Design, Installation & Servicing Instructions

ISSUE 2: MARCH 2012

Ecodan® Aerocyl PLUSme: Air Source Heat Pump and Stainless Steel Cylinder

MITSUBISHI ELECTRIC
LIVING ENVIRONMENTAL SYSTEMS

Air Conditioning | Commercial Heating
Domestic Heating | Photovoltaics

ecodan®
Renewable Heating Technology

Contents

Introduction

IMPORTANT NOTE TO THE INSTALLER

The Aerocyl Plus-me cylinder is specifically designed to be installed in conjunction with an air source heat pump. Aerocyl Plus-me cylinder is available as an indirect single or twin coil (or solar connection) versions.

Please read these instructions before commencing installation. Unvented cylinders are a controlled service as defined in the latest edition of the building regulations and should only be fitted by a competent person.

The relevant regulations are : England and Wales - Building Regulation G3 , Scotland - Technical Standard Section 4, N Ireland - Building Regulation Part F.

After installation the Benchmark log book must be completed and left, with these instructions, with the householder for future reference. To be installed in accordance to BS6700.

Any water distribution and central heating installation must comply with the relevant recommendation of the current version of the Regulations and British Standards listed below:

- Building Regulations
- I.E.E Requirements for Electrical Installations (BS7671)
- Water Regulations
- Manual Handling Operations Regulations
- British Standards BS6798, BS5449, BS5546, BS5540:1, BS5440:2, CP331:3, BS6700, BS7593 and BS7671
- Health and Safety Document No.635

Only Mitsubishi Electric Accredited Ecodan® Installers should install the Ecodan® system. Mitsubishi Electric's notes must not be taken as overriding statutory obligations. When installing unvented hotwater systems section G3 of the building regulations should be adhered to. An annual inspection would also be required to ensure safe, longterm operation. The information in this manual is provided to assist generally in the selection of equipment.The responsibility for the selection and specification of the equipment must however remain with the installer and any Designers or Consultants concerned with the design and installation.

Please note: Mitsubishi Electric do not therefore accept any responsibility for matters of design, selection or specification or for the effectiveness of an installation contain in gone of our products unless we have been specifically requested to do so.

All goods are sold subject to our Condition of Sale

Important Note: Included in the AEI introduction pack is the Mitsubishi Electric homeowner 10 year guarantee on the tank and 3 year component parts guarantee registration card. Please use this card to register within 30 days of commissioning / occupation if new build, and ensures the homeowner benefits from Mitsubishi Electric homeowner 3 year guarantee for the Ecodan® heat pump. This needs to be completed by both the Accredited Installer and the current homeowner (or signature of developer if new build). The registration card is freepost and is logged by our warranty department. In the unlikely event of failure of the Ecodan® heat pump, return of the card ensures the homeowner's warranty claim is hassle free. For additional supplies of the 3 year guarantee card please contact our heating department on 01707 278 666.

Please note - If you do not complete and return the registration card the product will only be under warranty for 12 months.

MITSUBISHI ELECTRIC
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MITSUBISHI ELECTRIC'S STANDARD GUARANTEE

This guarantee applies only to Ecodan Air Source Heat Pumps, including cylinders and associated interfacing equipment, purchased from Mitsubishi Electric and installed by a Mitsubishi Electric Accredited Ecodan Installer. Mitsubishi Electric Europe B.V. UK branch ("Mitsubishi Electric") guarantees the home owner from the date of commissioning (or 42 months from the date of delivery to the premises by Mitsubishi Electric, whichever is the shorter) the Mitsubishi Electric Ecodan Air Source Heat Pump and any cylinder and associated interface equipment supplied by Mitsubishi Electric (the "Product") will:
- conform to Mitsubishi Electric's specification; and
- be free from defects in design, materials and workmanship;
subject to the conditions set out below.

Please note: this guarantee excludes all pipework and connections and excludes any ancillary equipment as may be connected to the Product (for example, any descaling equipment).

This guarantee means that Mitsubishi Electric will take responsibility for the cost of guarantee service repair of a Product by a Mitsubishi Electric Accredited Ecodan Installer so that the Product shall conform to Mitsubishi Electric's specification. Mitsubishi Electric reserves the right, at its discretion, to replace a Product or major component where Mitsubishi Electric considers this to be beyond economic repair.

In the event of a breakdown during the guarantee period please contact your Mitsubishi Electric Accredited Ecodan Installer.

If there is a fault with the Product during the guarantee period you should first call your Accredited Ecodan Installer.

If the Accredited Ecodan Installer is unable to rectify the fault then the Accredited Ecodan Installer will contact Mitsubishi Electric. During the guarantee period Mitsubishi Electric will respond to any valid guarantee claim via the associated Accredited Ecodan Installer.

The Accredited Ecodan Installer may contact Mitsubishi Electric to verify Product registration status and that the Product is within the guarantee period before attending your home.

Guarantee servicing is free of charge to you for any parts and labour, subject to all the guarantee conditions having been met.

Fig 1.1

Checklist for Ecodan®

The following checklist has been created to help you understand the differences from other types of heating systems you may have installed. We suggest you use this checklist as a helpful summary of the main differences from conventional heating systems, but you will also need to understand and comply with all of the technical details contained within this document to ensure a successful installation. For further assistance please contact Mitsubishi Electric Technical Support Helpline on 0870 3000 300.

