



# Close Control EC Plug Fan Range



**Chilled Water Units  
Installation, Operation & Maintenance Manual  
50/60Hz**

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## INSTALLATION

### GENERAL

#### INSPECTION

On receiving the equipment it should be checked to ensure that it is complete and in perfect condition. The carrier should be notified immediately, in writing, of any damage that might have been caused in transit.

#### HANDLING

Always keep the unit vertically upright and do not leave it out in the open.

The unit can be moved with a pallet truck. If a forklift is being used ensure the forks extend beyond the pallet. Care should be taken not to damage the bottom of the unit. If a crane is being used to move the unit leave the packaging intact and place spreader bars across the top of the unit to prevent the slings causing damage.

The unit should be moved as near as possible to the installation position before removing the cardboard packing and the pallet.

#### UNPACKING THE UNIT

- 1) Cut the three straps binding the unit taking care to avoid any backlash caused by their tightness.
- 2) Remove the lid & the cardboard sleeve will then unravel itself revealing a plastic dust cover.
- 3) Remove dust cover. If it is a downflow model, to remove the front panels use the key attached to the sensor on the top of the unit.  
Front return units have the bottom front panel shipped separately.
- 4) Remove the two bolts securing the unit to the skid (19 mm spanner).
- 5) Manoeuvre the unit carefully from the pallet. If it is necessary, use rollers underneath the unit to locate it in its final position.
- 6) If the unit requires a plenum fix same before final positioning.
- 7) Ensure the unit is positioned on a level floor.

#### POSITIONING

The EC Plug Fan Chilled Water Range are built on a level base and its positioning is most important. The unit should be firmly supported on the floor itself or on an optional floorstand.

Ensure that the unit is level in all directions as failure to do so will result in operational problems, particularly in regards to drainage. Care should be taken in manoeuvring the unit as the paintwork could be damaged. Use rollers where possible and apply pressure to the bottom of the unit for final positioning. Before final positioning ensure that inaccessible panels are correctly fitted and plenums are secured.

#### ATTACHING THE PLENUM

The plenum and unit are pre-drilled. At the time of installation remove the grilles from the plenum and secure the plenum internally by means of self tapping screws provided. Also secure to the back of the unit.

#### SERVICE ACCESS

Downflow Units.

Service of a downflow unit can be completed from the front of the unit. To remove certain components from the unit it may be easier and quicker to have side access to assist in these operations.

When positioned there should be a minimum clearance in front of the unit of 0.6m. If it is feasible, leave a distance of 0.6m at the side of the unit. Access to the back of the unit is not necessary. It is strongly recommended to leave a distance of 0.6m at both sides of the unit. There is a minimum distance of 150mm needed above the unit to allow removal of the filters.

Upflow Units.

Unlike the downflow, side access is necessary for servicing the upflow. When installing ensure the left-hand side of the unit has access for the purpose of servicing.

Access to the back of the unit is not required. It is strongly recommended to leave a distance of 0.6m at both sides of the unit. The filters are located in the bottom front panel, a minimum distance of 1m is needed to allow the return air to enter the unit.

Space above the unit will be determined by location. If a standard plenum is being installed the overall height of the unit is extended to 2480mm.

## MECHANICAL INSTALLATION

### SYSTEM APPLICATION

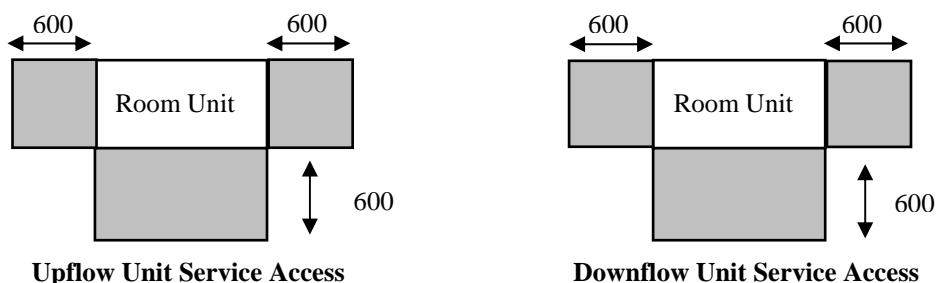
To achieve maximum performance and efficient energy usage following considerations should be given.

- 1) The room should be sealed effectively against air and vapour to minimise the loss and infiltration of uncontrolled humidity through concrete slab, walls, ceiling, roof, doors or any other opening or aperture.
- 2) Room location and orientation should be considered with regard to heat load and external variables should be reduced to a minimum.
- 3) The room should be kept at a positive pressure by introduction of pre-treated fresh air.
- 4) Low resistance to conditioned air distribution can be achieved by providing the maximum raised flooring height, minimum cable bunching and correct position of pipework (i.e. parallel to air flow).
- 5) Pipework that is not isolated or is fastened inadequately can transmit vibration along its full length.

## CHILLED WATER UNITS

### CHILLED WATER PIPING CONSIDERATIONS

Chilled water units are shipped with the flow and return pipes terminated with soft solder caps. The complete system is pressurised to 75psi with dry nitrogen. This pressure should be rechecked and discharged before caps are unsoldered. Supply and return pipes are



clearly marked. Check the site piping to ensure that the flow is in the proper direction.

The maximum allowable static pressure for the chilled water circuit is 1000kPa. If static pressure exceeds 1000kPa special valves should be installed. 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.

It is recommended that isolating valves be field fitted on both flow and return lines from the unit for isolation and maintenance operations. Automatic air bleed valves should also be fitted in appropriate locations.

