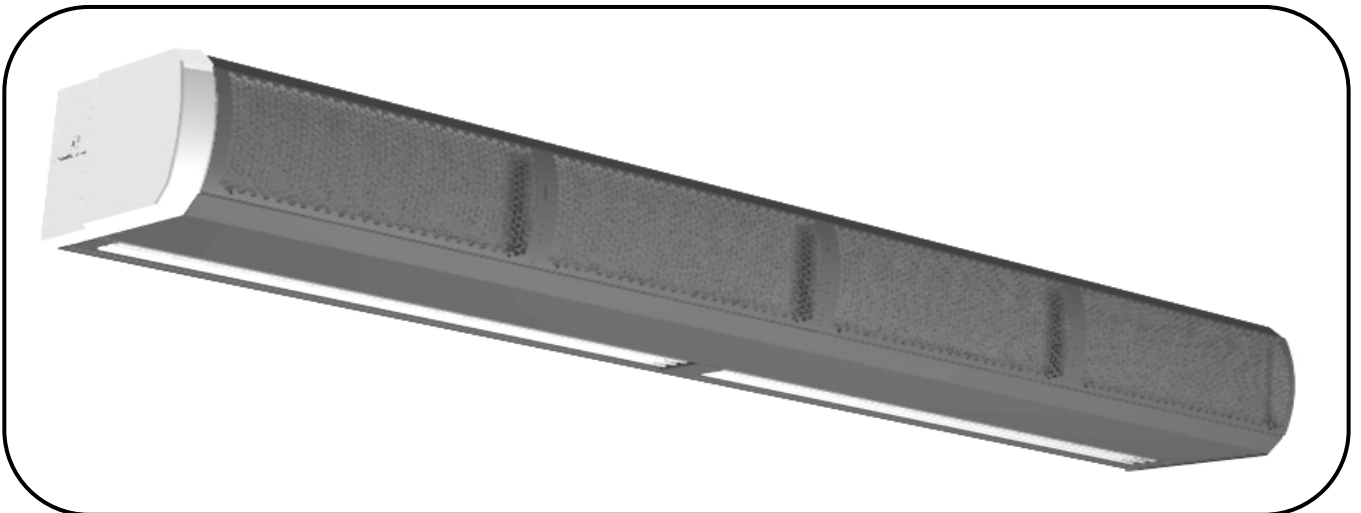




thermoscreens®

PHV2000NT CHILLED WATER HEAT PUMP,
SENSIBLE/DRY COOLING UNIT

INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS



For use with PUHZ-HW140VHA2 or YHA2 Outdoor Units

PLEASE READ THESE INSTRUCTIONS CAREFULLY BEFORE ATTEMPTING INSTALLATION

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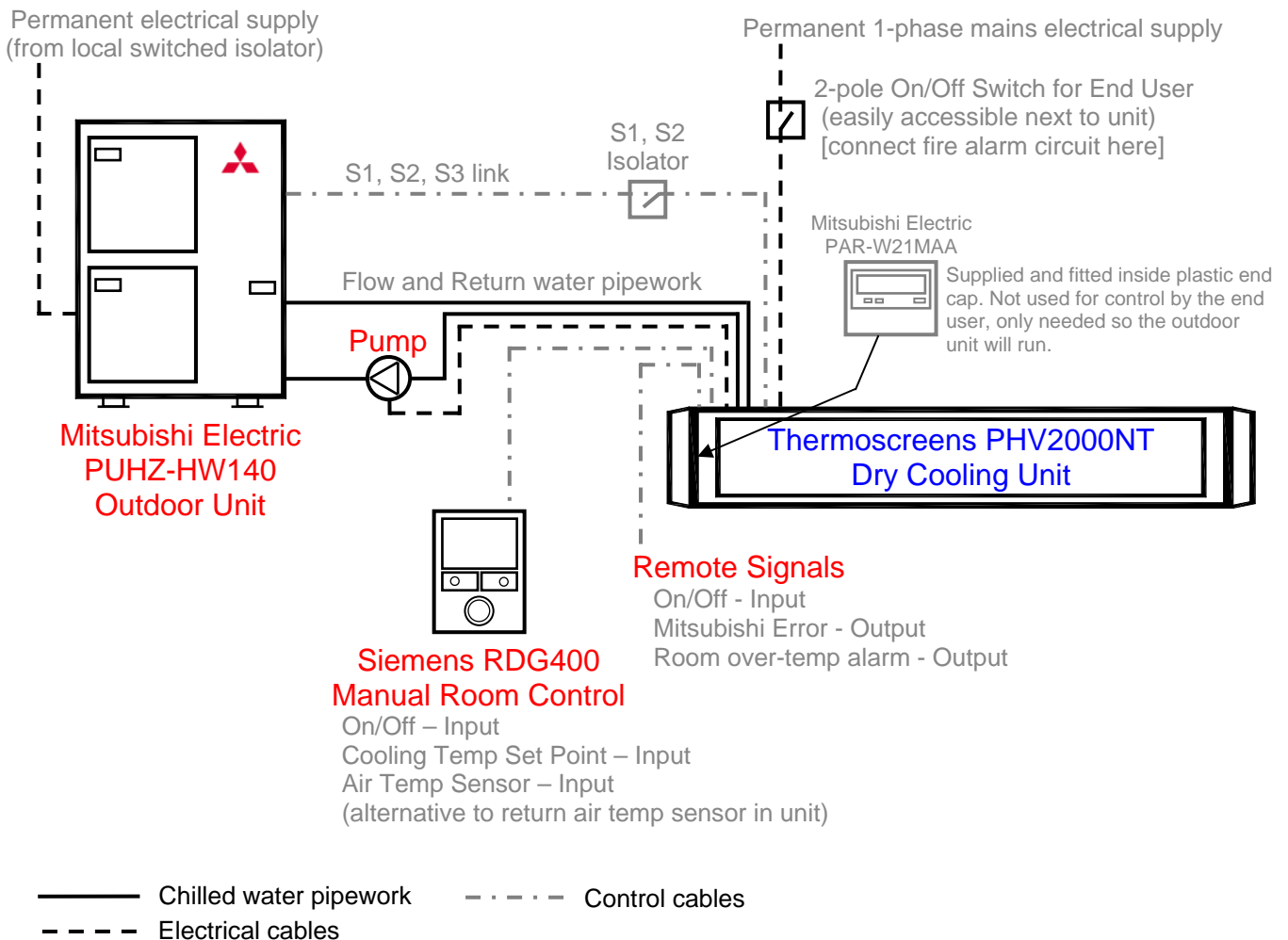
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English

Thermoscreens / Mitsubishi Electric

PHV2000NT Chilled Water Heat Pump, Dry Cooling Unit - Split System



The PHV2000NT Chilled Water Heat Pump System consists of :-

- a Thermoscreens 'PHV2000NT Dry Cooling Unit' with Mitsubishi Electric PAC-IF010B-E Interface PCB and PAR-W21MAA Controller and Siemens RDG400 Manual Room Control for manual control by the end user *
- a Mitsubishi Electric PUAZ-HW140VHA2/YHA2 Air to Water Outdoor Unit *

* - supplied by Mitsubishi Electric

- Water Pipework Installation and Water Pump(s) ‡
- Electrical installation ‡
- a 2-pole On/Off Switch for the end user ‡
- a 2-pole Isolator for the S1, S2, S3 link ‡

‡ - installation items supplied and fitted by installer

DESIGN INFORMATION

The Thermoscreens dry cooling unit is designed to provide up to 12kW * of dry/sensible cooling (SHR/SHF = 1) (e.g. zero latent cooling with no condensate coming from the unit) to areas where cooling is required but with no increase in moisture content of the air, i.e. IT Server Rooms, laboratory areas, etc. It will do this if the room environmental conditions are no higher than 24°C dry bulb with a relative humidity no greater than 40% and the chilled water flow temperature entering the unit is no lower than 10°C **. The 10°C chilled water flow temperature is set at commissioning and controlled by the Mitsubishi Electric PUAZ-HW140 Outdoor Unit. Under design conditions the return water temperature from the dry cooling unit is 13°C with a flow water temperature of 10°C.

* - output may be reduced if antifreeze additives are used.