Primary System Circuit

It is very important that the primary system is cleansed using a suitable cleansing agent such as Fernox F3 or Sentinel X300; to ensure that any flux residues / installation debris is removed.

The heat pump and external connecting pipework require protection against freezing. For this reason a combined anti-freeze and inhibitor product such as Fernox HP-5 / Alphi-11 (page 55) or Sentinel R600 (page 57) must be used in the correct quantity.

All primary pipework on flow and return between the Ecodan® unit and cylinder should be insulated by Armaflex or similar. Weather protection should be added to all outdoor pipework.

The Fernox TF1 filter should be fitted internally on the heat pump return to help protect the heat pump from any heating system contamination and provide an ongoing visual indication of the system water condition.

Interconnection Between Ecodan and Flow Temperature Controller (FTC2)

A 2 core signal cable is needed between the internal FTC2 and the external Ecodan®. This cable is NOT supplied with the package and should be sized in accordance with 17th Edition Wiring Regulations.

Radiator System Circuit

As the heat pump generates lower temperatures than a conventional boiler the radiators should be designed to suit the lower mean temperature. Sizes need to be calculated using the design tool supplied on the AEI training course.

Retrofit Situations

The heat exchanger in the heat pump should be protected from particulate contaminates in the water circuit. When fitting in a retrofit situation the existing radiator circuit MUST be chemically cleaned and thoroughly flushed before installation.

Supplied Parts

Fig 1.2

TFI Filter

Ecodan® Air Source Heat pump (see page 11 for pictures of each model)

Flexible pipes (x2)

Checklist for Aerocyl Plus-me

The Aerocyl Plus-me unvented cylinder is made from stainless steel for excellent corrosion resistance. Aerocyl Plus-me cylinder has a strong rust-proofed steel case and is highly insulated with environmentally friendly foam. It is available in 6 capacities from 150—300 litres. Aerocyl Plus-me cylinder is supplied complete with all the necessary safety and control devices needed to connect to the cold water mains. All are pre-adjusted. High quality controls have been selected to combine high flow rate performance with minimum pressure drop to make Aerocyl Plus-me cylinder perform well in all areas, even those with poor water pressure. Aerocyl Plus-me is KIWA approved to show compliance with Building Regulations G3+L.

In addition to the pre-plumbed parts the Aerocyl Plus-me has several loose parts within the package. Aerocyl Plus-me comes complete with all the fittings you need to complete the installation, these components are pictured below:

Fig 1.3

Expansion Vessel

Room Thermostat

Danfoss 2 Channel Timer

High Limit Thermostat

Manuals

Flow Setter Valve

The central heating expansion vessel is not supplied and should be sized by the installer for the total volume of the primary pipe work. For a complete parts list please refer to pages 12-14.

Sizing Expansion Vessels

To size the expansion vessel for the heating circuit the following formula and graph can be used.

$$V = \frac{\varepsilon \times G}{1 - \frac{P_1 + 0.0098}{P_2 + 0.0098}}$$

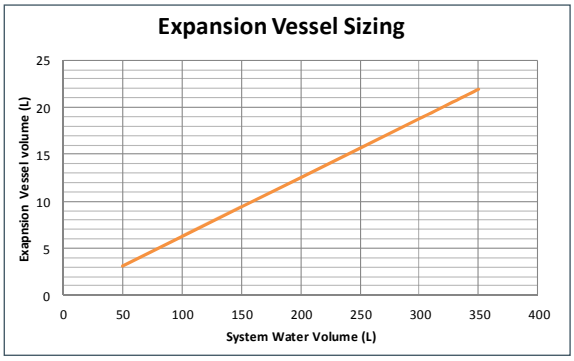


Fig 1.4

Where

V : Necessary expansion vessel volume
ε : Water expansion coeffiecient
G : Total volume of water in the system
P_1 : Expansion vessel setting pressure
P_2 : Max pressure during operation

Graph above is for the following values

ε : at 70ºC = 0.0229
P_1 : 0.1MPa
P_2 : 0.3MPa
* 30% safety margin is added

Water Supply

Aerocyl Plus-me operates at 3 bar (controlled by the inlet control set) and is capable of delivering over 50 litres of hot water per minute. The high quality inlet control has been designed to make the most of the flow rates available however the performance of any unvented system is only as good as the mains water supply. The maximum possible water demand should be assessed taking into consideration that both hot and cold services are supplied simultaneously from the mains.

The water supply should be checked to ensure it can meet these requirements. If necessary consult the local water company regarding the likely pressure and flow rate availability.

If measuring the water pressure note that a high static (no flow) mains pressure is no guarantee of good flow availability. In a domestic installation 1.5 bar and 25l/m should be regarded as the minimum pressure / flowrate.

Consideration should given to upgrading existing ½" (15mm) cold mains pipework to a larger size, if the recommended minimum pressure / flowrate is not being achieved.

Siting the Cylinder

Aerocyl Plus-me can supply outlets above it or at the same height some distance from it. Site the unit to minimise "dead leg" distances especially to the point of most frequent use. Outlets above the Aerocyl Plus-me will reduce the outlet pressure available by 0.1 bar for every 1m of height difference. The unit should be protected from frost. Particular care is needed if siting in a garage or outbuilding. All exposed pipework should be insulated. Aerocyl Plus-me must be installed vertically on a flat base capable of supporting the weight of the cylinder when full. The minimum recommended cupboard size is 750x750mm by the height; which will be dependent on the cylinder used. Allow an extra 300mm on the height of the cylinder. See page 9 for full specification.