## WATER AND DRAIN CONNECTIONS

### WATER SUPPLY

Water is fed from the mains supply to the humidifier inlet solenoid valve. The connection to the solenoid valve is a 3/4" male connection. The feed water characteristics should comply with the following values:

Characteristic	Minimum	Maximum
Feed Water Pressure	1 bar	10 bar
Electric Conductivity at 25°C	400 $\mu$ S/cm	800 $\mu$ S/cm
Impurity Size	-	0.1 mm

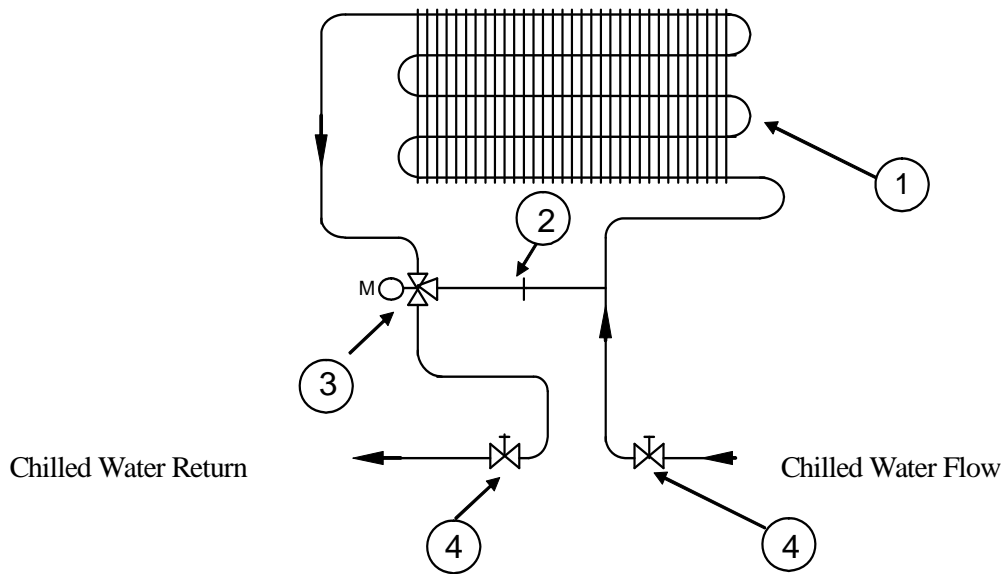
In the case of high water pressure a pressure reducing valve calibrated to between 3 - 4 bar should be fitted. Inlet water temperature must not exceed 50°C. It is recommended to install a shut-off valve and a mechanical filter with the wire mesh size less than 50 $\mu$ m. The humidifier pan drain connection is a 22 mm female connection. The humidifier drain can be discharged into the standard drainage system via a rubber or plastic hose suitable for temperatures up to 100°C. The hose should have a minimum internal diameter of 22mm. A trap or vertical loop should be fitted in the tubing to prevent blow back or odours and ensure that the drain has a fall of not less than 1:50.

Note: Do not feed demineralised water into the humidifier.

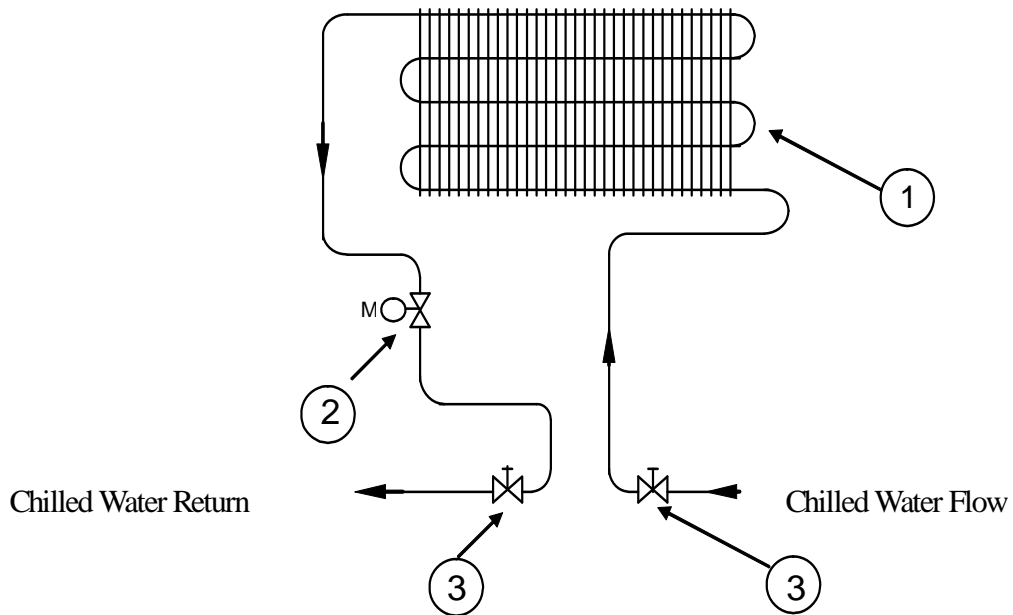
### CONDENSATE DRAIN

Install a drain pipe from the base of the drainpan (typically a 1" female B.S.P. fitting). Insulating this drain pipe is not necessary. It is advised to fit a trap in this drainpipe. On a twin circuit unit there are knockouts on the side panels to route drain hoses through to a single outlet. Copper pipe should be used for drains on units with humidifiers. If the system is equipped with a condensate pump, install a check valve on the discharge line of the pump to prevent backfilling the pump reservoir.

