ENVIRONMENTAL CONTROL

Installation Operation and Maintenance Manual

System 4

SLC-ES4-3E- - 271622 - 07.94

System 4

Liebert

We won't let you down

List of Contents

Part No.:	*SLC - ES4 - 3E*
Revision Date:	*July 1994*
Print Date:	*July 1994*

Introduction

The nomenclature for System 4 is as follows:

L D 46 A - F 05

Electronics level:
05 = Level 5
15 = Level 15

Voltage Code:

Letter	Voltage	Phase	Hertz
H	230	3	50
U	400	3	50

System type:
A = Air cooled
W = Water cooled
G = Glycol cooled
E = Glycool
C = Chilled water

Model size:
Nominal cooling capacity

D = Downflow
U = Upflow

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In total 68 different models of System 4 exist and can be categorised into the following groups

AIR	WATER	GLYCOL	GLYCOOL	CHILLED WATER
LD / LU 20A	LD / LU 20W	LD / LU 20G	LD / LU 20E	LD / LU 30C
LD / LU 30A	LD / LU 30W	LD / LU 30G	LD / LU 30E	LD / LU 40C
LD / LU 37A	LD / LU 37W	LD / LU 37G	LD / LU 37E	LD / LU 50C
LD / LU 46A	LD / LU 46W	LD / LU 46G	LD / LU 46E	LD / LU 60C
LD / LU 58A	LD / LU 58W	LD / LU 58G	LD / LU 58E	LD / LU 70C
LD / LU 67A	LD / LU 67W	LD / LU 67G	LD / LU 67E	LD / LU 80C
LD / LU 100A	LD / LU 100W	LD / LU 100G		LD / LU 90C

Installation

Follow all instructions marked or supplied with this product

Only trained personnel to operate/service

Isolate power before opening any panel

Preliminary considerations

Critical space preparation

The room should be well insulated and must have a sealed vapour barrier. The vapour barrier in the ceiling can be a polyethylene film type. Use a rubber or plastic base paint on concrete walls and floors. Doors should not be undercut or have grilles in them.

Outside (or fresh) air should be kept to an absolute minimum. Outside air adds to the heating, cooling, humidifying and dehumidifying loads of the site. It is recommended that outside air be kept below 5% of the total air circulated in the critical space.

Equipment inspection

Upon arrival of the unit, inspect all items for either visible or concealed damage. Damage should be immediately reported to the carrier and a damage claim filed.

Location considerations

Unit's are usually positioned on top of an accessible elevated flooring system. It may be necessary to furnish additional pedestal supports below the unit to ensure maximum structural support. A separate floorstand (independent of the elevated floor) can be used as a support, and installed prior to the flooring system. With downflow units, a turning vane is included in the support to enhance airflow.

When possible provide 1.2 metres in front of the unit and 870 mm at each end. The minimum space required for installation is 610 mm at the left and right of the unit and 610 mm in front of the unit.

Piping considerations

All piping fitted below the elevated floor must be located so that it offers the least resistance to air flow discharging from the system. Careful planning of the piping layout below the elevated floor is required to prevent the air flow being blocked from any portion of the room. When installing piping on the subfloor, it is recommended that the pipes be mounted side-by-side on support brackets rather than stacked one above the other and, whenever possible, the pipes should be run parallel to the air flow.

All condensate and unit drain lines should be trapped and pitched a minimum of 1 cm per 1 m. Adequate pipe insulation must be fitted on all chilled water and glycol lines.

Electrical connections

Three phase and ground electrical service is required for System 4 at 230 or 400 volts, 50 hertz. Electrical services should conform to both national and local electrical codes.

A manually operated electrical disconnect switch should be installed within 1.6m of the unit in accordance with codes, a factory supplied disconnect switch is mounted within the unit and made accessible from the exterior.

Air cooled models

Condensers

Full details on the installation of condensers are provided in the Condensers Technical Data Manual (P / N SLM-ECO-2E), supplied with the condenser.

Refrigerant piping

All refrigeration piping should be installed using high temperature brazed joints. Prevailing good refrigeration practices should be employed for piping supports, leak testing, dehydration and charging of the refrigeration circuits. The refrigeration piping should be isolated from the building using vibration isolating supports.

Traps should be installed in the hot gas lines on vertical risers every 8 metres in elevation. These traps will collect condensed refrigerant and refrigerant oil during the off-cycle of the unit and ensure flow of refrigerant oil during operation.

Factory approval is required whenever a refrigerant piping run exceeds 60 metres equivalent length, or when condensers must be located more than 9 metres below the level of the cooling coil.

Installation (continued)

Suggested pressure testing

1. Turn OFF the disconnect switch.
2. Turn OFF all MCB's except the transformer MCB's.
3. Turn the disconnect ON and install a jumper across the air flow switch between common and normally open (pins P3-7 and P3-5).
4. Energise the solenoid valves by activating a call for cooling (refer to Operating Instructions section).
5. Connect service guages to the suction and discharge service valves of compressors 1 and 2. Open the service valves fully, then rotate them by 1 turn in the opposite direction.

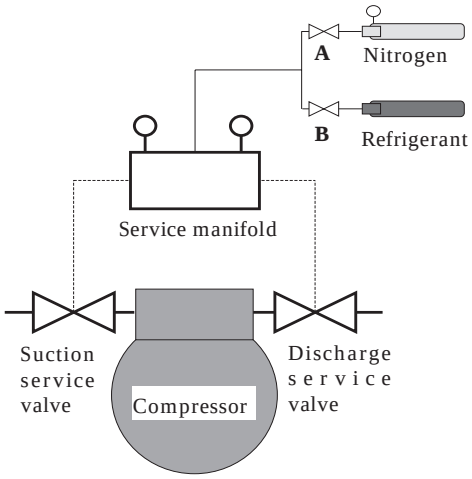


Figure 1 - Pressure testing schematic

6. Connect a nitrogen bottle to the service manifold of circuit no. 1 as shown in Figure 1. Pressurise the system to at least 10 bar (1000 kPa), by opening valve A.
7. Close the service valves.
8. If the pressure in the system begins to drop, check all field-brazed or soldered joints or any part of the refrigerant circuit which has been opened during installation with a soapy water solution. Leaks will be indicated by the formation of bubbles in the water.
9. Check the pressure in circuit no. 2. If this circuit experiences an increase in pressure, the systems have been inadvertantly cross-connected and this must be rectified before proceeding.
10. Once the leak check has been completed on circuit no. 1, release the nitrogen charge and repeat the above instructions (from step 6) for circuit no. 2.

Vacuum/dehydration

1. Release the test pressure and connect a vacuum pump to the system in place of the nitrogen bottle. Open valve 'X' (Figure 2), pull a vacuum to 250 microns or less on the system. Close valve 'X' and leave this vacuum for approximately four hours.
2. Check the pressure to ensure that it has not increased. Break the vacuum by opening valve 'Y' and introducing refrigerant into the system. Pressurise the system to 0.14 bar (14.0 kPa) and close valve 'Y'.
3. Pull a second and third vacuum of 500 microns (29.9 in. Hg), repeating Step 2 between evacuations. The vacuum must be held for at least two hours after each vacuum has been pulled.

RECOMMENDED LINE SIZES - O.D. COPPER (INCHES)

	20A		30A		37A		46A		58A		67A		100A	
	Hot Gas Line	Liquid Line	Hot Gas Line	Liquid Line	Hot Gas Line	Liquid Line	Hot Gas Line	Liquid Line	Hot Gas Line	Liquid Line	Hot Gas Line	Liquid Line	Hot Gas Line	Liquid Line
50 ft (15 m)	⅝	½	⅞*	½	⅞*	½	⅞	⅝	1⅛*	⅞	1⅛	⅞	1⅜	⅞
100 ft (30 m	⅞	½	⅞*	⅝	⅞	⅝	1⅛*	⅞	1⅛	⅞	1⅛	⅞	1⅜	⅞
150 ft (45 m	⅞	⅝	⅞	⅝	⅞	⅝	1⅛	⅞	1⅛	⅞	1⅛	⅞	1⅜	1⅛

* With 4-step models, use one (1) trade size smaller (⅞=⅝ ,1⅛=⅞, 1⅜=1⅛, 1⅝=1⅜)

Installation (continued)

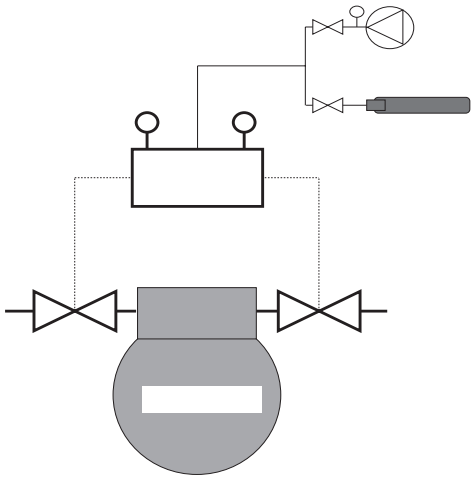


Figure 2 - Vacuum/dehydration schematic

4. Break the vacuum by opening valve 'Y' and introducing refrigerant into the system.
5. Fill the circuit with refrigerant vapour until a positive pressure has been achieved throughout the system.
6. Close valve 'Y'.
7. Check again for leaks using a Halide leak detector. Should a leak be discovered, use a refrigerant recovery unit to reclaim the charge prior to repairing the system.

Charging

1. Open the reheat and humidifier MCBs and remove the jumper lead across the air flow switch.
2. Remove all shipping blocks (if fitted) from under the compressor and ensure that all operational components are clear of debris.
3. Isolate the discharge service valve charging hose at the service manifold. Open valve 'Y' (Figure 2) and admit refrigerant vapour into the suction service valve port.
4. Turn the disconnect switch ON and check the evaporator fan for proper rotation.
5. Set the temperature set-point (see Operating Instructions section) to 15^{o}C to ensure that the solenoid valves are open during the charging procedure.
6. Open valve 'Y' and add refrigerant vapour to the suction side of the compressor to eliminate short-cycling. The low pressure switch can be electrically bypassed to allow the compressor to run at low suction pressures.

Note: *As head pressure builds the condenser fan will start rotating. The fan will become fully energised when sufficient head pressure is developed.*

7. Charge the unit until the liquid line sight glasses become clear. Watch the sight glasses for a period of 10 minutes to ensure that no bubbles reappear. At this point, add additional refrigerant to the circuit so that 4^{o}C subcooling is obtained in the liquid line.