Access for maintenance of the valves should be considered. The immersion heaters are 375mm long and care should be taken that they can be withdrawn for servicing if required. The discharge pipework from the safety valves should fall continuously and terminate safely.

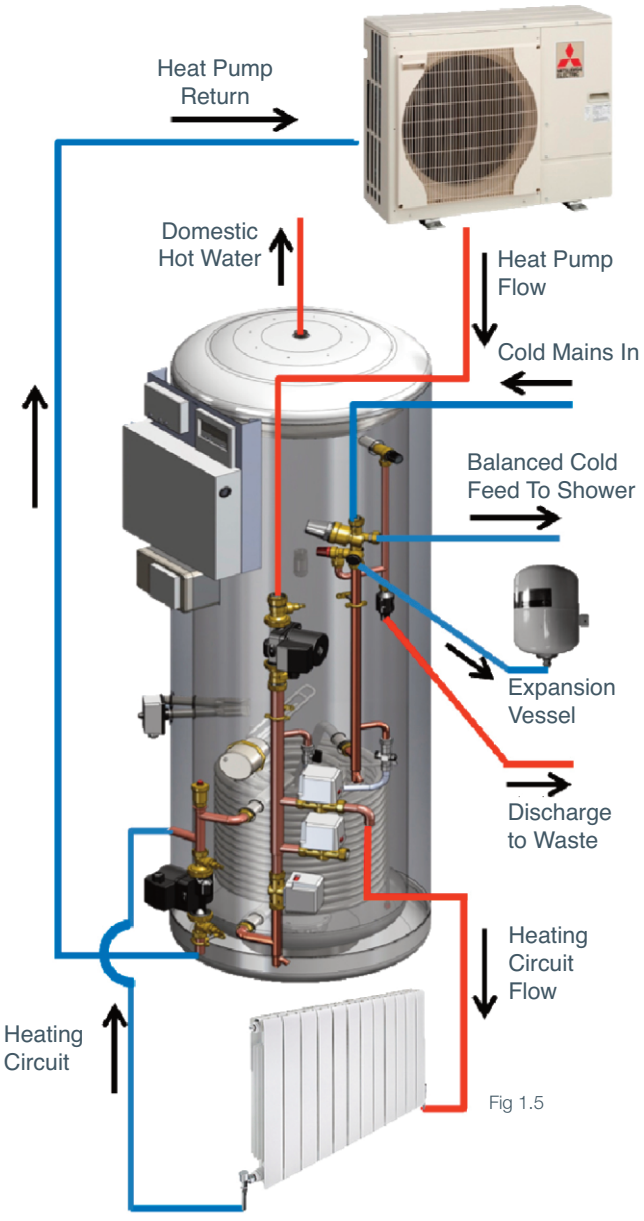


Fig 1.5

Solar Aerocyl Plus-me Connections

Solar Aerocyl Plus-me input cylinders are designed to accept heat input from a renewable/sustainable (i.e: Solar thermal) heat source. Where this input does not fully meet the desired temperature a guaranteed quantity of water can be heated to an acceptable temperature by the heat pump or immersion heater. The Domestic Heating Compliance Guide document L1A and L1B provides excellent advice in sizing both cylinder designated solar areas and heat exchangers to the surface area of the solar collectors.