### 3 Way Valve System



### 2 Way Valve System



### System Components

	3 Way Valve System	2 Way Valve System
1	Chilled Water Coil	Chilled Water Coil
2	Balancing Orifice	2 Way Modulating Valve
3	3 Way Modulating Valve	Isolating Valves
4	Isolating Valves	

**Note:** Isolating valves are field fitted by others.

## GENERAL ENGINEERING DATA

### Standard Models

Model Size		064/6	084/6	124/6	164/6	204/6	244/6	284/6	324/6
<b>Coil Data</b>									
Coil Face Area	m <sup>2</sup>	0.58	0.82	1.32	1.82	2.31	2.81	3.32	3.83
Rows	No.	4 & 6	4 & 6	4 & 6	4 & 6	4 & 6	4 & 6	4 & 6	4 & 6
<b>Air Side Data</b>									
Air Volume	m <sup>3</sup> /hr	5665	7830	12420	16830	21235	25735	30330	34920
External Static Pressure ESP	Pa	25	25	25	25	25	25	25	25
Fan Type	-	EC	EC	EC	EC	EC	EC	EC	EC
Fan Diameter / Fan Quantity	mm	450 / 1	500 / 1	630 / 1	560 / 2	630 / 2	630 / 3	630 / 3	630 / 3
Fan Absorbed Power - 4 Row	kW	0.9	1.3	1.8	1.1	1.3	1.0	1.2	1.6
Fan Motor Power	kW	1.45	2.6	3.6	3.1	2.8	2.8	2.8	2.8
Fan Absorbed Power - 6 Row	kW	1.1	1.6	2.2	1.4	1.7	1.3	1.6	1.9
Fan Motor Power	kW	1.45	2.6	3.6	3.1	2.8	2.8	2.8	2.8
<b>Filter Data</b>									
Grade	-	G4	G4	G4	G4	G4	G4	G4	G4
Filter Width	mm	520	710	550	497	625	570	670	615
Filter Height	mm	655	655	655	655	655	655	655	655
Filter Quantity	No.	2	2	4	6	6	8	8	10
<b>Noise Data</b>									
Freefield SPL	dBA	57	58	58	59	61	61	62	62
<b>Unit Piping Data</b>									
Chilled Water F&R Pipe Size	mm	35	35	42	54	54	54	54	54
Control Valve Size	mm	32	32	32	40	40	50	50	50
Control Valve Quantity	No.	1	1	1	1	1	1	1	1
Control Valve Kv	-	16	16	16	25	25	40	40	40

### Fan Under Floor Models

Model Size		204/6	244/6	284/6	324/6
<b>Coil Data</b>					
Coil Face Area	m <sup>2</sup>	2.77	3.38	3.99	4.59
Rows	No.	4 & 6	4 & 6	4 & 6	4 & 6
<b>Air Side Data</b>					
Air Volume	m <sup>3</sup> /hr	25485	30885	36395	41905
External Static Pressure ESP	Pa	25	25	25	25
Fan Type	-	EC	EC	EC	EC
Fan Diameter / Fan Quantity	mm	630 / 2	630 / 3	630 / 3	630 / 3
Fan Absorbed Power - 4 Row	kW	1.9	1.3	1.7	2.3
Fan Motor Power	kW	2.8	2.8	2.8	3.6
Fan Absorbed Power - 6 Row	kW	1.2	1.6	2.0	2.6
Fan Motor Power	kW	2.8	2.8	2.8	3.6
<b>Filter Data</b>					
Grade	-	G4	G4	G4	G4
Filter Width	mm	625	570	670	615
Filter Height	mm	655	655	655	655
Filter Quantity	No.	6	8	8	10
<b>Noise Data</b>					
Freefield SPL	dBA	61	61	62	62
<b>Unit Piping Data</b>					
Chilled Water F&R Pipe Size	mm	54	54	54	54
Control Valve Size	mm	50	50	50	50
Control Valve Quantity	No.	1	1	1	1
Control Valve Kv	-	40	40	40	40

#### Notes

- Indoor unit Freefield SPL dBA levels are measured at 3m.
- All filters are 97mm thick.
- Humidifier inlet connection is ¾" BSPM & drain connection is 1" BSPF.
- Coil drain pan connection is ¾" BSPF.

**Chilled Water Models - Standard**

Model	064/6	084/6	124/6	164/6	204/6	244/6	284/6	324/6
<b>400V/3PH/50Hz</b>								
EC Fans FLA	4.0	4.1	5.5	9.8	8.4	12.6	12.6	16.5
Reheat FLA	13.9	21.7	21.7	35.9	35.9	35.9	35.9	35.9
Humidifier FLA	3.2	8.4	8.4	8.4	8.4	8.4	8.4	8.4
Max Unit FLA - Cool only	4.0	4.1	5.5	9.8	8.4	12.6	12.6	16.5
Max Unit FLA - Cool & Dehumidify	17.9	25.8	27.2	45.7	44.3	48.5	48.5	52.4
Max Unit FLA - Heat & Humidify	21.1	34.2	35.6	54.1	52.7	56.9	56.9	60.8
<b>220V/3PH/60Hz</b>								
EC Fans FLA	7.3	7.5	10.0	17.8	15.2	22.8	22.8	30.0
Reheat FLA	25.3	39.5	39.5	65.3	65.3	65.3	65.3	65.3
Humidifier FLA	5.8	15.3	15.3	15.3	15.3	15.3	15.3	15.3
Max Unit FLA - Cool only	7.3	9.5	10.0	17.8	15.2	22.8	22.8	30.0
Max Unit FLA - Cool & Dehumidify	32.6	47.0	49.5	83.1	80.5	88.1	88.1	95.3
Max Unit FLA - Heat & Humidify	38.4	62.3	64.8	98.4	95.8	103.4	103.4	110.6
<b>380V/3PH/60Hz</b>								
EC Fans FLA	4.2	4.3	5.8	10.2	8.8	13.2	13.2	17.4
Reheat FLA	14.6	22.8	22.8	37.7	37.7	37.7	37.7	37.7
Humidifier FLA	3.4	8.8	8.8	8.8	8.8	8.8	8.8	8.8
Max Unit FLA - Cool only	4.2	4.3	5.8	10.2	8.8	13.2	13.2	17.4
Max Unit FLA - Cool & Dehumidify	18.8	27.1	28.6	47.9	46.5	50.9	50.9	55.1
Max Unit FLA - Heat & Humidify	22.2	35.9	37.4	56.7	55.3	59.7	61.7	63.9
<b>460V/3PH/60Hz</b>								
EC Fans FLA	3.5	3.6	4.8	8.6	7.4	11.1	11.1	14.4
Reheat FLA	12.1	18.9	18.9	31.2	31.2	31.2	31.2	31.2
Humidifier FLA	2.8	7.3	7.3	7.3	7.3	7.3	7.3	7.3
Max Unit FLA - Cool only	3.5	3.6	4.8	8.6	7.4	11.1	11.1	14.4
Max Unit FLA - Cool & Dehumidify	15.6	22.5	23.7	39.8	38.6	42.3	42.3	45.6
Max Unit FLA - Heat & Humidify	18.4	29.8	31.0	47.1	45.8	49.6	49.6	52.9