REFRIGERANT CONTROL SETTINGS kPA (bar) Air Cooled units			
Refrigerant Type	**Low Pressure Cut Out**	**Low Pressure Cut In**	**High Pressure Cut Out**
R-22	105 (1.05)	242 (2.42)	2480 (24.80)

Water cooled models

Piping considerations

It is recommended that manual service shut-off valves be installed in the supply and return lines of each unit. This will provide for routine maintenance or emergency isolation of the unit.

When the water source for the condenser is of poor quality, it is good practice to provide cleanable filters in the supply line. These filters will trap particles in the water supply and extend the service life of the water cooled condenser.

Wet traps and, if required, a 'free-water' detection system such as the Liebert Liqui-Tect alarm, should be installed below the raised floor to drain water leaks and prevent sub-floor flooding.

Condenser

The condenser is designed to operate in conjunction with either a cooling tower or city water supply.

Water regulating valve

Water regulating valves automatically open on refrigerant pressure increase and close on pressure decrease. The procedures for adjusting, manual flushing and testing of these valves are contained in the Maintenance section of this manual.

Installation (continued)

REFRIGERANT CONTROL SETTINGS bar (kPa) Water cooled units			
Refrigerant Type	**Low Pressure Cut Out**	**Low Pressure Cut In**	**High Pressure Cut Out**
R-22	1.38 (138)	4.48 (448)	24.8 (2480)

Glycol cooled models

Drycoolers

Full details on the installation of drycoolers are provided in the Drycoolers Technical Data Manual (P / N SLM-EDC-2E), supplied with the drycooler.

Glycol pump

All wiring to the 400V, 3 Phase, 50Hz pump and drycooler from the control box should be done in accordance with the electrical schematic on the inside lid of the drycooler control box and with local and national codes.

Glycol piping

It is recommended that manual shut-off valves be installed at the supply and return line to each indoor unit and drycooler. This will provide for routine service or emergency isolation of the unit.

Wet traps and, if required, Liebert water detection systems, should be installed below the raised floor to drain water leaks and prevent sub-floor flooding.

Consideration of the minimum glycol temperature to be supplied from the drycooler will determine the need to insulate the glycol supply and return lines. Insulation will prevent condensation on the glycol lines in low ambient conditions.

GLYCOL CONCENTRATION						
% Glycol by Volume	0	10	20	30	40	50
Freezing Point ^{o}C	0	-3.9	-8.9	-15.0	-23.3	-35.5
Apparent Specific Gravity @ 10^{o}C	1.000	1.014	1.028	1.042	1.057	1.071

ROOM DEW POINT TEMPERATURES ^{o}C			
Dry Bulb	***Wet Bulb***	***Rel. Humidity***	***Dew Point****
21.1	14.0	45	9.0
21.1	14.7	50	10.3
22.2	14.9	45	10.0
22.2	15.5	50	11.3
23.8	16.2	45	11.3
23.8	16.9	50	12.7

* *Minimum glycol temperature before condensation will occur*

Preparation of glycol solution

Ethylene glycol must be obtained from a reliable supplier and details of inhibitors and anti-leak additives obtained from the same source.

Caution

Automotive anti-freeze is unacceptable and must NOT be used.

Commercial ethylene glycol, when pure, is generally less corrosive to the common metals of construction than water itself. Aqueous solutions of these glycols, however, assume the corrosive properties of the water from which they are prepared and may become increasingly corrosive with use if not properly inhibited.

There are two basic types of corrosion inhibition; they are classified as corrosion inhibitors or environmental stabilisers. The corrosion inhibitors function by forming a surface barrier which protects the metals from attack. Environmental stabilisers, while not corrosion inhibitors in the strict sense of the word, decrease corrosion by stabilising or favourably altering the overall environment. An alkaline buffer, such as borax, is a simple example, since its prime purpose is to maintain an alkaline condition (ph above 7).

Installation (continued)

The quality of the water of dilution must be considered, because water from some sources may contain corrosive elements which reduce the effectiveness of the inhibited formulation. Preferably, surface water that is classified as soft and low in chloride and sulphate ion content (less than 100 parts per million each) should be used. Before an inhibited glycol solution is charged into a new or old system, residual contaminants such as sludge, rust, brine deposits, oil, etc, should be removed as completely as possible in order that the contained inhibitor may function properly. It is generally better to avoid the use of strong acid cleaners; however if they are required, inhibited acids should be considered. In any event, care should be taken to ensure that the cleaning agent is completely removed before charging with glycol.

Note: *Galvanised pipe must not be used in Glycol systems.*

REFRIGERANT CONTROL SETTINGS kPa (bar) Glycol cooled units			
Refrigerant Type	**Low Pressure Cut Out**	**Low Pressure Cut In**	**High Pressure Cut Out**
R-22	138 (1.38)	448 (4.48)	2480 (24.80)

SYSTEM 4 GLYCOL VOLUME Approximate Litres (Maximum)			
Model	**Glycol Units**	**Glycool Units**	
		Upflow	**Downflow**
LD / LU 20G / E	7.5	34.0	32.0
LD / LU 30G / E	7.5	34.0	32.0
LD / LU 37G / E	9.5	38.0	38.0
LD / LU 46G / E	17.0	53.0	51.0
LD / LU 58G / E	21.0	57.0	57.0
LD / LU 67G / E	21.0	-	-
LD / LU 100G	21.0	-	-

Chilled water models

Piping considerations

It is recommended that manual shut-off valves be installed in the supply and return lines to each unit. This will provide for routine maintenance or emergency isolation of the unit.

Consideration of the minimum water temperature to be supplied from the chiller will determine if the need exists to insulate the supply and return lines. Insulation will prevent condensation on the supply and return lines.

Wet traps and, if required, a 'free-water' detection system such as the Liebert Liqui-Tect alarm, should be installed below the raised floor to drain water leaks and prevent sub-floor flooding.

Balancing the air distribution (under floor discharge systems only)

These systems are designed for constant air delivery, therefore any unusual restrictions within the air circuit must be avoided. Select the air supply grilles and perforated panels for the raised floor to ensure minimum loss of pressure in the circuit.

Recommended free area m^2 for grilles or perforated panels at output velocities of 2.8 and 3.1 m / s

DIRECT EXPANSION UNITS		
Model LD/LU	**2.8 m/s**	**3.1 m/s**
20A / W / G / E	0.518 m^2	0.468 m^2
30A / W / G / E	0.757 m^2	0.684 m^2
37A / W / G / E	0.911 m^2	0823 m^2
46A / W / G / E	1.275 m^2	1.152 m^2
58A / W / G / E	1.557 m^2	1.406 m^2
67A / W / G / E	1.821 m^2	1.645 m^2
100A / W / G	2.275 m^2	2.055 m^2

Installation (continued)

CHILLED WATER UNITS		
Model LD/LU	**2.8 m/s**	**3.1 m/s**
30C	0.796 m^2	0.719 m^2
40C	0.918 m^2	0.829 m^2
50C	0.896 m^2	0.810 m^2
60C	1.411 m^2	1.274 m^2
70C	1.382 m^2	1.248 m^2
80C	1.896 m^2	1.713 m^2
90C	1.882 m^2	1.700 m^2

Liqui-tect/water detection sensor LT400 & LT 400S (optional)

The sensor should be located 2 to 3 metres from the environmental control unit in a wet trap, or near a floor drain. (Refer to Figure 3) It should not be mounted directly under the unit. Wire the sensor to the unit using cables designated HO5VV-F to IEC 53. Connect the cables to terminals 24 and 50 on the Level 5 PCB and terminals 24 and 50 - 56 on the Level 15 PCB.

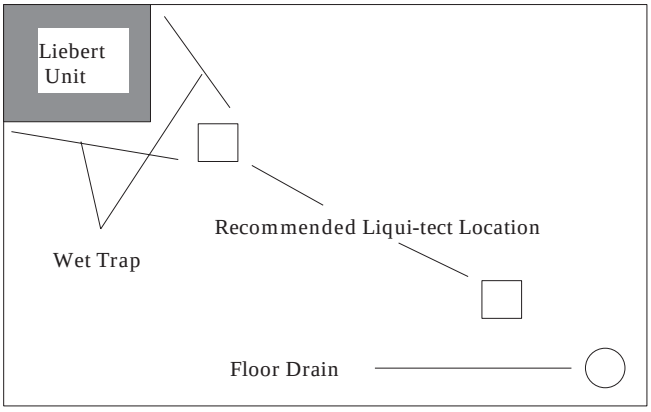


Figure 3 - Recommended location

Liqui-tect/water detection sensor LT450S (optional)

The LT450S is a supervised zone detection system that uses a flexible Liebert water sensing cable and provides detection in hard to reach areas that require protection against water damage (refer to Figure 4). It can be located up to 3.5 metres from the environmental control unit. Wire the sensor to the unit using cables designated HO5VV-F to IEC 53. Connect the cables to terminals 24 and 50 on the Level 5 PCB and terminals 24 and 50 - 56 on the Level 15 PCB.

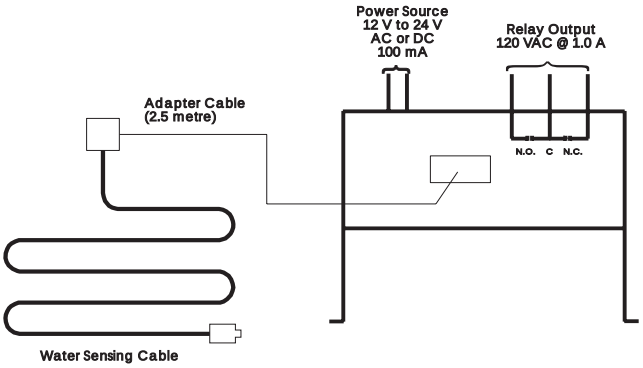


Figure 4 - LT 450S Zone Detection System

Note: *The above wiring conventions are also applicable to the LT 400 and LT 400S.*

General commissioning procedure

Before beginning , make certain that the unit has been installed in accordance with the installation instructions in the installation section of this manual. All exterior panels must be in place with the front panel open.

Remove the packing blocks from under the compressor before starting DX units.

WARNING

Potentially lethal voltages exist within this equipment during operation. Observe all cautions and warnings in this manual. Failure to do so could result in serious injury or death. Only qualified service and maintenance personnel should work with this equipment.