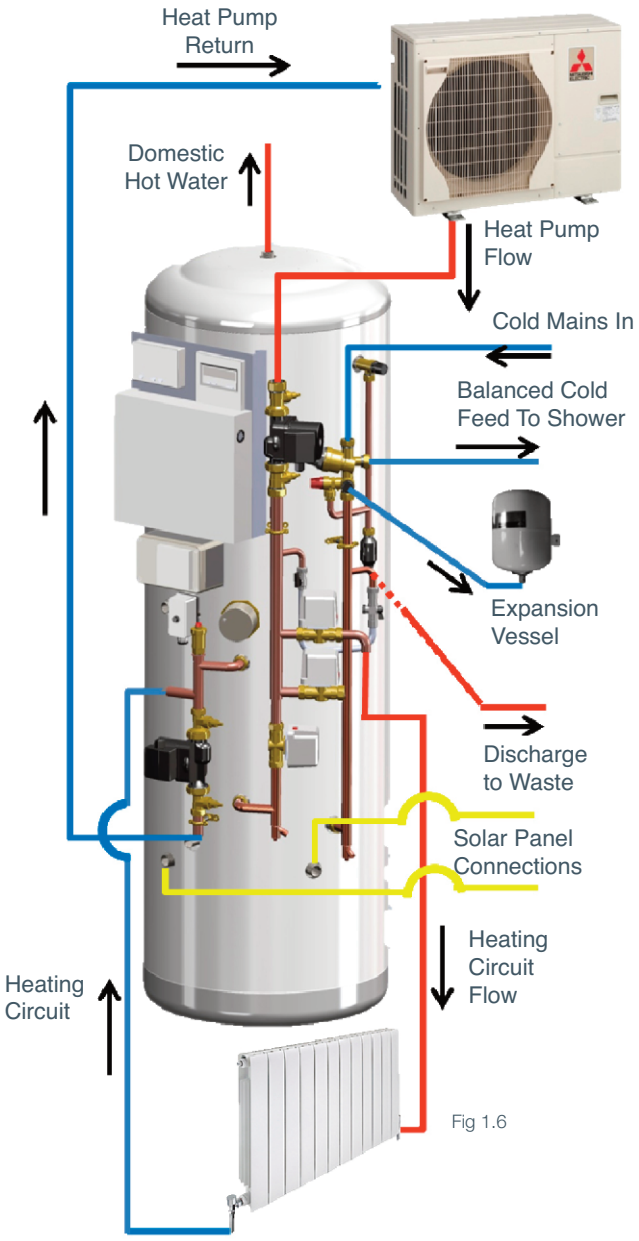


Fig 1.6

Using this guide Mitsubishi and Kingspan are able to offer the following sizing advice for specification.

Table 1.1

Model	Designated Solar Volume	Heat Pump Volume	Total Capacity
HUS 210CPR2ST	65	145	210
HUS 250CPR2ST	90	160	250
HUS 300CPR2ST	100	200	300

Heat Pump System Overview

The Ecodan® air source heat pump extracts thermal energy from the outside air and transfers this into a property in the form of hot water as a conventional heating system does.

The Ecodan® Aerocyl Plus-me package is controlled by conventional heating system control equipment. A two channel time clock for ON and OFF periods, a cylinder thermostat for DHW temperature and a room thermostat for space temperature.

Due to the outputs available domestic hot water always takes priority over space heating. The flow temperature controller 2 (FTC2) targets a preset cylinder temperature on the TH5 dry pocket sensor and communicates with the Ecodan® until this temperature is achieved. A high flow temperature is required in hot water heating to raise the domestic hot water (DHW) store then the temperature is reduced in space heating to increase the efficiency. See tables 4.1 and 4.3 (pages 42 and 45) for recommended settings.

Mounted in the rear of the Ecodan® is an outside temperature compensation sensor. This will modulate the flow temperature in space heating mode (according to the ambient temperature) to increase the efficiencies of the system. Due to the lower flow temperatures provided by the Ecodan® air source heat pump, radiators need to be sized correctly.

Two heating zones (2nd zone controller provided by AEI) can be connected to the Ecodan® Aerocyl Plus-me (except the 150 litre tank) system in the same way as a conventional heating system. When the system is installed and commissioned the control equipment will automatically switch between hot water and heating modes as and when required.

Each of the three Ecodan® models require sufficient primary flow rate for adequate operation. Due to the large resistances caused by the plate heat exchanger in the Ecodan®, the Aerocyl Plus-me system has two domestic circulating pumps in series to produce the required flow rates. These pumps must be set to the same speed or damage to the system may occur. Pipe diameters will need to increase on the PUHZ-HW140VHA(2)/ YHA(2) models to assist in reducing the resistance, required flow rates are listed on table 3.2 (page 27).

A flow setter valve is supplied with each system to give an indication of the actual flow rate achieved. It should be installed in the common flow or return pipe work to the Ecodan®. Details of this can be found on page 27 of this manual.

Automatic air vents must be installed at the highest point of the primary system. The slightest amount of air in the system can reduce efficiencies and even cause the Ecodan® to fault.

The primary loop must contain a 25% antifreeze concentration (or as recommended by manufacturer) to avoid possible freezing during periods when the appliance is not being operated. It is recommended that a dual inhibitor anti-freeze is used; such as Fernox Alphi-11, HP-5C or Sentinel R600. See pages 55, 56 and 57 for information on these products.

To comply with this requirement the hardness of the mains water(>200ppm) should be checked by the installer and if necessary the optional factory fitted in-line scale inhibitor should be specified at the time of order for hardness. To optimise running costs it is advisable the homeowners seeks the cheapest possible electricity tariff. An internet search facility like www.uswitch.com will help to identify the most suitable tarriffs.

The homeowner will need to control the Ecodan® Aerocyl Plus-me differently to a conventional gas boiler as hot water and space heating can not be performed at the same time. The correct use of controls is paramount in achieving low running costs. Although electricity prices are higher than gas or oil, the efficiency of the system means that it requires less energy to supply the same heating demands, thus producing cheaper energy bills. Compared to a regular electricity bills it will look higher than usual, but the homeowner should be aware that this bill incorporates heating that is usually achieved though gas or oil.

How a heat pump works

The heat pump essentially works the same way as your refrigerator but in reverse. The Ecodan® is hermetically sealed (no refrigeration piping involved) with R410A refrigerant, the cycle it completes to produce heat is known as the vapour compression refrigeration cycle:

Step 1
The first phase begins with the refrigerant being cold and low pressure. The refrigerant within the circuit is compressed as it passes through the compressor. It becomes a hot, highly pressurised gas. The temperature also rises typically to 60°C.

Step 2
The refrigerant is then condensed as it passes across a plate heat exchanger. Having a cooler side to the heat exchanger it decreases the temperature, so it changes the property of the refrigerant from a gas to a liquid.

Step 3
The refrigerant as a cold liquid still has a high pressure. For expansion to occur it passes through an expansion valve. The pressure drops but it is still a cold liquid.