**Notes:**

1. FLA = Full Load Amps.
2. Unit maximum FLA is the total of the components, which operate during maximum electrical load conditions.
3. Max FLA of cooling only unit : FLA = Controls + Fans.
4. Max FLA of unit with reheat in dehumidification : FLA = Controls + Fans + Reheat.
5. Max FLA of unit with heating & humidifiers : FLA = Controls + Fans + Reheat + Humidifier

## Chilled Water Models – Fan Under Floor

Model	204/6	244/6	284/6	324/6
<b>400V/3PH/50Hz</b>				
EC Fans FLA	5.5	4.2	4.2	5.5
Reheat FLA	35.9	35.9	35.9	35.9
Humidifier FLA	8.4	8.4	8.4	8.4
Max Unit FLA - Cool only	5.5	4.2	4.2	5.5
Max Unit FLA - Cool & Dehumidify	41.4	40.1	40.1	41.4
Max Unit FLA - Heat & Humidify	49.8	48.5	48.5	49.8
<b>220V/3PH/60Hz</b>				
EC Fans FLA	10.0	7.6	7.6	10.0
Reheat FLA	65.3	65.3	65.3	65.3
Humidifier FLA	15.3	15.3	15.3	15.3
Max Unit FLA - Cool only	10.0	7.6	7.6	10.0
Max Unit FLA - Cool & Dehumidify	75.3	72.9	72.9	75.3
Max Unit FLA - Heat & Humidify	90.6	88.2	88.2	90.6
<b>380V/3PH/60Hz</b>				
EC Fans FLA	5.8	4.4	4.4	5.8
Reheat FLA	37.7	37.7	37.7	37.7
Humidifier FLA	8.8	8.8	8.8	8.8
Max Unit FLA - Cool only	5.8	4.4	4.4	5.8
Max Unit FLA - Cool & Dehumidify	43.5	42.1	42.1	43.5
Max Unit FLA - Heat & Humidify	52.3	50.9	50.9	52.3
<b>460V/3PH/60Hz</b>				
EC Fans FLA	4.8	3.7	3.7	4.8
Reheat FLA	31.2	31.2	31.2	31.2
Humidifier FLA	7.3	7.3	7.3	7.3
Max Unit FLA - Cool only	4.8	3.7	3.7	4.8
Max Unit FLA - Cool & Dehumidify	36.0	34.9	34.9	36.0
Max Unit FLA - Heat & Humidify	43.3	42.2	42.2	43.3

### Notes:

1. FLA = Full Load Amps.
2. Unit maximum FLA is the total of the components, which operate during maximum electrical load conditions.
3. Max FLA of cooling only unit : FLA = Controls + Fans.
4. Max FLA of unit with reheat in dehumidification : FLA = Controls + Fans + Reheat.
5. Max FLA of unit with heating & humidifiers : FLA = Controls + Fans + Reheat + Humidifier.



## OPERATION

### GENERAL

#### MICROPROCESSOR CONTROLS

All Units shall be fitted as standard with the latest Delta range of DIN rail mounted Microprocessor Controls. The Control System utilises a main Microprocessor Interface Board equipped with a set of terminals necessary to connect the Board to the controlled devices. All software is permanently stored in flash RAM and is therefore protected even in the event of a power failure. Unit software is uploaded to the Microprocessor using a RAM key. On multi unit sites, this quickens unit commissioning. The software can also easily be changed or upgraded on site by qualified service personnel.

**Note:**

For more detailed information refer to Detailed Controls Manuals.

1)  $\Delta$ <sup>DELTA</sup> RANGE MICROPROCESSOR CONTROLLER SYSTEM PROGRAMMING MANUAL.

#### GENERAL SYSTEM OPERATION

Unit operation is completely automatic. The sequence below explains how the unit operates:

- The air, drawn in by the fan(s), enters the unit through top of the unit or the inlet grille.
- The air is immediately filtered.
- The temperature & relative humidity sensor verifies the condition of the inlet air and relays this to the microprocessor controller.
- The controller compares this information to the set point and proportional band values programmed into its memory. it then commands the air conditioner to treat the air as appropriate.

#### CUSTOMER CONNECTIONS

Power cables to the load break switch should be sized in compliance with local codes (see electrical data for permissible fuse size). Power cables required are 3 phase and a neutral (2.5mm minimum size neutral) and appropriately sized ground. The ground connection is vital. External device control connections to the control section are as follows:

- a) Connections to the condenser/dry cooler are via terminals 27 & 28.
- b) Connection to the remote shutdown feature is via terminals 15 & 16. Normally Closed N/C Unit On, Normally Open N/O Unit Off by Remote. A relay is required for this option.
- c) Connections for the external alarm relay's are via terminals 18, 19 & 20, (250 VAC rated - 10 Amps). Volt Free Contacts.
- d) Externally required A.C. voltage supplies are not to be taken from the unit, interface relays are to be utilised for these applications.

#### INITIAL START UP

- a) On initial start-up the controller will display the following message:

<b>SYSTEM BOOT PLEASE WAIT</b>
------------------------------------

- b) After a 5 second delay the controller will display the following:

<b>13:58</b>	<b>12/02/97</b>	<b>MOI</b>
<b>Temperature: 23.4 deg.C</b>		
<b>Humidity: 37.7 RH%</b>		
<b>UNIT ON</b>		

The unit is now ready for operation.

## AIRFLOW OPERATION

- a) When the electrical power has been energised for at least 3 hours, the unit may be energised by pressing the "On/Off" key on the keypad. The EC Fan is given a signal to run from the microprocessor controller establishing airflow.

