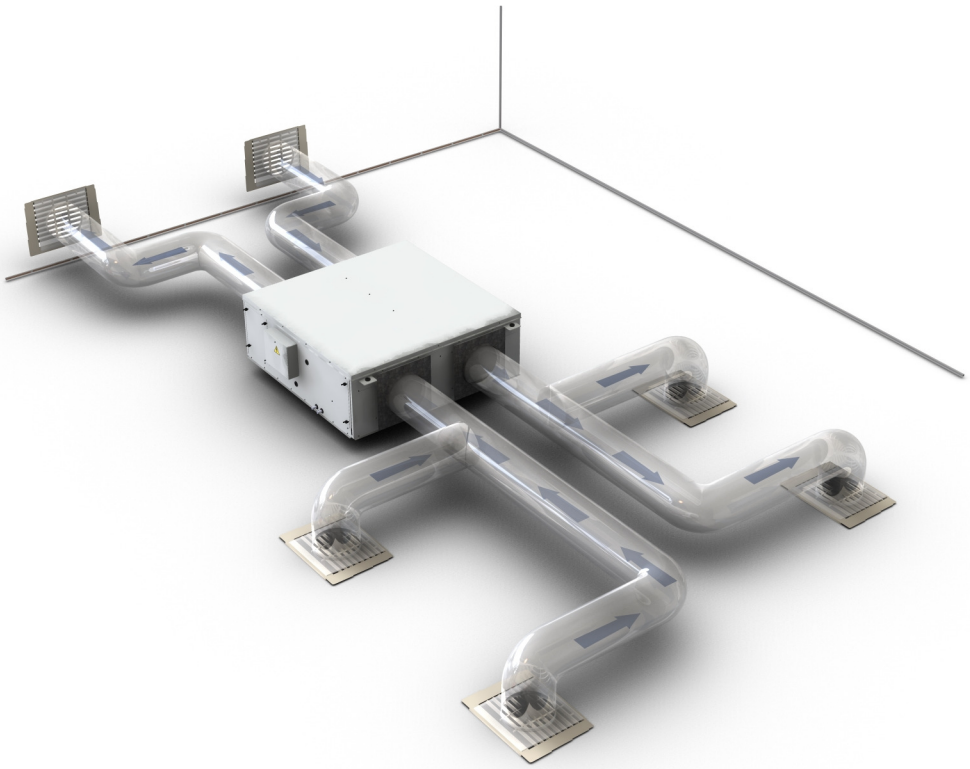
DERV UNITS

C/W CHILLED WATER COOLING COILS

INSTALLATION, OPERATING
AND MAINTENANCE INSTRUCTIONS



SPC

QA/IOM/63 ISSUE 1 – DERV

1 General Description

SPC DERV units are heat recovery ventilator units incorporating heat recovery heat pipes, dehumidifier heat pipes and an active chilled water cooling coil.

The units are intended to fully condition outside air by taking advantage of the cooling potential of dirty extract air and the cooling and dehumidifying potential of an available chilled water supply.

The units are constructed in two halves; one half incorporating the extract fan and extract section of the heat recovery heat pipe, the other half contains the supply fan, supply section of the heat recovery heat pipe plus chilled water cooling coil c/w heat pipe wrapped around it. The wrap around heat pipe precools the air prior to the chilled water coil and reheats it after the cooling and dehumidifying process to generate neutral ventilation air.

Units incorporate filtration on both the supply and extract side and are designed to be mounted out of sight above false ceilings and are designed to be suspended from the ceiling slab.

The supply and extract sections terminate in sheet metal flanges for the attachment of ducting. Ducting design will be to suit the desired distribution within the premises and is largely beyond the scope of this manual.

Units are supplied with an on/off and three speed controller to control the rotational speed of the backward curved centrifugal fans and hence control the throughput of air on both the supply and extract side. Further control of the air throughput must be made as part of the ducting design with branch sizes matched to air volumes and manual volume control dampers fitted where necessary.