** - validated by tests carried out at independent test house BSRIA, UK.

Chilled water pipework and water pump(s) must be supplied and installed to supply the chilled water from the PUAZ-HW140 Outdoor Unit to the Thermoscreens dry cooling unit. Hydraulic details for this installation are as follows:

Table 1

Water Volume Flow Rate for 12kW maximum output		Hydraulic Resistance of water coil in Thermoscreens Dry Cooling Unit at 3.2 m ³ /h (kPa)	Hydraulic Resistance of heat exchanger in Mitsubishi PUAZ Outdoor Unit at 3.2 m ³ /h (kPa)	Water Volume of water coil in Thermoscreens Dry Cooling Unit (litre)	Water Volume of heat exchanger in Mitsubishi PUAZ Outdoor Unit (litre)
3.2	53	36	15	5.1	2.5

A separate, self contained 'closed/unvented' water system must be used for the flow and return water pipework between the Thermoscreens dry cooling unit and the Mitsubishi Electric outdoor unit. This should incorporate water pump(s), expansion vessel, pressure relief valve, filling loop, pressure gauge, automatic air vents, water dirt trap device, flow setter valve (recommended), drain valve(s), isolating valves and union fittings for the removal of components. The water system must be suitable for chilled water and installed and commissioned by a qualified technician in accordance with CIBSE Commissioning Code W, CIBSE KS9, BSRIA AG 2/89.3 and BSRIA AG 1.2001.1. For the Mitsubishi Electric system to operate correctly the minimum water volume of the water system must be 80 litres, so a buffer vessel may be necessary. A water dirt trap device should be incorporated into the chilled water system to help protect the system from any contamination and provide an ongoing indication of the system water condition. Please note that the Fernox Boiler Buddy water dirt trap device has a hydraulic pressure drop of 12kPa (clean) at a water flow rate of 3.2m³/h**. If pressure drop in the system becomes an issue it may be necessary to use a commercial type water strainer with a lower hydraulic pressure drop. It is recommended that a flow setter valve is fitted in the water pipework system to verify the water flow rate. We recommend the AV23 SETTER Bypass SD 20-70 l/min DN32 (Code No.223.2561.00) by Taconova www.taconova.com or equivalent.

For a self contained, close coupled 35mm pipework installation the following suggested water pumps are given as a guide only :-

Wilo TOP-S 30/10 (230V/1ph/50Hz) or Grundfos UPS32-120F (230V/1ph/50Hz)

Pump selection must of course be checked by a Building Services Engineer for each installation !

Because of the relatively high hydraulic pressure drops it may be cost effective to incorporate two water pumps operating in series. Pump(s) need to be 230V/1ph/50Hz with a total maximum current = 2A for all pumps combined. If the pump(s) total current is higher than this an interface relay/contactor will need to be used.

If so required, the cooling duty can be reduced from 12kW and a smaller water pump used. Dry cooling will still be achieved providing the room environmental conditions are no higher than 24°C dry bulb with a relative humidity no greater than 40% and the chilled water flow temperature entering the unit is no lower than 10°C. The following table gives details for this:

Table 2

Cooling Duty (kW)	Water Volume Flow Rate		Water Return Temperature (°C)	Hydraulic Resistance of water coil in Thermoscreens Dry Cooling Unit (kPa)	Hydraulic Resistance of heat exchanger in Mitsubishi PUHZ Outdoor Unit (kPa)
	m ³ /h	l/min			
11.5	2.6	44	13.8	24	10
11.0	2.0	33	14.8	14	6
10.5	1.6	26	15.7	9	4

Calculated for Water Flow Temperature = 10°C

In case of emergency, condensate could form on the cooling coil if there was a failure in the air conditioning on site or environmental conditions in the server room went above 24°C/40%Rh due to some other circumstance, e.g. doors left open, extreme weather conditions. To allow for this the Thermoscreens dry cooling unit is supplied with an integral condensate drain tray and outlet pipe to drain condensate away from the unit. A gravity condensate drain system extending to a suitable drain outside of the room must be supplied and fitted by the installer in case this emergency situation were to occur. This should be connected to the 15mm copper drain pipe that protrudes from the right-hand rear of the cooling unit behind the plastic end cap. Condensate pumps are not recommended but if a gravity drain system is impossible and a condensate pump is the only alternative it must not be fitted at the dry cooling unit because of reliability issues with these devices. If the condensate needs to be pumped to a higher level with a condensate pump this should be done in a separate room away from the server room. If there was a spillage of condensate at the pump, therefore, it will not occur in the server room. Suitable condensate pumps are Peristaltic or Rotary Diaphragm type with a suction head. The condensate pump needs to have the facility so it only operates if water is detected in the drain tray. It should also have a pump overrun to empty the drain tray as much as possible. We recommend the Blue Diamond rotary diaphragm type with cooling signal sensor (drainStik) manufactured by Charles Austen Pumps Ltd. (www.miniblue.co.uk).

The condensate drain tray inside of the Thermoscreens dry cooling unit has a metal fixing bracket located at the right hand end so a condensate sensor can be fixed in the tray in the appropriate position by the installer. There is a rubber grommet with 9.5mm hole fitted in the fixing bracket which will accept a 10mm diameter condensate sensor. Different size grommets can be fitted by the installer to suit other condensate sensors or if the grommet is removed a larger condensate sensor can be located in the 13mm diameter hole in the fixing bracket and held with silicon sealant. See also the manufacturer's instructions that come with the condensate pump for further information.

Valuable or delicate equipment should not be placed beneath the dry cooling unit or directly in the path of the cool air discharge from the unit.

The Thermoscreens dry cooling unit operates from its own separate 1 phase electrical supply (1L+N+E) with a local switched isolator, see Page 12, and the fan within the unit runs continuously when this electrical supply is connected. If the local switched isolator is not easily accessible by the end user there should be a 2-pole On/Off switch fitted in an easily accessible position next to the dry cooling unit. The Mitsubishi Electric interface pcb fitted inside the dry cooling unit, however, is powered via the S1, S2, S3 wiring from the outdoor unit and a 2-pole S1, S2 isolator is required for this electrical/communications link.

Room temperature control of the Thermoscreens dry cooling unit is done using a Siemens RDG400 Manual Room Control that is supplied with the unit. This room control is used to select the target temperature (set point) of the room air temperature and it then switches the Mitsubishi Electric cooling system On and Off to achieve this temperature. The room air temperature is measured using either a return air temperature sensor in the air intake of the dry cooling unit or via an integral air temperature sensor within the RDG400 manual room control. This is selectable at the time of commissioning. A volt free remote On/Off control switch or BMS Dig/Output signal can be connected to the Thermoscreens dry cooling unit to turn the cooling system On and Off as an alternative to manually switching it On and Off at the RDG400 manual room control via the target temperature.

A separate thermostat with its air sensor positioned in the air intake is incorporated within the Thermoscreens dry cooling unit. This is to provide warning of elevated room air temperatures which could indicate a fault in the air conditioning system or some other problem. This thermostat can be set during commissioning to between 15°C and 35°C and terminals are provided within the unit for external monitoring of the contacts opening or closing on rising temperature. Contacts are rated 16A(4A) at 230v AC.

The Thermoscreens dry cooling unit includes the facility to provide a global error signal should an error occur in the Mitsubishi Electric heat pump system.

A Mitsubishi Electric PAR-W21MAA Remote Controller is supplied and pre-fitted inside the left hand end cap of the Thermoscreens dry cooling unit. It is needed for the Mitsubishi Electric heat pump system to operate and is also useful to diagnose error messages. It is not used for control of the system by the end user, this is done via the Siemens RDG400 manual room control, see above.

The Thermoscreens dry cooling unit is designed only for use with a Mitsubishi Electric air to water heat pump system for use on R410A. The complete Thermoscreens/Mitsubishi Electric air to water heat pump system, including fridge pipework, water pipework system, wiring, controls, etc. must be installed only by an approved Mitsubishi Electric refrigeration contractor in accordance with the relevant installation instructions.

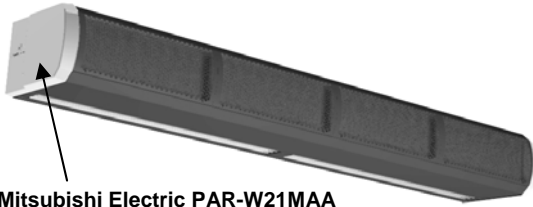
Persons using the dry cooling system must be given adequate instruction and supervision concerning the use of the appliance by a person responsible for their safety. The cooling system is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities.