1. Disconnect all power to the environmental control unit.
2. Tighten all electrical wiring connections which may have loosened during transit.
3. Open / isolate all line voltage MCBs on the electric panel, except for the main fan MCB and the Control Voltage MCB.

Installation (continued)

4. If the critical space has a fire suppression system, turn off or bypass the system during the start-up procedure. Dust may have collected on the reheat elements during storage, whilst in transit or on the job site. When this dust burns, it can trigger the smoke or fire detectors and set off the fire suppression system.
5. Turn ON the main breaker and check the line voltage at the main unit disconnect switch. The line voltage must be within 10% of the nameplate voltage.
6. Turn ON the main unit disconnect switch and check the secondary voltage at transformer T1. The voltage from T1 must be 24V (2.5V AC and 17.5 (1.8V AC.
7. Push the ON button. The blower will start and the ON lamp will light.
8. Air movement will cause the air flow switch to energise thus allowing other components to activate.
9. Set the temperature and humidity setpoints and sensitivities, alarm parameters and other control functions. Refer to the Level 5 (or Level 15, if applicable) Controller Operations Manual.
10. Set the Filter Clog switch, see below.
11. Turn OFF the main unit disconnect switch and the main breaker. The unit ON button should be set to OFF.
12. Close all MCB's that were opened in Step 3.
13. Restore power to the unit; turn ON the main unit disconnect switch.
14. Push the ON button - putting the unit into operation.
15. Note the current draw on all high voltage components and check them against the serial tag ratings.
16. Reset the fire suppression system after the unit has been running for approximately half an hour with all stages of reheat having been powered for at least 5 minutes or, after the room has cleared.

Commissioning - chilled water units only

First, follow the general commissioning procedure outlined above and then continue as follows:

1. Switch the main unit disconnect switch OFF.
2. Install a jumper cable across the air flow switch between common and normally open (pins P3-7 and P3-5) and switch ON the control voltage MCB only (All other MCB's should be OFF).
3. Switch the main unit disconnect switch ON.
4. Switch the controller ON. Select a temperature setpoint on the controller of 15 ^{o}C. (Refer to the Operating Instructions section, if necessary).
5. Open the shut-off valve on the water supply line and bleed the air at the schrader valves on top of the coil manifold. When all the air is clear, close the schrader valve
6. Open the shut-off valve on the water return line and bleed again as above.
7. Leave the water circulating through the coil for approximately 1 hour and then bleed again.
8. Close the caps on the schrader valves.
9. Switch the controller OFF.
10. Switch the main unit disconnect switch OFF.
11. Remove the jumper cable from the air flow switch.

Filter clog switch adjustment

The Filter Clog switch, located in the electric panel, is a differential pressure switch which sets the maximum allowable pressure drop across the filter. When the measured pressure drop across the filter exceeds this level, the "Change Filter" alarm is activated on the front panel.

The switch should be adjusted when the unit is first installed and each time a new filter is fitted. It is adjusted as follows:

1. With the main fan running, turn the adjustment screw counter-clockwise until the alarm light and sound are activated (the panels should be in place and closed to accurately find this position).
2. Turn the adjusting screw a ½ turn clockwise (each turn equals approximately 240 Pa).

Operating instructions

Controls

The standard System 4 unit is fitted with the Level 5 Microprocessor Controller. Full details of the control functions and their operation are provided in the Level 5 Controller Operation Manual (P / N SLS-ELV5-2E) supplied with the unit. If the optional Level 15 Graphics Controller has been requested, the manual supplied will be the Level 15 Graphics Controller Operation Manual (P / N SLC-EG15-2E). Refer to these manuals for all operating instructions.

Infrared humidifier

The standard infrared humidifier is controlled via the Level 5 or Level 15 Graphics (optional) Controller. For operating instructions, refer to the relevant manual.

Steam generating humidifier (optional)

Caution

Care should be taken when working near the steam humidifier and the outlet pipe. These can remain hot for some time after the unit is shut down.

The electrode boiler steam humidifier has an independent controller mounted in the electric panel. Incorporated in the controller is a push-button which allows the selection of 30%, 50%, 75% and 100% of total steam production capacity. Two different capacity models are available:

- 2.4 to 8 kg / h
- 3.9 to 13 kg / h

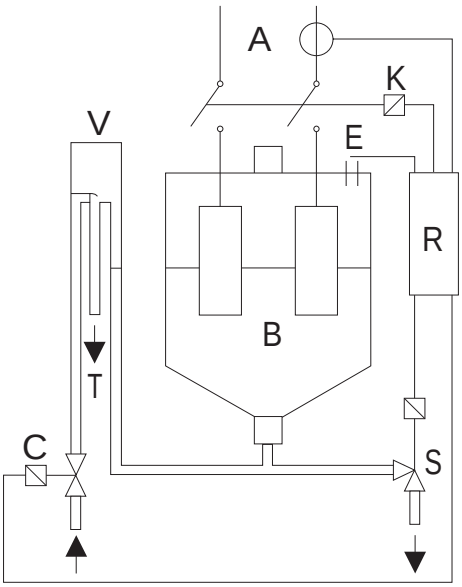
Note: *These humidifiers should only be used where the supply water has a conductivity between 125 and 1250 μS/cm.*

Introduction

Water, provided it contains even a small quantity of salts in solution, is a conductor of electricity. This means that if two or more metal elements - the electrodes - are put into a container containing undistilled water and a potential difference is applied to them, an electric current passes between them. The water then behaves like an ordinary electric resistance and, like it, transforms power into heat, raising its own temperature.

As opposed to an ordinary resistive element, however, the temperature of water can never exceed a well-defined limit - boiling point - and when this is reached the electric power supplied is entirely used to create steam. The quantity of dissolved salts in the water, if within normal limits, does not influence the process of boiling and its regulation. However, if water with a strong concentration of salts is used, the electrodes become encrusted and the boiler cannot be used. This process is slowed down by maintaining salt concentrations within defined limits by draining and topping up with water.

Steam production can be controlled by adjusting the flow of electric current by varying the depth of immersion of the electrodes. The depth of immersion is varied by pumping in or draining water from the boiler.



A = Power Sensor
B = Boiler
C = Fill Valve
E = Level Electrodes
K = Contactor
R = Controller PCB
S = Drain Valve
T = Overflow Tubes
V = Filling Cup

Figure 5 - Electrode boiler steam humidifier

Operating instructions (continued)

System description

When a call for humidification occurs, the Liebert controller sends a signal to the humidifier controller. This controller in turn activates the humidifier contactor supplying power to the boiler cylinder electrodes. The electric power dissipated in the boiler is kept constant by measuring the amount of current flow on one phase using a current transformer (TAM).

As evaporation proceeds, the controller opens the fill valve allowing water to enter the cylinder via a filter and a capacity regulator to the filling cup, and from there, by gravity, to the boiler. When the water level is so high that it touches the electrodes at the top of the boiler, the fill valve is closed and the excess water is drained through the overflow tube.

The drain valve opens periodically to drain water and reduce salt concentration in the boiler. It is also used to drain the humidifier completely under alarm conditions.

Humidifier controller

The humidifier controller PCB is mounted in the Liebert unit's electrical panel. The individual components of the controller and their use are described below.

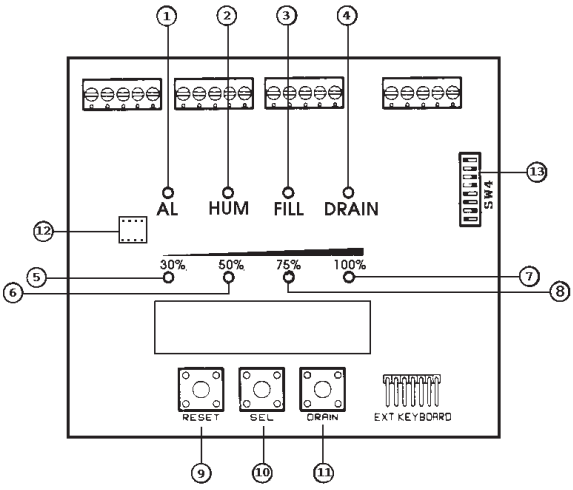


Figure 6 - Humidifier controller PCB

1. **Alarm LED** - when lit, it indicates an alarm condition.
2. **Humidifier LED** - when lit, it indicates active humidification.
3. **Fill LED** - when lit, it indicates filling of the cylinder with water.
4. **Drain LED** - when lit, it indicates draining of water from the cylinder.
5. **30% LED** - when lit, it indicates the humidifier is configured to produce 30% of the total steam capacity (the total steam capacity is dependent on the EEPROM supplied, see point 12 below).
6. **50% LED** - when lit, it indicates the humidifier is configured to produce 50% of the total steam capacity.
7. **75% LED** - when lit, it indicates the humidifier is configured to produce 75% of the total steam capacity.
8. **100% LED** - when lit, it indicates the humidifier is configured to produce 100% of the total steam capacity.
9. **Reset button** - resets the controller
10. **Selection button** - used to select the percentage of steam output.
11. **Drain button** - activates a manual drain cycle
12. **EEPROM** - determines the total steam capacity and rated voltage of the system. The humidifier EEPROM's are coded as follows:

    E*pccvvv*CD*x* where

    p is the number of phases

    cc is the capacity in kg / hr

    vvv is the rated voltage

    x is a mnemonic which specifies the type of regulation,
    x = C for ON / OFF regulation
    x = P for Modulating regulation

    e.g. If the code on the EEPROM is E308415CDC, then it is intended for use with a 3 phase, 415 V supply with ON / OFF regulation and the maximum steam production is 8 kg / hr.

Operating instructions (continued)

13. **Dip-switch** - dip-switch 1 to 7 are used to select the type and range of the input signal to the humidifier controller (for connection to Liebert units, these dip-switches are configured for ON/OFF regulation).

    Dip-switch 8 is used to select the type of washing cycle (to prevent excessive salt build-up inside the boiler by draining the boiler and refilling it with water). In the ON position, the washing cycle will only occur while the humidifier is active (when its contactor is pulled in) at intervals determined by the humidifier controller on the basis of conductivity of the feed water and cumulative time of humidification.

    In the OFF position, the washing cycle occurs at time intervals determined by the controller regardless of whether the humidifier is active or not.