2 Technical Details

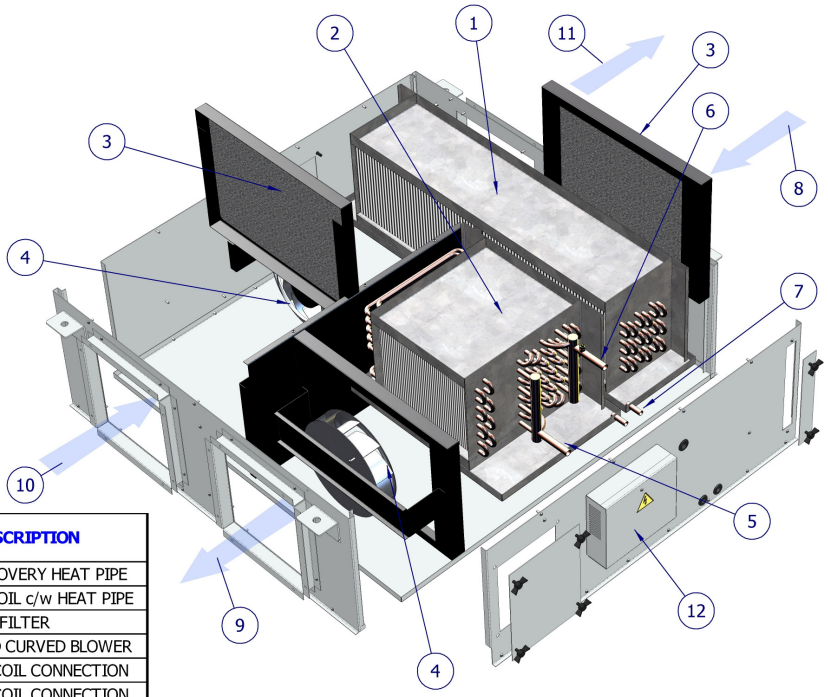
The table below gives details of the nominal operating characteristics of the DERV units along with pertinent weights and dimensions. Operating limits for the units are as follows:

Maximum outside air temperature: 55°C
Minimum outside air temperature: 5°C
Maximum extract air temperature: 40°C
Minimum extract air temperature: 5°C
Units should be installed in a non-condensing environment.

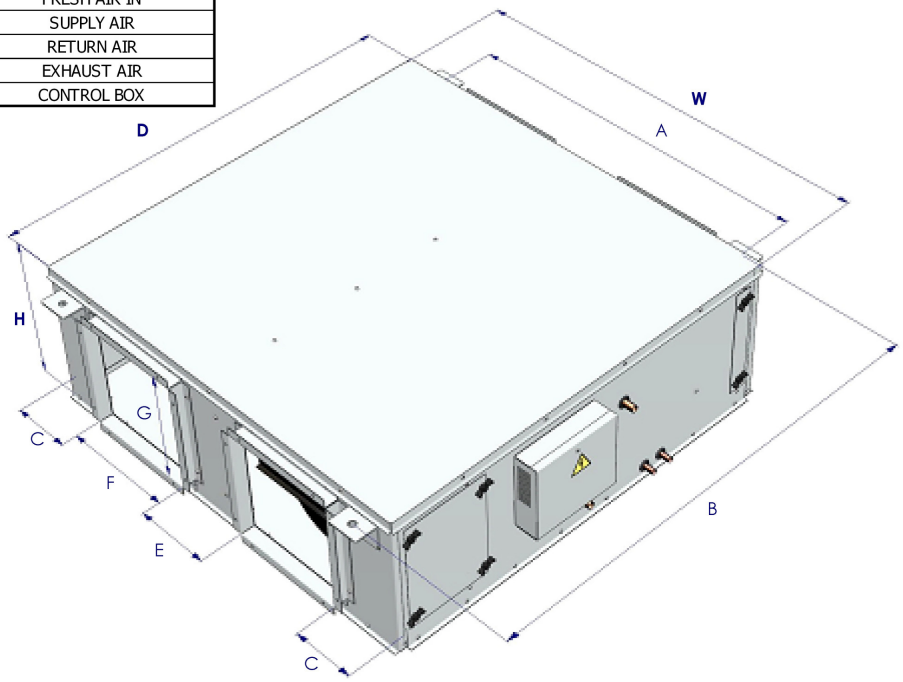
Unit size	DERV80	DERV150	DERV250
Nominal supply volume (litres/s)	80	150	250
Nominal extract volume (litres/s)	80	150	250
Nominal outside air db/wb (°C)	46.0/30.0	46.0/30.0	46.0/30.0
Nominal extract air db (°C)	25.0	25.0	25.0
Nominal supply air db/wb (°C)	19.4/15.8	19.4/15.8	19.4/15.8
Nominal supply external static (Pa)	80	80	80
Nominal extract external static (Pa)	80	80	80
FLA (A)	0.8	1.3	1.4
Power drawn (W)	196	302	318
Nominal CHW F/R (°C)	7.2/12.8	7.2/12.8	7.2/12.8
Nominal CHW flowrate (litres/s)	0.17	0.32	0.54
CHW pressure drop (kPa)	7	9	22
Power supply (V/Ph/Hz)	230/1/50	230/1/50	230/1/50
Approximate resultant noise (NR)	35	35	35
Approximate weight (kg)	50	70	90
CHW connection sizes	15mm copper	22mm copper	22mm copper
Drain connection sizes	30mm plastic	30mm plastic	30mm plastic

