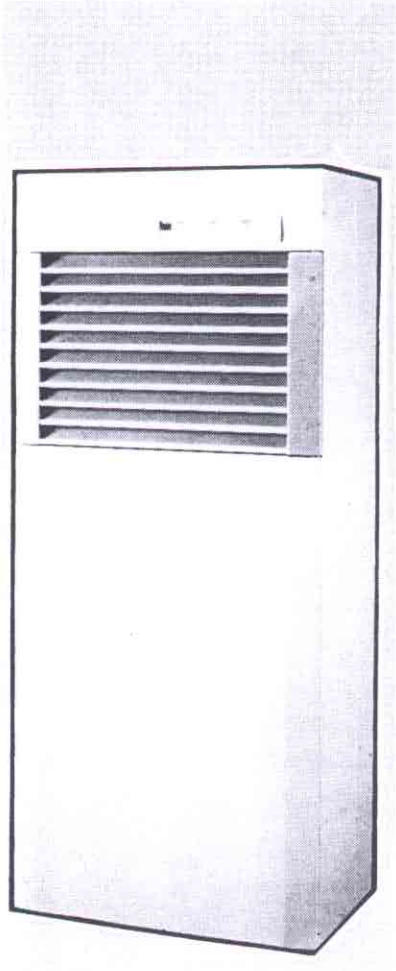
ENVIRONMENTAL CONTROL

Installation Operation and Maintenance Manual

Mini Tower

SLC-EMT-3E (Rev. 1)



Mini-Tower

Liebert

We won't let you down

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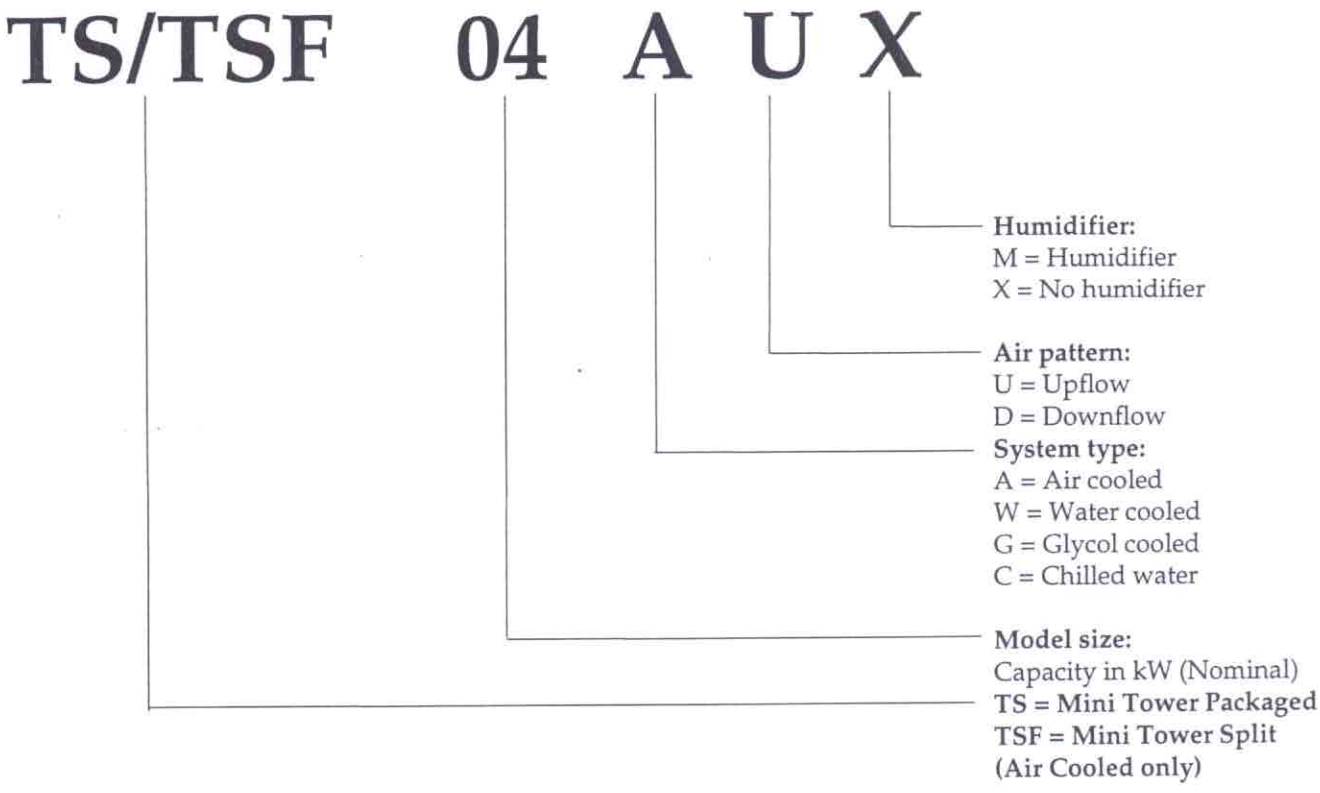
Part No.: SLC - EMT - 3E
Revision Date: June 1994
Print Date: June 1994

Nomenclature

The nomenclature for Mini Tower packaged (compressor in indoor unit) and split (compressor located in condensing unit) systems is as follows:



TS/TSF	06		A		U		M	
	Model size		System type		Air pattern		Humidification	
Mini Tower	04	4kW nom. cap.	A	Air cooled	D	Downflow	M	Humidifier
	06	6kW nom. cap.	W	Water cooled	U	Upflow	X	No humidifier
	07	7kW nom. cap.	G	Glycol cooled				
	09	9kW nom. cap.	C	Chilled water				
	11	11kW nom. cap.						

AIR (Packaged)	AIR (Split)	WATER	GLYCOL	CHILLED WATER
TS 04 AUX/ADX	TSF 04 AUX/ADX	TS 04 WUX/WDX	TS 04 GUX/GDX	TS 07 CUX/CDX
TS 04 AUM/ADM	TSF 04 AUM/ADM	TS 04 WUM/WDM	TS 04 GUM/GDM	TS 07 CUM/CDM
TS 06 AUX/ADX	TSF 06 AUX/ADX	TS 06 WUX/WDX	TS 06 GUX/GDX	TS 11 CUX/CDX
TS 06 AUM/ADM	TSF 06 AUM/ADM	TS 06 WUM/WDM	TS 06 GUM/GDM	TS 11 CUM/CDM
TS 09 AUX/ADX	TSF 09 AUX/ADX	TS 09 WUX/WDX	TS 09 GUX/GDX	
TS 09 AUM/ADM	TSF 09 AUM/ADM	TS 09 WUM/WDM	TS 09 GUM/GDM	

Introduction

Follow all instructions marked or supplied with this product

Only trained personnel to operate/service

Isolate power before opening any panel

Preliminary considerations

Critical area preparation

The room into which the unit is to be placed should be adequately insulated and should also have a sealed vapour barrier to prevent the ingress of moisture.

The vapour barrier in the ceiling can be of a polythene film type. A rubber or plastic base paint on concrete walls or floors should be used. Doors should not be undercut or have grilles in them.

External or fresh air should be kept to an absolute minimum as it adds to the heating, cooling, humidification and dehumidification of the site.

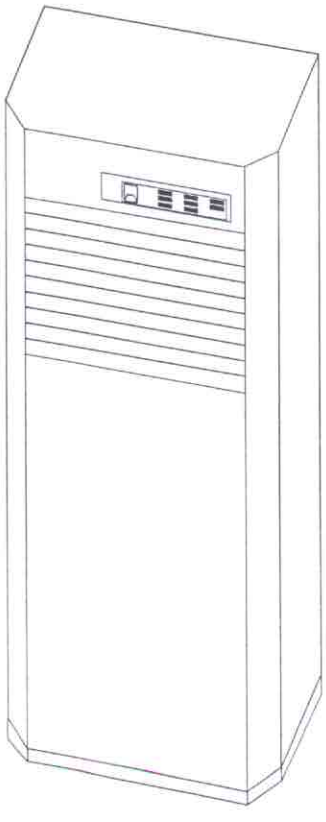


Figure 1 - The Mini Tower unit

Liebert recommend that external air be kept to a minimum while complying with local or national codes for ventilation requirements.

Location considerations

The unit can be 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 floor stand, independent of the elevated floor, can be used as a support and installed prior to the flooring system.

Note: A template to mark out the holes in the floor is printed on the packaging.

Piping considerations

All piping fitted below the elevated floor must be located so that it presents the least resistance to air flow discharging from downflow units. 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 10 mm per metre. Adequate pipe insulation must be fitted on all chilled water, glycol and hot discharge lines.

Electrical connections

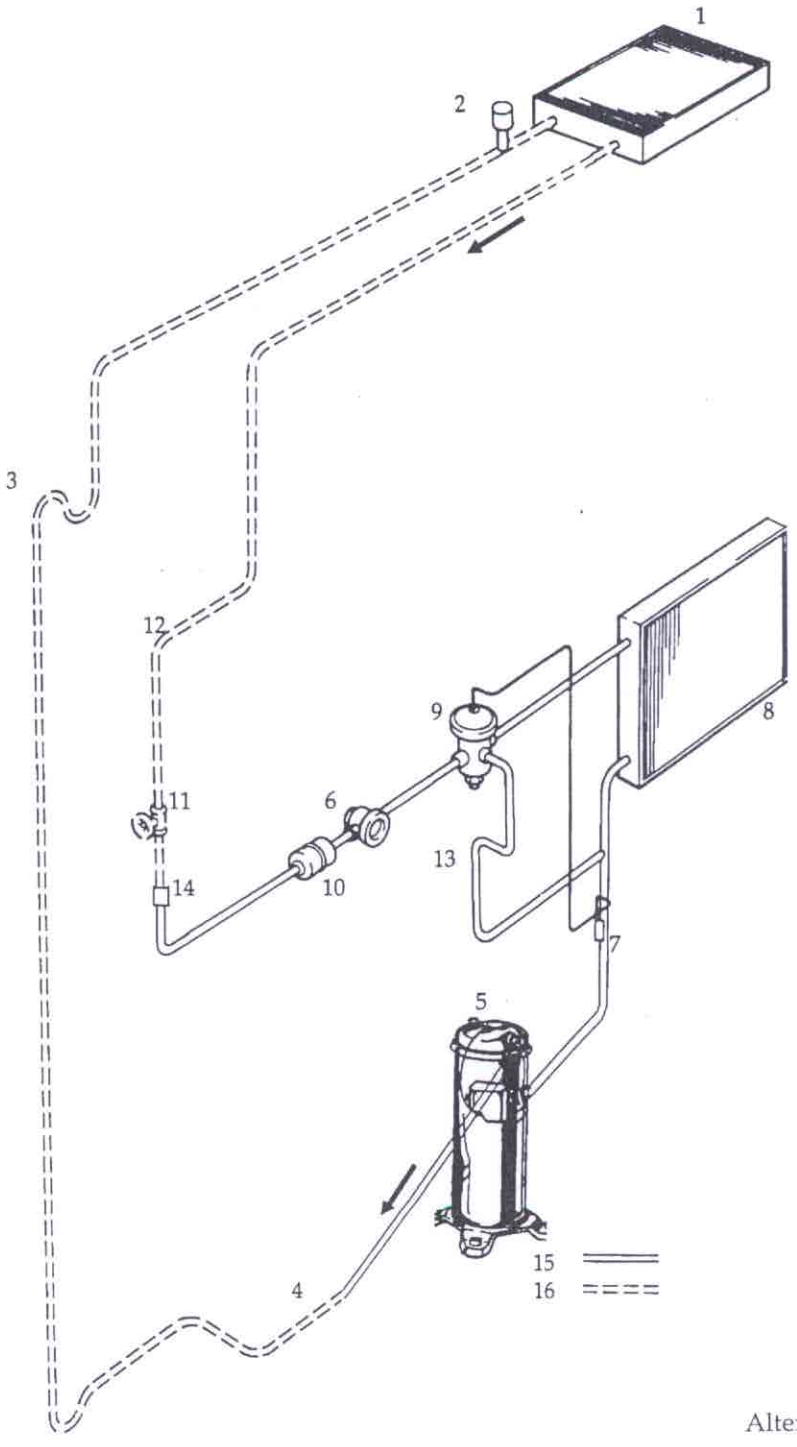
Three phase, neutral and earth electrical service is required for the Mini Tower indoor unit at 380/415 volts, 50 hertz. An isolating switch should be fitted near the unit. Electrical services should conform to both national and local electrical codes.

Equipment inspection

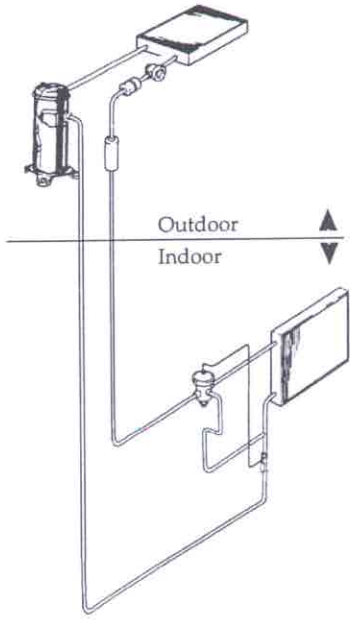
Inspection of the unit should be carried out immediately upon arrival. Visible and/or concealed damage should be looked for. Damage should be immediately reported to the carrier and a damage claim filed with your transport/freight agent.

The units should only be lifted/moved when fully supported under the base. The unit should be kept upright and level at all times and evenly supported at all four corners. Failure to handle the unit properly may result in serious damage to the unit.