Step 4
The final stage of the cycle is when the refrigerant passes into the evaporator and evaporates. It is at this point when some of the free heat energy in the outside air is absorbed by the refrigerant.

It is only the refrigerant that is being passed through this cycle; the water is heated up by the plate heat exchanger. The cooler water extracts energy from the hotter refrigerant, i.e. the water is heated as it passes across the plate heat exchanger. This water flows towards the heating system and hot water storage tank, where its energy is used to provide domestic hot water and space heating.

Boiling points:
The refrigerant used within the cycle has a different boiling point to water, which boils (turns from liquid to gas) at 100°C. This is only true at atmospheric pressure. When the pressure increases so does the boiling temperature; decrease the pressure and boiling temperature drops. Liquid turns to gas at a lower temperature. The boiling point changes when the pressure changes. Refrigerants have different properties to water and have much lower boiling temperatures. During the fourth stage of the cycle the outside ambient temperature even in winter is therefore hotter than the temperature of the refrigerant and will heat it.

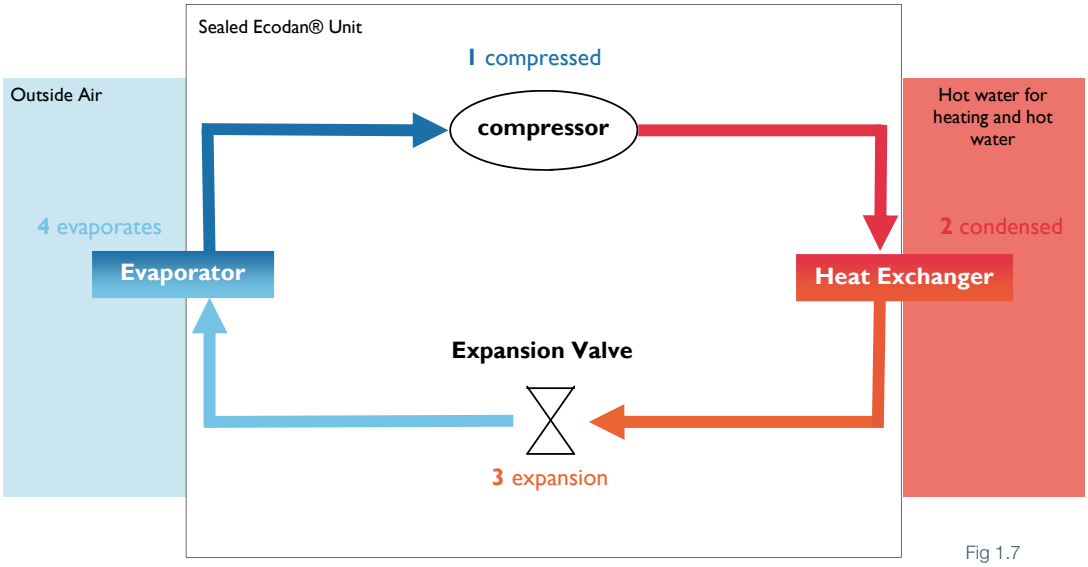


Fig 1.7

Aerocyl Plus-me Specification

Model		HU150CPR2ST	HU180CPR2ST	HU210CPR2ST	HU250CPR2ST	HU300CPR2ST
Nominal domestic hot water storage volume (litres)		150	180	210	250	300
Overall cylinder dimensions (height x width x depth)		1410x550x700	1410x550x700	1495x550x720	1700x550x720	2050x550x720
Minimum Installation Requirements		1710x750x750	1710x750x750	1795x750x750	2000x750x750	2350x750x750
Weight (kg)	(Empty / Full)	48 / 198	50 / 230	55 / 265	60 / 310	67 / 367
Unvented store expansion vessel	Nominal Volume (litres)	12	19	19	19	24
	Charge Pressure (bar)	3.0	3.0	3.0	3.0	3.0
Control / relief valve pressure settings	Mains Inlet Pressure Regulator (bar)	12.0	12.0	12.0	12.0	12.0
	Expansion Relief Valve CW (bar)	3.0	3.0	3.0	3.0	3.0
	P & T Valve	7.0 bar & 90°C	7.0 bar & 90°C	7.0 bar & 90°C	7.0 bar & 90°C	7.0 bar & 90°C
Backup immersion heater rating		3kW	3kW	3kW	3kW	3kW
Performance Rating of Cylinder Coil: BS 12897 (kW)		23.2	28.3	28.1	27.4	26.7
Surface Area of Heat Pump Coil (m^2)		3.0	3.0	3.0	3.0	3.0
Heat up 15°C to 60°C (80°C flow @ 15l/m)		19 min 12 sec	23 min 50 sec	27min 22 sec	34 min 16 sec	35 min 14 sec
Heat up 70% to 60°C (80°C flow @ 15l/m)		15 min 40 sec	17 min 41 sec	19 min 18 sec	23 min 25 sec	26 min 10 sec
Insulation thickness (mm)		50	50	50	50	50
Insulation Ozone Depletion Potential (ODP)		ZERO				
Insulation Global Warming Potential (GWP)		1.1				
Heat pump circuit circulating pump		UPS 25-40	GRUNDFOS UPS 25-55			
System circulating pump (DHW and zone 1 CH)		UPS 25-40	GRUNDFOS UPS 25-55			
DHW circuit zone valve– type HP22 (mm)		22	22	22	22	22
CH circuit zone valve– type HP22 (mm)		22	22	22	22	22
Control & overheat safety thermostat settings	Control stat	Directly controlled by FTC2 using TH5 sensor				
	High limit stat	80°C	80°C	80°C	80°C	80°C
	Voltage	230-240 V	230-240 V	230-240 V	230-240 V	230-240 V
	Electronic immersion time switch	Type—ETU8000				
Room thermostat & receiver (1no)		DANFOSS Type—TP5000 Si FR & RX1				
7 day programmer, 24 hour 2 channel timer		DANFOSS Type—FP715 Si				
Standing losses kWh/ 24hours		1.38	1.63	1.90	2.21	2.43