Table 1. Technical data

Detailed unit dimensions and construction information is highlighted on the figure below:



ITEM	DESCRIPTION
1	HEAT RECOVERY HEAT PIPE
2	COOLING COIL c/w HEAT PIPE
3	FILTER
4	BACKWARD CURVED BLOWER
5	COOLING COIL CONNECTION
6	COOLING COIL CONNECTION
7	DRAIN CONNECTION
8	FRESH AIR IN
9	SUPPLY AIR
10	RETURN AIR
11	EXHAUST AIR
12	CONTROL BOX



UNIT SIZE	EXTERNAL DIMENSIONS			FIXING CENTRES		APERTURE POSITIONS			
	HIEGHT	WIDTH	DEPTH	A	B	C	E	F	G
80	335	960	982	810	950	135	170	255	255
150	335	1110	982	910	950	163	323	255	255
250	386	1360	1080	1130	1030	201	248	350	250

Figure 1. Physical unit data

3 Reception & storage

DERV units are delivered in purpose made cardboard containers. Upon receipt of the units the packaging should be checked for any obvious damage and the labeling checked against the project requirement. Any damage or delivery discrepancy should be reported to the SPC local office immediately. After checking the packaging the units should be removed and a visual inspection carried out and any damage reported immediately. If the units are not to be installed immediately then they should be returned to the packaging for storage.

It is recommended that the units be stored in a safe location away from site activity and they must not be exposed to the ambient. Units must be stored in non-condensing atmospheres where temperatures cannot exceed 50°C.

4 Installation

4.1 Mounting

DERV units must be installed horizontally and are intended to be fitted in a concealed location, ideally above a false ceiling. The units must be suspended from the concrete ceiling slab or other fixed and firm horizontal steelwork. Care must be taken to ensure that the DERV unit is fixed to a structure that will accept the unit weight as shown in the above table and that vibrations are not transmitted.

DERV units are supplied with 4-off robust fixing lugs at each of the corners of the unit. Each of these lugs incorporates a rubber bush to prevent unit vibrations being directly transmitted to the mounting/support rods. The units should be mounted from the ceiling/steelwork using threaded drop-rods. These drop-rods are not supplied with the units but we recommend the use of M6 threaded rod as a minimum size.

The ceiling or support structure should first be marked out to match the position of the holes in the DERV unit fixing lugs. The structure should then be drilled and fitted with suitable anchors capable of accepting the weight of the DERV unit. Brackets can then be secured to the ceiling anchors for securing the threaded drop rods. The rods should be cut to length and secured to the ceiling bracket or supporting steelwork and the other end passed through the fixing lugs on the DERV unit.

The drop-rods should be secured with suitable nuts on either side of the fixing lugs around the anti-vibration bushes. It is important that the unit is fitted level in both directions so that correct operation and drainage are ensured. A maximum deviation of 2mm from the horizontal should be maintained and checked on installation using a spirit level and adjusted using the retaining nuts on the fixing lugs.