System diagram (air cooled)



1. Condenser coil (outside unit)
2. Pressure relief valve
3. Traps every 7.5m of rise *
4. Hot gas discharge line
5. Compressor
6. Sight glass
7. Expansion valve sensing bulb
8. Evaporator coil
9. Expansion valve
10. Filter drier
11. Shut-off valve *
12. Liquid line
13. External equaliser for TEV
14. Non-return valve *
15. Factory piping
16. Field piping



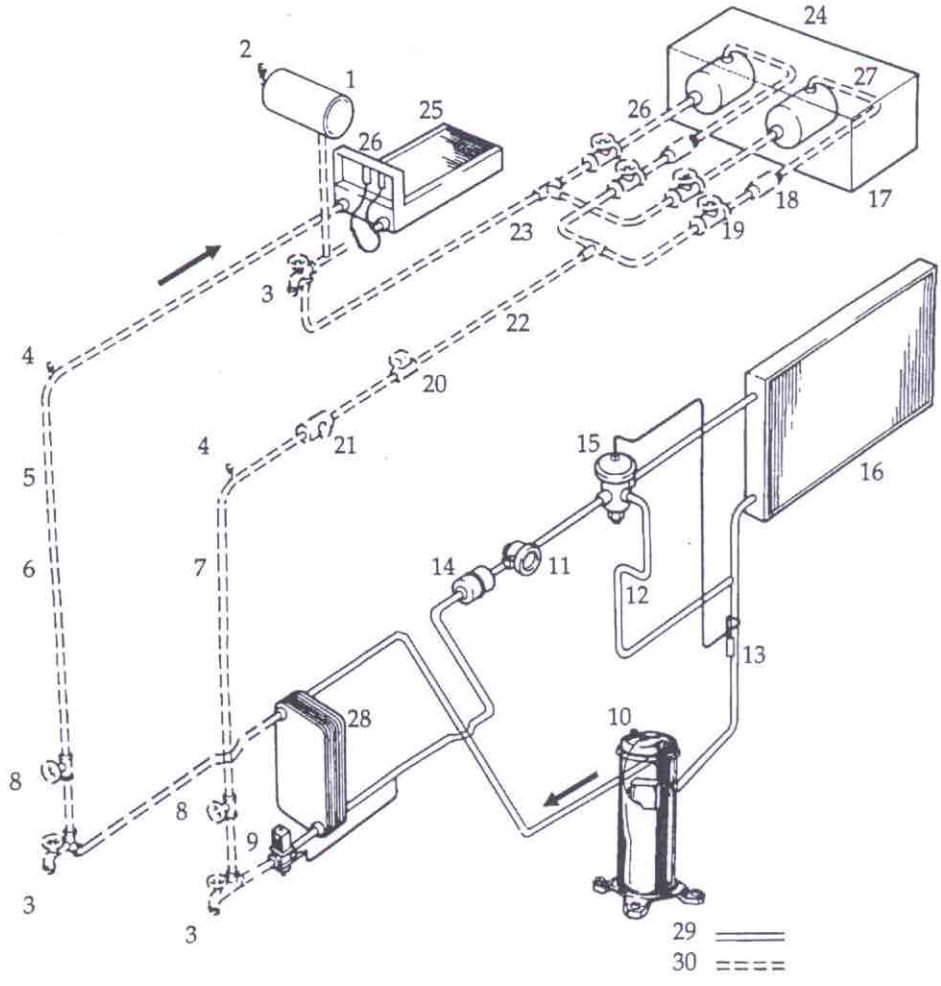
Alternative split systems arrangement

Figure 2 - Air cooled units schematic (packaged)

* Components are not supplied by Liebert but are recommended for proper circuit operation and maintenance.

→ Indicates flow direction

System diagram (water/glycol cooled)



1. Expansion tank field installed at highest point in system
2. Fill cock
3. Hose bib
4. Air vents at top of risers *
5. Glycol coolant circuit (one required per unit)
6. Fluid return from unit
7. Fluid supply to unit
8. Shut-off valves *
9. 2-way water regulating valve
10. Compressor
11. Sight glass
12. External equaliser for TEV
13. Sensing bulb
14. Filter drier
15. Expansion valve
16. Evaporator coil
17. Pump housing
18. Check valves on dual pump system only *
19. Gate valves *
20. Flow switch supplied with dual pump systems
21. Flow regulating valve *
22. Fluid supply from pump
23. Fluid return to pump
24. Optional dual pump system shown
25. Drycooler coil
26. Drycooler electric box
27. Glycol pumps
28. Condenser (plate type)
29. Factory piping
30. Field piping

* Components are not supplied by Liebert but are recommended for proper circuit operation and maintenance.

→ Indicates flow direction

Figure 3 - Water/Glycol cooled units schematic

System diagram (chilled water cooled)

Chilled water systems

A chilled water unit uses a customer supply of chilled water which is pumped through the slab coil and acts as the cooling medium for the air passing over the coil. The flow of chilled water to the coil is regulated by the electronic controller via a chilled water valve. This valve opens and closes as required to regulate the return air temperature.

The system uses a 3-way valve. Chilled water is pumped to port 'AB' (see Figure 4) of the valve and passes via port 'A' to the slab coil. When cooling is no longer required, port 'A' is closed and water flows through port 'AB' to port 'B' and then to the return pipework. This ensures that when cooling is not required, the water continues to flow.

1. Chilled water coil
2. 3-way chilled water valve
3. Valve actuator
4. Shut-off valve *
5. Hose bib *
6. Chilled water supply
7. Chilled water return
8. Factory piping
9. Field piping

* Components are not supplied by Liebert but are recommended for proper circuit operation and maintenance.

→ Indicates flow direction

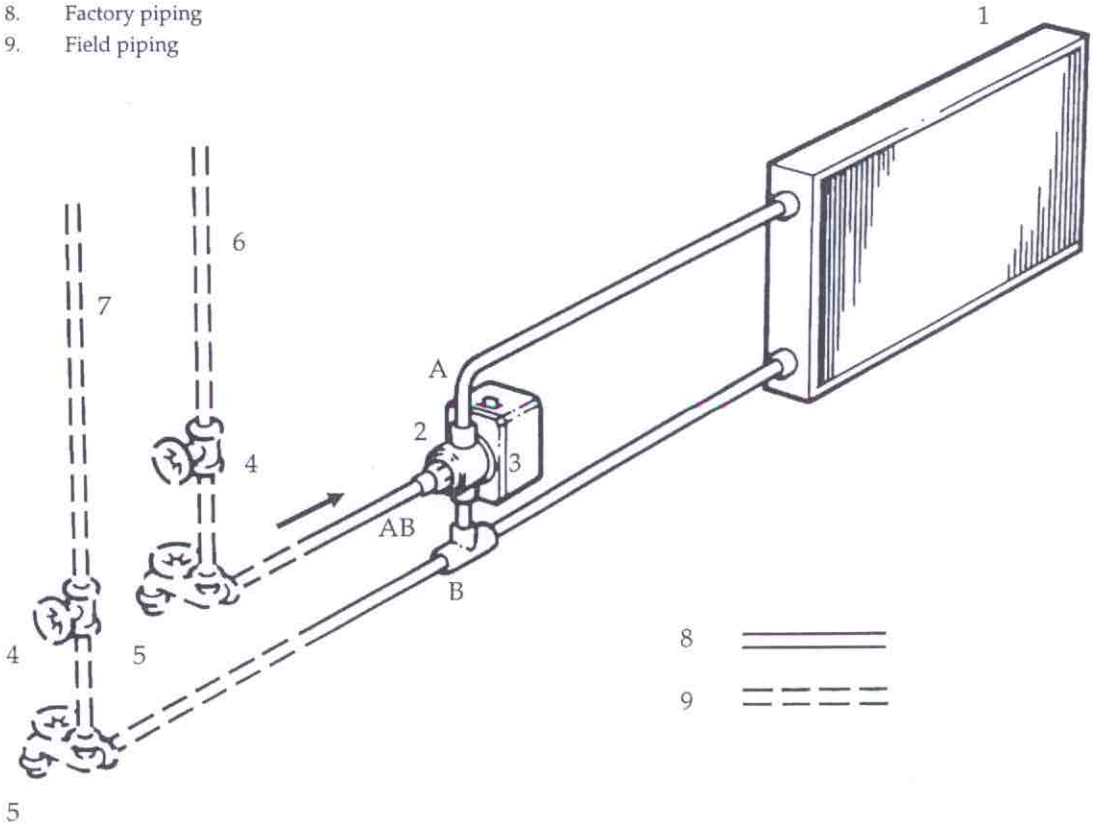


Figure 4 - Chilled water units schematic

Installation

Electrical connections

The Mini Tower requires a 380/415V, 3-phase supply, neutral and ground electrical service. The electrical and control connections are field wired to the terminal block located inside the unit on the bottom right hand side. An isolating switch should be fitted near the unit.

Note: It is the responsibility of the installation engineer to ensure that the electrical supply to the unit conforms to local electrical and safety codes.

Reference should be made to the electrical schematics included in this manual.

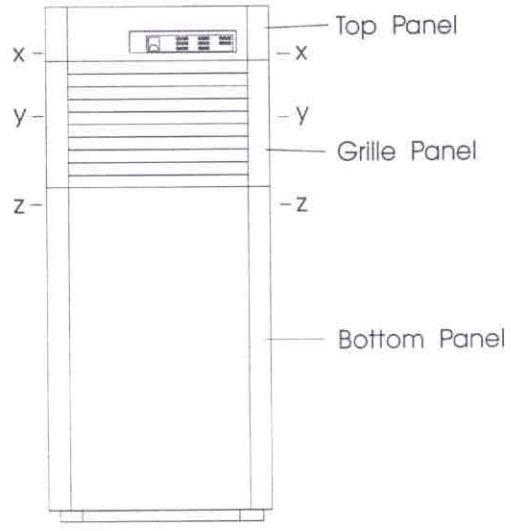


Figure 6 - Access panel removal

Access panel removal

The front of the unit contains three panels, one hinged and two removable.

Top panel (Figure 6)

The top (electrical) panel of the unit contains the Level 05 Controller display. The panel is hinged at the top and secured by slam latch connectors at the bottom.

The panel is opened by pulling it forward at positions x - x. It is secured in the open position by means of an extendible arm in the top right-hand corner of the unit's frame.

Grille panel (Figure 6)

The grille panel is secured to the frame by means of two slam latch connectors.

It is removed by pulling it forward at positions y - y.

Bottom panel (Figure 6)

The bottom panel is secured to the frame by two slam latch connectors at the top and two support lugs at the bottom.

It is removed by pulling it forward at positions z - z to release the latch connectors and then lifting it off the support lugs.

Side panel gland apertures

Caution

It is imperative that services passing through the gland apertures are properly sealed to prevent air ingress into the unit.

If it is required, owing to site limitations, to run the unit power and piping through the side of the unit, suitably sized and plugged apertures have been provided on the bottom left-hand side of the frame (when viewed from the front) for this purpose (refer to the Dimensional Data drawing for further details).

Recommended pipe line sizes

PIPE LINE SIZES* (INCHES) (COPPER)	
Chilled Water Unit Supply	7/8
Chilled Water Unit Return	7/8
Air Cooled Unit Supply	5/8
Air Cooled Unit Return	1/2
Water/Glycol Unit Supply	7/8
Water/Glycol Unit Return	7/8

**: These pipes are field fitted - where the pipe run exceeds 20 meters, contact Cork Applications Engineering.*

Installation (continued)

Mini Tower connection sizes

Model	Chilled Water Return	Chilled Water Supply	Hot Gas Line	Liquid Line	Water Connections	Humidifier Supply	Steam Distributor Drain	Humidifier & Coil Drain
TS/TSF 04 A	-	-	½ in.[3]	⅜ in.[3]	-	¼in. OD	¼ in. Male Flared	¾" Female BSP
TS /TSF06 A	-	-	½ in.[3]	⅜ in.[3]	-			
TS /TSF09 A	-	-	½ in.[3]	⅜ in.[3]	-			
TS 04 W/G	-	-	-	-	¾ in. BSP[2]			
TS 06 W/G	-	-	-	-	¾in. BSP[2]			
TS 09 W/G	-	-	-	-	¾in. BSP[2]			
TS 07 C	¾ in. BSP[1]	¾ in. BSP[1]	-	-	-			
TS 11 C	¾ in. BSP[1]	¾ in. BSP[1]	-	-	-			
DMC04/6/9A	-	-	¾ in.	½ in.	-	-	-	-

BSP = British Standard Pipe; [1]: Male Thread Connections; [2]: Female Thread Connections; [3]: Male flare connector

Air cooled models (packaged)

Condensers

Installation

Full installation instructions and technical details on the condensers are provided in the Condenser Technical Data Manual (SLM-ECO-2E), provided with the condenser.

Electrical connections

High voltage

High voltage electrical services consisting of one phase, neutral and earth are required for the Mini Tower range of air cooled condensers. The power supply for the condenser does not necessarily have to be the same as that for the indoor unit. A disconnect switch is factory-fitted. Refer to the Condenser Technical Data Manual provided with the condenser for full electrical details.

Note: If the Mini Tower is to be used with ambient temperatures greater than 32°C, contact the Applications Engineering department in Cork, Ireland.

Refrigeration piping circuits

All refrigeration piping should be installed with high temperature brazed joints. Good refrigeration practices should be employed for brazing, piping supports, leak testing, dehydration and charging of the refrigeration circuits. The refrigeration piping should be isolated from the building by the use of vibration isolating supports.

Traps should be installed in the hot gas line on vertical risers every 7.5 metres. These traps will collect condensed refrigerant oil during operation.

The units leave the factory with a dry inert gas holding charge of approximately 1.4 bar - 2.1 bar (140 - 210 kPa).

Condenser fan speed control systems

The fan speed controller provides an infinite number of speed variations in response to changes in refrigerant pressure.

Installation (continued)

Air cooled models (split)

Condensing units (split systems)

Location considerations

To ensure an adequate air supply, it is recommended that condensers be located in a **clean area,** away from loose dirt and foreign matter that may clog the coil. Condensers must not be located in the vicinity of steam, hot air or fume exhausts, or closer than 1 metre from a wall or obstruction. Avoid areas where heavy snow will accumulate at the air inlet and discharge locations.

The condenser should be located for maximum security and maintenance accessibility. Avoid ground level sites with public access.

Install a solid base, capable of supporting the weight of the condensing unit. The base should be at least 50mm higher than the surrounding grade and 50mm larger than the dimensions of the condensing unit base.

Note: Condenser may be located up to 6 metres above the cooling coil or 30 metres from the indoor unit.

Condensing Unit Weight	
Model	**kg**
DMC 04 A	98
DMC 06 A	102
DMC 09 A	106

Note: Refer to the dimensional drawings section for Condensing Unit dimensions

Field piping connections

Two refrigerant lines are required to connect the outdoor condensing unit to the evaporator unit. The bottom connection is for the insulated copper suction line. The top connection is for the copper liquid line.

WARNING

Ensure supply power is turned *OFF* before making any electrical connections.

Electrical connections

Refer to the electrical schematics when making connections.