These instructions must be read in conjunction with the separate Mitsubishi Electric instructions that come with the PUAZ-HW140 Outdoor Unit. All instructions should be kept by the building facilities manager for future reference.

UNPACKING THE DRY COOLING UNIT

The following items are supplied and packaged within the dry cooling unit box :-

PHV2000NT Dry Cooling Unit



Mitsubishi Electric PAR-W21MAA fitted inside LH end cap

End caps are supplied loose to be fitted during installation

Wall Brackets and Fixing Bolts



for if Dry Cooling Unit is to be fixed to a wall

Siemens RDG400 Manual Room Control



If anything is missing or damaged please contact your supplier immediately.

There will also be a PUHZ-HW140VHA2 or YHA2 Air to Water Outdoor Unit supplied by Mitsubishi Electric.

The complete Thermoscreens/Mitsubishi Electric dry cooling system, to provide dry cooling to a server room or other space, including chilled water pipework system and wiring is to be installed only by an approved Mitsubishi Electric contractor.

For your records

Date of Purchase.....
Supplier/Installer.....
Serial Number.....

For warranty purposes proof of purchase is necessary so please keep a copy of your invoice.

IMPORTANT

This Dry Cooling Unit is intended only for use with a Mitsubishi Electric PUHZ-HW140VHA2 or YHA2 Air to Water Outdoor Unit.

These instructions must be read in conjunction with the separate instructions that come with the Mitsubishi Electric PUHZ-HW140VHA2 or YHA2 Air to Water Outdoor Unit.

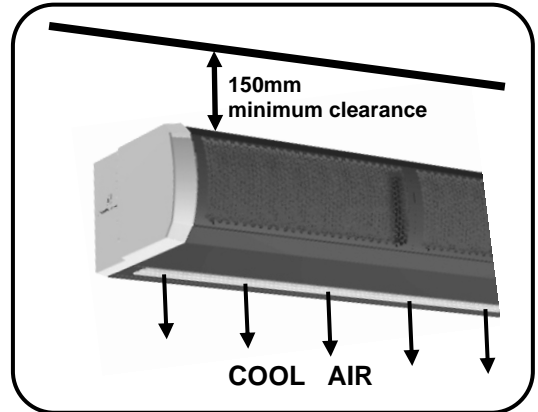
(All documentation supplied with the unit should be stored and kept for future reference.)

INSTALLING THE DRY COOLING UNIT

The dry cooling unit has been designed to be mounted on a wall or suspended from above using M10 drop rods. It must not be installed on the outside of the building, or built into a cabinet or recessed in anyway.

Location

The dry cooling unit must be mounted so the unit is horizontal and **level** and the discharge grille faces downwards. The discharge grille must be at least 2.4m above ground level and located so the downwards flowing cool air will distribute throughout the room or across equipment to be cooled. It should not, however, be positioned directly above valuable or delicate equipment in case of water leaks or an emergency condensate situation, e.g. doors left open, extreme weather conditions. Beware of obstructions in the room that may interfere with air distribution. Leave a gap of 150mm minimum above the unit to allow for installing the water pipework.



Wall Fixing

There are three wall brackets supplied and these need to be bolted to the rear face of the cooling unit as shown in the adjacent picture using the M10 bolts supplied. A suitable wall fixing system (not supplied) needs to be used to fix the brackets to the wall, taking into account the type of wall and the weight of the unit - 76kg.*

Step 1. Refer to Figure 1, Page 8 for mounting details and drill the fixing points in the wall.

Step 2. Screw in the top wall bolts leaving a small gap between the bolt head and the wall. Lower the cooling unit onto the bolts via the key-hole slots in the top of the wall brackets and then screw in the bottom wall bolts.

Step 3. Ensure all fixing bolts are tightened and the dry cooling unit is safely secured to the wall.



White unit shown for picture clarity only

Ceiling Suspension

There are six M10 threaded inserts provided in the top face of the cooling unit (see Figure 1, Page 8 for positions) so it can be suspended on M10 threaded hanging rods with lock nuts (not provided). All six suspension points **must** be used. Ensure each of the hanging rods is secured onto a suitable structure that can support the weight of the unit - 76kg.* Screw the M10 hanging rods into the threaded inserts by a minimum of 20mm and fit locking nuts to prevent the rod rotating and coming away from the casing. Do not screw the hanging rods too far in or they could interfere with internal components.



White unit shown for picture clarity only

* It is the sole responsibility of the installer to ensure that the building fixing locations and suspension system used are suitable for the dry cooling unit being installed.

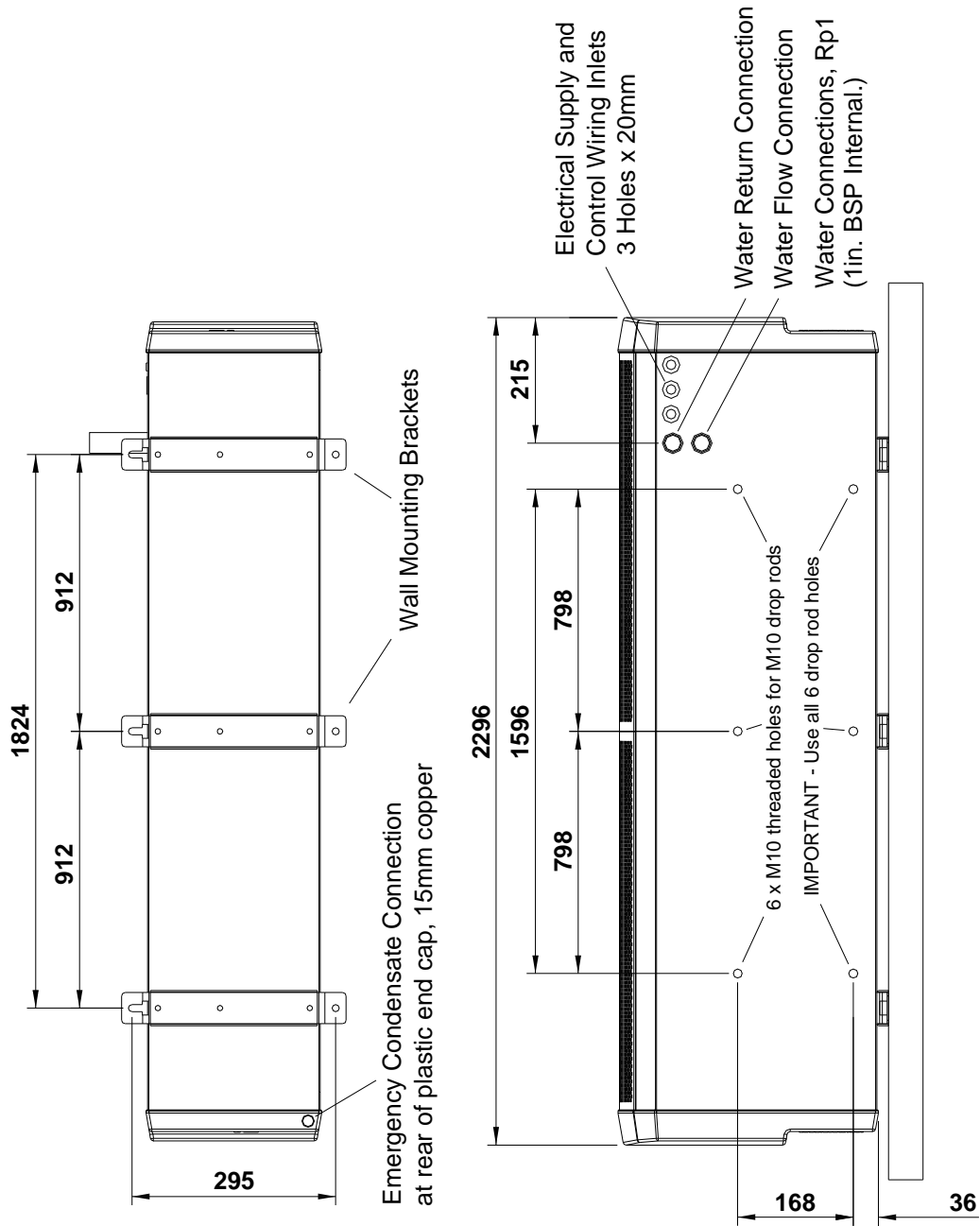
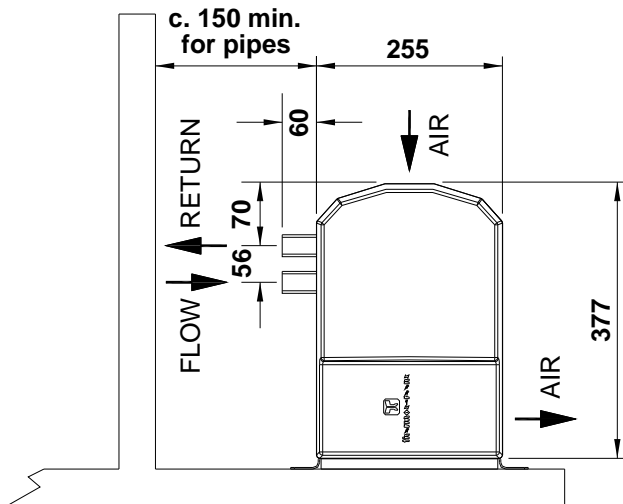


