants left by the burnout. Successive burnouts of the same system can usually be attributed to improper system cleaning.

DAMAGE TO A REPLACEMENT COMPRESSOR CAUSED BY IMPROPER SYSTEM CLEANING CONSTITUTES ABUSE UNDER THE TERMS OF THE LIEBERT WARRANTY.

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

1. Check all fuses.
2. Check Hi-Lo 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 service port. Motor attempts to run.

MECHANICAL FAILURE

If it has been determined that a mechanical failure has occurred, 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 ports.
3. Front seat service valves, venting charge from compressor.

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

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

ELECTRICAL FAILURE

In an 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.

Failure to properly clean the system after a compressor motor burnout will VOID THE COMPRESSOR WARRANTY.

There are two methods that can be used with a complete compressor burnout.

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

BURN OUT KITS

Sporlan System Cleaner

This method of cleaning is thoroughly described in Sporlan's Bulletin No. 40-15 and 40-10.

This bulletin describes the following procedure:

1. Close the compressor service valves and remove the burned out compressor.
2. Install the new compressor and System Cleaner. Always use the same hose between the System Cleaner and the compressor to make sure it is clean.
3. Evacuate the compressor and the System Cleaner with a good vacuum pump, break the vacuum with a refrigerant and reevacuate. Only the compressor and System Cleaner need to be evacuated, since the service valves have been closed, isolating the refrigerant in the system.
4. Open the compressor service valves, close the liquid line valve and pump down the system. Install an oversized Catch-All (at least one size larger than the normal selection size) in the liquid line, removing the old filter-drier if one exists.
5. Place the system into operation by opening the liquid valves, installing the fuses, and setting the thermostat to the low position. Check the pressure drop across the System Cleaner during the first half hour of operation and change the cores if it becomes excessive.
6. In the next 8 to 24 hours, take an oil sample. Observe the color, and test with Sporlan Acid Kit. If the oil is clean and free of acid, remove the System Cleaner. If the oil is either dirty or acidic, change the cores and leave the System Cleaner in for an additional day or two before checking another oil sample.
7. When the System Cleaner is removed, replace the liquid line Catch-All and install a See-All in the liquid line.
8. In the next two weeks, recheck the color and acidity of the oil to see if another liquid line Catch-All is necessary. (This step requires that a means be available to obtain an oil sample). Before the job is completed, it is essential that the oil be clean and acid free. The See-All will indicate if the Catch-All must be changed or reduced to the moisture content of the system.

Alco Dri-Kleaner Method

With this method of cleaning, the refrigerant is reclaimed into a separate drum and recharged to the system through a dehydrator. If this method is used, the following procedure should be used.

1. Save the refrigerant charge. If necessary transfer it to a clean refrigerant cylinder.
2. Thoroughly inspect all system controls such as expansion valves, solenoid valves, check valves, reversing valves, etc. Clean or replace if required. Remove any liquid line strainers or Filter-Driers.
3. Install the replacement compressor. Complete the installation of the new parts as quickly as possible so the system is exposed to the atmosphere as little as possible.
4. Install an Alco ADK Filter-Drier in the suction line. (Refer to Alco's Instruction Pamphlet.)
5. Install a new oversize ADK Filter-Drier in the liquid line.
6. Pressurize and leak test the system at approximately 150 psi pressure.
7. Triple evacuate the system, using the following procedure. Evacuate the system twice to 1,500 microns and the third time to 500 microns, breaking the vacuum each time with clean, dry refrigerant to 2 psi. While evacuating the system, make a complete and thorough electrical check, cleaning or replacing these components as necessary.
8. Charge the system through an ADK Filter-Drier with the same refrigerant that was originally installed.
9. Start the compressor and put the system into operation. As the contaminants in the system are absorbed or filtered out by the porous block ADK Alco Filter, the pressure drop across the Filter-Drier will increase. This proves that the Filter-Drier is doing the job of cleaning the system. Observe the system operation during the first four hours.
If the pressure drop across the Filter-Driers should increase to an objectionable amount, replace the drier or install new blocks of desiccant. Change the Filter-Driers as often as required until no further pressure drop is observed.
10. After the completion of the above step, allow the unit to operate 48 hours and check the odor and color of the oil. It should be clean, but if it is still discolored or has an acid odor, replace both the liquid and suction line Filter-Driers. The compressor oil might be changed if considered desirable if the discoloration is too heavy. Repeat this procedure every two weeks until the oil remains clean and odor free.
11. If the oil is clean and odor free and if the pressure drop across the Filter-Drier is not excessive, the clean-up is complete and the system can be operated normally.

COMPRESSOR REPLACEMENT

Replacement compressors are available from the Liebert Corporation in Columbus, Ohio.

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 to the Liebert factory.

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 LIEBERT CORPORATION, COLUMBUS, OHIO. FREIGHT PREPAID.





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