Power connections

The outdoor condensing unit requires its own power source and earth ground, with a disconnect switch (field supplied) to isolate the unit for maintenance. Voltage supplied must agree with the voltage specified on the unit nameplate.

The DMC04A condensing unit requires a 230V/1ph/50Hz power supply. The DMC06/09A condensing units require a 400V/3ph/50 Hz and neutral power supply.

Control connections

A two-wire control connection (24V AC) is required between the outdoor condensing unit and the evaporator. Refer to the electrical schematics.

Control wiring between the evaporator and the condensing unit must not allow a voltage drop in the line of more then 1 volt . Do not connect additional electrical devices to the control circuit. The circuit breakers and the transformer are sized only for the factory supplied control system.

Additional control wiring will be required if your system includes other optional monitoring and control devices.

Installation (continued)

Dehydration

1. Isolate the unit's power supply.
2. Remove the unit's front panels (the bottom two). Remove the condensing unit cover in split systems.

WARNING

Extreme care should be taken when carrying out this procedure. Lethal voltages are present when the unit is energised. Care should also be taken to avoid the body or articles of clothing becoming entangled in the moving parts.

3. Connect refrigeration gauges to the access valves (Schrader® Connectors) on the suction and discharge lines.

Note: It is recommended that you use a 'KWIK COUPLER' or similar to connect service hoses to the access valves. This will avoid loss of refrigerant when attaching or removing hoses.

4. Open the access valves and put a charge of dry Nitrogen (20.68 bar/2068 kPa) into the refrigeration system. Using a Halide leak detector and/or a soapy water solution, leak check the refrigeration circuit.
5. After successful completion of the leak test, release the pressure and pull a vacuum of 0.995 bar (99.5 kPa) on the system. Leave for four hours.
6. Check for vacuum depletion. If the vacuum has decreased, leak test the system again. If the vacuum has remained static, pull another vacuum to 0.995 bar (99.5 kPa).
7. Fill the refrigeration circuit with Freon vapour through the suction access valve until pressure between the suction and discharge has equalised.

Charging

Having dehydrated the refrigeration circuit (see 'dehydration') charge the unit as follows:

1. Ensure that the operational components are clear of debris.

WARNING

Extreme care should be taken when carrying out this procedure. Lethal voltages are present when the unit is energised. Care should also be taken to avoid the body or articles of clothing becoming entangled in the moving parts.

2. Close the main fan MCB.
3. Check for proper fan rotation.
4. Connect a charging hose to a drum of refrigerant and purge the hose of non-condensibles. Introduce refrigerant vapour through the access valve on the suction line via the refrigeration gauges.
5. Close the compressor MCB.

Note: Check the compressor to ensure it is rotating in the correct direction. A scroll compressor rotating in the wrong direction:

- *will be noisy*
- *will not pump*
- *will cut out after a short time (with no damage to the compressor)*

If the compressor is incorrectly wired, reverse two of the phases on the power circuit and then re-start it.

6. Charge the unit until the liquid line sight glass becomes clear. Check that no bubbles reappear for at least ten minutes.

REFRIGERANT CONTROL SETTINGS For Air-Cooled Indoor Units			
Refrigerant Type	Low Pressure Cut Out	Low Pressure Cut In	High Pressure Cut Out
R-22	1.0 bar 100 kPa	2.4 bar 240 kPa	24.8 bar 2480 kPa

Water cooled models only

Piping considerations

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

When the water source to the 2-way water regulating valve and condenser is of poor quality, it is good practice to provide cleanable filters in the supply line. These filters will trap any particles in the supply line and extend the service life of the water cooled condenser. The condenser is designed to operate in conjunction with either a cooling tower or a city water supply.

WARNING

Eliminate any areas in the pipe runs where water could become stagnant and promote the growth of harmful bacteria in the system. Local codes relating to cooling tower piping must be followed.

Installation (continued)

Water regulating valve (2-way)

Adjustable water regulating valves are installed on Liebert units in the factory. They automatically open on refrigerant pressure increase and close on pressure decrease.

Testing the valve function

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

If the water should continue to flow, the valve is either improperly adjusted (with too low a head pressure), the pressure capillary is not properly connected to the condenser or the valve is not seating properly (refer to the Maintenance section).

Glycol cooled models only

Drycooler

Installation

Full installation instructions and technical details on the drycoolers are provided in the Drycooler Technical Data Manual (SLM-EDC-2E), provided with the drycooler.

Glycol piping considerations

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

It is good practice to insulate the glycol supply and return lines. Insulation will prevent the formation of condensation on the glycol lines between the unit and the drycooler.

Preparation of glycol solution

Mono-ethylene glycol can be obtained from reputable manufacturers and suppliers. These mono-ethylene glycols are supplied with an inhibitor and do not contain an anti-leak formula. Information regarding recommended inhibitors or additives should be sought from your glycol supplier.

Caution

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

Commercial mono-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).

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.

A consultant water specialist will be able to give advice for producing a water treatment program to suit the proposed supply.

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

REFRIGERANT CONTROL SETTINGS For Water/Glycol-Cooled Indoor Units			
Refrigerant Type	Low Pressure Cut Out	Low Pressure Cut In	High Pressure Cut Out
R-22	1.4 bar 140 kPa	4.5 bar 450 kPa	24.8 bar 2480 kPa

Installation (continued)

MINI-TOWER UNIT GLYCOL VOLUME Approximate Litres (Maximum)	
Model	Litres
TS 04 GUX/GDX	0.75
TS 04 GUM/GDM	0.75
TS 06 GUX/GDX	0.75
TS 06 GUM/GDM	0.75
TS 09 GUX/GDX	0.75
TS 09 GUM/GDM	0.75

Chilled water units only

Piping considerations

It is recommended that manual service shut-off valves be installed at the supply and return lines of 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 whether the supply and return lines to the chilled water unit should be insulated. Insulation will prevent condensation forming on the water lines in low ambient conditions.

Field adjustments - all models

Downflow configuration - field conversion

WARNING

Isolate the unit's power supply before removing the panel. Lethal voltages are present when the unit is energised.

1. Disconnect all power to the unit.
2. Remove the removable front panels. Place them in a safe location where they will not be damaged.
3. Remove the six screws securing the fan to the hopper.
4. Remove the two screws securing the bottom front section of the frame (the section containing the support lugs) and withdraw the frame section.
5. Unplug all cables from the fan.
6. Remove the six screws securing the fan angle brackets to the bottom of the frame and withdraw the fan and angle bracket assembly from the unit.
7. Remove the blanking plate from the bottom of the unit and fit it to the bottom of the hopper.
8. Refit the fan after rotating it vertically through 180°.
9. Secure the configuration by refitting the retaining screws removed in Steps 3 and 6. Ensure that the blanking plate is secure.
10. Reconnect the cables to the fan.
11. Refit the bottom section of the frame
12. Refit the unit's front panels.
13. Restore power to the unit.

Site tuning of fan

Site tuning of the fan is undertaken to enable a balance to be achieved between the requirements of people and the electronics at any individual environmentally controlled site.

Site tuning of the fan is used to achieve the optimum Sensible Heat Ratio (SHR) for the site concerned. A site that contains only electronic equipment with no personnel can function with an SHR of near unity since there is no generation of latent heat.

When personnel are introduced, the production of latent heat in the form of body heat must be taken into consideration.

The machine is tuned before it leaves the factory for the site that it is intended for and so should not require adjustment in the field. However, as the requirements of the environmentally controlled site change then the requirements of the Mini Tower are altered.

When it is necessary to site tune the Mini Tower, the work should be carried out by a qualified Liebert engineer. The site tuning is achieved by carrying out the following procedure:

WARNING

Lethal voltages are present when the unit is energised. Care should be taken when adjusting the speed controller. Problems may be encountered under certain environmental operating conditions if the air volume is too low.

Installation (continued)

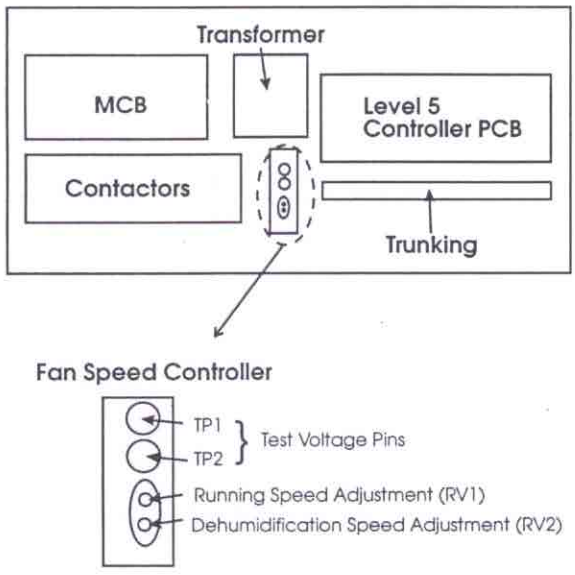


Figure 7 - Location of Fan Speed Controller

Note: Use insulated test probes - be careful not to short TP1/TP2 to ground or the chassis of the unit.

1. Open the top panel to gain access to the electrical controls and use the extendible arms to hold the panel open.
2. Refer to Figure 7 to locate the fan speed controller.
3. Start the unit.

Note: Fan speed is adjusted by rotating the top potentiometer in the oval slot. The bottom potentiometer adjusts dehumidification speed. Both fan speed and dehumidification speed are factory-preset.

4. With a fine screwdriver, rotate potentiometer RV1 until the desired speed is set. Clockwise rotation increases the speed.

Note: If the actual speed needs to be checked during the above procedure, this is best done with an electronic R.P.M. meter. The unit must first be switched OFF and the rev counter probe situated in the bottom section of the unit, with the wire to the instrument run out between the front bottom panel and the unit. It is essential that the bottom panel is in place to maintain static pressure on the fan.

5. An alternate method of adjusting the fan speed is to measure the D.C. voltage between TP1 and TP2 (see Figure 7) and using the scales in Figure 8, select a D.C. voltage to give the required fan speed/air volume. This D.C. voltage can then be set by rotating RV1.
6. Dehumidification speed is adjusted by rotating RV2 when the unit is in dehumidification mode. The dehumidification speed voltage is available at TP1 and TP2.
7. Close the top panel.

Note: The required fan speed for a required capacity can be obtained from the applications engineers at Liebert, Cork or by using a copy of the LSN program.

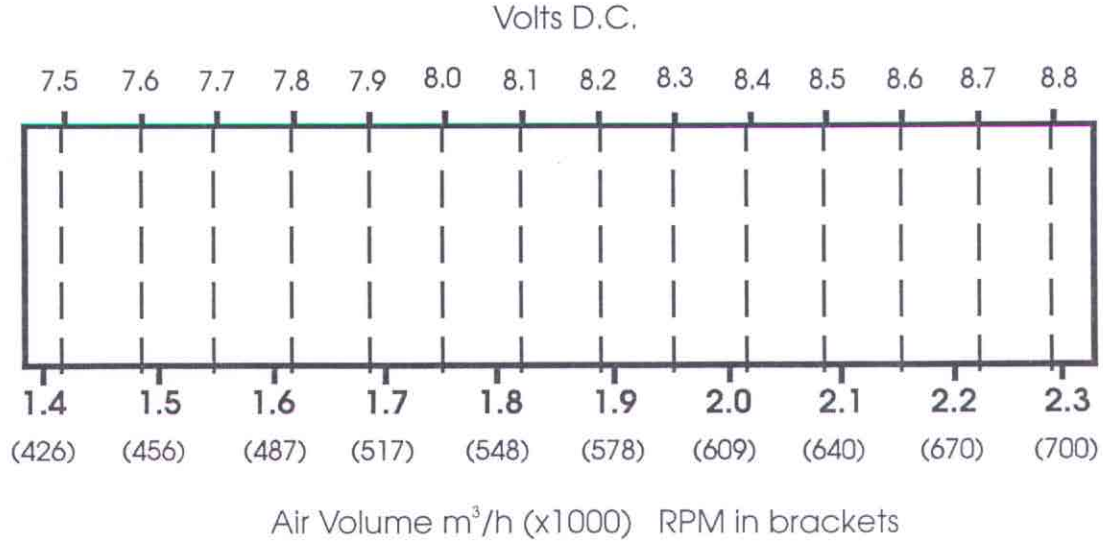


Figure 8 - Guide for fan speed adjustment

Installation (continued)

Balancing the air distribution (downflow systems only)

Liebert 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

Model Number	2.8 m/s	3.1 m/s
TS/TSF04A/W/G	0.1587 m^2	0.1434 m^2
TS/TSF06A/W/G & TS07C	0.1786 m^2	0.1613 m^2
TS/TSF09A/W/G & TS11C	0.2282 m^2	0.2061 m^2

Liqui-tect/water detection sensor LT400/400S (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 9) 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 .

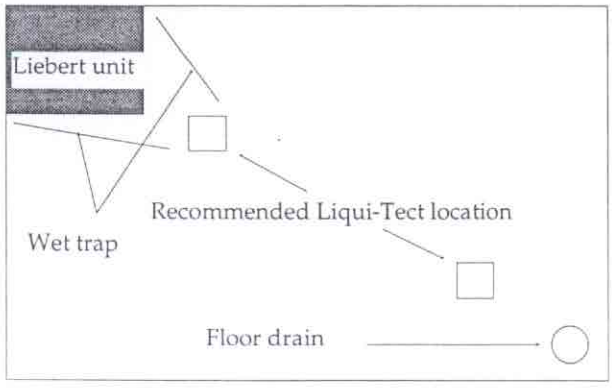


Figure 9 - Recommended location

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 10). 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 .

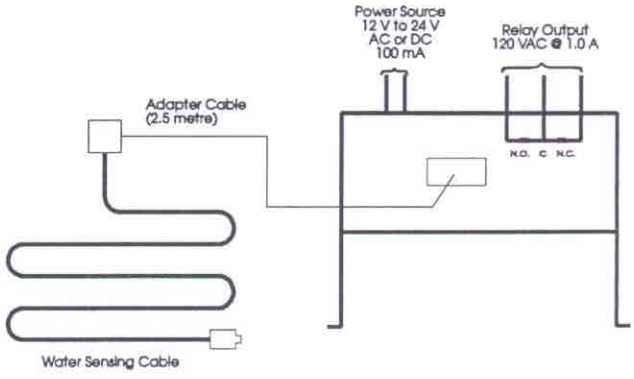


Figure 10 - LT 450S Zone Detection System

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

Installation (continued)

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.