FIGURE 1 – DIMENSIONS OF THERMOSCREENS DRY COOLING UNIT

■ To gain access inside the Dry Cooling Unit

To gain access for connection of the chilled water pipework, electrical supply, controls wiring and to work on the unit during commissioning, remove the air inlet grilles and the bottom access panel.

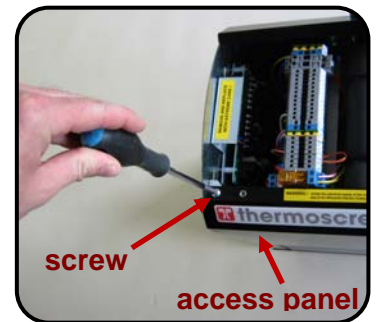
First remove the plastic end caps at each end of the unit, if already fitted, by pulling off to the side (see picture).



Then remove each inlet grille in turn with its air filter by unscrewing the M4 Pozi Head screws at the bottom corner of the grille. Use a Pozi No.1 screwdriver to access each screw via the elongated hole at the bottom corners of the grille (see picture).



To remove the bottom access panel unfasten the access panel securing screws, one at each end (see picture) plus two in the centre and pull the panel out forwards.

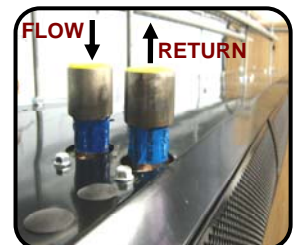


■ Chilled Water Pipework (*Left hand side of unit*)

This should ideally be carried out before connection of any electrical and controls cables.

The water system must be suitable for chilled water and installed by a qualified technician.

Install chilled water flow and return pipe connections to the dry cooling unit using suitable pipework fittings. The flow and return connections on the cooling unit are Rp1 (1in. BSP Internal). The chilled water flow is the rear connection, the chilled water return is the front connection – these are marked. It is important that the flow and return is connected the right way around or the performance of the unit will be compromised, see picture opposite.



Ensure that when tightening the pipe connections onto the dry cooling unit that pipe grips are used to hold the 1 inch steel bush of each pipe connection to avoid damaging the copper coil inside the unit, see picture opposite.



Install the expansion vessel, pressure relief valve, filling loop, pressure gauge, automatic air vents, water dirt trap device, flow setter valve, drain valve(s), isolating valves and union fittings for the removal of components. Installation pipework should be supported independently from the cooling unit. The fitting of test points, e.g. binder, should be considered for measuring pressures and temperatures. See Section 'Design Information' Page 3 and 4 for selection information on water pumps and flow setter valve.

The chilled water system needs to be cleaned using a suitable cleaning agent to ensure that any flux residues/installation debris is removed (see BSRIA AG 1/2001.1). Fill the chilled water system with water, vent air from the water system and thoroughly check the whole system for water leaks. Once the system is ready add inhibitor to the correct concentration. If necessary, the system should be protected against freezing and anti-freeze should be added to the correct concentration.

NB. output may be reduced if antifreeze additives are used.

Fully insulate the chilled water system to prevent energy loss and to avoid condensation dripping from chilled surfaces. External pipework, if used, must be weather-wrapped or installed in suitable trunking.

■ **Condensate Disposal System** (*Right hand side of unit*)

As explained in Section 'Design Information' Page 3, the dry cooling unit is supplied with an integral condensate drain tray and outlet pipe to drain condensate away from the unit in an emergency condensate situation.

Remove the right hand plastic end cap by pulling off and connect a gravity condensate drain pipe system to the 15mm copper drain pipe that protrudes from the right-hand rear of the cooling unit. Extend this to a suitable drain or condensate pump (if required) outside of the room that the dry cooling unit serves. Condensate pumps are not recommended but if a gravity drain system is impossible and a condensate pump is the only alternative it must not be fitted at the dry cooling unit because of reliability issues with these devices. If the condensate needs to be pumped to a higher level with a condensate pump this should be done in a separate room away from the server room. If there was a spillage of condensate at the pump, therefore, it will not occur in the server room.



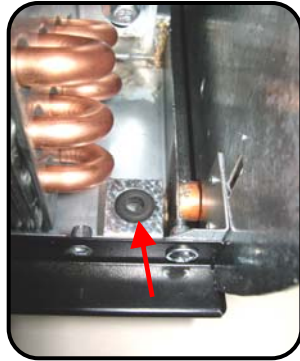
If using wall brackets use copper elbow to extend drain pipe downwards



If using hanging rods and there is space to the rear the drain pipe can extend backwards

Make sure condensate pipework can be unclipped for when the drain tray needs to be inspected and cleaned, see Page 22.

If a condensate pump is being used the pump condensate sensor that starts/stops the pump and indicates an alarm situation should be fitted in the metal fixing bracket at the right hand end of the condensate drain tray within the unit. There is a rubber grommet with 9.5mm hole fitted in the fixing bracket which will accept a 10mm diameter condensate sensor. Different size grommets can be fitted to suit other condensate sensors or if the grommet is removed a larger condensate sensor can be located in the 13mm diameter hole in the fixing bracket and held with silicon sealant. See also the manufacturer's instructions that come with the condensate pump for further information.



Condensate sensor fixing bracket at RH end of drain tray with 9.5mm hole grommet



Condensate sensor fixing bracket at RH end of drain tray with grommet removed to give 13mm hole

■ Electrical Supply to the Dry Cooling Unit (*Left Hand Side of the Unit*)

All electrical wiring and connections MUST be carried out by a competent qualified electrician in accordance with the latest edition of the IEE wiring regulations and/or local statutory regulations. (see also Wiring Diagram on Page 13)

- A 2-pole local isolator having a contact separation of at least 3mm on both live and neutral poles must be fitted in the 230V electrical supply to the Thermoscreens dry cooling unit and located in an accessible position within 1m of the unit. This local isolator will also serve as the On/Off switch for the fans inside of the cooling unit.
- The unit must be connected using cables having an appropriate temperature rating (heat resistant).
- Ensure that the supply cables, circuit breakers and other electrical installation equipment are correctly sized for the cooling unit.