Note: *If factory installed the dip-switchs will already be set. If the humidifier is field fitted, set the dip-switches as shown in figure 7.*

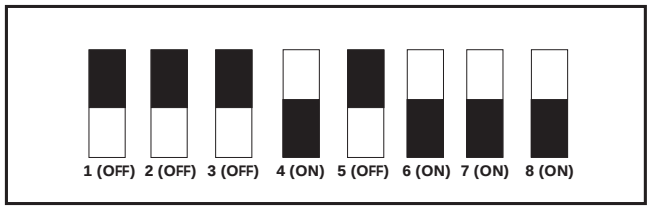


Figure 7 - Dip-switch setting

Commissioning

1. Check both the high voltage and control voltage wiring to the controller and steam cylinder.
2. Check the water inlet and discharge connections.
3. Check the steam pipe between the steam cylinder and the distributor.
4. Check that the correct EEPROM is fitted for the rated voltage of the Liebert unit and the required total steam output.
5. Select the required percentage of steam production by depressing the selection button until the relevant LED (LED's 5 to 8 in figure 6) illuminates.
6. Select the type of washing cycle required by positioning dip-switch 8. (The default setting is dip-switch 8 to ON).
7. Activate a call for humidification from the Liebert controller, refer to the relevant Liebert controller manual, if necessary.
8. The Humidifier LED on the humidifier controller will then illuminate, causing the fill valve to open. The FILL LED illuminates and remains lit until the current reaches the required value to provide the requested steam output.

Alarms

When a call for humidification is sent to the humidifier controller, it may respond by signalling a pre-alarm or an alarm condition. These pre-alarms/alarms are indicated by the illumination of the red Alarm LED and a combination of the 4 percentage steam production LED's (LED's 5 to 8 in figure 6). The combination of the 4 percentage steam production LED's denotes a specific Error code, the meaning of which is given in the table overleaf.

Pre-alarms are transient alarms and will normally reset themselves, alarms indicate that a malfunction/error has occurred which requires action to be taken to correct it.

In the case of one or more pre-alarms occurring, the four LED's show a steady light for 6 seconds to indicate the percentage of steam production selected followed by a flashing light for 2 seconds to indicate the alarm code.

Start-up with feed water having a conductivity value between 1000 and 1250 mS/cm

The humidifier reaches its steady state working condition immediately and goes on working until the current reaches the necessary value to produce the selected quantity of steam.

Start-up with feed water having a conductivity value between 125 and 1000 mS/cm

The humidifier starts in a "soft cycle" and reaches its steady state working condition slowly. It may take some time for the water in the cylinder to reach the required level of conductivity and during this phase, a high level pre-alarm (E05) and a reduced operation pre-alarm (E02) may occur. These pre-alarms do not affect the normal operation of the humidifier and should reset themselves.

Operating instructions (continued)

Pre-Alarm Conditions				
LED's Lit	**Error Code**	**Reason**	**Possible Cause**	**Check/Remedy**
●❍❍❍	E01	**High current** - the current has exceeded the safety threshold	- very conductive feed water	- if the situation does not resolve itself, an E06 alarm condition will result
❍●❍❍	E02	**Reduced operation** - cannot reach the required steam output	- water conductivity too low - the boiler cylinder needs attention	- if the situation does not resolve itself, an E08 alarm condition will result
●●❍❍	E03	**Foaming of boiling water** - poor steam production	- caused by some abnormal characteristic of the water	- if the situation persists, check the water conductivity level
●❍●❍	E05	**High water level** - water level reaches maximum capacity	- water conductivity too low - the boiler cylinder needs attention - foaming of boiling water	- if the situation does not resolve itself, an E08 alarm condition will result
Alarm Conditions				
❍●●❍	E06	**Current too high** - current exceeds safety threshold	- buildup of mineral deposits between the electrodes - leaking feed water valve	- clean or replace the cylinder - check the feed water valve
●●●❍	E07	**Current too low** - current remains below the required value	- feed water pressure inadequate - feed water valve obstructed - leaking discharge valve	- check the water pressure - check the discharge valve - check the feed valve
❍❍❍●	E08	**Boiler cylinder exhausted** - poor steam production	- Build up of mineral deposits on the grid	- clean or replace the cylinder
●❍❍●	E09	**Lack of water** - the feed valve remains open for 20 minutes without circulation of current	- lack of water in the system - blocked feed valve	- check for presence of water - check the feed valve - check the filter
❍●❍●	E10	**Lack of current** - when the transformer does not register current circulation and the level electrodes are immersed in water	- electrode(s) malfunction - transformer malfunction - contactor defective	- check the line fuses - check the electrical connections - check the transformer - check the contactor
●❍●●	E13	**Drain malfunction** - when the solenoid valve remains open for 20 minutes without lowering the water level	- drain valve blocked - cylinder filter blocked	- check the drain valve - check the filter and the cylinder
❍❍●●	E14	**Conversion error** - when there is a faulty conversion of the analogue input values from the TAM, conductivity meter etc.	- wiring fault - incorrect dip-switch setting	- check the wiring connections - check the dip-switches
●●●●	E32	**Self-test failure**	- defective hardware	- replace EEPROM or controller **- DO NOT PRESS RESET**
Key: ● indicates LED illuminated;				

Maintenance

WARNING

Isolate the unit power supply before removing the panels and carrying out any of the following procedures. Lethal voltages are present when the unit is energised.

Preventive maintenance

Fan deck - examine

WARNING

Care should be taken to aviod hands and clothing becoming entangled in the rotating parts of the fan assembly.

1. Remove the unit front, right-hand side and rear panels and inspect the fan motor for any loose electrical connections and retighten as necessary.
2. Inspect the fan deck, motor and casing for signs of defects, damage or corrosion. Correct any defects found and restore the surface finish where corrosion has occurred.

Fan impellers and bearings

1. Inspect the fan impellers and remove any debris.
2. Check that the fan impellers are securely mounted on the fan shaft. Rotate the impellers and ensure freedom of movement.
3. Inspect the bearings for signs of wear. Shake the pulley and look for movement in the fan shaft. If any excessive movement is noticed the bearings must be renewed.

Note: *If records show bearing life to be shorter than expected, investigate the cause of bearing wear and carry out the necessary corrective maintenance.*

Drive belt - inspection

1. Check the drive belts monthly for signs of wear and proper tension. Pressing on the belts midway between the sheave and pulley should produce from 12mm to 25mm of movement. Belts that are too tight can cause excessive bearing wear.

Drive belt - re-tensioning

1. Correctly tension the belts by adjusting the fan motor slide base as necessary.

Note: *If belts appear cracked or worn, they should be renewed with matched belts (identically sized). Both belts should be renewed at the same time. With proper care, belts should provide a long service life.*

2. After adjusting or renewing the belts, always check that the motor mounts are tight. Loose mounts will produce vibration that may damage the unit.

Caution

After renewal of any of the major drive components, you should confirm dynamic balance.

Completion

1. Refit the unit front, right-hand side and rear panels and restore the electrical supply to the unit.
2. Record and report any defects found during the inspection.

Air flow switch - examine

1. Open the unit front accent panel and inspect the air flow switch on the electric panel for any loose electrical connections and retighten as necessary.
2. Ensure that the switch mounting bolts are tight.
3. Examine the pressure sensing tube between the switch and the fan casing for defects, damage and loose connections. Renew the tube if necessary.
4. Close the unit front accent panel and restore the electrical supply to the unit.
5. Record and report any defects found during the inspection.

Chilled water control valve - examine

1. Inspect the valve gland for water leaks in the closed as well as the open position.

   If leaks are observed, tighten the gland nut. If the valve continues to leak, replace the gland packing.
2. Activate a call for cooling so that the chilled water valve opens fully (change the temperature setpoint to about 10 ^{o}C below room temperature).
3. If a full stroke of 19mm between the fully open and fully closed positions is not attained:

   The linkage between the modulating motor and valve requires adjustment (Honeywell valves) or:

   The modulating motor requires internal adjustment (Johnson valves).

Maintenance (continued)

WARNING

Isolate the unit power supply before removing the panels and carrying out any of the following procedures. Lethal voltages are present when the unit is energised.

Shell and tube condenser - examine

1. Remove the unit front panels.
2. As far as possible, examine the refrigerant and coolant pipework for defects, damage and signs of oil leaks.
3. Examine the condenser body and end caps. Check for signs of leaks at the end cap gaskets.
4. Refit the unit front panels and restore the electrical supply to the unit.
5. Record and report any defects found during the inspection.

Drycooler - examine

Refer to the Drycoolers Technical Data Manual (P/N SLM-EDC-2E) supplied with the drycooler.

Steam generating humidifier (optional) - examine

1. Remove the unit front and left-hand side panels and examine the humidifier for any loose electrical connections. Retighten any loose connections.

WARNING

Care should be taken when working near the steam outlet pipe. This can remain hot for some time after the unit is shut down.

2. Examine all pipes and connections for defects, damage and security of attachment.
3. Ensure that the steam generating canister is properly secured to the unit frame.
4. Refit the unit front and side panels and restore the electrical supply to the unit.
5. Record and report any defects found during the inspection.

Infrared humidifier - examine

1. Remove the unit front panels and inspect the humidifier for any loose electrical connections and retighten as necessary.
2. Examine the water supply pipe, drain pipe and make-up valve for any signs of defects or damage.
3. Examine the bottom and sides of the humidifier pan for build-up of mineral deposits. If deposits are present, clean out the pan.

Note: *The humidifier pan is easily removed for cleaning by disconnecting the drain coupling and removing the retaining screw at the right hand end of the humidifier.*

WARNING

Before removing the pan, ensure that power to the unit is disconnected and water in the humidifier pan is no hotter than lukewarm.

4. Remove scale on the sides and bottom of the pan by loosening with a stiff brush. Flush with water and refit the pan to the humidifier.
5. Refit the unit front panels and restore the electrical supply to the unit.
6. Record and report any defects found during the inspection.

Compressor - examine

1. Remove the front and left-hand side panels and examine the compressor for any obvious defects or corrosion. Correct any defects found and restore the surface finish where corrosion has occurred.
2. Examine the compressor vibration isolation mounts for defects and security. Retighten the mounts if necessary.
3. Inspect the refrigerant pipework connections for signs of oil leaks.
4. Examine the service valves for defects and signs of oil leaks.
5. Remove the compressor terminal cover and examine the electrical connections for damaged insulation and security. Retighten any loose connections.
6. Refit the compressor terminal cover and refit the unit front and left-hand side panels.
7. Restore the electrical supply to the unit.
8. Record and report any defects found during the inspection.