Remove the packing blocks from under the compressor (if fitted) before starting the unit.

⚠ 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.
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 isolating switch. The line voltage must be within 10% of the nameplate voltage.
6. Turn ON the main unit isolating 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. Set the temperature and humidity setpoints and sensitivities, alarm parameters and other control functions. Refer to the Level 5 Controller Operations Manual.
9. Turn OFF the main unit isolating switch and the main breaker. The unit ON button should be set to OFF.
10. Close all MCB's that were opened in Step 3.
11. Restore power to the unit; turn ON the main unit isolating switch.
13. Push the ON button - putting the unit into operation.
14. Note the current draw on all high voltage components and check them against the serial tag ratings.
15. 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.

Operating instructions

Controls

All models of the Mini Tower are fitted with the Level 5 controller as standard. The controller comprises of a control board and a panel-mounted display connected by a single ribbon-cable. It is powered by a dual-secondary, double wound transformer.

Not all of the functions supported by the Level 5 controller are used by the Mini Tower.

A complete description of all of the features of the controller and its operation is provided in the Level 5 Controller Operation Manual (SLC-ELV5-2E) supplied with the Mini Tower.

Steam generating humidifier

Caution - Hot Surface

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 in the unit consists of a boiler, controller and steam pipe assembly. The 2.4 kW (at 380V) humidifier produces a maximum steam output of 3 kg/hr*.

Note: These humidifiers should only be used where the supply water has a conductivity between 80 and 1000 µS/cm and a water pressure of 0.3 to 8 bar (Max. supply water temperature 30 °C).

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 and boiling.

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.

*: *Confirm these values with manufacturers ratings on the humidifier nameplate, as specifications are subject to change.*

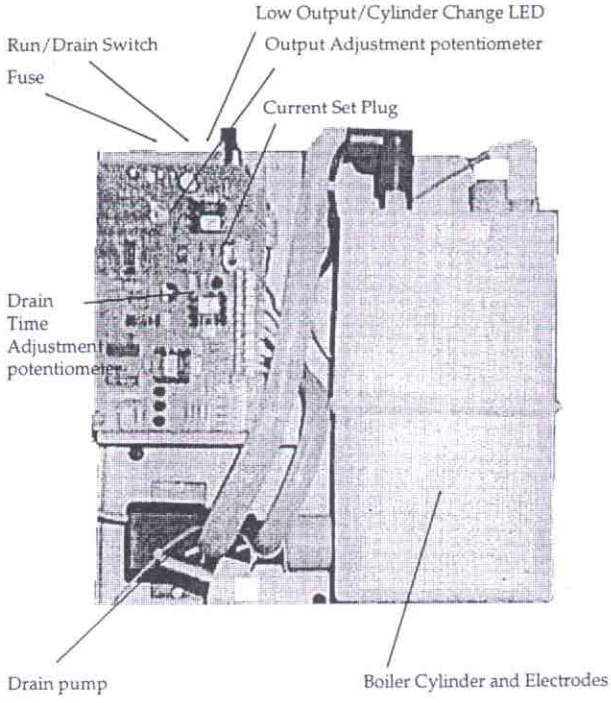


Figure 11 - Steam boiler humidifier (cover removed)

System description

In normal operation, once the water conductivity has risen to the preset operating level, the unit will heat up and the water in the steam boiler will continue to boil without further feed water additions. When boiling is complete, a drain cycle will commence. Immediately following the drain cycle, the feed valve will open and refill the cylinder (without interrupting the boiling action).

The drain cycle is necessary to prevent the water conductivity rising above the normal operating level. The drain cycle is variable and depending on the supply water quality may occur at half hour, one hour or longer periods.

If the unit has not operated for some hours, the water in the unit will cool down. At the next call for humidification, as no water has been lost from the cylinder and water conductivity is optimum, the start up time will only be the time taken to boil the water.

Operating instructions (continued)

Under certain conditions, if the water has a high electrical conductivity and/or the unit is operated well below its rated maximum capacity, operation will be governed by a pre-set plug - the Current Set Plug

If the current rises 10% above the pre-set level, the unit will automatically lower the water and current levels, and this process of continuous boiling together with intermittent draining, may occur one or more times until the water is boiling steadily. Eventually as deposits build up in the cylinder electrodes the unit will go into the standard mode of operation.

Level 5 controller interaction

On a call for humidification from the Liebert unit, 24V a.c. is provided at P9-4 which energises KM4, supplying power to the boiler cylinder, a 24V a.c control signal to the Vapac controller and activating the standard mode of operation described above.

Humidifier components

Steam output potentiometer

Located on the humidifier PCB, this potentiometer regulates the steam output capacity. The potentiometer is adjustable from 30 to 100% of the maximum output. The potentiometer is factory preset at 100% yielding 3 kg/h.

Drain time potentiometer

Located on the humidifier PCB, this potentiometer regulates the timing of the drain cycle. The potentiometer is adjustable but does not require adjustment unless the supply water is highly conductive. It is factory preset for the maximum drain cycle interval.

Run/Drain switch

The Run/Drain switch is a three position switch located on top of the humidifier controller. For normal operation the switch MUST be left in the RUN position. In the middle position, the humidifier is OFF. In the DRAIN position, the humidifier goes through a manual drain cycle, this position is normally only used for servicing.

Low output/cylinder change lamp

When lit, the lamp indicates that the steam output of the unit is below 60% of required output (calculated as percentage of total capacity selected on the steam output potentiometer.

In normal operation, when a call for humidification is received, the the lamp will remain lit for a short period until 60% of output is reached and will then extinguish.

Should the lamp remain lit continuously, it indicates that the boiler is no longer capable of producing the required output. In this case, the boiler cannister should be replaced (see the Maintenance section). A further possibility is that the feed water is not conductive enough, in which case, the addition of a small amount of salt to the water may overcome the problem.

Maintenance

WARNING

Isolate the unit's power supply before opening/removing the panels. Lethal voltages are present when the unit is energised.

Preventive maintenance

Air cooled condenser (packaged) - examine

Refer to the Condenser Technical Data Manual (SLM-ECO-2E) supplied with the condenser.

Condensing unit (split) - examine

Clean the air cooled condenser coil of all debris that will inhibit air flow. This can be done with compressed air or with a commercial coil cleaner. Check for bent or damaged coil fins and repair as necessary. On outdoor units in winter, do not permit snow to accumulate on or around the condensing unit. Check all refrigerant lines and capillaries for vibration isolation and support as necessary. Check all refrigerant and coolant lines for signs of leaks.

Caution - Hot Surface

The compressor crankcase heater is energised as long as power is supplied to the unit. If the main switch is disconnected for long periods, do not attempt to start a condensing unit until 1½ hours after applying power. This allows enough time for all liquid refrigerant to be driven out of the compressor. Note that this is especially important at low ambient temperatures.

Drycooler - examine

Refer to the Drycooler Technical Data Manual (SLM-EDC-2E) supplied with the drycooler.

Cabinet and frame - examine

1. Examine the cabinet exterior for any obvious defects or damage and repair as necessary.
2. Remove the unit's front 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 unit's front panels and restore the electrical supply to the unit.
4. Record and report any defects found during the inspection.

Evaporator coil - examine

1. Remove the unit's front panels and inspect the evaporator coil for defects, damage or 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. Check for any refrigerant leaks.
5. Refit the unit's front panels and restore the electrical supply to the unit.
6. Record and report any defects found during the inspection.

Refrigerant lines - check

1. Remove the unit's front panels.
2. As far as possible, examine the refrigerant pipework and component parts for defects, damage and signs of oil and/or refrigerant 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 and sensing lines from the expansion valve and ensure that they are properly secured and supported. Take care not to over tighten or damage the sensing bulb.
6. Refit the unit's front panels and restore the electrical supply to the unit.
7. Record and report any defects found during the inspection.

Liquid line sight glass - examine

1. Remove the unit's front panels (or the condensing unit cover in a split system) and inspect the liquid line sight glass and connections for any signs of oil or refrigerant leaks.

Maintenance (continued)

WARNING

Isolate the unit's power supply before opening/removing the panels. Lethal voltages are present when the unit is energised.

2. Check the window in the sight glass to view the moisture indicator. If moisture is shown to be present in the system the filter drier should be renewed and the system dehydrated and recharged.
3. Refit the unit's front panels and restore the electrical supply to the unit.
4. Record and report any defects found during the inspection.

Filter-drier - examine

1. Remove the unit's front panels (or the condensing unit cover in a split system) and identify the filter-drier.
2. Check the filter-drier for oil or refrigerant leaks and renew as necessary. Check the filter for complete or partial blockage by measuring the temperature drop across it. If the temperature drop is excessive, renew the filter-drier.
3. Inspect the refrigerant pipework connections for signs of oil leaks.
4. Refit the unit's front panels and restore the electrical supply to the unit.
5. Record and report any defects found during the inspection.

Compressor - examine

1. Remove the unit's front panels (or the condensing unit cover in a split system) 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 and/or refrigerant leaks.
4. Remove the compressor terminal cover and examine the electrical connections for damaged insulation and security. Retighten all connections.
5. Refit the compressor terminal cover and refit the unit's lower panels.
6. Restore the electrical supply to the unit.
7. Record the run current of the compressor and ensure that it is correct.
8. Close the unit's electrical panel and restore the electrical supply to the unit.
9. Record and report any defects found during the inspection.

Steam generating humidifier - examine

1. Remove the unit's front panels and examine the humidifier for any loose electrical connections. Retighten any loose connections.

Caution - Hot Surface

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 scaling of the canister or electrodes.
3. The canister will have to be renewed if it is scaled, and at an interval dependent on the conductivity of the water.
4. Ensure that the steam generating canister is properly secured to the unit frame.
5. Refit the unit's front panels and restore the electrical supply to the unit.
6. Carry out a functional test of the humidifier operation.
7. Record and report any defects found during the inspection.

Chilled water valve - check

1. Remove the unit's front panels.
2. Inspect the chilled water valve for any signs of damage or leaks.
3. Open the main fan MCB.
4. Reconnect power to the unit.
5. Adjust the temperature setpoint on the control panel and close the valve. Ensure that the valve opens and closes correctly.
6. Isolate the unit's power supply.

Maintenance (continued)

WARNING

Isolate the unit's power supply before opening/removing the panels. Lethal voltages are present when the unit is energised.

7. Close the main fan MCB.
8. Refit the unit's front panels.
9. Restore power to the unit and reset the temperature setpoint to its original setting.
10. Record and report any defects found during the inspection.

Fan - examine

1. Remove the unit's front panels and inspect the fan motor for any loose electrical connections and retighten as necessary.
2. Inspect the fan, 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. Check for excessive movement in the fan shaft. If any excessive movement is noticed the motor must be renewed.

Completion

1. Refit the unit's front panels and restore the electrical supply to the unit.
2. Check and record the fan motor current.
3. Record and report any defects found during the inspection.

Fan safety switch - examine

WARNING

Extreme care should be taken when carrying out this procedure. Lethal voltages are present when the unit is energised. Care should also be taken to avoid the body or articles of clothing becoming entangled in the moving parts.

1. With the unit running, carefully remove the lower front panel covering the fan and compressor. Before the panel is completely removed, the fan should stop owing to the fan safety interlock attached to the front panel.
2. Isolate the unit from the mains. Completely remove the front panel and physically inspect the micro-switch which is located on the bottom right-hand side of the unit. Ensure that the switch mounting bolts are tight and that the wiring connections are secure.

Note: If the interlock switch fails to operate correctly it must be repaired or renewed.

3. Refit the unit's front panel and restore the electrical supply to the unit.
4. Record and report any defects found during the inspection.

Fan motor thermal protection - check

WARNING

Isolate the unit's power supply before opening/removing the panels. Lethal voltages are present when the unit is energised.

1. Remove the unit's front panels and identify the fan.

Note: The fan motor thermal protection is internal to the motor windings and wired in series with the fan contactor coil (refer to the Mini Tower electrical schematic for further details).

2. If a fault is suspected the thermal safety switch should be checked for continuity. If the switch is found to be defective the motor must be renewed.
3. Refit the unit's front 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's power supply before opening/removing the panels. Lethal voltages are present when the unit is energised.

Water regulating valves - check

WARNING

Isolate the unit's power supply before opening/removing the panels. Lethal voltages are present when the unit is energised.

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

Plate condenser - check

1. Remove the unit's front panels.
2. Examine the refrigerant and coolant pipework to the condenser for defects, damage and signs of oil and/or leaks. Ensure that the condenser is secure in its mounting brackets.
3. Refit the unit's front panels and restore the electrical supply to the unit.
4. Record and report any defects found during the inspection.

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.

Electric panel - inspection and functional checks

General

WARNING

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

1. Open the unit's electrical panel and inspect it for any loose electrical connections. Re-tighten as necessary.
2. Open the main fan MCB.

Note: The functioning of all control circuits can be tested by actuating each of the main functions. This is done by adjusting the controller set points.

3. Restore power to the unit.

Cooling functional test

1. Select a set point for a temperature of 6°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.

Reheat functional test

1. Select a temperature set point for 6°C above the room temperature.
   a) A call for heating should be observed.
   b) The heating contactor should energise, and the heating coils should begin to heat.
   c) Disregard the low temperature alarm.
2. Check and record the reheat current.

Note: Do not power the reheats for long when there is no air flow to avoid overheating.

3. Return the set point to the desired temperature.

Maintenance (continued)

WARNING

Isolate the unit's power supply before opening/removing the panels. Lethal voltages are present when the unit is energised.

Humidification functional check

1. Set the humidification to 10%RH above the room humidity reading. You will hear solenoid click as the steam generating humidifier energises. After a short delay, the 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.

Dehumidification functional check

1. Set the humidification to 10%RH below the room relative humidity. Make sure that the temperature set point is at or above room temperature.
2. The compressor contactor should energise, the main fan should run at the lower dehumidification speed and the system should begin to cool/dehumidify.
3. Return the humidity setting to the desired room relative humidity setting.

Completion

1. Isolate the unit's power supply.
2. Close the main fan MCB.
3. Refit the unit's front panels and restore the electrical supply to the unit.
4. Record and report any defects found during the inspection.

Corrective Maintenance

Air filter - renewal

To maintain efficient operation, the air filter should be checked monthly and changed as required.