Rated Electrical Power Input =

0.5kW for cooling unit + kW rating of water pump installed
--

Rated Current =

2.7A for cooling unit + Amps of water pump installed (max. 2A)
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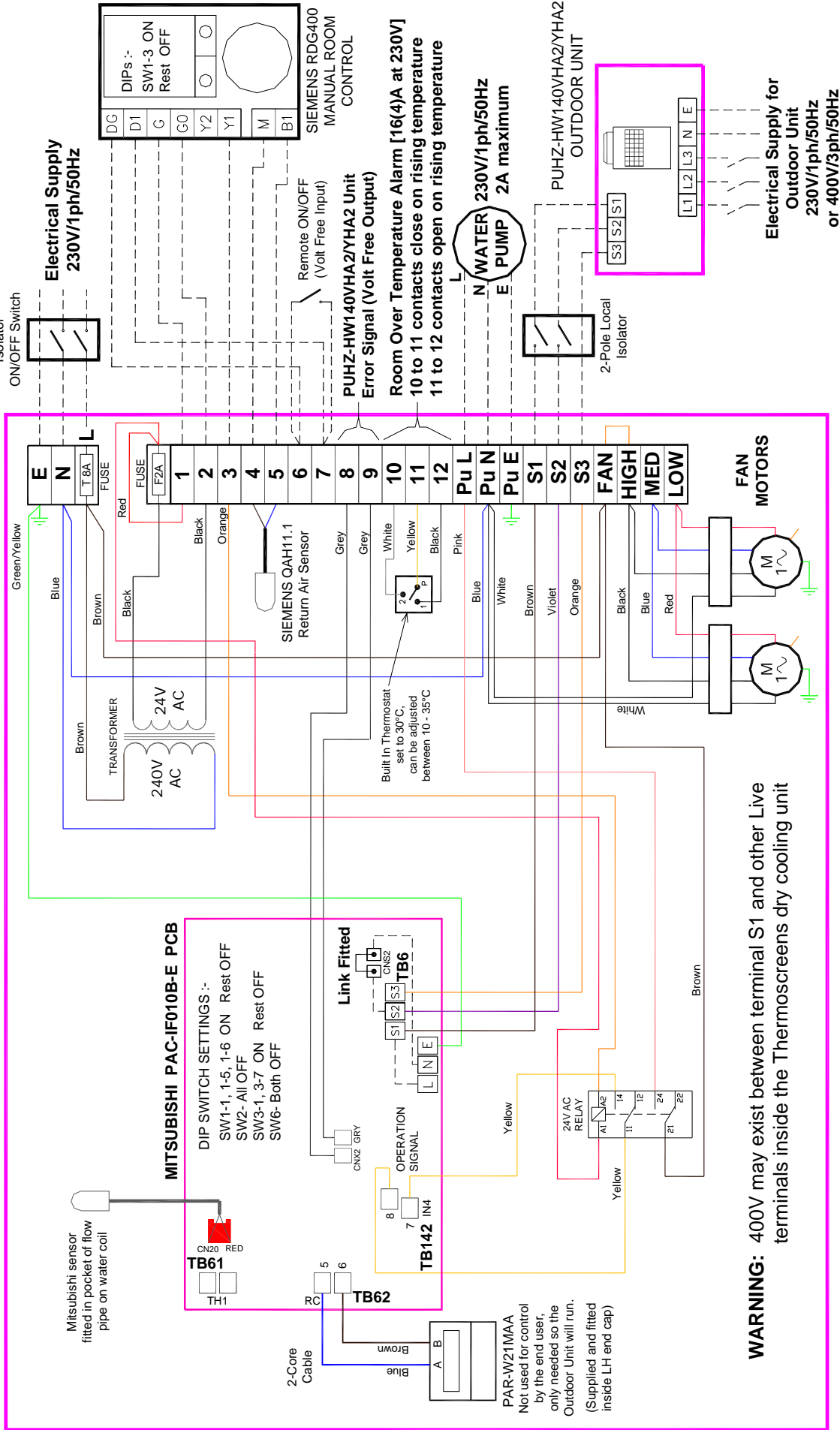
IMPORTANT: Please note that the water pump is supplied and fitted by the installer and the electrical power consumption of it (kW and Amps) is entirely dependent on which pump the installer selects, see Section 'Design Information' Page 3 & 4 for water pump selection. The electrical feed to operate the water pump is a 230V/1ph/50Hz switched feed that comes from the dry cooling unit (terminal Pu L), so the sizing of the electrical supply to the dry cooling unit must also include for the pump as well.

NB. If the rated current of the water pump(s) is more than 2A an interface relay/contactors will need to be used, powered from terminal Pu L, and the pump electrical feed may then be from a separate electrical supply.

- A 20mm size cable gland or conduit connector should be used for the 230V/1ph/50Hz Electrical Supply into the unit. See Figure 1, Page 8 showing where the electrical supply enters the unit.
- This appliance must be Earthed.
- Connect the 230V/1ph/50Hz Electrical Supply to terminals L, N and Earth in the dry cooling unit.

THERMOSCREENS PHV2000NT DRY COOLING UNIT

SITE WIRING



WARNING: 400V may exist between terminal S1 and other Live terminals inside the Thermoscreens dry cooling unit

WIRING DIAGRAM – PHV2000NT DRY COOLING UNIT

■ Controls Wiring to the Dry Cooling Unit (*Left Hand Side of the Unit*)

All electrical controls wiring and connections MUST be carried out by a competent qualified electrician in accordance with the latest edition of the IEE wiring regulations and/or local statutory regulations. (see also Wiring Diagram on Page 13)

The following connections need to be made, except where stated as *optional*. Use 20mm size cable glands or conduit connectors:

Terminal on Dry Cooling Unit	Terminal on SIEMENS RDG400 Manual Room Control (use 0.5mm ² max. cable size - small terminals)
1	G
2	G0
3	Y1
4 – for return air sensor in air intake	M (do not wire if using air sensor inside RDG400)
5 – for return air sensor in air intake	B1 (do not wire if using air sensor inside RDG400)
6 - <i>optional</i>	DG (volt free input, for remote On/Off or Run/Standby or Fire Alarm Circuit)
7 - <i>optional</i>	D1 (ditto as above)

Terminal on Dry Cooling Unit	Optional Error Signal Output Connection
8	Mitsubishi Electric heat pump system, Error Signal (volt free contacts, rated 1A max, Error = Closed)
9	

Terminal on Dry Cooling Unit	Optional Room Over Temperature Alarm Volt Free contacts rated at 16(4)A at 230V (use 1.0mm ² maximum cable size)
10	10 – 11 contacts close on rising temperature
11	
12	11 – 12 contacts open on rising temperature

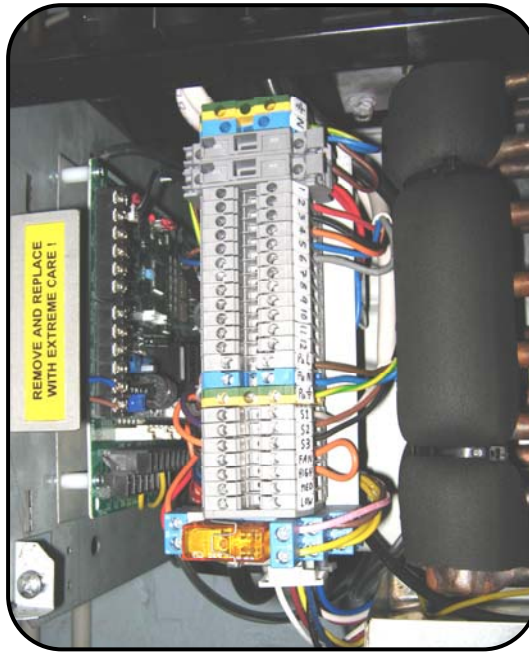
Terminal on Dry Cooling Unit	Terminal on 230V/1ph/50Hz Water Pump – 2A maximum (use 1.5mm ² maximum cable size)
Pu L	L
Pu N	N
Pu E	E

Terminal on Dry Cooling Unit (electrical supply and communications link for interface pcb inside dry cooling unit)	Terminal on Mitsubishi Electric PUHZ-HW140VHA/YHA2 (use 1.0mm ² maximum cable size)
S1	S1
S2	S2
S3	S3

A local isolator to switch S1 and S2 On/Off is required within 1m of the dry cooling unit.
NB. The interface PCB is already Earthed via the supply to the dry cooling unit.
WARNING: 400V may exist between terminal S1 and other Live terminals inside the Thermoscreens dry cooling unit.

The Mitsubishi Electric PUHZ-HW140 Outdoor Unit needs to be installed in accordance with the relevant sections of the Mitsubishi Electric instructions supplied with the unit.

Once complete the electrical supply and controls wiring should appear as shown in the picture:-



NB. For clarity the site wiring to terminals 6 to 12 for the optional items:
Remote ON/OFF
Mitsubishi Error Signal
Room Over Temperature Alarm
is not shown in this picture.

Please note: All the panels of the Thermoscreens dry cooling unit are covered in a protective plastic film which should now be removed.

COMMISSIONING THE DRY COOLING UNIT

Ensure that the electrical supply to the Mitsubishi Electric Outdoor Unit and the local electrical supply switch to the Thermoscreens Dry Cooling Unit are switched off.