Maintenance (continued)

WARNING

Isolate the unit power supply before removing the panels and carrying out any of the following procedures. Lethal voltages are present when the unit is energised.

Compressor oil level - check

1. Remove the unit left-hand side panels and identify the sight glass on each compressor which permits the oil level to be observed.
2. Select a set point for a temperature of 6°C below room temperature (to put the compressor into operation).

Note: *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 necessary to have the compressor operating for five to ten minutes before viewing the oil level.*

3. The oil level should be ½ to ¾ up from the bottom of the sight glass with the compressor running.

Note: *This level may vary during operation owing to the action of the moving parts. When idle, the oil level may be higher owing to the absorption of the refrigerant.*

4. Inspect the compressor compartment for signs of oil leakage. If a leak is present, it must be corrected and the oil level returned to its proper level using a recommended compressor oil.

Note: *It is recommended that oil be taken from sealed containers opened at the time of use. Oil exposed to air will absorb moisture.*

5. When the oil levels are satisfactory, return the set point to room temperature, and refit the unit left-hand side panels.

Note: *On a 4-step system, if either compressor runs in an unloaded state for 1 hour, the controller will load the compressor fully for 30 seconds to help recirculate any oil that may have settled.*

Compressor oil level - fill

1. Connect a low pressure service guage to the compressor and close the suction side service valve.
2. Run the compressor until the pressure falls to about 0.34 bar (34 kPa). Carefully open the oil fill plug, allowing the remaining gas to escape before removing it completely.
3. Fill with oil as required, then replace the oil fill plug.
4. Open the service valve, remove the service guage and run the compressor.
5. Check the oil fill plug for leaks and the oil level sight glass for bubbles.

Refrigerant lines - examine

1. Remove the unit front, side and rear panels.
2. As far as possible, examine the refrigerant pipework for defects, damage and signs of oil leaks.
3. Examine the pipework for chafing damage, particularly where pipes are routed close to the cabinet structure and internal components.
4. Ensure that the insulation is sound and properly wrapped around the pipes.
5. Inspect the equaliser lines from the expansion valve and ensure that they are properly supported.
6. Refit the unit front, side and rear panels and restore the electrical supply to the unit.
7. Record and report any defects found during the inspection.

Regulating valves - examine

1. Remove the unit front and side panels.
2. Visually inspect the valve(s) for damage and ensure that the connections are not leaking.
3. Ensure that the valve(s) are securely mounted in position.
4. Refit the unit front and side panels and restore the electrical supply to the unit.
5. Record and report any defects found during the inspection.

Liquid line sight glass - examine

1. Remove the unit front and left-hand side panels and inspect the liquid line sight glass and connections for any signs of oil leaks or damage.
2. Check the window in the sight glass to view the moisture indicator. If moisture is shown to be present in the system a new filter dryer must be fitted.
3. Refit the unit front and left hand side panels and restore the electrical supply to the unit.
4. Record and report any defects found during the inspection.

Maintenance (continued)

WARNING

Isolate the unit power supply before removing the panels and carrying out any of the following procedures. Lethal voltages are present when the unit is energised.

Glycol solution - check

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

The complexity of water-caused problems and their correction makes it important to obtain the advice of a water treatment specialist, and a regularly scheduled maintenance program should be followed. 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.

Note: *Refer to your glycol supplier for suitable inhibitors.*

Evaporator coils - examine

1. Remove the unit front, side and rear panels and inspect the A-frame coil for defects, damage and corrosion.
2. Check that the coil fins are in good condition. If they are found to be bent, they should be carefully straightened using a proprietary fin comb.

Note: *Fin combs are available from distributors or any reputable environmental products supplier.*

3. Inspect the refrigerant pipework connections for signs of oil leaks.
4. Refit the unit front, side and rear panels and restore the electrical supply to the unit.
5. Record and report any defects found during the inspection.

Electric panel - inspection and functional checks

General

1. Open the unit front and right-hand side panels. Inspect the electric panel for any damage or loose electrical connections and re-tighten as necessary.

Note: *The functioning of all control circuits can be tested by actuating each of the main functions, by adjusting the set points.*

Cooling functional test

1. Select a set point for a temperature of 6^{o}C below room temperature.
   a) A call for cooling should be observed and the liquid line solenoid valves should open.
   b) The compressor contactor should energise, and the equipment should begin to cool.
   c) A high temperature alarm may annunciate. Disregard it.
2. Return the set point to the room temperature.

Note: *For chilled water units, a call for cooling should cause the chilled water valve to open.*

Reheat functional test

1. Select a temperature set point for 6^{o}C above the room temperature.
   a) A call for heating should be observed.
   b) Both heating contactors should energise, and the heating elements should begin to heat.
   c) Disregard the low temperature alarm.
2. Return the set point to the desired temperature.

Humidification functional check

1. Set the humidification to 10%RH above the room humidity reading.
   a) For infrared humidifiers, the solenoid valve and contactor should energise and the infrared element should come on. Refer to page 9 for humidifier operation.
   b) For a steam generating humidifier, you will immediately hear clicks as it energises. After a short delay, the pan or canister will fill with water. The water will heat and steam will be produced.
2. Return the humidity setting to the desired room relative humidity setting.

Maintenance (continued)

WARNING

Isolate the unit power supply before removing the panels and carrying out any of the following procedures. Lethal voltages are present when the unit is energised.

Dehumidification functional check

1. Set the humidification set point to 10%RH below the room humidity reading. Make sure that the temperature set point is at or above room temperature.
2. The liquid line solenoid valve should open, the compressor contactor should energise and the system should begin to cool / dehumidify.

Note: *In chilled water systems the chilled water valve should open fully.*

3. Return the humidity setting to the desired room relative humidity setting.

Completion

1. Close the unit front and side panels and restore the electrical supply to the unit.
2. Record and report any defects found during the inspection.

Firestat (optional) - examine

1. Open the unit front accent panel and inspect the firestat on the electric panel for any loose electrical connections and retighten as necessary.
2. Examine the firestat for any obvious defects or damage.
3. Close the unit front accent panel and restore the electrical supply to the unit.
4. Record and report any defects found during the inspection.

Cabinet and frame - examine

1. Examine the cabinet exterior for any obvious defects or damage and repair as necessary.
2. Remove the front, side and rear panels and examine the cabinet interior for signs of damage or corrosion. Repair any damage found and restore the surface finish where corrosion has occurred.
3. Refit the front, side and rear panels and restore the electrical supply to the unit.
4 Record and report any defects found during the inspection.

Front accent panel - examine

1. Open the unit front accent panel and examine the panel for any obvious defects or damage.
2. Ensure that the gas struts at each end of the panel are serviceable and provide controlled panel opening.
3. Examine the gas strut mounts for defects or damage.
4. Close the unit front accent panel. Ensure that the Dzus fasteners hold the panel securely in the closed position and restore the electrical supply to the unit.
5. Record and report any defects found during the inspection.

Liqui-Tect/water detection sensors (optional) - examine

1. Remove the unit front and right-hand side panels.
2. Identify the water detection sensors. These are located below raised floors next to wet traps and floor drains, and in drainage channels.
3. Inspect the sensors for damage, defects and corrosion. Ensure that the sensors are securely mounted.
4. Examine the electrical connections at the unit for security and retighten if necessary. Ensure that the wiring insulation is sound and that the wires are correctly routed.
5. Refit the unit front and right-hand side panels and restore the electrical supply to the unit.
6. Record and report any defects found during the inspection.

Air cooled condenser - examine

Refer to the Condensers Technical Data Manual (P / N SLM-ECO-2E) supplied with the condenser.

Maintenance (continued)

WARNING

Isolate the unit power supply before removing the panels and carrying out any of the following procedures. Lethal voltages are present when the unit is energised.

Filter-dryer - examine

1. Open the unit front and left-hand side panels and identify the filter-dryer.
2. Examine the filter-dryer canister for defects damage or corrosion. Correct any defects found and restore the surface finish where corrosion has occurred.
3. Inspect the refrigerant sight glass for dirt particles. If present, renew the filter-dryer
4. Inspect the refrigerant pipework connections for signs of oil leaks.
5. Close the unit front and left-hand side panels and restore the electrical supply to the unit.
6. Record and report any defects found during the inspection.

Corrective Maintenance

Air filters - renewal

To maintain efficient operation, the air filters should be checked monthly and renewed as required. (Refer to the air filter table on the following page). Because renewal intervals may vary with environmental conditions and filter type, each unit is equipped with a filter clog switch which warns of restricted air flow through the filter compartment by activating the 'Change Filter' alarm.

1. Remove the unit front and side panels and remove the filters from the inside of the unit.

Note: *On Glycool models, filters may only be accessed from the fan motor end of the unit or from the top of the unit.*

2. Fit new filters, refit the unit front and side panels and restore the power supply.

Note: *When the filters have been renewed, test the operation of the filter clog switch as follows:*

a. Turn the adjusting screw on the Filter Clog Switch counter clockwise until the 'Change Filter' alarm annunciates.

b. With the fan running, all panels fitted and the door closed, adjust the switch so that it just energises the front panel LED with clean filters.

c. Turn the adjusting knob a ½ turn clockwise from this position (each turn equals approx 240 Pa).

Shell and tube condensers - cleaning

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

It may be necessary to clean the copper tubing periodically to remove any deposits of lime scale. (Periods between cleaning will vary with local water conditions). As deposits build up, a cleaning tool, available from any reputable refrigeration supplier, should be used to clean the heat exchanger tubes.

1. Stop the unit (using the start/stop switch), and allow the compressor to pump down.
2. Open the disconnect switch.
3. Shut off the water supply to the condenser.
4. Drain all water from the condenser and piping.

Note: *Take care not to damage the head gaskets during the following action.*

5. Remove the bolts securing each head and slowly pry them free.
6. Swab the condenser tubes with a tube cleaning tool.
7. When the tubes are clean, fit new gaskets, if required, and refit the heads.
8. Reconnect the piping, open the water supply, vent the system and check for leaks.
9. Restart the system by closing the disconnect switch and continue to check for leaks with the system running. Once it has been established that no leaks are present, the unit panels can be refitted.