## POWER FAILURE, INTERRUPTION OR SYSTEM RESET

- a) Should a 'brownout' (where voltage is low enough to cause the electronics to fail) or electrical power failure occur, the controller will be alerted as the voltage begins to drop. It will then de-energise all contactors. During power failure all data entered through the keypad will be held in a memory back-up which is supported by an Eprom. The Eprom will retain data indefinitely without external power.
- b) If a unit is in the "RUN" mode when a power failure occurs, then, upon power restoration the unit will automatically commence "RUN" operation. The settle timer will count down to zero and at zero the unit will then continue as outlined in the **Airflow, Temperature Control and Humidity Control** sections.

## EC FAN OPERATION

### GENERAL

The EC plug fan is a backward curved fan with integrated EC electrically commutated motor which is controlled directly from the microprocessor using a 0-10V output. Options on setup are:

- Strategy 1: Fixed speed
- Strategy 2: Track temperature band
- Strategy 3: Maintain pressure setpoint
- Strategy 4: Control from BMS
- Strategy 5: Maintain airflow setpoint
- Dehumidification control mode

### FIXED SPEED

A fixed 0-10V signal is set through the user display to operate the fan at a constant speed.

### TRACK TEMPERATURE BAND

The unit is set up to track the heating and cooling bands with set voltage limits. Max voltage / fan air volume is at set point plus control band & min voltage / fan air volume at set point

Max voltage / air volume is typically design air volume and min air volume is typically around 60% for chilled water units. Minimum value needs to insure that there are no hot spots due to lack of airflow that there is no loss of sensible cooling capacity to latent cooling capacity at the cooling coil.

### MAINTAIN PRESSURE SETPOINT

The microprocessor reads the underfloor pressure via a pressure transducer. The fan speed is then controlled to maintain a fixed underfloor pressure at all times. Pressure setpoint and min & max voltages are input through the user display. A reading of the underfloor pressure can also be viewed.

### CONTROL FROM BMS

The speed of the fan can be controlled directly from a BMS if one of the optional BMS interface cards are installed in the unit. The BMS writes a value of between 0 & 100.0% to an analog BMS address. The fan then operates to this speed. Min and max voltage can be input through the user display to insure the fan operates within acceptable limits.

### MAINTAIN AIRFLOW SETPOINT

The microprocessor calculates the airflow through the unit with the use of a pressure transducer and a special inlet ring across one of the fans designed for measuring airflow. PID control is then utilized to control the speed of the fans to insure a steady supply air volume. Airflow setpoint and min & max voltages are input through the user display. A reading of the total airflow through the unit can also be viewed.

### DEHUMIDIFICATION CONTROL MODE

Unit set up to give a reduced fan air volume in dehumidification mode to conserve energy in dehumidification while quickly achieving the dehumidification effect at the cooling coil. This output voltage is again user selectable.

## HEATING OPERATION

### GENERAL

This can take one of two forms:

- Electrical heating: The electric elements heat the air passing over them. Heating is supplied by 3 elements configured to support 2 stages of heating. Airflow has to be established before the elements are energised. The heaters are protected by a manual reset thermostats. This thermostat is a capillary type stat positioned across the coil near the elements.
- Hot Water Heating (optional): If hot water is available this flows through the hot water coil thus heating the air passing over it. The hot water flow is controlled by an on-off (2 or 3-way) valve.

On a Duplex unit the heating operation is carried out in the master module only.

**NOTE:** Heating and cooling cannot occur simultaneously.

### ELECTRIC HEATING

**CAUTION:** When commissioning the heater stage, be aware that the electric heater elements may at first give off smoke and may cause smoke detectors on site to alarm, e.g. Halon System.

### ELECTRIC HEATER PROTECTION & ALARMS

- a) The electric heaters are protected by one high temperature stats (RS1) which is fitted in the heater termination box.
- b) RS1 is a capillary type temperature stat. This capillary wrapped around the electric heater elements. If the temperature of the heater elements rises above 145 Deg. C the stat contacts will open and electric heating will be terminated.
- c) When the return air temperature drops sufficiently RS1 can be manually reset. Electric heating will continue as normal.

### Hot Water Reheat

- a) Hot Water Heating occurs when the return air temperature falls below the return air temperature setpoint. The solenoid valve or modulating valve will energise.
- b) As the return air temperature rises above the return air setpoint the controller will cancel the heating process by de-energising the solenoid valve or modulating valve.

Note: Heating can occur when compressor 1 is operating in the dehumidification mode and the return air temperature is below the return air temperature setpoint by the appropriate amount.

## COOLING OPERATION

### GENERAL

**Note 1:** Cooling can only occur when airflow is established.

**Note 2:** Modulating valves are fitted as standard on all units.

### SINGLE CIRCUIT COOLING MODULATING VALVES.

- a) A rise in return air temperature above the return air setpoint (default 22.0 Deg.C) will prompt the controller to call for cooling.
- b) The chilled water modulating control valve will energise. The modulating valve will modulate to balance the load as the temperature increases.
- c) As the return air temperature falls the controller will calculate the optimum use of the modulating valve.
- d) As the return air temperature drops to above the return air setpoint, the controller will modulate the valve until completely closed.

## DEHUMIDIFICATION CONTROL

- a) With the airflow established, an increase in return air relative humidity above the return air relative humidity setpoint (default 50.0%) will prompt the controller to call for dehumidification.
- b) The chilled water proportional valve opens 100% to produce 100% cooling.
- b) Should the return air relative humidity drop the return air relative humidity setpoint, the controller will cancel the dehumidification stage.
- c) Heating can only occur when the cooling valve is operating in the dehumidification mode and the return air temperature is below the return air temperature setpoint by the appropriate amount. Cooling/Heating take priority control over Dehumidification

### DEHUMIDIFICATION OVERRIDE

During dehumidification, should the return air temperature drop below temperature setpoints then the controller will override the call for dehumidification until the heaters cause the return air temperature to be within setpoint tolerances and will then re-energise the dehumidification stage if it is required.