1. Remove the grille panel at the front of the unit (see Figure 6), then remove the filter.
2. Fit a new filter, refit the unit's grille panel and restore the power supply.

Chilled water valves - examine

1. Remove the unit's front panels.
2. Open the main fan circuit breaker.
3. Inspect the chilled water valve for any signs of damage or leaks.

WARNING

Care should be taken to avoid limbs or clothing becoming entangled in the drive motor or other moving parts when working inside the unit with the fan assembly operating.

4. Repair or renew the valve if necessary.

Note: The valve actuator contains the motor, gearing, return spring and shaft and, is secured to the valve body with four screws. An 'O' ring seal is used to provide a water tight joint between the actuator and the valve body. If a leak is traced to this 'O' ring seal, it must be renewed.

5. Reconnect power to the unit.
6. Adjust the temperature setpoint on the control panel and close the valve. Ensure that the valve opens and closes correctly.

Note: If the valve actuator fails to control it must be renewed complete since there are no field serviceable parts for the actuator.

7. Isolate the unit's power supply.
8. Close the main fan circuit breaker.
9. Refit the unit's front panels.
10. Restore power to the unit and reset the temperature setpoint to its original setting.
11. Record and report any defects found during the inspection.

Water regulating valves - head pressure control

The valve can be flushed by inserting a screwdriver 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.

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.)

Maintenance (continued)

WARNING

Isolate the unit's power supply before opening/removing the panels. Lethal voltages are present when the unit is energised.

3. Remove the four round-head screws extending through the main spring housing from the end of the valve opposite the bellows.
4. Remove the 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.

Water regulating valves - adjustment

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

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 counter-clockwise until the desired setting is obtained.

Note: For optimum efficiency, the valve should be set for 40.5°C to 43.3°C condensing temperature.

Steam generating humidifier - canister renewal

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.

Over a period of operation, the humidifier electrodes become coated with mineral solids. This coating insulates the electrodes and decreases the current flow. To maintain humidifier capacity, the water level slowly rises to expose fresh electrode. Eventually, the entire electrode becomes coated and the water level reaches the top. From this moment on, the output of the humidifier will begin to fall until it is practically non-operational. When this happens, it is necessary to renew the canister; proceed as follows:

1. Record the humidity set point then turn off the humidifier by lowering the humidity set point below the ambient humidity level.
2. Open the unit's front panels.
3. Activate the drain switch on the top of the humidifier to drain the water from the canister.
4. Turn OFF the power at the main unit.
5. Locate the power and level probe wires to the steam canister. They are connected to the canister connectors. Make a note of the wiring configuration before removing any wires.
6. Remove the power wires and the level sensing wires by pulling directly upwards on the connectors.

Note: These connectors are of the slide-on type and care should be exercised to prevent damage when fitting or removing them. The power electrode connectors are opened by releasing the thumbscrew on the connector and removing the connector cover to reveal the wire connections.

7. With the wires removed, tighten all the power connections.
8. Locate and remove the screw at the top of the canister.
9. Remove the drain/fill connection at the bottom of the canister.

Note: The drain pump is connected to the canister via a manifold that includes the fill port. These assemblies are interconnected by tight fit 'O' ring seals. Care should be exercised when removing or fitting these seals that the connectors are not damaged and the 'O' ring seals are in good condition. Failure to check and secure these seals will lead to flooding within the unit and the introduction of water into the airflow.

Maintenance (continued)

WARNING

Isolate the unit's power supply before opening/removing the panels. Lethal voltages are present when the unit is energised.

Caution

The drain line from the pump contains a check valve (one-way valve) which allows the pump to draw air inwards but not to discharge fluid. If removed, this valve must be refitted correctly.

10. Remove the drain pump from the fill manifold.
11. Remove the fill manifold from the canister.
12. Remove the canister through the front of the unit.
13. Fit a new canister by reversing the procedures in Steps 6 to 12.
14. Ensure all seals are tight and secure and that all electrical connections are made to the electrodes.
15. Refit the unit's front panels.
16. Reconnect power to the unit and raise the humidity setpoint until a call for humidity exists.
17. Allow the system to operate for one hour to ensure correct operation.
18. Return the setpoint to the required setting.
19. Isolate the unit's power supply, remove the unit's front panels and examine the interior of the unit for any sign of water leakage.
20. If no leaks are found and operation of the humidifier is satisfactory, refit the unit's front panels and restore the power supply.

Superheat - calculation

Calculation

1. Measure the temperature (temperature (1)) of the suction line at the point where the TEV bulb is clamped.
2. Attach a service guage to the suction line access valve and obtain the evaporating temperature (temperature(2)).
3. Subtract temperature (2) from temperature (1) to get the approximate superheat value.

Maintenance procedures

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 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.

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

1. Check all MCBs, contactors and connectors.
2. Check the operation of the high and low pressure switches. If a compressor failure has occurred, determine whether it is an electrical or mechanical failure.

Mechanical - No burned odour from gas released at the schrader access valves. Motor attempts to run.

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

Maintenance (continued)

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.

Compressor renewal procedure - mechanical failure

If it has been determined that a mechanical failure has occurred the compressor must be renewed using the following procedure:

1. Disconnect power.
2. Attach suction and discharge gauges to the compressor schrader access valves.
3. Reclaim the charge from the unit.

Caution

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

4. Unbraze or cut the suction and discharge lines at the compressor, remove the pressure switch capillaries and all electrical connections; then remove the compressor.
5. Fit a new compressor and make all connections.
6. Evacuate and then charge the system with R22 as described in the dehydration section of the installation chapter.
7. Start the unit and check the sight glass for bubbles. If any are present, top up the unit with refrigerant until the sight glass contains only liquid.

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 burnout with the new compressor.
2. Check the MCBs and contactor and ensure that the connections to them are secure and that they are of the correct value.
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.
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, reclaim all of the refrigerant in the system 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 vented.

Replacement compressors - warranty procedure

Replacement compressors are available through Liebert International BV, Model Farm Road, Cork, Ireland and will be shipped in a permanent type crate. The distributor will be invoiced for the replacement compressor but may be credited in full, if requested, when the faulty compressor (or complaint) is analysed by the factory; and the analysis reveals component failure.

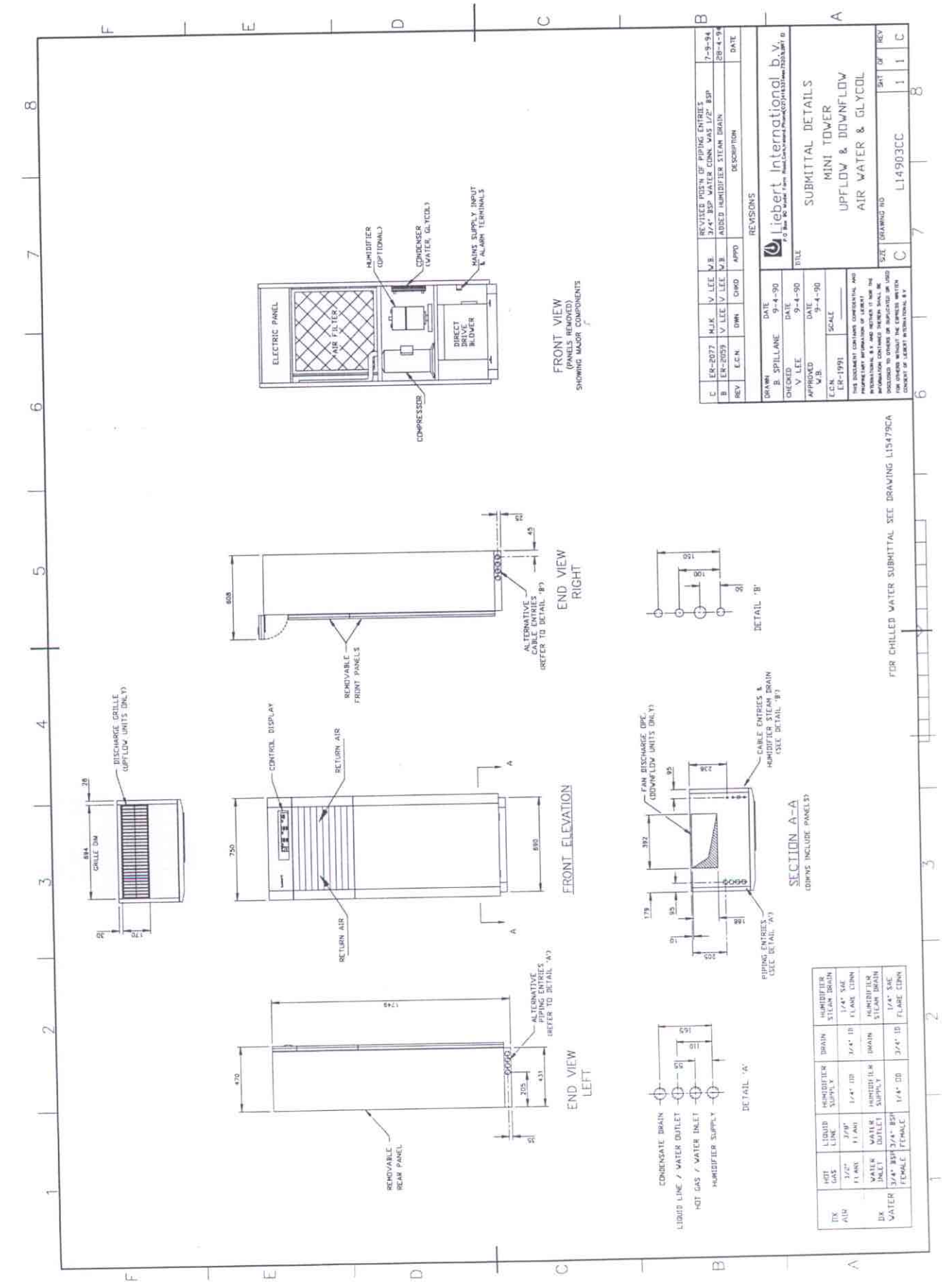
Note: Use the same container for returning the faulty compressor as that used to ship the replacement compressor.

Details of the problems found, together with the serial number of the unit and the model and serial number of the compressor, should be indicated on the warranty return tag. A sample copy of the warranty claim tag is included at the rear of this manual.

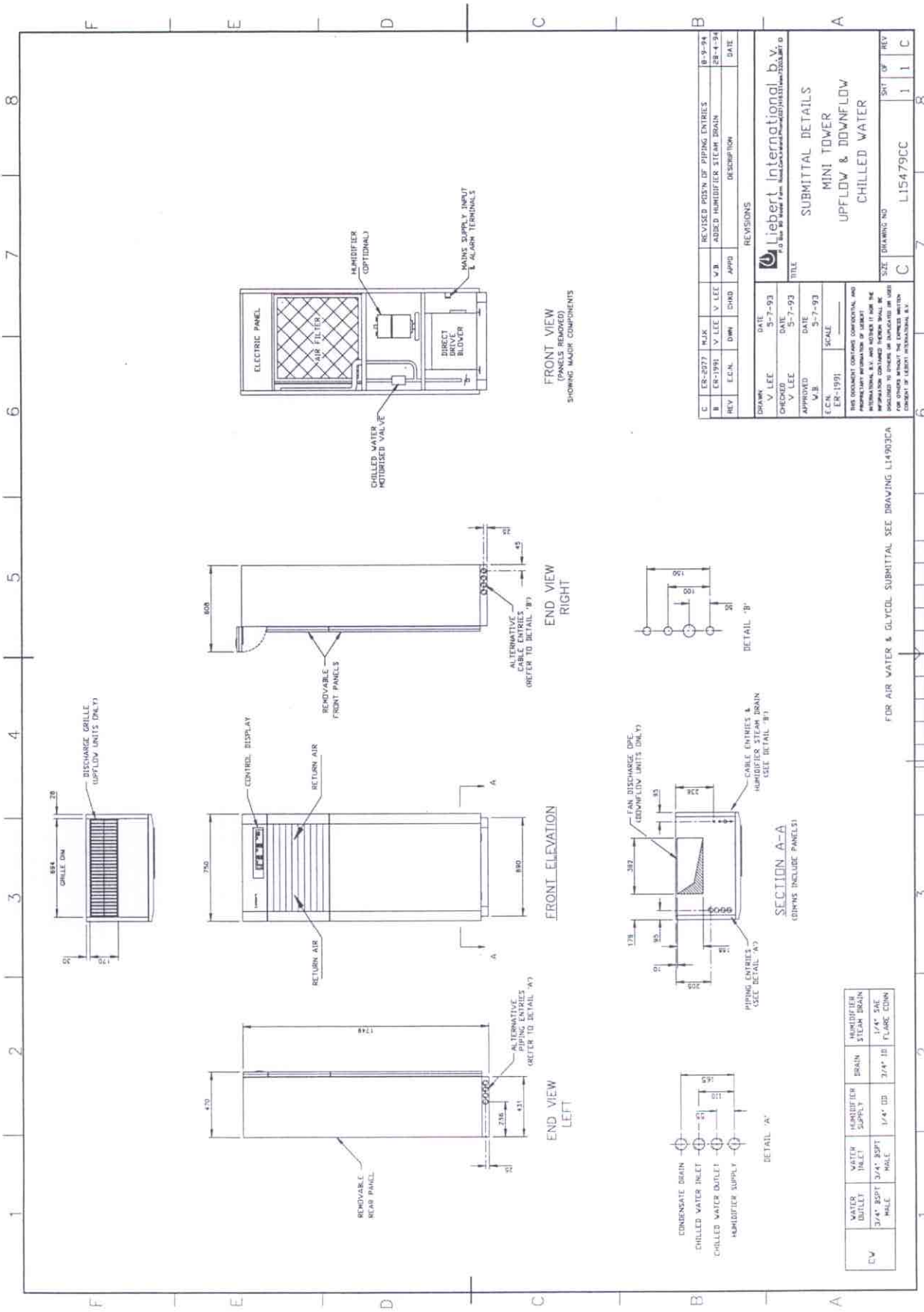
IMPORTANT

Failure to advise these details within a reasonable time scale after the failure/replacement occurs will invalidate the warranty.