Maintenance (continued)

AIR FILTER DIMENSIONS (mm)				
Model	**Frame Size**	**Return Type**	**Air, Water, Glycol**	**Glycool**
LD 20	1829mm	Top	(3) 610 x 610	(2) 610 x 610 + (1) 457 x 610
LU 20 *	1829mm	Front	(3) 508 x 406 + (2) 508 x 635	(3) 508 x 406 + (2) 508 x 635
LD 30	1829mm	Top	(3) 610 x 610	(2) 610 x 610 + (1) 457 x 610
LU 30 *	1829mm	Front	(3) 508 x 406 + (2) 508 x 635	(3) 508 x 406 + (2) 508 x 635
LD 37	1829mm	Top	(3) 610 x 610	(2) 610 x 610 + (1) 457 x 610
LU 37 *	1829mm	Front	(3) 508 x 406 + (2) 508 x 635	(3) 508 x 406 + (2) 508 x 635
LD 46	2464mm	Top	(4) 610 x 610	(3) 610 x 610 + (1) 457 x 610
LU 46 +	2464mm	Front, Rear	(3) 508 x 406 + (2) 508 x 635	(3) 508 x 406 + (2) 508 x 635
LD 58	2464mm	Top	(4) 610 x 610	(3) 610 x 610 + (1) 457 x 610
LU 58 +	2464mm	Front, Rear	(3) 508 x 406 + (2) 508 x 635	(3) 508 x 406 + (2) 508 x 635
LD 67	2464mm	Top	(4) 610 x 610	(3) 610 x 610 + (1) 457 x 610
LU 67 +	2464mm	Front, Rear	(3) 508 x 406 + (2) 508 x 635	(3) 508 x 406 + (2) 508 x 635
LD 100	3048mm	Top	(5) 610 x 610	
LU 100 +	3048mm	Front, Rear	(3) 508 x 635 + (3) 508 x 406	
Model	**Frame Size**	**Return Type**		**Chilled Water**
LD 30	1219mm	Top		(2) 610 x 610
LU 30 *	1219mm	Front		(2) 610 x 610
LD 40	1219mm	Top		(2) 610 x 610
LU 40 *	1219mm	Front		(2) 610 x 610
LD 50	1219mm	Top		(2) 610 x 610
LU 50 *	1219mm	Front		(2) 610 x 610
LD 60	1829mm	Top		(3) 610 x 610
LU 60 *	1829mm	Front		(3) 508 x 406 + (2) 508 x 635
LD 70	1829mm	Top		(3) 610 x 610
LU 70 *	1829mm	Front		(3) 508 x 406 + (2) 508 x 635
LD 80	2464mm	Top		(4) 610 x 610
LU 80 +	2464mm	Front, Rear		(3) 508 x 406 + (2) 508 x 635
LD 90	2464mm	Top		(4) 610 x 610
LU 90 +	2464mm	Front, Rear		(3) 508 x 406 + (2) 508 x 635

Notes:

Frame size is length of unit less panels.

All dimensions are nominal sizes only. 406mm = 16in, 457mm = 18in, 508mm = 20in, 610mm = 24in, 635mm = 25in.

Standard filters 30% efficient (Eurovent 4-5, Class B2, 1.5 microns) 100mm (4in) depth.

High efficiency filters 65% efficient (Eurovent 4-5, Class C1, 1 micron) 150mm (6in) depth.

Pre-filters 20% efficient (Eurovent 4-5, Class C2, 5 microns) 50mm (2in) depth.

* Bottom and rear return filters are as the downflow filter sizes.

Maintenance (continued)

WARNING

Isolate the unit power supply before removing the panels and carrying out any of the following procedures. Lethal voltages are present when the unit is energised.

Regulating valves - adjustment

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

1. To lower the head pressure setting, turn the square adjusting screw clockwise until the high pressure gauge indicates the desired setting.
2. To raise the head pressure setting, turn the adjusting screw counterclockwise until the desired setting is obtained.

Note: *For optimum efficiency, the valve should be set for 40.5^{o}C to 43.3^{o}C condensing temperature.*

Steam generating humidifier - boiler cleaning and renewal (see Figure 8)

Note: *Regular maintenance is limited to descaling or renewing the boiler. This is necessary when scale on the active surfaces of the electrodes prevents sufficient passage of electrical current.*

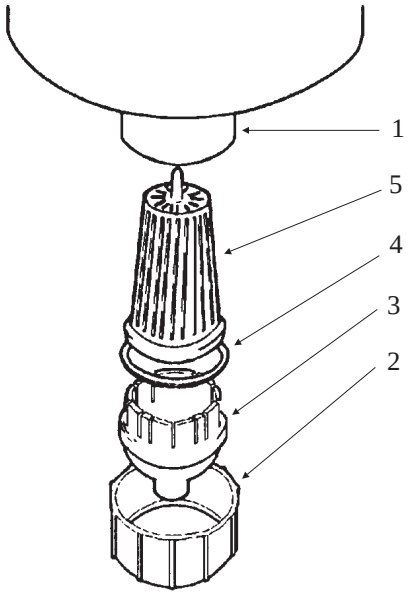


Figure 8 - Bottom filter

Dismantling the boiler

1. Drain the water completely by pressing the DRAIN button on the humidifier control panel.
2. Disconnect the power supply to the equipment.
3. Unscrew the steam pipe from the boiler.
4. Disconnect the wiring to the main electrodes and the level electrodes.
5. Unhook the holding spring and unscrew the boiler by rotating it anti-clockwise on its axis.
6. Remove the boiler.

Note: *The boiler may generally be used again after descaling.*

7. Unscrew the ring nut (1) and extract the bottom filter (4). Remove any scale and calcareous deposits under a jet of water and clean the grids mechanically or chemically with a commercially available cleaner.

Note: *When electrode wear is such that regeneration is insufficient, the boiler must be renewed. Exchange the body of the boiler (5) and the 'O' ring (3). The ring nut (1), connection piece (2) and filter (4) do not deteriorate with use.*

8. Reassemble the boiler in the reverse sequence after checking and if necessary, renewing the washer between the threaded connection and the discharge group.

Cleaning

Depending on local water conditions, it will be necessary from time to time to clean the humidifier assembly completely.

1. Drain the water from the boiler by pressing the DRAIN button on the humidifier control panel and isolate the power supply.
2. Dismantle and wash the water intake valve and check that the intake filter is clean.
3. Dismantle the drain group. Clean conduits and nozzles and remove any solids from the base of the syphon.
4. Inspect the water intake, drain, steam and condensation pipes, and renew them if they are worn or fragile.

Maintenance (continued)

WARNING

Isolate the unit power supply before removing the panels and carrying out any of the following procedures. Lethal voltages are present when the unit is energised.

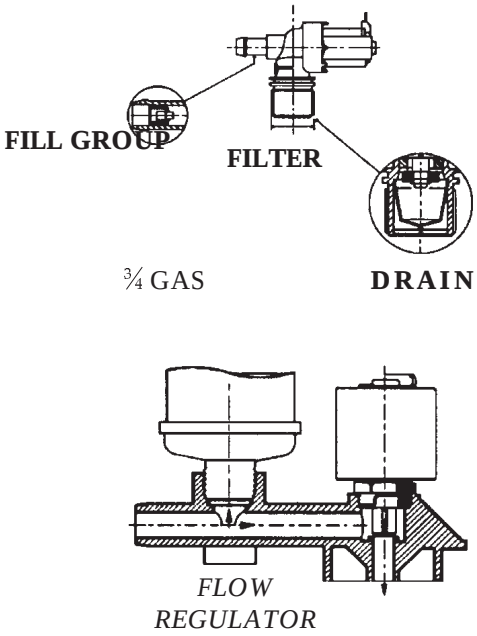


Figure 9 - Fill and drain groups

Infrared humidifier - lamp renewal

1. Remove the unit front panels.
2. Remove the humidifier pan by disconnecting the drain coupling and removing the retaining screw at the right hand end of the humidifier.
3. Remove the lamp brackets under the lamps.
4. Remove the high voltage compartment cover.
5. In the high voltage compartment, locate the burned-out bulb with a continuity tester.
6. Loosen the two screws securing the bulb wires to the junction block.
7. Pull the bulb straight down.

Caution

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

8. Fit a new bulb making sure that the lamp wires are secure in the junction block.
9. Reverse steps 1 to 6.
10. Refit the unit front panels and restore power to the unit.

Hot gas by-pass valve - adjustment

1. Remove the unit front and side panels.
2. Install pressure gauges on the suction and discharge lines to the valve.
3. Start the compressor by lowering the temperature setpoint on the controller.
4. Remove the TOP cap to reveal the adjusting nut on the valve.
5. Insert a suitable Allen key in the brass hole at the top of the valve in the adjusting port. Turn clockwise if a higher evaporator temperature is required and anti-clockwise if a lower temperature is required.
6. After obtaining the required suction pressure, reinstall the cap tightly, making sure that there are no leaks.
7. Let the evaporator operate for approximately 10 to 15 minutes to make sure that the suction pressure is within the desired range.

Note: *There will be a fluctuation of approximately 20 to 40 kPa on the evaporator owing to the differential pressure on the hot gas bypass.*

8. Reset the temperature setpoint to its original value.
9. Remove the pressure gauges from the suction and discharge lines.
10. Close the unit front and side panels.

Maintenance (continued)

WARNING

Isolate the unit power supply before removing the panels and carrying out any of the following procedures. Lethal voltages are present when the unit is energised.

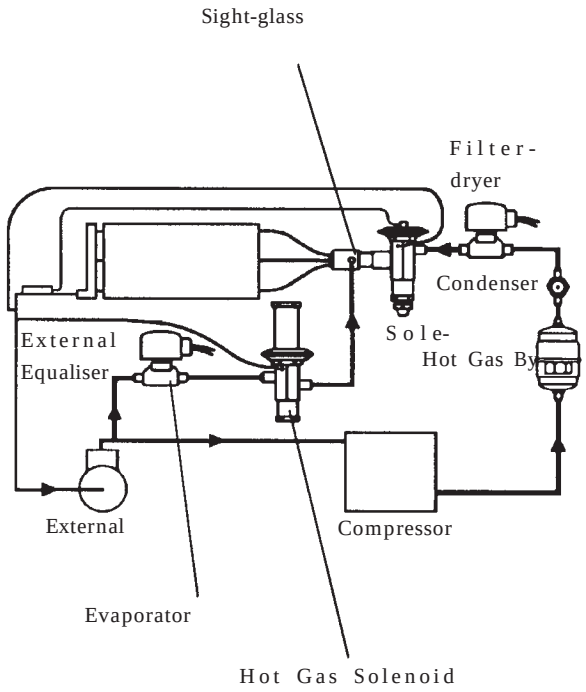


Figure 10 - Hot gas bypass

Superheat - calculation and adjustment

Calculation

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

Adjustment

1. Remove the cap at the bottom of the thermostatic expansion valve.

Note: *Make no more than a ¼ turn of the stem at a time. As long as thirty minutes may be required for the new balance to take place.*

2. Turn the adjusting stem counter-clockwise to lower the superheat.
3. Turn the adjusting stem clockwise to increase the superheat.