4.2 Electrical connections

DERV units are designed to allow simple operation with the minimum of electrical power and control wiring required on site. A wiring diagram for the unit is attached within the electrical box and delivered with each unit. A copy of the wiring diagram is shown below.

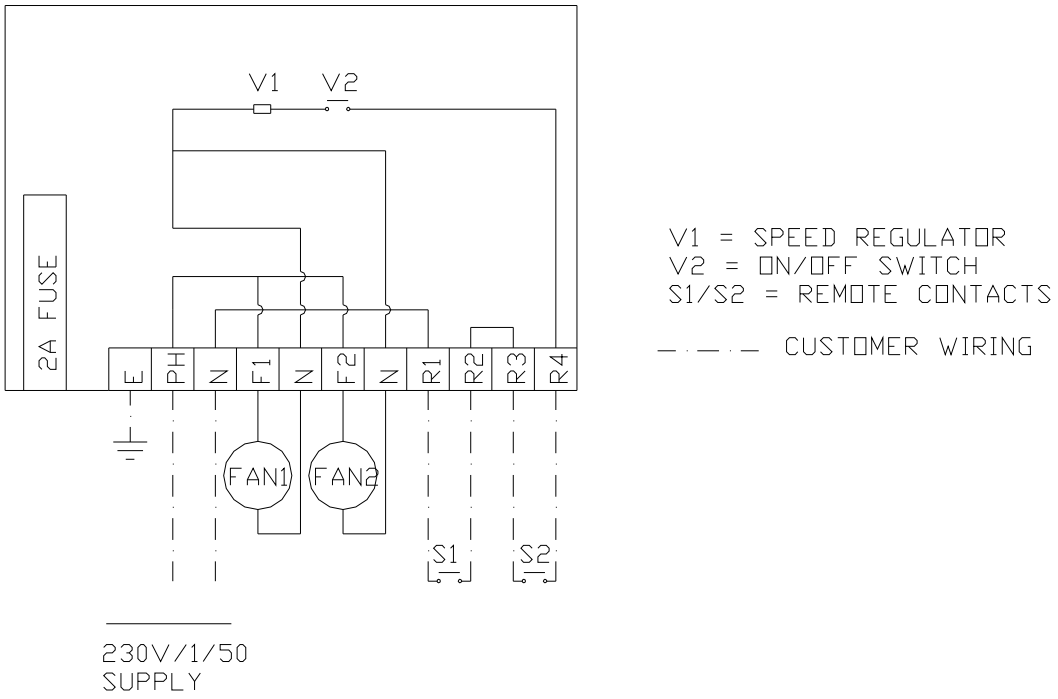


Figure 2. Wiring details

Power supply to the units is single phase 230V/50Hz. A three wire supply is required (PH/N/E) and this should be taken from a suitably isolated power supply. Maximum running current and power drawn are given in the technical data table but minimum wire size for the power supply should be 1mm2.

The terminal block is accessed by removing the outer protective cover on the electrical box fitted on the side of the DERV unit. The 3-core power cable should pass through this cover via a suitably sized gland.

The DERV units incorporate a built-in controller allowing the speed to be changed (speed 1,2 & 3) along with an on/off switch. Provision has also been made for remote control of the DERV units via two volt free contacts. These contacts can be used to switch the units on and off remotely via switches or relays attached to BEMS, occupancy sensors etc. The two remote contacts are wired into terminals R1/R2 and R3/R4 respectively. Again wire should be a minimum of 1mm2 and remote contacts should be rated at a minimum of 2A. Wiring from remote contacts should enter the electrical box via suitably sized cable glands.

If one or both of the remote contacts are not used then links must be fitted between R1/R2 and R3/R4.

4.3 Chilled water connections

The DERV unit is supplied with a combined chilled water cooling coil/heat pipe assembly with chilled water flow and return pipes terminating outside the unit. In order for the assembly to operate correctly the lower of the two chilled water connections must be made the flow connection and the upper the return connection.