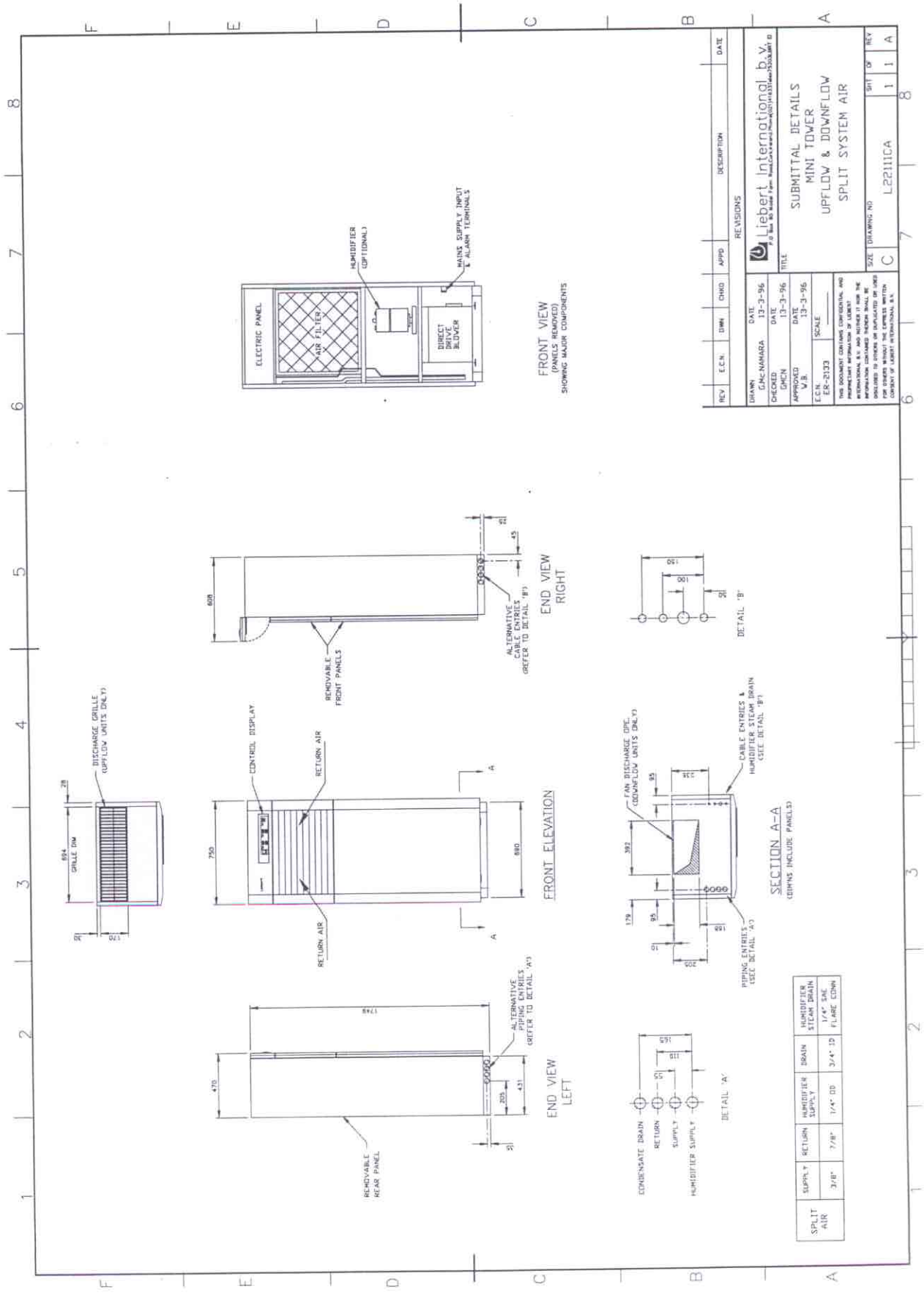
Dimensional data - air, water and glycol (packaged)



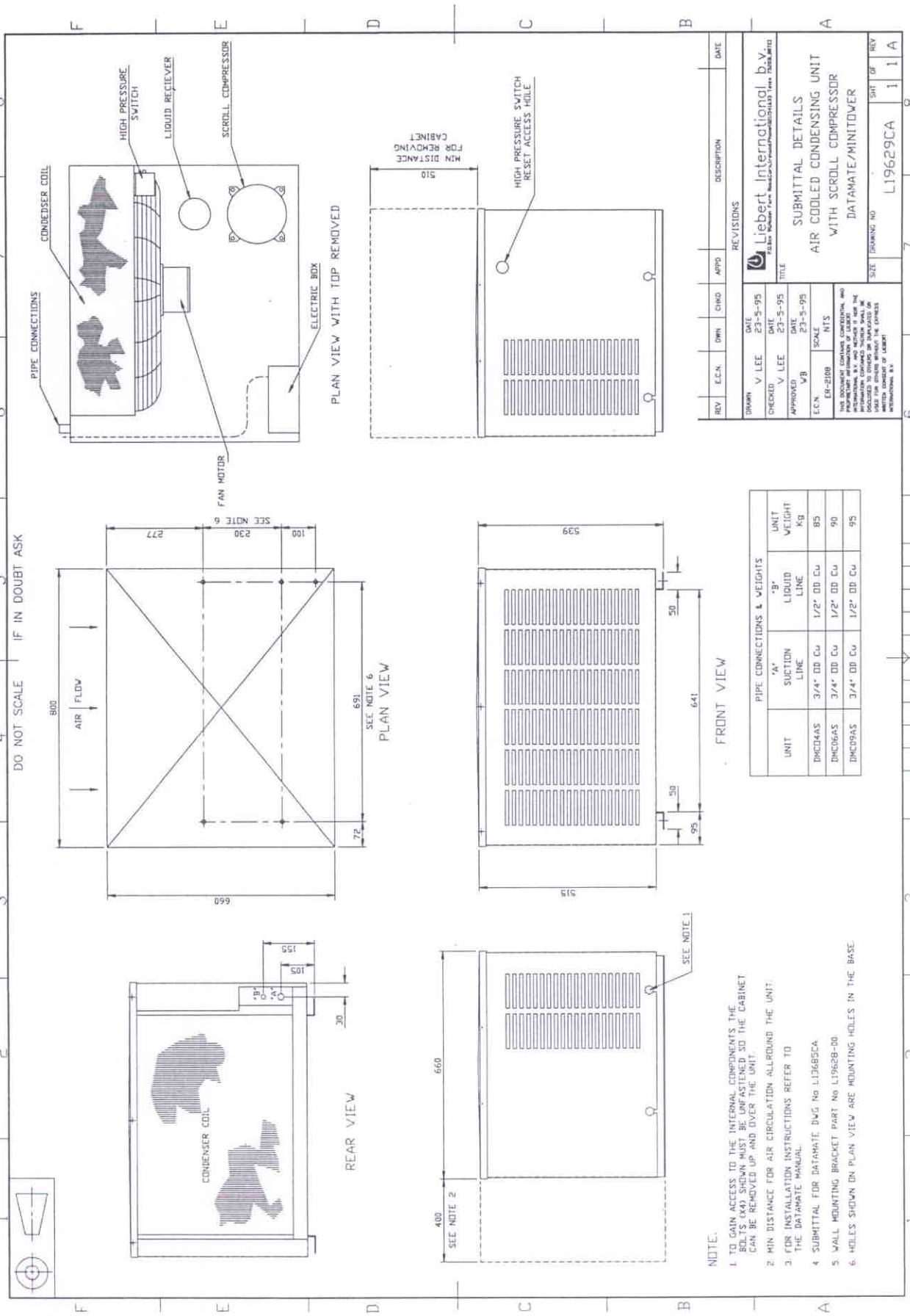
Dimensional data - chilled water



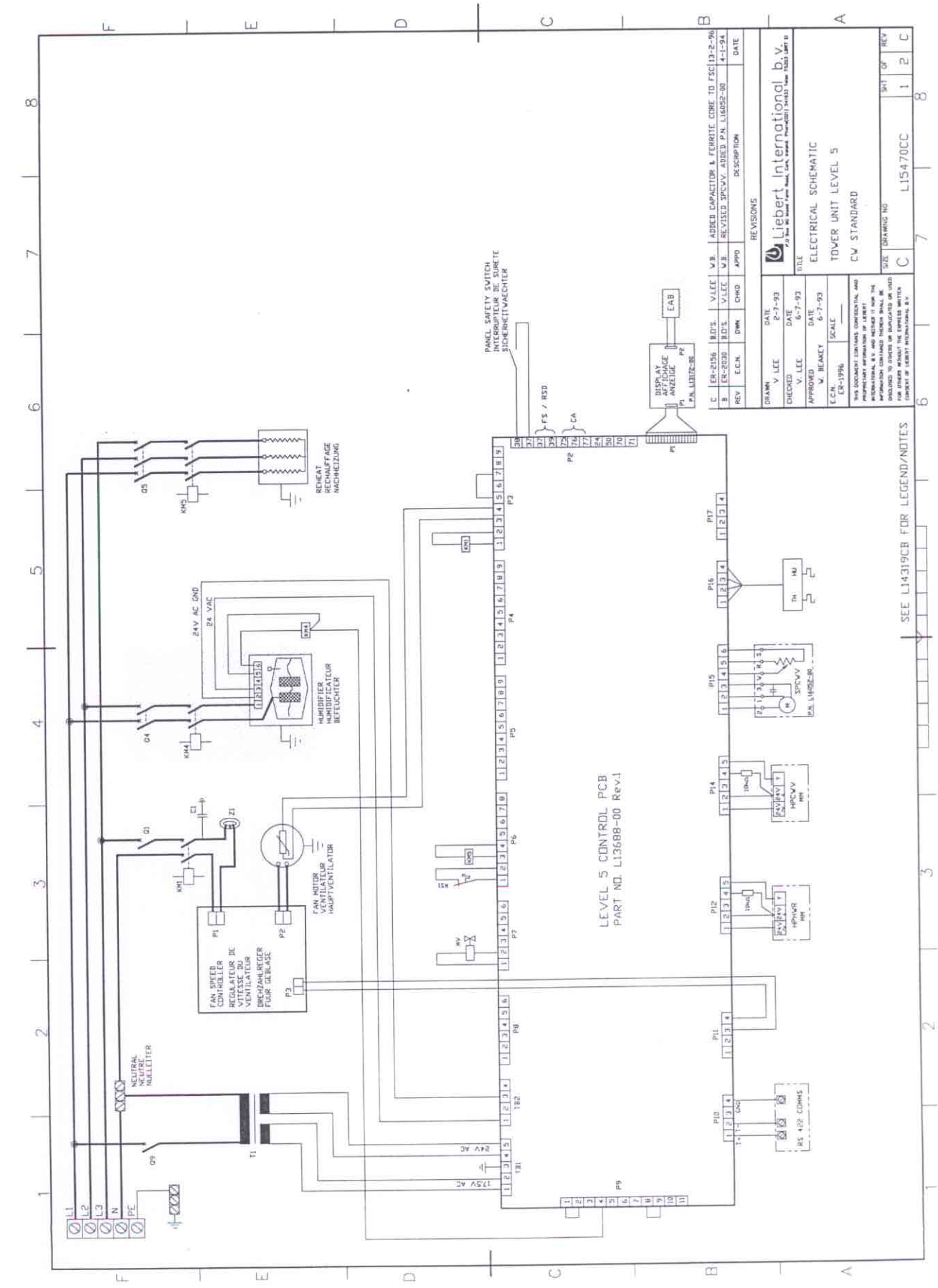
Dimensional data - air cooled (split)



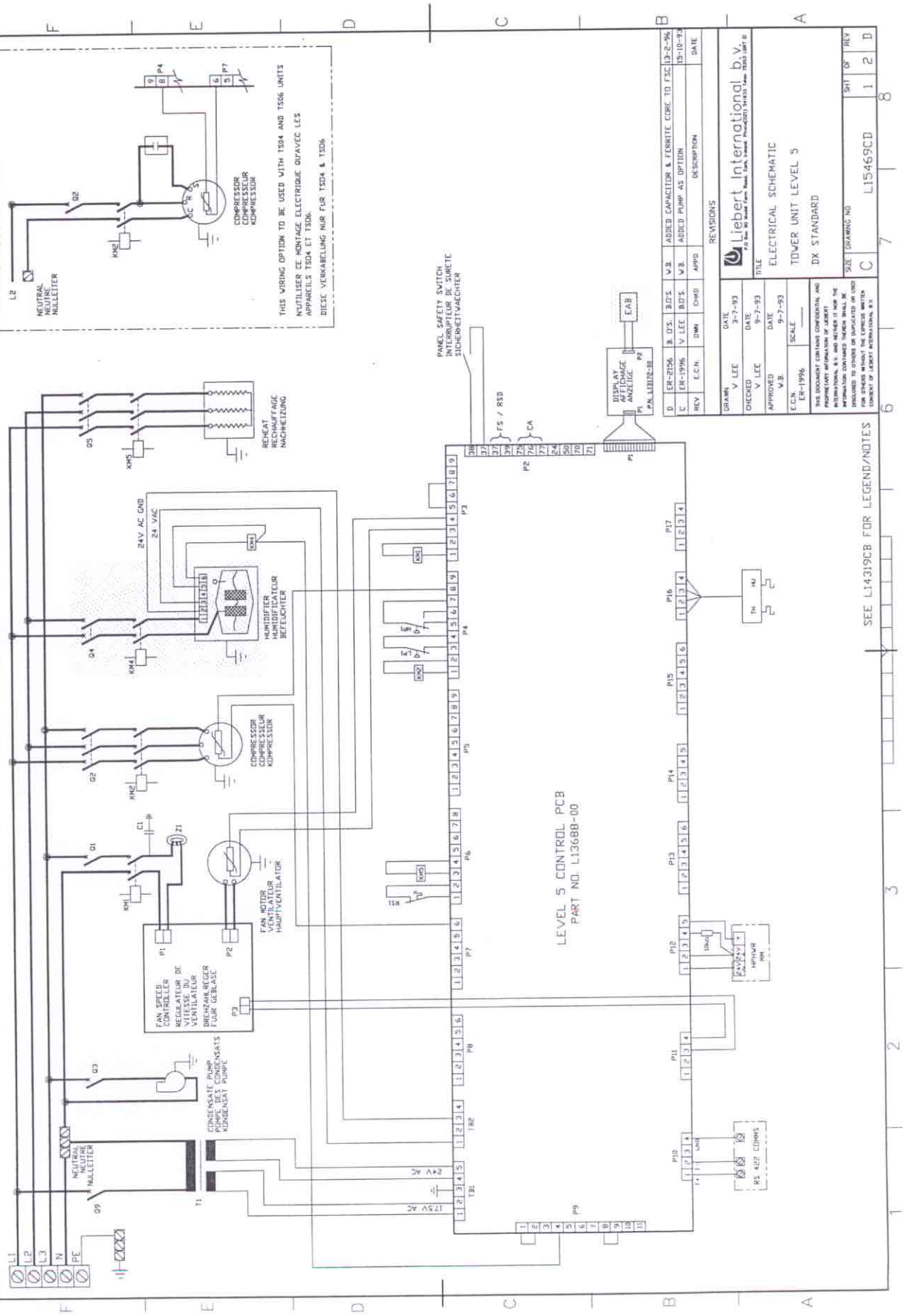
Dimensional data - air cooled condensing unit (split)