Applicable Units					
PUHZ-W50VHA-BS	✓	✓	×	×	×
PUHZ-W85VHA(2)-BS	✓	✓	✓	×	×
PUHZ-HW140VHA(2)-BS / YHA(2)-BS	×	×	✓	✓	✓

Table 2.1

Solar Aerocyl Plus-me Specification

Model		**HUS210CPR2ST**	**HUS250CPR2ST**	**HUS300CPR2ST**
Nominal domestic hot water storage volume (litres)		210	250	300
Overall cylinder dimensions (height x width x depth)		1495x550x720	1700x550x720	2050x550x720
Minimum Installation Requirements		1795x750x750	2000x750x750	2350x750x750
Weight (kg)	(Empty / Full)	60 / 270	65 / 315	72 / 372
Unvented store expansion vessel	Nominal Volume (litres)	19	19	24
	Charge Pressure (bar)	3.0	3.0	3.0
Control / relief valve pressure settings	Mains Inlet Pressure Regulator (bar)	12.0	12.0	12.0
	Expansion Relief Valve CW (bar)	3.0	3.0	3.0
	P & T Valve	7.0 bar & 90°C	7.0 bar & 90°C	7.0 bar & 90°C
Backup immersion heater rating		3kW	3kW	3kW
Performance Rating of Cylinder Coil: BS 12897 (kW)		28.1	27.4	26.7
Surface Area of Heat Pump Coil (m^2)		3.0	3.0	3.0
Surface Area of Solar Coil (m^2)		0.963	0.963	0.963
Insulation thickness (mm)		50	50	50
Insulation Ozone Depletion Potential (ODP)		ZERO		
Insulation Global Warming Potential (GWP)		1.1		
Heat pump circuit circulating pump		GRUNDFOS UPS 25-55		
System circulating pump (DHW and zone 1 CH)		GRUNDFOS UPS 25-55		
DHW circuit zone valve– type HP22 (mm)		22	22	22
CH circuit zone valve– type HP22 (mm)		22	22	22
Control & overheat safety thermostat settings	Control stat	Directly controlled by FTC2 using TH5 sensor		
	High limit stat	80°C	80°C	80°C
	Voltage	230-240 V	230-240 V	230-240 V
	Electronic immersion time switch	Type—ETU8000		
Room thermostat & receiver (1no)		DANFOSS Type—TP5000 Si FR & RX1		
7 day programmer, 24 hour 2 channel timer		DANFOSS Type—FP715 Si		
Standing losses kWh/ 24hours		1.90	2.21	2.43

Applicable Units			
PUHZ-W50VHA-BS	✓	✓	×
PUHZ-W85VHA(2)-BS	✓	✓	✓
PUHZ-HW140VHA(2)-BS / YHA(2)-BS	✓	✓	✓

Table 2.2

Ecodan® Specification

Model		PUHZ-W50VHA-BS	PUHZ-W85VHA(2)-BS	PUHZ-HW140VHA(2)-BS/ PUHZ-HW140YHA(2)-BS
Dimensions (mm)	Width	950	950	1020
	Depth	330+30*	330+30*	330+30*
	Height	740	943	1350
Weight (kg)		64	77	134 / 148
Airflow (m3/min)		50	55	100
Nominal sound level (dBA)		45 ◊	48 ◊	53 ◊
Low noise mode (dBA) @ 7°C		40	42	46
Guaranteed operating range	(Outdoor)	- 15 ~ +35°C	- 20 ~ +35°C	- 25 ~ +35°C
Electrical Supply		220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz / 380-415v, 50Hz
Phase		Single	Single	Single / 3 Phase
Running current (A) [Max]		5.4 [13]	10.3 [23]	14.9 [35] / 5.1 [13]
Fuse Rating (MCB sizes BS EN 60947-2) (A)		16	25	40 / 16
Heating A2/W35	Capacity (kW)	5.0	8.5	14
(Eco label)	COP	3.13	2.95 *(3.17)*	2.69 *(3.11)*
(Eco label)	Power Input (kW)	1.6	2.88 *(2.68)*	5.21 *(4.52)*
	Nominal Flow Rate (L/min)	14.3	25.8	40.1
Heating A7/W35	Capacity (kW)	5.0	9.0	14.0
(Eco label)	COP	4.1	3.85 *(4.18)*	4.19 *(4.25)*
(Eco label)	Power Input (kW)	1.22	2.34 *(2.15)*	3.34 *(3.31)*
	Nominal Flow Rate (L/min)	14.3	25.8	40.1
Primary Flow Rate	Maximum (L/min)	14.3	25.8	40.1
	Minimum (L/min)	6.5	10	17.9