## HUMIDIFICATION

When a call for humidification exists, the microprocessor controller sends a 24V ac signal to 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 phase (L3) via a current transformer.

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 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.

### SYSTEM OPERATION

The humidifier interface PCB maintains the electric current dissipated in the boiler at the programmed set point. The PCB therefore changes the immersion level of the electrodes by adding or draining water from the boiler through the respective valves. The operating current may be programmed on the front display panel between 30% and 100% of the rated value of the equipment. The functions of the equipment are described below:

**FILL VALVE** - maintains absorbed current between -10% and +10% of set point (percentages refer to rated current) by opening or closing respectively, with the first or second thresholds. The fill valve is automatically closed when:

- The drain valve is opened

The free surface of the water reaches the level electrodes

- The system is in a state of alarm

**DRAIN VALVE** - this is opened when:

- The absorbed electrical current reaches set point +30% (it closes as soon as current falls set point +10%)
- The washing cycle (initial or periodic) is activated
- The system is in a state of alarm

**TOP LEVEL ELECTRODES** - these prevent water overflowing from the boiler. When they are covered with water for approx. three seconds the valve is closed. After the level electrodes have been out of water for approx. 25 seconds, the fill valve opens again. The level electrodes also control topping-up when absorbed current does not reach the programmed threshold because:

- The water conductivity is too low
- The electrodes are partially or totally encrusted

**WASHING CYCLE** - this prevents excessive salt build-up inside the boiler. It is activated as follows:

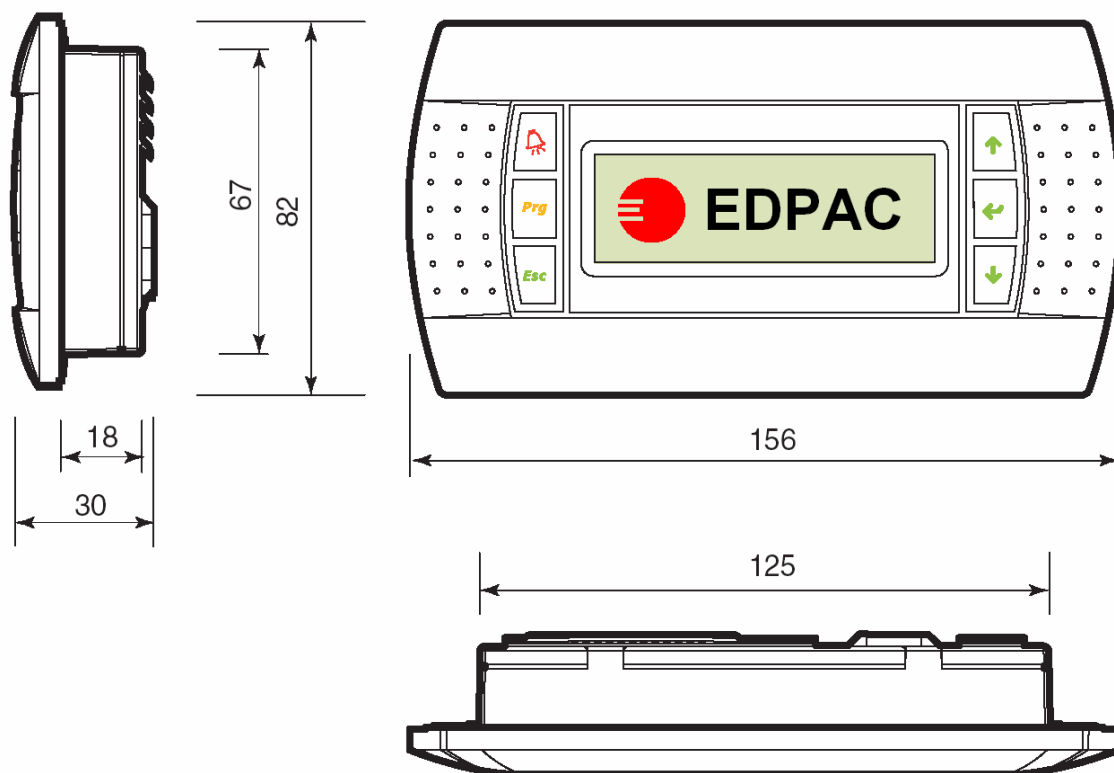
- At regular intervals, programmable according to the size of the equipment on the basis of cumulative time of humidification, memorised while the equipment is supplied with power

### ALARM CONDITION

- The red ALARM button on the front display panel lights up, the drain valve opens and electrical supply to the boiler is cut off when:

- Absorbed current exceeds 1.8 times the rated current (generally due to the fill valve overload)
- The valve remains open for more than 10 minutes without the threshold of current set point +10% being reached and without the level electrodes intervening (e.g., due to failure in the water supply, blocked intake filter, defective fill valve, power probe current transformer, contactor, blown fuses, encrusted electrodes, etc.)

## PGD DISPLAY



+



**Turning the unit On/Off :** Pressing the “ESC” & the “Enter / Return” arrow buttons together turns on and off the unit at the display. Pressing the up arrow button followed by the “Enter / Return” arrow button also turns unit on/off. Follow on screen instruction.



**Alarm button:** By pressing this button you can display the alarm that has occurred & reset it manually. When the red led indicator lights up, at least one alarm condition has occurred. If there are multiple alarms then using the arrow “up” & “down” buttons lets you scroll through them.



**Up arrow button:** Displays the program windows and allows the user to set the value of the control parameter



**Down arrow button:** Displays the program windows and allows the user to set the value of the control parameter. In default menu, pressing down arrow button displays unit operating mode.