Regulating valves - manual flushing

It will be necessary to dismantle the valve to clean the seat if leakage past the valve seat is suspected.

1. Shut off the water supply.
2. Relieve the tension on the main spring by turning the adjusting screw clockwise as far as it will go. (Provide a means of catching water below the valve.)
3. Remove the four screws extending through the main spring housing from the end of the valve opposite the bellows.
4. Remove the centre assembly screws; this allows access to all internal parts.
5. Clean the seat if possible. If the seat is pitted or damaged, renew the valve rubber disc and valve seat.
6. After the valve is reassembled check for leaks.
7. Re-adjust the head pressure control.

Testing the function of the 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 a head pressure) or the pressure sensing capillary is not properly connected to the condenser gas port.

Maintenance (continued)

Maintenance procedures

Compressor failure

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

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

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

WARNING

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

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

1. Check all MCB's.
2. Check the operation of the Hi-Lo pressure switch. If a compressor failure has occurred, determine whether it is an electrical or mechanical failure.

Mechanical - No burned odour from gas released at service port. Motor attempts to run.

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

In the event of 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.

Note: *Failure to properly clean the system after a compressor motor burnout will invalidate the compressor warranty.*

WARNING

Before servicing the compressor, read the safety precautions listed below and on the terminal box cover. Failure to follow these instructions could result in serious injury.

Compressor renewal procedure - mechanical failure

If it has been determined that a mechanical failure has occurred, other than suction on discharge valve plates, the compressor must be renewed using the following procedure:

1. Disconnect power.
2. Attach suction and discharge gauges to the compressor service ports.
3. Close the service valves by turning them clockwise and reclaim the charge from the compressor.

Caution

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

4. Remove the service valves, pressure switch capillaries and all electrical connections; then remove the compressor.
5. Fit a new compressor and make all connections.
6. Crack open the suction valve and allow refrigerant to flow through the compressor and out of the charging hose into a reclaim cylinder.
7. Open both service valves and turn on the disconnect switch.
8. Close the liquid line hand valve (if available) and pump the compressor down.
9. When the system is completely pumped down, open the liquid line hand valve (if available) and start the unit.
10. Check the refrigerant charge and carry out a leak test.

Maintenance (continued)

Compressor renewal procedure - compressor motor burnout

1. Determine the cause of the burnout and make the necessary corrections to ensure that there won't be a repeat burn out with the new compressor.
2. Check the control box for blown fuses, welded starter contacts, welded overload contacts and burned out heater elements.
3. Check the compressor terminal plate for burned or damaged terminals or insulation and check for shorted or grounded wires.
4. Check the unit wiring for loose power connections. Check for high and low voltages.
5. Disconnect all electrical wiring to the compressor.

Clean-up procedure

When a compressor motor burns out, the stator winding decomposes forming carbon, water and acid which may contaminate the refrigeration system. These impurities must be removed from the system to prevent repeated motor failures.

1. Follow recognised safety practices and wear protective goggles.
2. Do not operate the compressor or connect any electric power to this unit unless the terminal box cover is in place and the suction and discharge valves are open.
3. Do not remove the compressor terminal box cover until all electrical power has been disconnected.
4. If there is a refrigerant leak around the terminals, shut off the suction and discharge service valves to isolate the compressor and reclaim all of the refrigerant in the compressor for return to the manufacturer. Do not disturb the terminals or wiring at the terminals or perform any disassembly until the compressor has been isolated and discharged.

Note: *For severe burnouts, ensure that the suction and discharge service valves are not contaminated. They must be thoroughly cleaned or renewed before they can be reconnected.*

Replacement compressors

Replacement compressors are available through Liebert International BV, Model Farm Road, Cork, Ireland. The service contractor will be invoiced for the replacement compressor but will be credited in full when the faulty compressor is returned to the Liebert factory as stipulated in the warranty agreement.

Contact the Liebert International BV, Model Farm Road, Cork, Ireland, for shipping details on returning faulty compressors.

Note: *Use the same packing for returning the faulty compressor as that used to ship the replacement compressor. All compressors must be hermetically sealed to avoid contamination during shipment; failure to do so may void your warranty claim.*

Details of the problems found, together with the serial number of the unit and the compressor must be indicated on the warranty return tag, a sample of which is provided at the rear of this manual.

Troubleshooting

Fault	Indication	System response
	Temperature sensing alarm	
Indicates a failure of the temperature sensing function (loss of signal)	**Level 5:** Simultaneous High & Low Temperature alarms, accompanied by dashes on the numeric read-out for temperature	Activates 100% cooling
	Level 15: Indicates ALARMS	Activates 100% cooling
	Humidity sensing alarm	
Indicates a failure of the humidity sensing function (loss of signal)	**Level 5:** Simultaneous High & Low Humidity alarms, accompanied by dashes on the numeric read-out for humidity	Deactivates humidification and dehumidification
	Level 15: Indicates ALARMS	Deactivates humidification and dehumidification

Symptom	Possible cause	Check or remedy
	Humidifier - steam generating	

If the humidifier controller does not respond to a call for humidification from the Liebert unit:

- Check the supply and control voltage to the humidifier
- Check the electrical connections at the humidifier terminal block
- Check the dip-switch settings

If the humidifier controller signals an alarm condition, refer to page 12, for the appropriate action to be taken.

	Blower	
Blower will not start	No main power	Check L1, L2 and L3 for rated voltage
	MCB tripped	Check the main fan MCB. Check the control voltage manual reset breakers
	Air flow switch	Check the operation of the air flow switch
	Overloads tripped	Push the reset button on the main fan overload. Check the amp draw
	No output voltage from T1 transformer	Check for 24V AC between TB2-1 and TB2-3 (Level 5). If there is no voltage, check the primary voltage of the transformer
	Circuit breaker KM1 tripped	Check for 24V AC between TB2-1 and TB2-3 (Level 5). If there is no voltage, check for a short and reset the breaker KM1
	ON / OFF switch not working	Check the ribbon cable to the display
	Broken belt	Check the belts
Blower runs but controls will not operate	Remote shutdown operating	Check to see if the remote shutdown is connected (Terminals 37 and 38 - Level 5). If they are not in use, link both terminals together.

Troubleshooting (continued)

Symptom	Possible cause	Check or remedy
	Reheat	
Reheat will not operate; contactor not pulling in	Control not calling for heating	Check the control to see if a call for heating is indicated on the display
	Reheat safety stat open	Check the reheat safety stat
Reheat not operating; contactor pulling in	Re-heat element burned out	Turn off the power and check the heater resistance with an ohm meter
		Renew the element if faulty
	Compressor	
Compressor contactor pulled in but the compressor will not operate	Blown MCB	Check for line voltage after MCB and after contactors
Compressor will not operate, contactor not pulled in	No call for cooling or dehumidification	Check that the Cooling or Dehumidification LED is ON (front display)
	Solenoid valve not energising	Hold a screwdriver over the solenoid and check for a magnetic field. The presence of a magnetic field indicates that the solenoid is energised
	Low Pressure Switch not making contact	Check the gas pressure, by-pass the Low Pressure Switch
	High Pressure Switch open	Determine the cause, rectify and then reset the switch - See Refrigeration section
	Compressor overload or thermostat tripped	Check the voltage between P4-8 and P4-9 on the interface board for Level 5 or P32-4 to P33-6 on the interface board for Level 15. If this is 24 V AC, the safety stat is open
Compressor runs for three minutes then stops; contactor de-energises	Low Pressure Switch not making contact	Check for low gas pressure. Compressor may be running on the winter start kit
	Solenoid is not opening	Check the magnetic field to see if the solenoid is energised
	Glycol pumps	
Suddenly stops pumping	Clogged strainer or impeller	Clean out the debris
Suddenly slows pumping	Clogged impeller, diffuser or line	Clean out the debris and use a strainer

Troubleshooting (continued)

Symptom	Possible cause	Check or remedy
	Glycol pumps (continued)	
Excessive leakage around the pump shaft while operating	Worn seal or packing	Renew the seal or packing
Performance poor	Worn impeller or seal	Fit new impeller or seal
	Suction lift too high	Relocate the pump closer to supply
	Motor not up to speed; low voltage	Larger lead wires required
	Worn motor bearings	Renew
Noisy operation	Worn motor bearings	Renew
	Low discharge head	Throttle discharge - improve suction conditions
	Debris in impeller	Remove the cover and clean out
	Dehumidification	
No dehumidification	Control not calling for dehumidification	Check to see if call for dehumidification is indicated on display
	Compressor contactor not pulling in	See Compressor section
	Compressor will not run	Check line voltage after MCB and after contactors
	MCB tripped	Check line voltage after MCB and after contactors
	Humidifier - infrared	
No humidification	Humidifier pan not filling	Check the water supply (should be ⏐ 2 litres / min.)
		Check the auto-flush and pan size setting (Refer to the controller manual)
		Check the drain
		Check for a clogged water strainer in the water valve
	Control not calling for humidification	Check to see if call for humidification is indicated on the display
	Humidifier contactor not pulling in	Check visually. If the contactor is made, check the line voltage after the contactor and MCB, check the phase current
	Thermostats activated	Check if the thermostats under the pan and on the reflector have de-activated the unit.
		Note: *The thermostat on the reflector is self-resetting and responds to insufficient air flow. The thermostat under the pan has a manual reset and responds to a low water level.*
	Humidifier bulb burned out	Renew the bulb