Flow and return pipes are from plain copper either 15mm or 22mm (see data table). Connections to the chilled water piping can be realized using either brazed/soldered joints or compression

fittings, alternatively flexible hoses can be used with push fit connections. The flow and return connections from the DERV units are capped-off on delivery and need to be opened shortly before connecting using a pipe cutter.

It is recommended that isolating valves are fitted close to the flow and return connections of the DERV unit so as to facilitate servicing.

The nominal chilled water flowrates are given in the data table and should be used to set the flow in the absence of further information. If project specific flowrate information is available then this should be used in preference.

In order to properly commission the hydronic system, manual setting, double regulating valves (commissioning sets) should be fitted to each unit; these would normally be installed in the return pipework. Alternatively, automatic flow setting devices can be used in line to simplify the balancing process.

As the flow and return pipes carry chilled water, any atmospheric air in contact with same will condense on the pipe surfaces. It is essential therefore that all pipework is effectively insulated right up to the casing of the DERV unit.

The return pipe connection on the DERV units is supplied c/w a manual air vent. This should be opened to release any trapped air during the commissioning of the system.

The design of the hydronic system in total is beyond the scope of this manual and is the responsibility of the contractor/installer. Bear in mind, however, that DERV unit control and piping will differ with respect to the conventional piping systems employed on fan coil units. Fan coil units are employed to maintain a comfortable space temperature and hence are typically controlled on the waterside using three port diverting valves. These valves will be fitted with actuators which respond to a change in the room sensed temperature and control the flow of water through the heat exchanger. DERV units are designed to generate ‘neutral’ ventilation air and hence automatic control on the waterside should not be required. If necessary control of either chilled water flowrate or chilled water temperature can be employed using diverting or mixing systems on an overall basis but it should not be required for individual DERV units.

4.4 Drain connection piping

The DERV units incorporate two internal draintrays; one beneath the heat recovery heat pipe and one beneath the cooling coil/heat pipe section. There is an individual drain pipe extending out from the side of each drainpan. These drainpipes are 30mm diameter plastic and must be properly trapped in order to ensure than condensate is not held within the unit. The drainpans are both on the suction side of the supply fan and subject to negative pressure and if not fitted with drain traps will draw air into the unit and prevent the release of moisture. As these two drain points are adjacent to one another and subject to very similar levels of vacuum it is permissible to join the two together prior to the trap.

Suction pressures at the inlet to the supply fan can be as high as 200Pa depending on the external resistance of the systems and traps should be sized to cope with this level of pressure. Incorporating a safety factor to account for the effect of dirty filters etc the required minimum dimensions are shown in the diagram below.