**Enter / Return arrow button:** Confirms the set data.



**Escape button:** By pressing this button, you go back one level from where you are.



**Program button:** By pressing this button, you get a range of sub-menu's.

## ALARMS

The following alarms can be activated in an alarm condition & displayed on the display screen. All alarms can be set as serious or non-serious through the keypad

### ALARM LIST

AL 01	Compressor 1 HP / Thermal Overload
AL 02	Compressor 2 HP / Thermal Overload
AL 03	Compressor 1 LP
AL 04	Compressor 2 LP
AL 05	Air Flow Alarm (Serious Alarm)
AL 06	Air Flow Alarm – Slave
AL 07	Alarm Electric Reheat High Temp Trip
AL 08	Condensate Pump / High Water Level
AL 09	Smoke/Fire (Serious Alarm)
AL 10	Alarm Air Filter
AL 11	High Temperature Alarm
AL 12	Low Temperature Alarm
AL 13	High Humidity Alarm
AL 14	Low Humidity Alarm
AL 15	High Entering Water Temperature
AL 16	Low Entering Water Temperature
AL 17	Compressor 1 Run Hours
AL 18	Compressor 2 Run Hours
AL 19	Fan Run Hours
AL 20	Return Air Temperature Probe Fault Or Offline
AL 21	Entering Water Temperature Probe Fault Or Offline
AL 22	External Air Temperature Probe Fault Or Offline
AL 23	Supply Air Temperature Probe Fault Or Offline
AL 24	Return Air Humidity Probe Fault Or Offline
AL 25	Leaving Water Temperature Probe Fault Or Offline
AL 26	High Leaving Water Temperature
AL 27	Low Leaving Water Temperature
AL 28	High Current Into Humidifier
AL 29	Lack Of Water Into Humidifier
AL 30	Lack Of Current Into Humidifier
AL 31	Alarm Clock
AL 32	Spare / Custom
AL 33	Spare / Custom
AL 34	Spare / Custom
AL 35	Water Under Floor
AL 36	Loss of Water Flow Alarm

Default List: : Actual Alarms Model Dependant

## MAINTENANCE

### GENERAL

#### CHECKLIST

##### SAFETY NOTE

This equipment is designed for safe operation provided it is installed, maintained and serviced in accordance with the guidelines laid down in this section of the manual. They should therefore be studied in advance by any person wishing to work on the equipment

The equipment contains electrical components at high voltage. The main power isolation switch should therefore be opened before access is gained to the equipment

Care should be taken to avoid hands and clothing becoming entangled in the rotating parts.

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

Any service and maintenance operations requiring access to the inside of the equipment while in operation should be carried out by an appropriately qualified or experienced person who is fully aware of the potential dangers and precautions to be taken.

The following should be incorporated in a planned maintenance schedule to ensure that the equipment is well maintained. In all cases the various sections of the equipment should be examined and any defects logged for replacement/repair. For performance analysis a detailed service/maintenance log book should be kept outlining problems encountered and defects found during routine maintenance. Examples can be found at the end of this section.

### GENERAL COMMON COMPONENTS

#### 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.

#### DRIVE PACKAGE

- 1) Remove the unit front panels and inspect the fan motor for any loose electrical connections and retighten as necessary.
- 2) Inspect the fan impellers and remove any debris.
- 3) Check that the fan impellers are securely mounted. Rotate the impellers and ensure freedom of movement.

#### AIRFLOW SWITCH

- 1) Open the unit front panel and inspect the airflow switch located below the electric panel for any loose electrical connections and retighten as necessary.
- 2) Examine the pressure sensing tube between the switch and the fan casing for defects, damage and loose connections. Renew the tube if necessary.
- 3) Refit the unit front panel and restore the electrical supply to the unit.
- 4) Record and report any defects found during the inspection.

#### AIR FILTERS

To maintain efficient operation, the air filters should be checked monthly and renewed as required. 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) On downflow models the filters can be removed from the top of the unit, whereas on upflow units the bottom front panel contains the filters.
- 2) Fit new filters, refit the unit front panel on upflow units and restore the power supply.

## STEAM GENERATING HUMIDIFIER

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

## CHILLED WATER COIL

- 1) Remove the unit front panels and inspect the 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.
- 3) Inspect the pipework connections for any signs of leaks.
- 4) Refit the front panels and restore electrical supply to the unit.
- 5) Record and report any defects found during the inspection.

## CHILLED WATER VALVES

- 1) Remove the unit front 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) Ensure that the actuator(s) are securely fitted to the valve body.
- 5) Refit the unit front panels and restore the electrical supply to the unit.
- 6) Record and report any defects found during the inspection

## ELECTRICAL PANEL – INSPECTION AND FUNCTIONAL CHECKS

Open the unit front, 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

Select a set point for a temperature of 6°C below room temperature.

- a) A call for cooling should be observed.
- b) The chilled water valve should open, and the equipment should begin to cool.
- c) A high temperature alarm may enunciate. Disregard it.

Return the set point to the room temperature.

## REHEAT FUNCTIONAL TEST

Select a temperature set point for 6°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.

Return the set point to the desired temperature.

## HUMIDIFICATION FUNCTIONAL CHECK

Set the humidification to 10%RH above the room humidity reading.

- a) For a steam generating humidifier, you will immediately hear clicks as it energises. After a short delay, the canister will fill with water. The water will heat and steam will be produced.

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

## DEHUMIDIFICATION FUNCTIONAL CHECK

Set the humidification setpoint to 10%RH below the room humidity reading. Make sure that the temperature set point is at or above room temperature.

- a) The chilled water valve should open, and the system should begin to cool/dehumidify.

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

**NOTE:** - IN CHILLED WATER SYSTEMS THE PROPORTIONAL VALVE OPENS 100%.



### THE BASIC CONTROL CHECKS ARE NOW COMPLETED.

- 1) Replace the unit front panels and restore the electrical supply to the unit.
- 2) Record and report any defects found during the inspection.

### STEAM GENERATING HUMIDIFIER – CLEANING AND REMOVAL

**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.



- 1) Drain the water completely. (See Controls Manual for details on drain procedure).
- 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 humidifier bottle by rotating it anti-clockwise on its axis.
- 6) Remove the bottle.