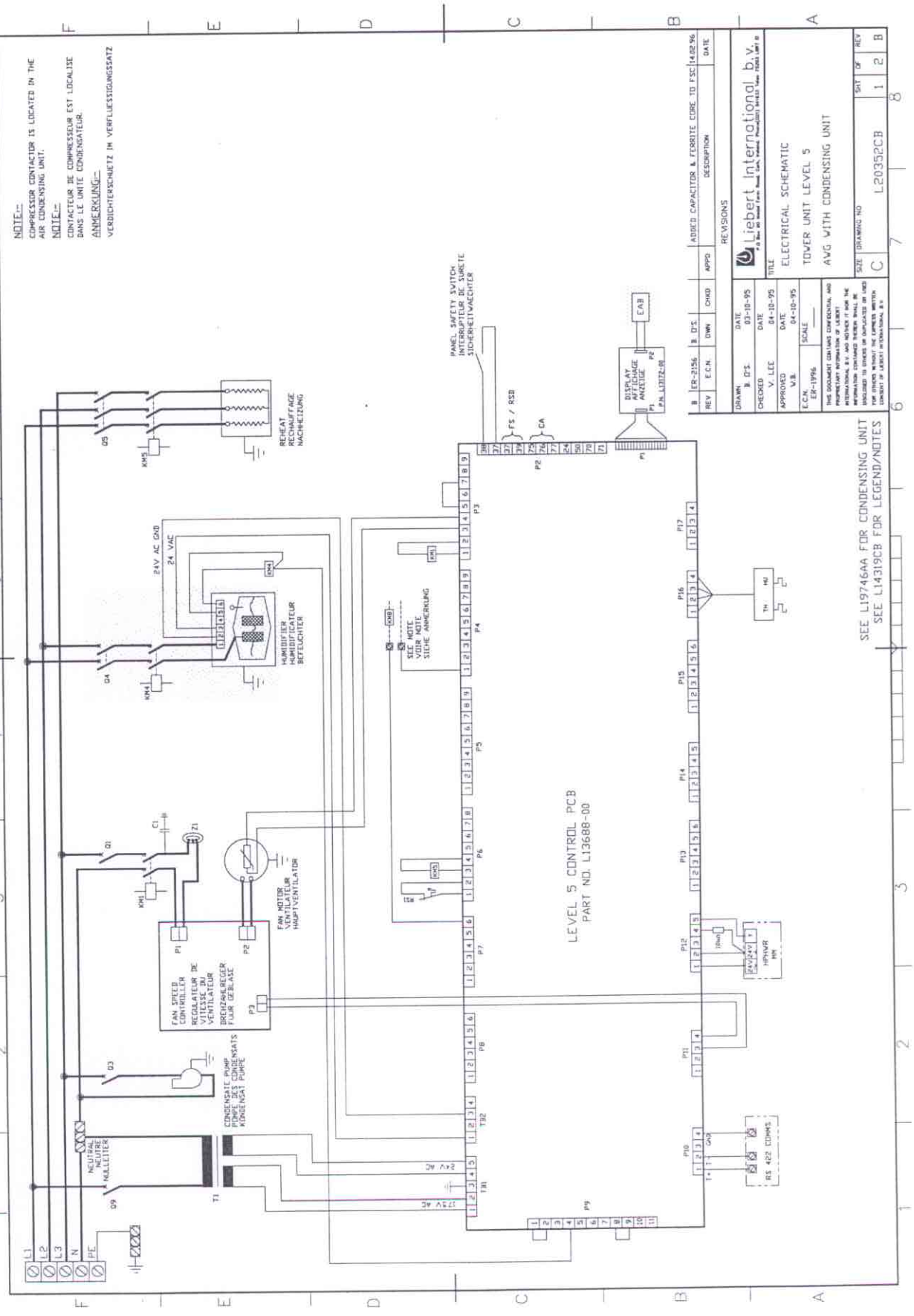
Electrical schematic - chilled water



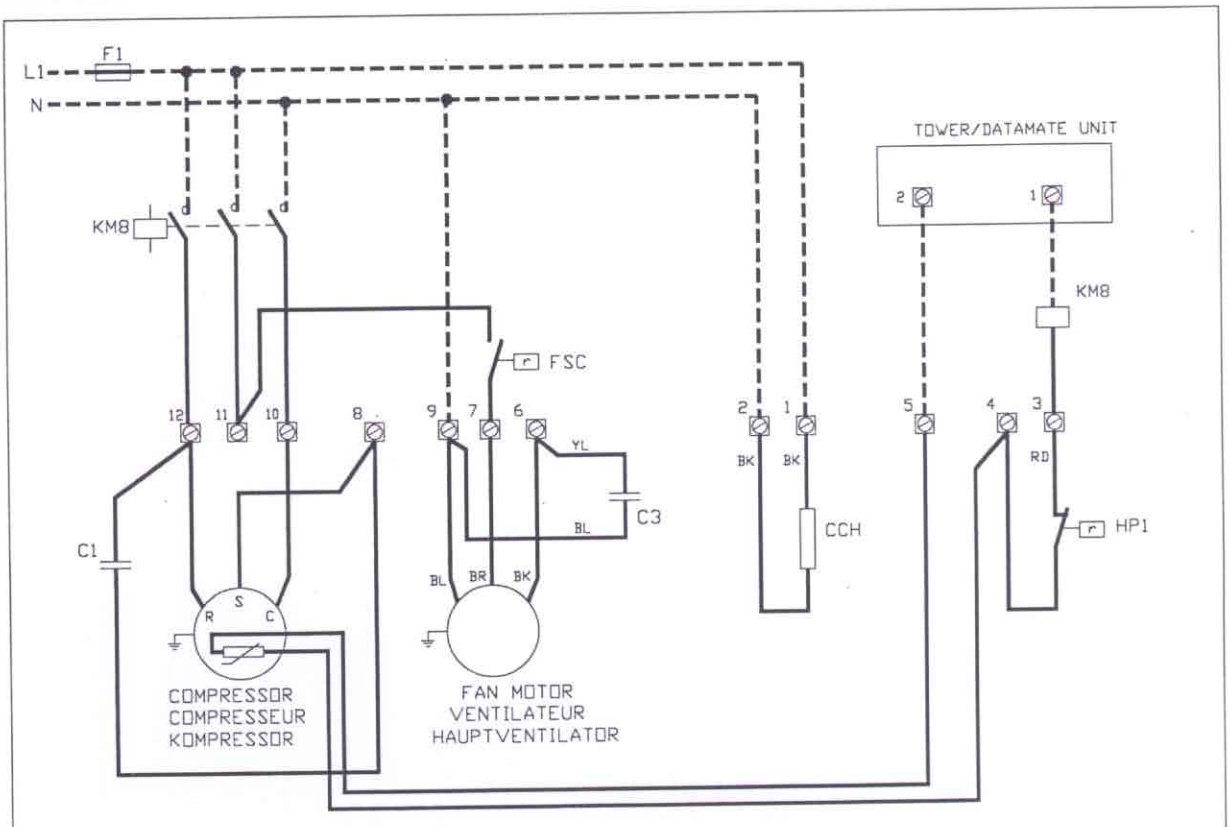
Electrical schematic - air, water, glycol cooled



Electrical schematic - air cooled (split)



Electrical schematic - 4kW air cooled condensing unit (split)



NOMENCLATURE	NOMENCLATURE	BEZEICHNUNGEN
KM8 - COMPRESSOR CONTACTOR FSC - FAN SPEED CONTROLLER C1,C2,C3 - CAPACITOR HP1 - HIGH PRESSURE SWITCH CCH - CRANKCASE HEATER F1 - FUSE (FIELD SUPPLIED)	KM8 - COMPRESSEUR CONTACTEUR FSC - REGULATEUR DE VITESSE DE VENTILATEUR C1,C2,C3 - CONDENSATEUR HP1 - PRESSOSTAT HAUTE PRESSION CCH - RESISTANCE DE CARTER F1 - FUSIBLE (NON FOURNI SUR CHANTIER)	KM8 - KOMPRESSOR FSC - DREHZAHLREGER FUR GEBLASE C1,C2,C3 - KONDENSOR HP1 - DRUCKWAECHTER UEBER SOLLWERT CCH - KURBELWANNEHEIZUNG F1 - SICHERUNG (BEI MONTAGE MONTIERT)
LEGEND	**LEGENDE FILERIE**	**KENNZEICHNUNG**
TERMINAL BLOCK CONNECTION FACTORY WIRING FIELD WIRING	BORNIERS CONNEXION CABLES PUISSANCE FOURNIS CABLES PUISSANCE NON FOURNIS	ANSCHLUSS NETZSTROMKABEL (EINGEBAUT) NETZSTROMKABEL (BEI AUFSTELLUNG VERLEGTE)
COLOUR CODE	**CODE COULEUR FILERIE**	**KABEL-FARBKODE**
RD - RED BK - BLACK WH - WHITE BL - BLUE BR - BROWN YL - YELLOW	RD - ROUGE BK - NOIR WH - BLANC BL - BLEU BR - MARRON YL - JAUNE	RD - ROT BK - SCHWARZ WH - WEIB BL - BLAU BR - BRAUN YL - GELB

SEE TOWER ELECTRICAL SCHEMATIC L20352CA
SEE DATAMATE ELECTRICAL SCHEMATIC L13473CB

REV	E.C.N.	DWN	CHKD	APPD	DESCRIPTION	DATE
B	ER-2108	B.O'S.	B.O'S.	W.B.	REVISED DRAWING	04-06-96

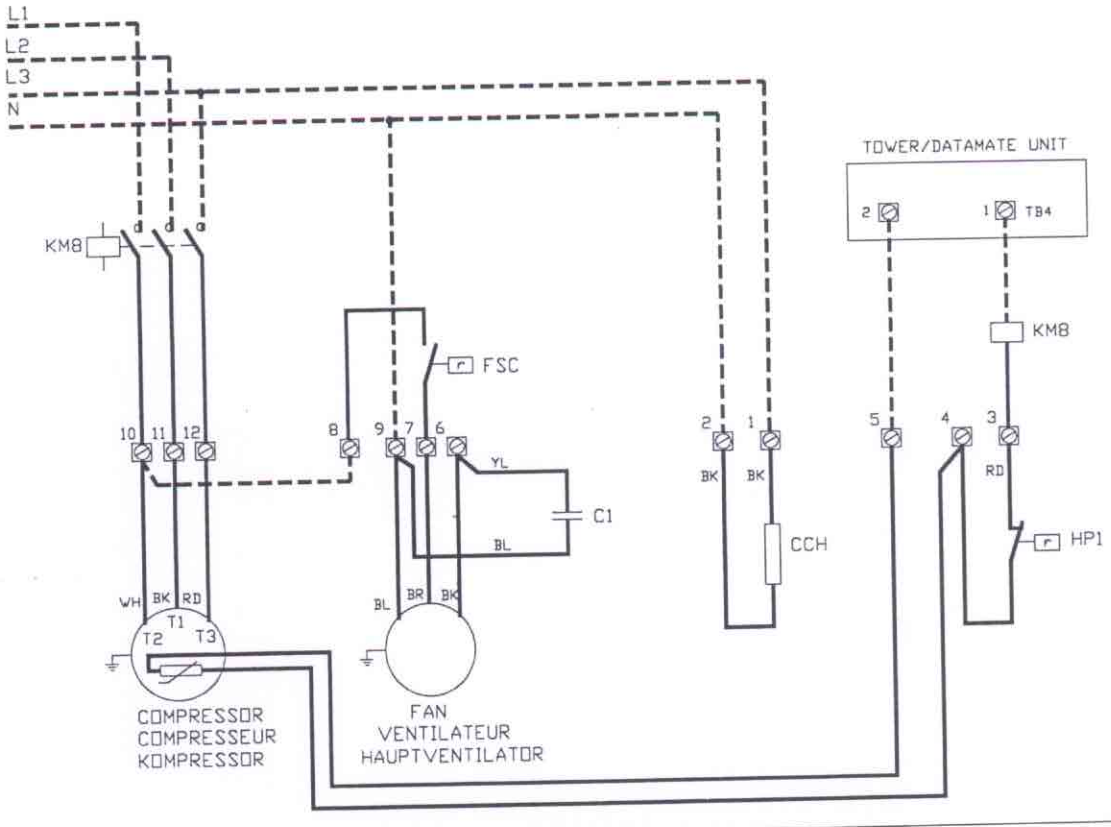
DRAWN	B.O'S.	DATE	13-03-96
CHECKED	B. O'SULLIVAN	DATE	13-03-96
APPROVED	W. BEAKEY	DATE	13-03-96
E.C.N.	ER-2108	SCALE	NTS

Liebert International b.v.
P.O.Box 90,Model Farm Road,Cork,Ireland.Phone(021)541633 Telex 75203LBRTEI

TITLE: ELECTRICAL SCHEMATIC
SINGLE FAN UNIT
AIR CONDENSING UNIT
TOWER & DATAMATE 4kW

SIZE	DWG NO	SHT	OF	REV
A	L19746AB	1	1	B

Electrical schematic - 6 & 9kW air cooled condensing unit (split)