* Grille
◊ At distance of 1m from the outdoor unit
Eco label models denoted by **(2)** after product

Table 2.3

5kW Unit

Fig 2.1

8.5kW Unit

Fig 2.2

14.5kW Unit

Fig 2.3

Ecodan® Capacity Drop Offs

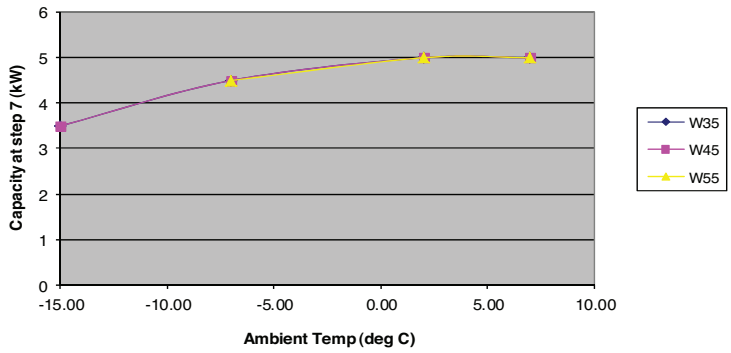
Table 2.4

Ambient Air Temperature	PUHZ-W50			PUHZ-W85			PUHZ-HW140		
	*W35	*W45	*W55	W35*	W45*	W55*	W35*	W45*	W55*
-15	3.5	3.5	N/A	5.5	5.5	N/A	11	11	11
-7	4.5	4.5	4.5	7.7	7.7	7.7	13	13	13
2	5	5	5	8.5	8.5	8.5	14	14	14
7	5	5	5	9	9	9	14	14	14

* Where W35 is a flow temperature of 35ºC
Where W45 is a flow temperature of 45ºC
Where W55 is a flow temperature of 55ºC

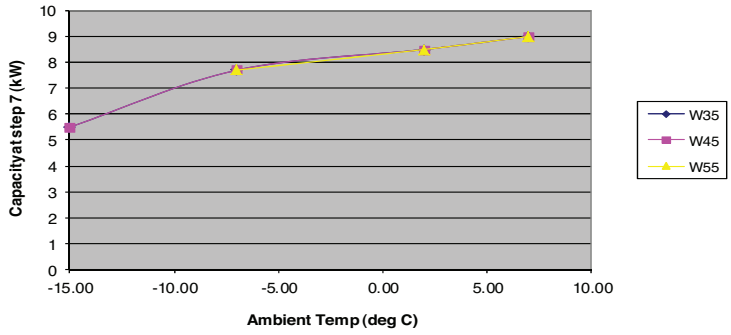
PUHZ-W50

Fig 2.4



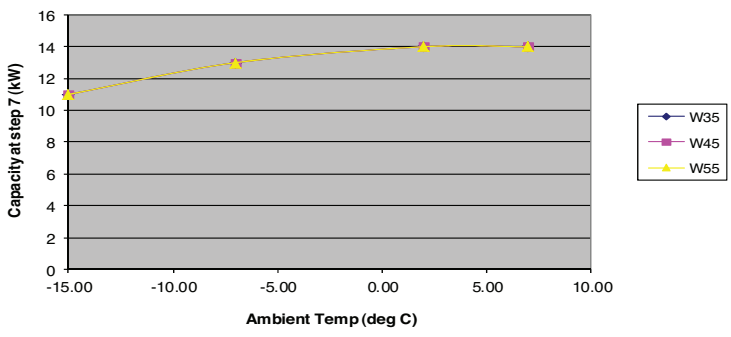
PUHZ-W85

Fig 2.5



PUHZ-HW140

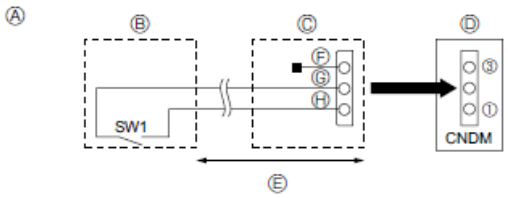
Fig 2.6



Ecodan® Low Noise Mode Settings

To activate low noise mode an optional 3 wire adaptor is required (PAC-SC36NA), this can either be wired into a manual switch or a timed version. The level of low noise mode which will be activated (as shown in the relevant graphs below and over the page) is determined by the combination of DIP switch settings (SW5-1 and SW5-2) on the outdoor unit as shown below. As low noise mode reduces maximum capacity it is important that the capacity at the low noise mode selected is sufficient to overcome the building's calculated heat losses at design temperature.