**NOTE:** - THE BOILER MAY GENERALLY BE USED AGAIN AFTER DESCALING.

- 7) Unscrew the ring nut and extract the bottom filter. Remove any scale and 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.

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

In the case of serviceable humidifiers the bottle can be dismantled and thoroughly cleaned.

### FAULT FINDING GUIDE

SYMPTOM	POSSIBLE CAUSE	REMEDY
LACK OF AIRFLOW Loss of Airflow alarm	1) No power to the fan motor	Check the fan motor MCB and electric supply at the motor box terminals
	2) Clogged filters	Replace the filters
	3) The airflow is obstructed	Check fan inlets, air intake and supply paths are free
	4) The main fan overload has tripped	Check the electrical resistance of the motor windings. After re-set, measure the supply voltage and current drawn.
	5) The pressure drop in the air distribution system (ducts, ceilings, flooring, plenum, grilles, etc.) is too high	Check the design and sizing of the air distribution system
THE HEATER SAFETY THERMOSTAT CUTS OUT (Heater trip alarm)	1) Lack of airflow	See LACK OF AIR FLOW
	2) thermostat faulty connection wire	Check the electrical continuity of the safety thermostat connection to the controller
	3) Defective thermostat	Replace the heater safety thermostat

SYMPTOM	POSSIBLE CAUSE	REMEDY
No Power (Green On/Off control button not lit)	No power to the unit electric panel	Check that the electrical power source is live and the main disconnect switch is closed
	No power to the control circuit	1) Check that the control circuit breaker is closed 2) Check the 24V secondary fuse
THE UNIT DOES NOT OPERATE	The display does not operate the unit	1) Check the display connection. 2) Check the processor connections 3) Refer to the unit electrical schematic and user control manual
ROOM TEMPERATURE TOO HIGH Unit high Temperature Alarm	1) Controls not properly set	Check the room temperature setpoint - Refer to User Control Manual
	2) Lack of airflow	See "LACK OF AIRFLOW" section
	3) The chilled water valve does not work when required by the controller	Check linkage for adjustment and ensure that it is tight on the valve. If the valve still does not open, even though voltage is present, then renew the valve motor.
	4) The control system does not operate properly	See "User Control Manual". Check that the display and processor and/or the sensor function properly
	5) Heat load higher than expected	Check the room heat load Check the condition and volume of fresh air make-up check the quantity of infiltration of external air
ROOM TEMPERATURE TOO LOW Unit High Temperature Alarm	1) Controls not properly set	Check the room temperature setpoint - Refer to User Control Manual
	2) The heater does not work properly (if fitted)	1) Check the heating elements 2) Check the electric heater MCB 3) In the case if electric heater alarm, eliminate the cause and re-set the safety thermostat
	5) The control system does not operate properly	See "User Control Manual". Check that the display and processor and/or the sensor function properly
	6) Thermal losses higher than expected	Check the room heat loss calculations, check the quantity of infiltration of external air
ROOM RELATIVE HUMIDITY TOO HIGH Controller high humidity alarm	1) Controls not properly set	Check the room humidity setpoint - Refer to User Control Manual
	2) Latent load higher than expected	Check the room latent load, check the quantity of infiltration of external air
	3) The chilled water valve does not work in the dehumidification mode	Check linkage for adjustment and ensure that it is tight on the valve. If the valve still does not open, even though voltage is present, then renew the valve motor.
	4) The control system is not functioning properly	See "User Control Manual". Check that the display and/or the sensor are functioning properly
ROOM RELATIVE HUMIDITY TOO LOW Controller low humidity alarm	1) Controls not properly set	Check the room humidity setpoint - Refer to User Control Manual
	2) Latent load higher than expected	Check the room latent load, check the quantity of infiltration of external air
	3) The humidifier does not function properly	Check the make-up water pressure Check the humidifier and cylinder

## MONTHLY MAINTENANCE INSPECTION CHECK

MODEL NUMBER

SERIAL NUMBER

DATE

INSPECTOR

### FILTERS

- ☐ Check filter switch (if fitted)
- ☐ Inspect filters and replace if necessary

### DRIVE PACKAGE

- ☐ Blower impellers moving freely and free of debris
- ☐ Check airflow switch setting and operation.
- ☐ Inspect blower anti-vibration mounts

### STEAM HUMIDIFIER

- ☐ Check humidifier bottle for deposits
- ☐ Check condition of steam hoses

### CHILLED WATER SECTION

- ☐ Check that the valve motor is correctly secured
- ☐ Check pipework is secure.
- ☐ Check joints for leaks
- ☐ Check coil for damage
- ☐ Check bypass valve setting

### GENERAL NOTES AND OBSERVATIONS

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## ANNUAL MAINTENANCE INSPECTION CHECK

MODEL NUMBER

SERIAL NUMBER

DATE

INSPECTOR

**FILTERS**

- ☐ Check filter switch (if fitted)
- ☐ Inspect filters and replace if necessary

**DRIVE PACKAGE**

- ☐ Blower impellers moving freely and free of debris
- ☐ Bearings in good condition
- ☐ Check airflow switch setting and operation
- ☐ Inspect blower anti-vibration mounts

**STEAM HUMIDIFIER**

- ☐ Check humidifier bottle for deposits
- ☐ Check condition of steam hoses
- ☐ Inspect inlet filter
- ☐ Check fill/drain valves

**CHILLED WATER SECTION**

- ☐ Check that the valve motor is correctly secured
- ☐ Check pipework is secure.
- ☐ Check joints for leaks
- ☐ Check coil for damage
- ☐ Check bypass valve setting

**AIR DISTRIBUTION**

- ☐ Ensure that inlet/return airways are unrestricted

**ELECTRIC PANEL**

- ☐ Check MCB's
- ☐ Check electrical connections
- ☐ Check operational sequence

**GENERAL NOTES AND OBSERVATIONS**

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