■ Chilled Water System Checks

The chilled water system must be commissioned by a qualified technician in accordance with CIBSE Commissioning Code W, CIBSE KS9, BSRIA AG 2/89.3 and BSRIA AG 1.2001.1.

Check that the chilled water system has been cleaned using a suitable cleaning agent to ensure that any flux residues/installation debris is removed (see BSRIA AG 1/2001.1).

Check that the chilled water system has been filled and the correct concentration of inhibitor has been added.

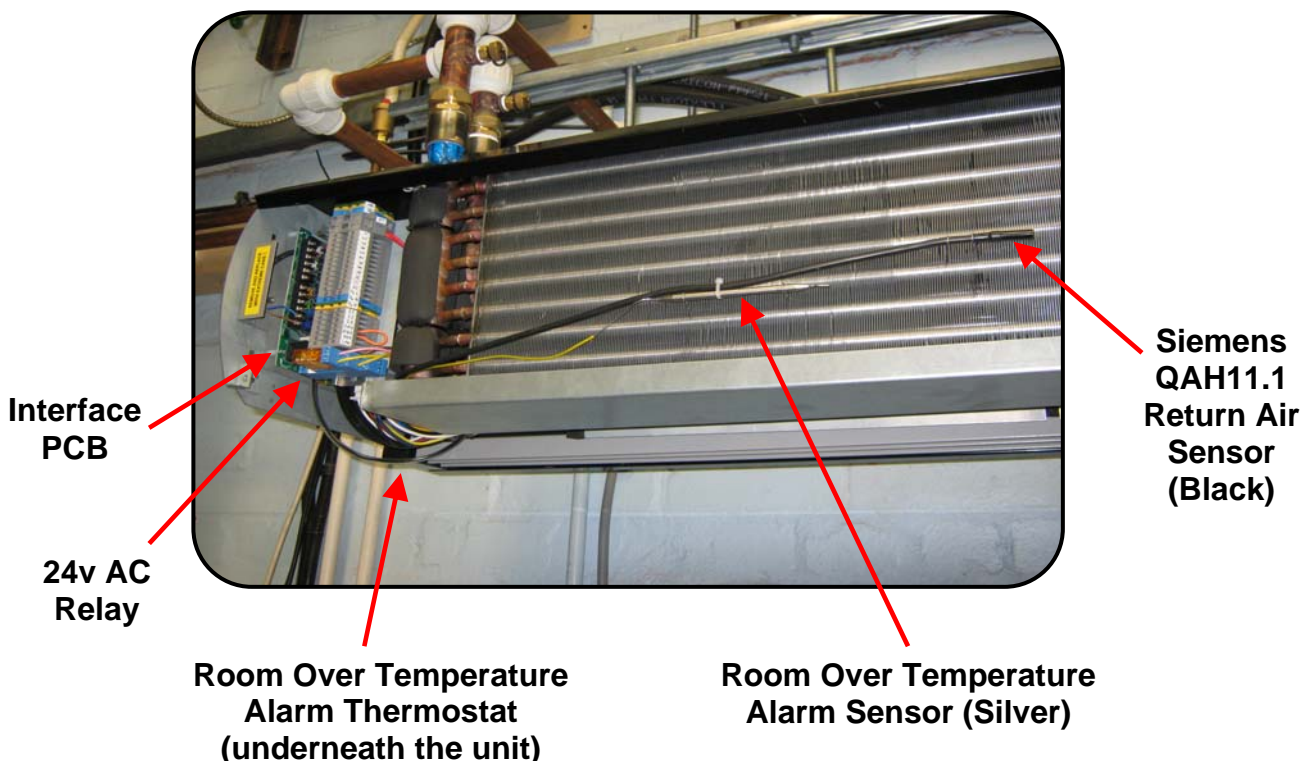
If necessary, check that the system has been protected against freezing and that the correct concentration of anti-freeze has been added.

Check that all water valves are open.

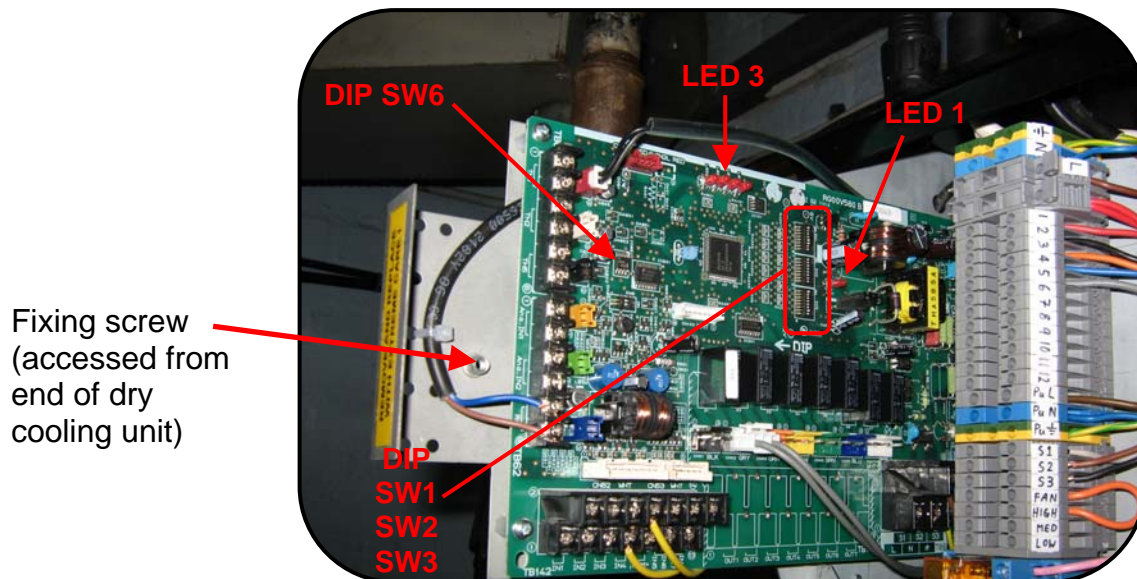
Check that air has been vented from the water system and thoroughly check the whole system for water leaks – repair as necessary.

■ Dry Cooling Unit Checks

Check that the components inside the dry cooling unit are as shown in the picture below



A Mitsubishi Electric Interface PCB is located within the left hand end of the Thermoscreens Dry Cooling Unit to provide communication between the Outdoor Unit and the Dry Cooling Unit. The Interface PCB on its mounting plate is held in place by a fixing screw located in the left-hand end panel of the dry cooling unit under the left-hand plastic end cap. Remove the screw and carefully slide the pcb partially out.



Check that the dip switches on the Interface PCB are set as follows:

SW1-1, 1-5, 1-6 ON; SW1-2, 1-3, 1-4, 1-7, 1-8 OFF
SW2 – All OFF
SW3-1, 3-7 ON; SW3-2, 3-3, 3-4, 3-5, 3-6, 3-8 OFF
SW6 – Both OFF

Room temperature control of the dry cooling unit is done via a Siemens RDG400 Manual Room Control that is supplied with the unit. This room control is used to select the target temperature (set point) of the room air temperature and to then switch the Mitsubishi Electric cooling system On and Off to achieve this temperature.

If there is site wiring between terminals 4 & 5 in the dry cooling unit and terminals M & B1 in the Siemens RDG400 manual room control the room air temperature will be measured using the black return air temperature sensor clipped onto the coil in the air intake of the dry cooling unit. If there is no wiring from terminals 4 & 5 the room air temperature will be measured in the RDG400 manual room control using its integral air temperature sensor.

Remove the RDG400 manual room control from its back-plate (2 screws at LH side of control and pull at LH) and check that the dip switches in the control are set as follows:

SW1-3 ON
SW1-1, 1-2, 1-4, 1-5 OFF

Check that the wiring between the Thermoscreens dry cooling unit and the Siemens RDG400 Manual Room Control, the water pump and, if used, the remote On/Off, error signal and room over temperature alarm is in accordance with the Wiring Diagram on Page 13.

Check that the S1, S2, S3 wiring between the Thermoscreens dry cooling unit and the Mitsubishi Electric outdoor unit is in accordance with the Wiring Diagram on Page 13.

Carefully slide the Interface PCB back into place if still withdrawn on its slide rails. Ensure cables are not trapped inside and refit the fixing screw in the left hand end panel.