NOMENCLATURE	NOMENCLATURE	BEZEICHNUNGEN
KM8 - COMPRESSOR CONTACTOR FSC - FAN SPEED CONTROLLER C1,C2,C3 - CAPACITOR HP1 - HIGH PRESSURE SWITCH CCH - CRANKCASE HEATER F1 - FUSE (FIELD SUPPLIED)	KM8 - COMPRESSEUR CONTACTEUR FSC - REGULATEUR DE VITESSE DE VENTILATEUR C1,C2,C3 - CONDENSATEUR HP1 - PRESSOSTAT HAUTE PRESSION CCH - RESISTANCE DE CARTER F1 - FUSIBLE (NON FOURNI SUR CHANTIER)	KM8 - KOMPRESSOR FSC - DREHZAHLREGER FUR GEBLASE C1,C2,C3 - KONDENSOR HP1 - DRUCKWAECHTER UEBER SOLLWERT CCH - KURBELWANNEHEIZUNG F1 - SICHERUNG (BEI MONTAGE MONTIERT)
LEGEND	LEGENDE FILERIE	KENNZEICHNUNG
TERMINAL BLOCK CONNECTION FACTORY WIRING FIELD WIRING	BORNIERS CONNEXION CABLES PUISSANCE FOURNIS CABLES PUISSANCE NON FOURNIS	ANSCHLUSS NETZSTROMKABEL (EINGEBAUT) NETZSTROMKABEL (BEI AUFSTELLUNG VERLEGTE)
COLOUR CODE	CODE COULEUR FILERIE	KABEL-FARBKODE
RD - RED BK - BLACK WH - WHITE BL - BLUE BR - BROWN YL - YELLOW	RD - ROUGE BK - NOIR WH - BLANC BL - BLEU BR - MARRON YL - JAUNE	RD - ROT BK - SCHWARZ WH - WEIB BL - BLAU BR - BRAUN YL - GELB

REV	E.C.N.	DWN	CHKD	APPD	DESCRIPTION	DATE
B	ER-2108	B. O'S.	B. O'S.	W.B.	REVISED DRAWING	04-06-96

SEE TOWER ELECTRICAL SCHEMATIC L20352CA
SEE DATAMATE ELECTRICAL SCHEMATIC L13473CB

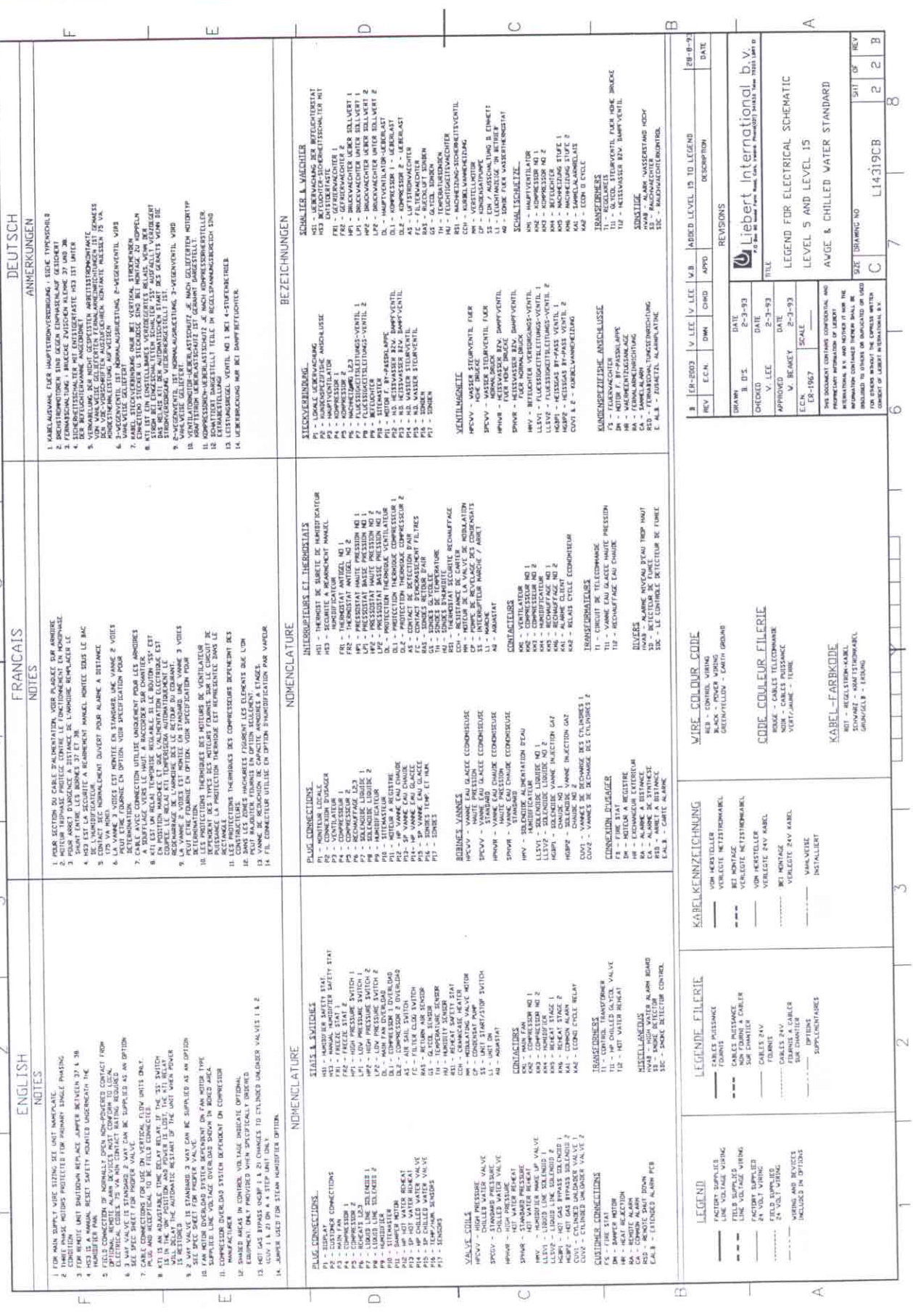
DRAWN	B. O'S.	DATE	13-05-96
CHECKED	B.O'SULLIVAN	DATE	13-05-96
APPROVED	W. BEAKEY	DATE	13-05-96
E.C.N.	ER-2108	SCALE	NTS

Liebert International b.v.
P.O.Box 90,Model Farm Road,Cork,Ireland.Phone(021)541633 Telex 75203(LBRTE)

TITLE
ELECTRICAL SCHEMATIC
SINGLE FAN UNIT
AIR CONDENSING UNIT
TOWER & DATAMATE 6kW & 9kW

SIZE	DWG NO	SHT	OF	REV
A	L19747AB	1	1	A

Electrical schematic legend



Troubleshooting

Fault	Indication	System response
	Temperature sensing alarm	
Indicates a failure of the temperature sensing function (loss of signal)	Simultaneous High & Low Temperature alarms, accompanied by dashes on the numeric read-out for temperature	Activates 100% cooling
	Humidity sensing alarm	
Indicates a failure of the humidity sensing function (loss of signal)	Simultaneous High & Low Humidity alarms, accompanied by dashes on the numeric read-out for humidity	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 and the humidifier fuse
- Check that the Run/Drain switch is in the RUN position

Refer to page 15 for further details on the operation of the humidifier.

	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
	Overloads tripped	Push the reset button on the main fan overload. Check the current draw
	Fan Safety Switch	Check the operation of the Fan Safety Switch
	No output voltage from the T1 transformer	Check for 24V AC between TB2-1 and TB2-3. If no voltage, is measured, check the primary voltage of the transformer
	Circuit breaker KM1 tripped	Check for 24V AC between TB2-1 and TB2-3. If no voltage, is present, check for a short and reset the breaker KM1
	ON/OFF switch not working	Check the ribbon cable to the display
Blower runs but controls will not operate	Remote shutdown operating	Check to see if the remote shutdown is connected (Terminals 37 and 38). If they are not in use, link both terminals together.
	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

Troubleshooting (continued)

Symptom	Possible cause	Check or remedy
	Compressor	
Compressor contactor pulled in but the compressor will not operate	Blown MCB	Check for line voltage after MCB and after contactors
Compressor contactor not pulled in and compressor will not operate,	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 . 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	
Pump stops pumping	Clogged strainer or impeller	Clean out the debris
Pump slows pumping	Clogged impeller, diffuser or line	Clean out the debris and use a strainer
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 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

Troubleshooting (continued)

Symptom	Possible cause	Check or remedy
	Refrigeration system	
Low suction pressure; high superheat	Moisture, dirt or wax in system	Check the filter drier and/or sight glass
	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 the valve for leaks
	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 sight glass on the compressor
High discharge pressure	Dirty condenser or drycooler fins	Clean the coil
	Condensing equipment not operating	Check the condenser
	High refrigerant charge	Check the sight glass
	Water regulating valve improperly adjusted	Adjust properly, see page 22
	Incorrect adjustment/ malfunction of the Condenser/Drycooler Speed Controller	Refer to relevant manual

MONTHLY MAINTENANCE INSPECTION CHECK LIST

DATE: _____ *ENGINEER:* _____

MODEL NO: _____ *SERIAL NO:* _____

Filter

- ☐ Check for restricted air flow

Blower section

- ☐ Impeller free of debris and move freely
- ☐ Bearings in good condition
- ☐ Check fan safety switch operation
- ☐ Check motor mounts
- ☐ Check wiring is in good condition

Air cooled condenser (if applicable)

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

Steam generating humidifier

- ☐ Check canister for deposits
- ☐ Check condition of steam hoses
- ☐ Check all drains are unblocked

Compressor

- ☐ Check for oil and refrigerant leaks
- ☐ Check compressor supports
- ☐ Check compressor mountings

Refrigeration cycle/section

- ☐ Check refrigerant lines
- ☐ Check for moisture (sight glass)
- ☐ Check suction pressure
- ☐ Check discharge pressure
- ☐ Check thermostatic expansion valve
- ☐ Check filter/drier for restriction

Air distribution section

- ☐ Restriction in grille free area

Refrigerant charge

- ☐ Check refrigerant level
- ☐ Check sight glass

NOTES: _____

_____

_____

_____

SIGNATURE: _____

MAKE PHOTOCOPIES OF THIS FORM FOR YOUR RECORDS

ANNUAL MAINTENANCE INSPECTION CHECK LIST

DATE: _____ *ENGINEER:* _____

MODEL NO: _____ *SERIAL NO:* _____

Filter
- ☐ Check for restricted air flow
- ☐ Wipe section clean
- ☐ Renew filter

Blower section
- ☐ Impellers free of debris and move freely
- ☐ Bearings in good condition
- ☐ Check fan safety switch operation
- ☐ Check motor mounts
- ☐ Check wiring is in good condition

Air cooled condenser (if applicable)
- ☐ Condenser coil clean
- ☐ Motor mounts tight
- ☐ Bearings in good condition
- ☐ Refrigerant lines properly supported
- ☐ Check all electrical connections

Water/glycol condenser (if applicable)
- ☐ Water regulating valves function
- ☐ Glycol solution
- ☐ Check for water/glycol leaks
- ☐ Check condenser is secure

Glycol pump
- ☐ Glycol leaks
- ☐ Pump operation

Steam generating humidifier
- ☐ Check canister for deposits
- ☐ Check condition of steam hoses
- ☐ Check operation of humidifier
- ☐ Check all drains are unblocked

Compressor
- ☐ Check for oil and refrigerant leaks
- ☐ Check compressor supports

Refrigeration cycle/section
- ☐ Check refrigerant lines
- ☐ Check for moisture (sight glass)
- ☐ Check suction pressure
- ☐ Check discharge pressure
- ☐ Check thermostatic expansion valve
- ☐ Check filter/drier for restriction

Air distribution section
- ☐ Restriction in grille free area

Refrigerant charge
- ☐ Check refrigerant level
- ☐ Check sight glass

Electric panel
- ☐ Check MCBs and contactors
- ☐ Check all electrical connections
- ☐ Check operation of contactors

Controls
- ☐ Functionally test the controls

NOTES: _____

_____

_____

SIGNATURE: _____

MAKE PHOTOCOPIES OF THIS FORM FOR YOUR RECORDS

Sample Warranty Claim Tag

WARRANTY CLAIM TAG

ONE TAG MUST BE ATTACHED TO EACH PART RETURNED

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 ☐

Q/1001/F REV:1

CUSTOMER COPY

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

PART RETURN AUTHORISATION
ONE TAG FOR EACH PART

UK Sales Office

Liebert Limited

Globe Park,
Marlow,
Buckinghamshire SL7 1YG,
England.
Tel: 44 628 403200
Fax: 44 628 403203

Deutscher Hauptsitz

Liebert GmbH

Liebigstraße 9,
8011 Kirchheim,
Germany.
Tel: (49) 89-991 9220
Fax: (49) 89-904 3151
Telex: 529936

Schweizer Hauptsitz

Liebert AG

Staffelstraße 4,
CH-8045 Zürich,
Switzerland.
Tel: (41) 1-2022450
Fax: (41) 1-2027122
Telex: 817560

Sede Italiana

SICE

Via Rosisini 6,
San Giuliano Milananse,
Milano 20098,
Italy.
Tel: 39 2 984 0582
Fax: 39 2 984 4633
Telex: 320552 SICELE I

Siège Français

Ferco

124 Avenue Galliéni,
93170 Bagnolet,
France.
Tél: (33) (1) 43 60 01 77
Fax: (33) (1) 43 60 70 07
Telex: 236332 F

Hong Kong Sales Office

Liebert Hong Kong Ltd

19th Floor,
Causeway Bay Plaza 1,
489 Hennessy Road,
Causeway Bay,
Hong Kong.
Tel: (852) 5722201
Fax: (852) 8345035
Telex: 82087 LBTHK HX

Far East Sales Office

Liebert Far East Pte Ltd

896 Dunearn Road,
Sime Darby Centre,
Singapore 2158.
Tel: (65) 4672211
Fax: (65) 4670130
Telex: 642529 HE BJ

Australian Sales Office

Liebert Australia Pty Ltd

P.O. Box 255,
Regents Park,
New South Wales 2143,
Australia.
Tel: (61) 27438555
Fax: (61) 27438737

European Manufacturing Facility

Liebert International B.V.

Model Farm Road,
Cork, Ireland.
Tel: 353-21-541633
Fax: 353-21-541543
Telex: 75203

Liebert

European Headquarters

Liebert

Globe Park, Marlow,
Buckinghamshire, SL7 1YG,
England.
Tel: 44-628-403200
Fax: 44-628-403203

International Headquarters

Liebert Corporation

1050 Dearborn Drive, P.O. Box 29186
Columbus, Ohio 43229 USA
614-888-0246
Telex: 246-655 LIEBERT WOGN

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