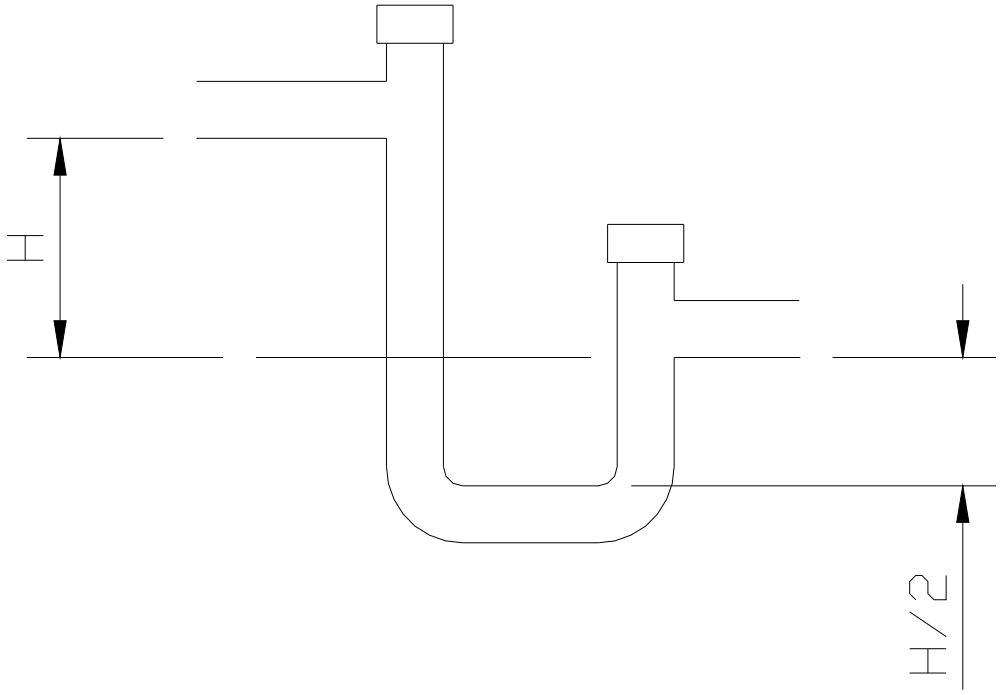


Figure 3. Trap dimensions

The minimum value for H should be 40mm which represents an equivalent water column height of 400Pa.

Traps should be regularly inspected, particularly after periods of inoperation, to ensure that they are not dry.

Immediately downstream of the drain trap there should be an air break to prevent any back pressure. From this point the drain piping should either slope to waste or a condense pump should be included. As the drain piping contains cool condense it should be insulated to prevent sweating.

4.5 Ductwork connections

DERV units are complete with four rectangular spigots; two for the supply air and two for the extract air. The spigots are sized to give a resultant velocity which is sufficiently low as to allow air distribution through ducting or direct to diffusers without transformation of the duct size.

The ducting can be transformed to a smaller size after the outlet spigot and can be transformed to circular ducting if this is preferred. A single DERV unit can be arranged to take its extract air from one or more sources and its supply ducting can be arranged to supply one or a number of different areas. Extract and supply grilles and diffusers should be used in line with good air distribution practice.

Duct sizes should be selected to maintain an air velocity of less than 5m/s in all main ducts and branches. This will not only minimize the external static pressure that the unit is operating against but will also eliminate any noise problems. If the ducting runs through areas subject to high humidity then the ducting should be lagged to prevent moisture formation, this is particularly important for the supply ducting from the DERV unit which will be carrying cool air at around

20℃. Supply diffusers should be fitted with plenum boxes to reduce the velocity of the air before introducing it to the occupied space.

If designing against a maximum duct velocity of 5m/s than a good approximation to the pressure drop associated with the straight ducting is 2Pa/m. Fittings, branches, bends and grilles offer additional dynamic resistances due to momentum changes of the air flow. A reasonable approximation is to sum the number of the above fitting losses and allow 5 Pa for each. The above will allow duct sizes to be reasonably approximated but the final design should be undertaken by a designer/installer qualified in duct design and space air diffusion.

It is recommended that manually operated butterfly dampers are incorporated in the final branch of all duct connections. This will simplify the commissioning process and provide the facility for accurately setting the airflows to and from each zone. Without the use of dampers the air volumes from each zone will only vary with the length and diameter of the ducting runs.

5 Operation

DERV units are supplied with a speed controller, on/off switch and the possibility to incorporate remote contacts to switch the units on and off. The above controls vary the throughput of air by varying the power supply to the fans. The unit incorporates two-off fans; one for the supply air and one for the extract air.

The units will have been selected to provide a particular supply and extract air volume; these will be equal for a balanced ventilation application. If the area is to be pressurized then the supply air volume will be higher than the extract and vice versa if the space is to be kept under negative pressure.

The respective air volumes must be set by both adjusting the fan speed on the controller located in the unit electrical box and manual adjustment of damper blades in the ducting. The speed of the two fans can be adjusted between speeds 1, 2 and 3 and the power supplied to the fan motors is then controlled by TRIAC control logic which varies the conduction angle. The controller provides the same power to both fans so the speed selection switch should be used to achieve just in excess of the required air volume through the least favoured leg of ducting. Accurate balancing of the air distribution system should then be carried out by adjustment of the dampers.

The units can be put into operation by simply switching the on/off switch in the control box but under normal circumstances this would be inaccessible to users. More obvious control possibilities are to break the supply to the units via a switched fuse spur box or to take advantage of the remote contacts provided. These contacts are discussed in the installation section and allow on/off control of the units via switched contacts (manual switching or via relay). If the units are to be controlled from a central system or BEMS then the requirement for ventilation should be sensed via occupancy or carbon dioxide sensors.