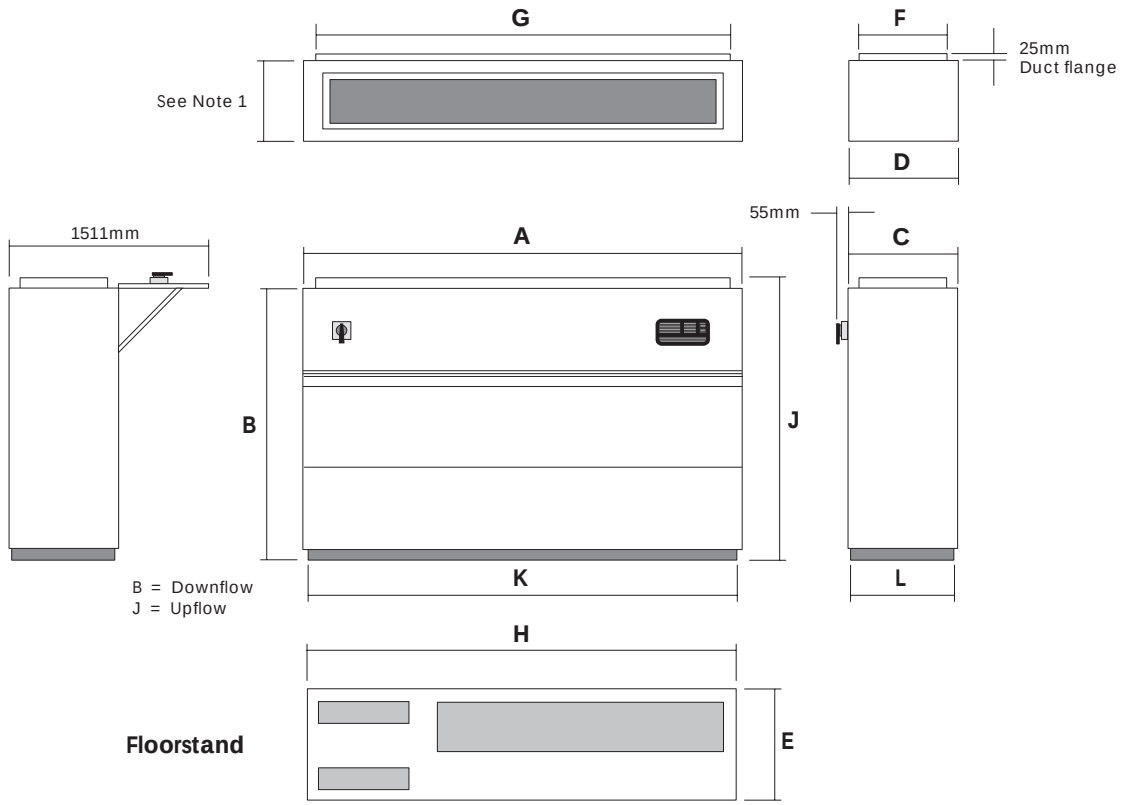
Troubleshooting (continued)

Symptom	Possible cause	Check or remedy
	Refrigeration system	
Low suction pressure; high superheat	Moisture, dirt or wax in system	Filter drier and / or sight glass
	High superheat adjustment	Reset the TEV, see page 22
	Faulty thermostatic adjustment element in the TEV	Renew the TEV
	Restricted external equaliser	Check TEV operation
	Low refrigerant charge	Check the sight glass
	Clogged drier	Check the sight glass
High suction pressure; low superheat	TEV seat leak	Check valve for leaks
	Low superheat adjustment	Reset the TEV, see page 22
	Moisture, dirt or wax in the system	Check the filter drier and / or sight glass
	Restricted external equaliser	Check TEV operation
Low suction pressure; low superheat	Dirty air filters	Check the air filters
	Poor air distribution	Check the air distribution
	Residual oil in the evaporator	Check the compressor oil level
High discharge pressure	Dirty condenser or drycooler fins	Clean the coil
	Condensing equipment not operating	Check operation
	High refrigerant charge	Check the refrigerant charge
	Hot gas by-pass valve improperly adjusted	Adjust properly, see page 21
	Water regulating valve improperly adjusted	Adjust properly, see page 20
	Incorrect adjustment / malfunction of the Condenser / Drycooler Speed Controller	Refer to relevant manual (Check for defective capillary thermistor operation on Drycoolers)

Troubleshooting (continued)

Symptom	Possible cause	Check or remedy
	Chilled water valve	
HP chilled water valve not opening	Motor operates but the valve will not open	Check the linkage for adjustment and ensure that it is tight on the valve
	No 24V AC power to the motor	Check for 24V AC on the actuator
	No signal from the controller	Check the control voltage to the actuator (refer to electrical schematics for more details). 2 - 10 V DC = 0 - 100% valve opening. If the valve still does not open, even with voltage present, then renew the modulating motor
Standard pressure chilled water valve not opening	Motor operates but the valve will not open	Check the linkage for adjustment and ensure that it is tight on the valve
	No 24V AC power	Check for 24V AC control signals
	No signal from controller	Check for 24V AC control signals on the actuator (up and down). Check the position feedback potentiometer. (Refer to the electrical schematics for more details.) If voltages are present but motor does not operate then renew the valve modulating motor.

Dimensional data



Note: Floorstands are available in heights from 250 - 625mm in 75mm increments, and are adjustable over a 40mm range.

MODELS	DIMENSIONAL DATA (mm)										
	A	B	C	D	E	F	G	H	J	K	L
LD 30/40/50C	1270	1880	889	864	838	813	1168	1219	-	1220	839
LU 30/40/50C	1270	-	889	864	838	813	1168	1219	1935	1220	839
LD 20/30/37/A/W/G/E	1880	1880	889	864	838	813	1778	1829	-	1830	839
LD 60/70C	1880	1880	889	864	838	813	1778	1829	-	1830	839
LU 20/30/37/A/W/G/E	1880	-	889	864	838	813	1778	1829	1935	1830	839
LU 60/70C	1880	-	889	864	838	813	1778	1829	1935	1830	839
LD 46/58/67A/W/G/E	2515	1880	889	864	838	813	2413	2464	-	2465	839
LD 80/90C	2515	1880	889	864	838	813	2413	2464	-	2465	839
LU 46/58/67A/W/G/E	2515	-	889	864	838	813	2413	2464	1935	2465	839
LU 80/90C	2515	-	889	864	838	813	2413	2464	1935	2465	839
LD 100A/W/G	3099	1829	889	864	838	813	2977	3048	-	3049	839

Notes:

1. Standard nominal plenum heights are 510mm, 578mm and 883mm. 578mm minimum is required for vertical units with steam reheat, hot water reheat or steam humidifier options.
2. Dimensions C and A are external unit dimensions, i.e. to the outside of exterior panels.
3. The above data is intended as a guide only. For specific or non-specified dimensions, refer to Cork applications engineering.

MONTHLY MAINTENANCE INSPECTION CHECKLIST

DATE: _____ ***PREPARED BY:*** _____

MODEL NO: _____ ***SERIAL NO:*** _____

Filters

- ❑ Check for restricted air flow
- ❑ Check the filter clog switch
- ❑ Wipe the return air section clean

Blower section

- ❑ Impellers free of debris and move freely
- ❑ Check belt tension and condition
- ❑ Bearings in good condition
- ❑ Check the air flow switch operation
- ❑ Check pulleys and motor mounts
- ❑ Measure and record the phase current

Air cooled condenser (if applicable)

- ❑ Condenser coil clean
- ❑ Motor mounts tight
- ❑ Bearings in good condition
- ❑ Refrigerant lines properly supported
- ❑ Measure and record the phase current

Steam generating humidifier (if applicable)

- ❑ Check canister for deposits
- ❑ Check condition of steam hoses
- ❑ Replace the bottle if required
- ❑ Measure and record the phase current

Infrared humidifier

- ❑ Check the pan drain for blockages
- ❑ Check humidifier lamps
- ❑ Check pan for mineral deposits
- ❑ Measure and record the phase current

Compressor

- ❑ Check oil levels
- ❑ Check for leaks
- ❑ Measure and record the phase current

Refrigeration cycle/section

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

Air distribution section

- ❑ Restriction in grille free area

Refrigerant charge

- ❑ Check refrigerant level

NOTES: _____

_____

_____

_____

SIGNATURE: _____

MAKE PHOTOCOPIES OF THIS FORM FOR YOUR RECORDS

ANNUAL MAINTENANCE INSPECTION CHECKLIST

DATE: _____ ***PREPARED BY:*** _____

MODEL NO: _____ ***SERIAL NO:*** _____

Filters

- ❑ Check for restricted air flow
- ❑ Check the filter clog switch
- ❑ Wipe the return air section clean

Blower section

- ❑ Impellers free of debris and move freely
- ❑ Check belt tension and condition
- ❑ Bearings in good condition
- ❑ Check the air flow switch
- ❑ Check pulleys and motor mounts

Air cooled condenser (if applicable)

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

Water/glycol condenser (if applicable)

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

Glycol pump (if applicable)

- ❑ Glycol leaks
- ❑ Pump operation

Steam generating humidifier

- ❑ Check canister for deposits
- ❑ Check condition of steam hoses

Infrared humidifier

- ❑ Check pan drain for clogs
- ❑ Check humidifier lamps
- ❑ Check pan for mineral deposits

Compressor

- ❑ Check oil levels
- ❑ Check for leaks

Refrigeration cycle/section

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

Air distribution section

- ❑ Restriction in grille free area

Refrigerant charge

- ❑ Check refrigerant level

Electric panel

- ❑ Check MCBs
- ❑ Check electrical connections

Controller

- ❑ Check setpoints and DIP switch settings
- ❑ Check all optional devices and safety interlocks
- ❑ Check control supply voltage - 17.5 / 24 V AC

NOTES: _____

MAKE PHOTOCOPIES OF THIS FORM FOR YOUR RECORDS

WARRANTY CLAIM TAG

ONE TAG MUST BE ATTACHED TO EACH PART RETURNED

PART RETURN AUTHORISATION
ONE TAG FOR EACH PART

LIEBERT INTERNATIONAL B.V., MODEL FARM ROAD, CORK,
CUSTOMER SERVICE & SUPPORT

UNIT MODEL NO _____ **DISTRIBUTOR NAME** _____

UNIT SERIAL NO _____ **REASON FOR RETURN** _____

PART NO _____ _____

LIEBERT REPLACEMENT ORDER NO _____

DISTRIBUTOR REPLACEMENT ORDER NO _____

TO BE COMPLETED BY LIEBERT INTERNATIONAL B.V.

DATE RECEIVED _____

MANUFACTURERS NAME _____

MANUFACTURERS WARRANTY **YES** ☐ **NO** ☐

REPAIR ☐ **SCRAP** ☐ **VENDOR** ☐ **INSPECTION** ☐

CUSTOMER COPY

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Printed in Ireland.
Part No. SLC-ES4-3E