■ Testing the Dry Cooling System

Ensure that the local electrical ON/OFF Switch/Isolator to the Thermoscreens dry cooling unit is switched OFF !!

Switch on the S1, S2 local isolator adjacent to the Thermoscreens dry cooling unit.

Switch on electrical power to the Mitsubishi Electric Outdoor Unit.

WARNING! – Terminal S1 and the Mitsubishi Interface PCB inside the dry cooling unit will now become Live with 230V electrical power from the outdoor unit !! LED 1 on the Interface PCB should be lit to indicate power onto the PCB. Wait for the PAR-W21MAA controller at the left hand end of the unit to initialize. The message 'PLEASE WAIT' will repeat on the screen of the PAR-W21MAA controller until communication is set-up and the heat pump system is ready to operate. The PAR-W21MAA controller will not respond to push button commands because of the dip switch settings on the Mitsubishi Interface PCB. The outdoor unit **must** now be left energised for 12 hours before carrying out any further operations.

Now switch on the local electrical ON/OFF Switch/Isolator to the Thermoscreens dry cooling unit.

WARNING! – The fans inside of the dry cooling unit will now operate, beware of fast spinning fans.

WARNING! – 400V may exist between terminal S1 and other Live terminals inside the Thermoscreens dry cooling unit.

Check there is no mechanical noise coming from the fans and that both fans work.

If there is a Remote On/Off wired into terminals 6 & 7 on the dry cooling unit, switch this On. Check that the LCD display screen on the Siemens RDG400 Manual Room Control is working and lit-up. The display screen will be indicating the room temperature in large numerals. Rotate the knob on the room control anti-clockwise and the numerals will change to indicate the target (set-point) temperature. Set this target temperature at least 5°C below the room temperature. The numerals will then flash this target temperature 5 times and go back to showing the air temperature. At this point the water pump(s) will start to operate and the outdoor unit will also start to work. The display on the PAR-W21MAA controller will change to show that the outdoor unit is working and LED 3 on the interface PCB should be lit to indicate the compressor in the outdoor unit is working.

Stop and start the water pump(s) by adjusting the target temperature up and down on the manual room control to help bleed air out of the chilled water system. Ensure air is bled out of the pump(s). If a flow setter valve is fitted check that the water flow rate of the chilled water system is in accordance with Table 1, Page 3 or Table 2, Page 4.

After the system has been operating for a few minutes check that the chilled water pipework is cooling down and the pipe temperature indicator on the PAR-W21MAA controller (small numerals) shows a falling temperature. If the system is operating correctly the pipe temperature should go down to 10°C. Check that cold air is being discharged from the dry cooling unit across the whole length of the unit and that there is

no moisture forming on the surface of the cooling coil after at least 15 minutes of operation at 10°C water flow temperature.

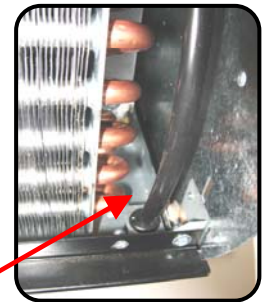
NB. If the outdoor unit has just been switched off via the controls it will require a few minutes to start cooling again after the controls switch it back on.

If necessary adjust the angle of the outlet grille louvres in the air discharge of the dry cooling unit to suit the air stream required in the room. Take care not to push objects into the outlet grille.

Using the Siemens RDG400 manual room control take a mental note of the room air temperature displayed on the screen and rotate the knob on the manual room control clockwise and set the target temperature to above the room temperature. Check that the water pump(s) and outdoor unit switches off. The fans in the dry cooling unit will stay on.

Set the knob of the Room Over Temperature Alarm very high and using a multimeter check that contacts 10 to 11 go open contact. Set the knob very low and check that contacts 10 to 11 then go closed contact. Then set the knob to the setting that is required by the operator to indicate there is a room over temperature alarm situation.

If a condensate disposal system has been installed check that it operates correctly by filling the drain tray with some water and that the water completely drains away from the unit. If a condensate pump is being used ensure this is operating correctly and if possible simulate a pump alarm fault condition to check that the alarm will function. Some condensate pumps may require distilled water to do this working test.



Fill tray with water

Switch off electrical power to the Thermoscreens dry cooling unit and the Mitsubishi Electric outdoor unit. Replace the bottom access panel, air inlet grilles (with air filters) and plastic end caps (see 'To gain access inside the Dry Cooling Unit', page 9). Switch electrical power back on to the dry cooling unit and the outdoor unit and fully test all operating parameters as above using the Siemens RDG400 manual room control.

■ Hand-over to End-User

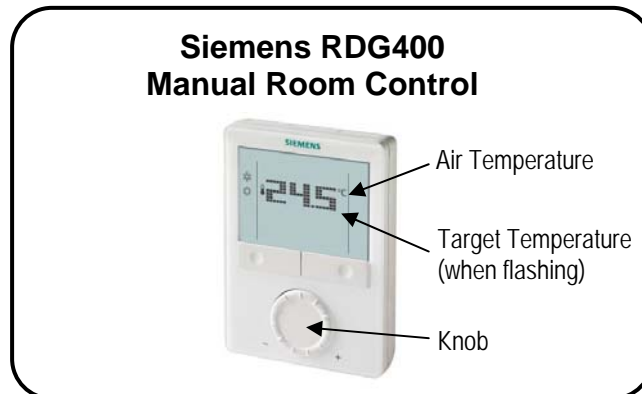
Before leaving site it is important that there is a 'Hand-Over Meeting' to hand-over the dry cooling system to the end user or their representative. This should include a full and clear explanation of how the system operates and a demonstration showing the dry cooling system running. Be sure to explain that the air inlet grilles and the air filters inside the grilles must be regularly vacuum cleaned and the unit serviced at regular intervals.

Fully explain and demonstrate the operation of the Siemens RDG400 Manual Room Control. Also the remote On/Off, room over temperature alarm & Mitsubishi error signal, if used. Explain that the fans in the Thermoscreens dry cooling unit can be switched off in an emergency at the local electrical On/Off Switch/Isolator to the dry cooling unit.

Ensure that all instructions and manuals are handed to the end user or their representative.

USER INSTRUCTIONS FOR THE DRY COOLING SYSTEM

For manual control using the Siemens RDG400 Manual Room Control



To Switch On and Off:

Make sure the On/Off Switch adjacent to the Thermoscreens dry cooling unit is switched on. When it is switched on the fans in the dry cooling unit will operate continuously.

The display screen on the manual room control will be indicating the air temperature in large numerals.

Rotate the knob on the room control either clockwise or anti-clockwise and the numerals will change and indicate the target (set-point) temperature as you rotate the knob.

Set this target temperature to the temperature required, say, 24°C.

The numerals will then flash this target temperature 5 times and go back to showing the air temperature.

If the target temperature is lower than the air temperature the outdoor unit and the water pump(s) will start to operate.

NB. If the outdoor unit has just been operating it will be necessary to wait several minutes before it will restart again to provide chilled water.

Control of the room temperature will now be fully automatic and the dry cooling system should be left to do its job. Fans will run continuously in the Thermoscreens dry cooling unit and the outdoor unit and water pump(s) will automatically cut in and out to control the room temperature.

If the On/Off Switch adjacent to the dry cooling unit is switched off the fans will turn off and the outdoor unit and water pump(s) will not operate.

SERVICING THERMOSCREENS DRY COOLING UNIT

■ Vacuum Clean the Air Inlet Grilles / Air Filters (Weekly, or when they show signs of getting dirty)

Switch the dry cooling unit OFF at the local On/Off switch so the fans stop operating. A vacuum cleaner with an extension tube and brush attachment at its end should then be used to clean the face of the air inlet grilles. This is important to minimise the build-up of dust and lint on the air filters which are just inside the inlet grilles as this will affect the performance of the dry cooling unit. This is a simple service task that can be carried out by the Cleaner or Janitor on a regular basis from floor level without having to access the dry cooling unit at high level. This should be done weekly as a regular service task or when the inlet grilles show signs of getting dirty.



White unit shown for picture clarity only

■ Servicing the Dry Cooling Unit (suggest every 3 Months or when conditions merit it)

Always disconnect and isolate the mains electricity supply both at the local electrical supply to the Thermoscreens Dry Cooling Unit and at the Mitsubishi Electric Outdoor Unit before servicing, maintaining or repairing the Unit.