In order to achieve the necessary dehumidification of the ventilation air a supply of chilled water is required to the DERV unit. The correct flowrate and flow temperature will be documented with the quotation documents for the project. If these are unavailable then the values given in the technical data table can be used. To ensure that the chilled water arrives at the cooling coil connections ensure that all isolating valves are open and that the coil has been properly vented through the vent plug provided. The pump system for the DERV units should be sized against the total flowrate for the units and the waterside resistance figures with due consideration given to additional losses associated with pipework, fittings and other flow regulating valves.

Under normal operating conditions the DERV units will generate considerable amounts of condensed moisture. This must be adequately trapped and run to waste as described in the installation section above.

6 Maintenance

It is suggested that the DERV units should be maintained on a monthly basis so as to ensure continued correct operation. The maintenance routine should involve the following:

Filter cleaning: The units incorporate two filters; one on the extract air side and one on the supply air side. Access is provided for filter withdrawal from the sides of the unit via the slimmer removable panels on either side of the unit, held in place by wing nuts (see diagram above). After removing the panel the filters can be slid out of the unit and cleaned using a vacuum hose or pressure line. During cleaning the air should be drawn/blown through the filter in the opposite direction to the operating airflow.

Airflow check: A check should be made to ensure that both the supply and extract fans are operating. This can usually be ascertained by placing a hand over the supply/extract grilles within the space. If there is no airflow through either the supply or the extract system then a further investigation should be made. The fans and their associated wiring are accessible from either side of the unit via the larger access panels which are released by unscrewing the wing nuts. Any electrical servicing must be undertaken by qualified personnel after electrically isolating the unit.

Drain trap check: Drain trap(s) should be regularly checked to ensure that they are not dry and that there is a liquid seal.

Coil cleaning: The coil fin blocks should be regularly checked and cleaned with a soft brush, vacuum or pressure hose to clear any debris from the surfaces. This will involve removal of access panels and in some instances removal of the ducting attached to the spigots of the DERV unit.

General cleaning: The outer casing of the DERV unit is finished in corrosion resistant epoxy paint and can be wiped down with a wet cloth or with dilute cleaning agents.

7 Fault finding

The table below details faults that may occur, their cause and means of rectification.

Fault	Cause	Remedy
One fan does not run	Motor failure	Replace faulty fan/motor assemby
	Loose wire	Check integrity of wiring on fan terminal
	Capacitor burn-out	Look for signs of damage and replace capacitor
Both fans do not run	Unit switched off	Switch on at unit or remote switch
	Unit held off by remote contact/switch	Check power at terminals and remote contact signals
	Power failure	Check power supply to unit
	Fuse blown	Replace fuse
	Loose wire	Check and tighten
Low airflow	Dirty filter	Remove and clean
	Low speed selected	Increase speed setting
	Ducting blocked	Check dampers, grilles etc
High airflow	High speed selected	Reduce speed setting
	Unbalanced ducting	Check damper positions
High supply air temperature	No chilled water available	Check chilled water supply
	Chilled water flowrate too low	Check position of valves and pump operation
	Chilled water temperature too high	Check chiller operation or temperature of chilled water supply
	Air trapped in coil	Vent coil
Humid supply air	No chilled water available	Check chilled water supply
	Chilled water flowrate too low	Check position of valves and pump operation
	Chilled water temperature too high	Check chiller operation or temperature of chilled water supply
	Air trapped in coil	Vent coil
Moisture in supply airstream	No drain trap fitted	Fit drain trap
	Drain trap dry	Prime trap
	Drain trap too small	Increase trap height
No moisture from unit	No drain trap fitted	Fit drain trap
	Drain trap dry	Prime trap
	Drain trap too small	Increase trap height
Ductwork sweating	Humid environment	Insulate ducting
Pipework sweating	Uninsulated piping	Insulate all piping

Table 2. Fault finding

8 Spares

Spare filters, fans, coils and other components are available for DERV units. These can be ordered with the units or subsequently. Please contact the local SPC office for details.

SPC Heat Pipes FZC
PO Box 50816, Dubai, UAE
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