Note: All servicing, maintenance and repairs to the dry cooling unit must be carried out by an approved Service Agent. Keep any loose fixings for re-assembly.



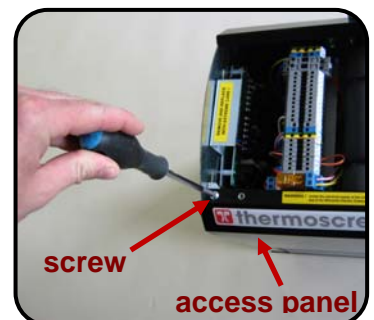
Remove the plastic end caps by pulling off to the side as shown.

Then remove each inlet grille in turn with its air filter by unscrewing the M4 Pozi Head screw at the bottom corner of the grille. Use a Pozi No.1 screwdriver to access each screw via the elongated hole at the bottom corners of the grille (see picture).



Remove the air filters from the air inlet grilles by gently prizing them free as shown. Gently vacuum clean and refit the filters into the curved air inlet grilles. The filters are durable but may need to be replaced after a number of service intervals.

Remove the bottom access panel by unfastening the panel fixing screws, one at each end (see picture) plus two in the centre and pull the panel out forwards.



Vacuum clean and remove any build-up of dust, dirt and debris within the dry cooling unit, especially on the cooling coil.

Note: Fan motors are permanently lubricated and require no additional lubrication.

■ **If the Dry Cooling Unit has been condensing during the last service interval :-
(e.g. has experienced an emergency situation)**

Unclip the condensate pipe at the right hand rear of the dry cooling unit.



Loosen by 3 turns, the rear row of drain tray fixing screws along the whole length of the tray. Do not remove these screws completely.



Remove the front row of drain tray fixing screws along the whole length of the drain tray. Keep the screws.

The drain tray now angles down along its front edge and the inside surface of the tray can be easily cleaned. Remove all debris from the drain tray, outlet spout and condensate hose. **BEWARE** of sharp metal fins on the cooling coil !

Check there are no kinks in condensate hoses. If the condensate pump is a peristaltic type change the rubber pump head tube.



If the dry cooling unit has been condensing it is important to find out why this has been happening and correct the situation. It may be that there has been a failure in the air conditioning on site or environmental conditions in the server room have gone above 24°C/40%Rh due to some other circumstance, e.g. doors left open, extreme weather conditions.

Once the dry cooling unit has been cleaned, visually inspect the cooling unit components. Ensure the two temperature sensors are located correctly on the front face of the cooling coil (see Section – Commissioning, Page 16). Check all electrical connections and terminals within the unit are tight and that crimp connections have not become loose.

Refit the drain tray (if released), bottom access panel and air inlet grilles with air filters. Switch on the electrical supplies and fully function test the dry cooling unit to ensure correct operation (see Section – Commissioning, Page 16). Check the condensate pump operates, if fitted.

■ Annual Service of the Dry Cooling System

Always disconnect and isolate the mains electricity supply both at the local electrical supply to the Thermoscreens Dry Cooling Unit and at the Mitsubishi Electric Outdoor Unit before servicing, maintaining or repairing the Unit.

In addition to the 3 monthly checks as described above carry out the following service procedures:-

Clean the casing of the Thermoscreens dry cooling unit using a damp cloth. Do not use scouring cream products.

Visually inspect the pipe work system for water leaks and repair as necessary.

Check the condition of the pipework insulation and repair as necessary.

Check for loose electrical connections in the Thermoscreens dry cooling unit and in the Mitsubishi Electric outdoor unit and tighten connections if necessary.

Clean the water dirt trap device in the chilled water pipework.

Check the concentration of anti-freeze/inhibitor in the chilled water system and replenish if necessary.

Test the operation of the dry cooling system as described from Page 18 onwards.

■ Fault Conditions

If the Dry Cooling System does not operate as expected see fault finding table below:

Symptom	Possible Cause	Action Required
Fans in Dry Cooling Unit do not operate	Electrical power is not switched on at the local electrical isolator next to the Thermoscreens dry cooling unit	Switch on power to the Thermoscreens dry cooling unit
	Wire link missing between FAN terminal and HIGH or MED or LOW terminals	Fit wire link to required speed (HIGH for specified cooling output)
	T8A fuse in dry cooling unit has blown	Replace T8A fuse and investigate why it has blown
	Problem with dry cooling unit motor(s), or internal wiring, or controls	Use wiring diagram to investigate possible cause of fault
Dry Cooling Unit does not cool well or does not cool at all	Outdoor unit not switched on and/or (S1, S2 isolator) not switched on	Switch on power to outdoor unit and (S1, S2 isolator)
	Dry cooling heat pump system has been running for less than 10 minutes and is still cooling down	Give system sufficient time to reach operating condition
	Remote ON/OFF Control: Dry cooling unit is set to 'Off'.	Switch Remote ON/OFF to ON
	Siemens Manual Room Control: Target temperature is set too high for cooling	If necessary adjust the Manual Room Control target temperature down.
	Room temperature is low - Air Inlet Sensor is measuring low air temperature so target temperature has been exceeded	NB. Dry cooling unit will only cool if room air temperature is above the target temperature
	Water dirt trap device is blocked	Clean water dirt trap device
	F2A fuse in dry cooling unit has blown	Replace F2A fuse and investigate why it has blown
Airflow is low coming from the discharge grille	Water pump has failed in water circuit	Repair water pump
	Dry cooling unit air filters and/or cooling coil is dirty.	Service dry cooling unit as described in Section – Servicing on pages 21 to 23
Mitsubishi Electric system is indicating an error code	A variety of error codes can occur because of a fault within the heat pump system. These will display on the Mitsubishi Electric PAR-W21MAA.	Refer to Mitsubishi Electric Service Manual to understand fault, then inspect, adjust and/or repair as appropriate
Condensate forming on the chilled water coil in the dry cooling unit	Failure in the site air conditioning system	Repair site air conditioning system
	Environmental conditions in the server room are above 24°C/40%Rh due to some other circumstance, e.g. doors left open, extreme weather conditions	Reduce environmental conditions if possible
	Chilled water flow temperature below 10°C	Investigate why water flow temperature is too low

If the Heat Pump Dry Cooling System is still not operating correctly call for a Mitsubishi Electric Service Agent.

■ Warranty

If any problems are encountered with the heat pump dry cooling system please contact your Mitsubishi Electric Service Agent.

Care has been taken in compiling these instructions to ensure they are correct, although Thermoscreens Ltd. disclaims all liability for damage resulting from any inaccuracies and/or deficiencies in this documentation. Thermoscreens Ltd. retain the right to change the specifications stated in these instructions.

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thermoscreens®

EC DECLARATION OF CONFORMITY

as defined by the EC Council Directive on Machinery 2006/42/EC, the Low Voltage Directive 73/23/EEC, the Electromagnetic Compatibility Directive 89/336/EEC and the Pressure Equipment Directive 97/23/EC

Herewith we declare that the air movement equipment designated below, on the basis of its design and construction in the form brought onto the market by us in accordance with the relevant safety, health and performance requirements of the Machinery.

If alterations are made to the machinery without prior written permission from us this declaration becomes invalid.

Designation of Equipment : THERMOSCREENS DRY COOLING UNIT

Series Type : PHV2000 NT used with Mitsubishi Electric PUHZ-HW140VHA/YHA
VRF PHV2000 NT used with Mitsubishi Electric PWFY-P200VM-E-AU

Relevant EC Council the Machinery Directive (2006/42/EC)
the Low Voltage Directive (73/23/EEC)
the Electromagnetic Compatibility Directive (89/336/EEC) as amended by
Directive 92/31/EEC

Applied Harmonised Standards : Machinery - EN 294, EN 414, EN ISO 14121-1
LVD - EN 60335-1, EN 60335-2-30, EN 60335-2-40
EMC - EN55011, EN 61000-3-2, EN 61000-3-3, EN 61000-4-2,
EN 61000-4-4, EN61000-4-5, EN61000-4-11, EN61000-6-4

Basis of Self Attestation : Quality Assurance to BS EN ISO 9001 : 2000
B.S.I. Registered Firm Certificate Number FM 85224

Responsible Person : Mr. M. Francis, Managing Director, Thermoscreens Limited

Date : 15th April 2011

Signed : 