Fig 2.7



Ⓐ Circuit diagram example (low noise mode)
Ⓑ On-site arrangement
Ⓒ External input adapter (PAC-SC36NA)
Ⓓ Outdoor unit control board
Ⓔ Max. 10 m
Ⓕ Red
Ⓖ Brown
Ⓗ Orange

SW5	1	Max. fan step selection	STEP 9	STEP 9	OFF	Selection of max. fan step at the silent mode	Always
	2	Max. frequency selection	Middle Level	Low Level	OFF	Selection of compressor frequency at the silent mode	Always
	3	No Function	Do NOT use	PUHZ-W50,85VHA	OFF		
	4	No Function	Do NOT use	PUHZ-W50,85VHA	OFF		

Table 2.5

PUHZ-W50VHA-BS Noise Curve

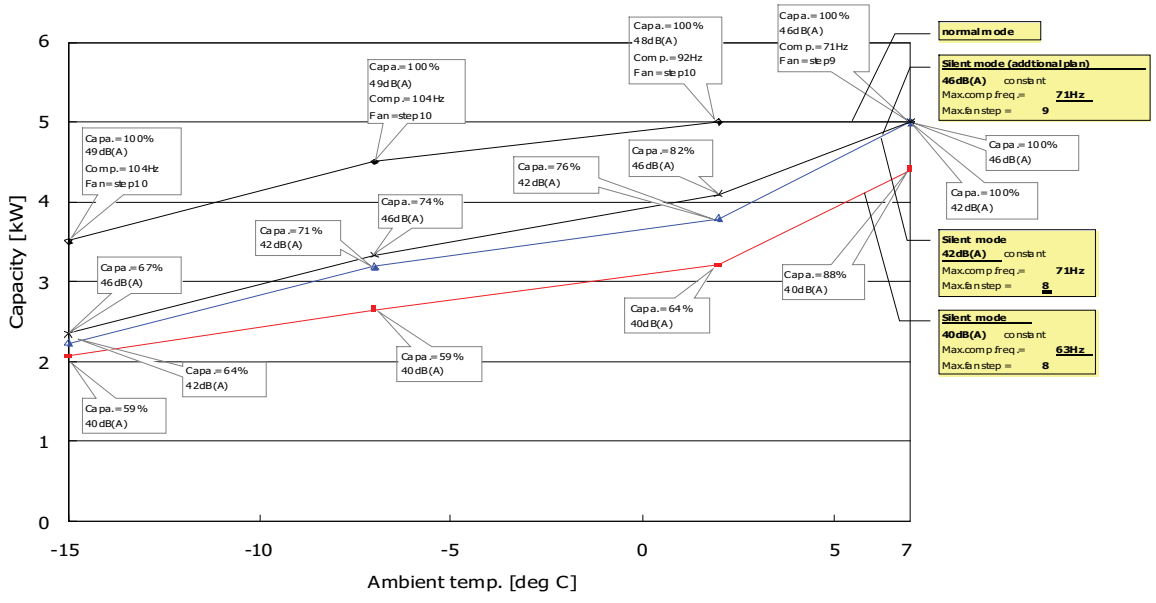


Fig 2.8

PUHZ-W85VHA2-BS Noise Curve

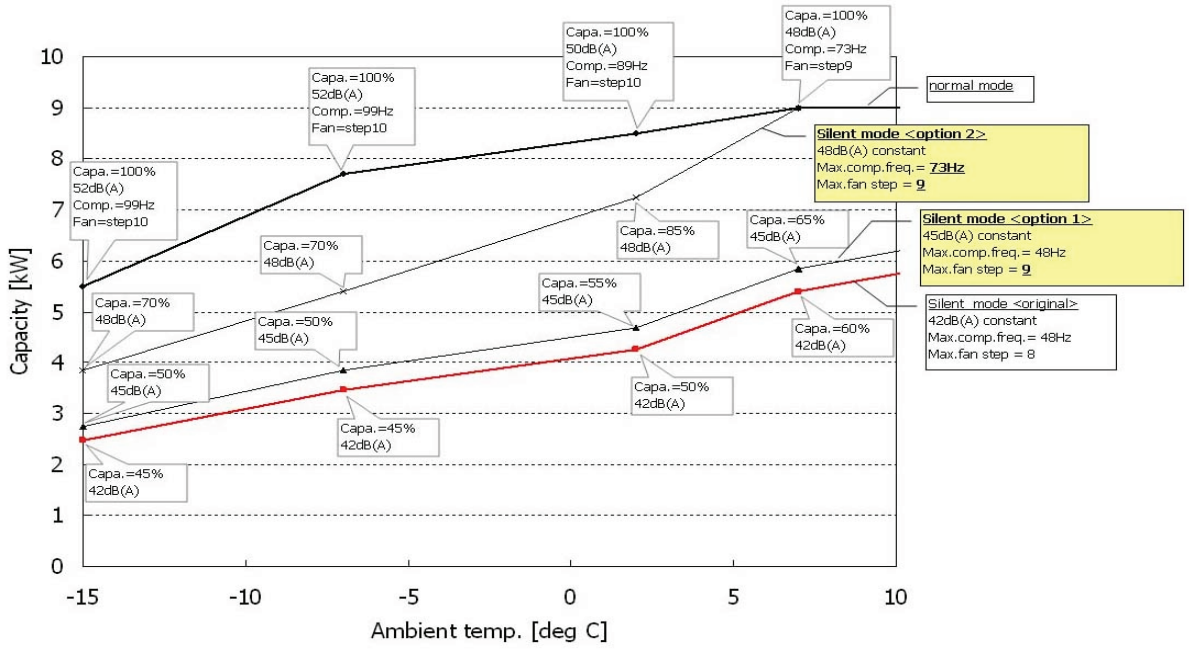


Fig 2.9

PUHZ-HW140VHA2-BS Noise Curve

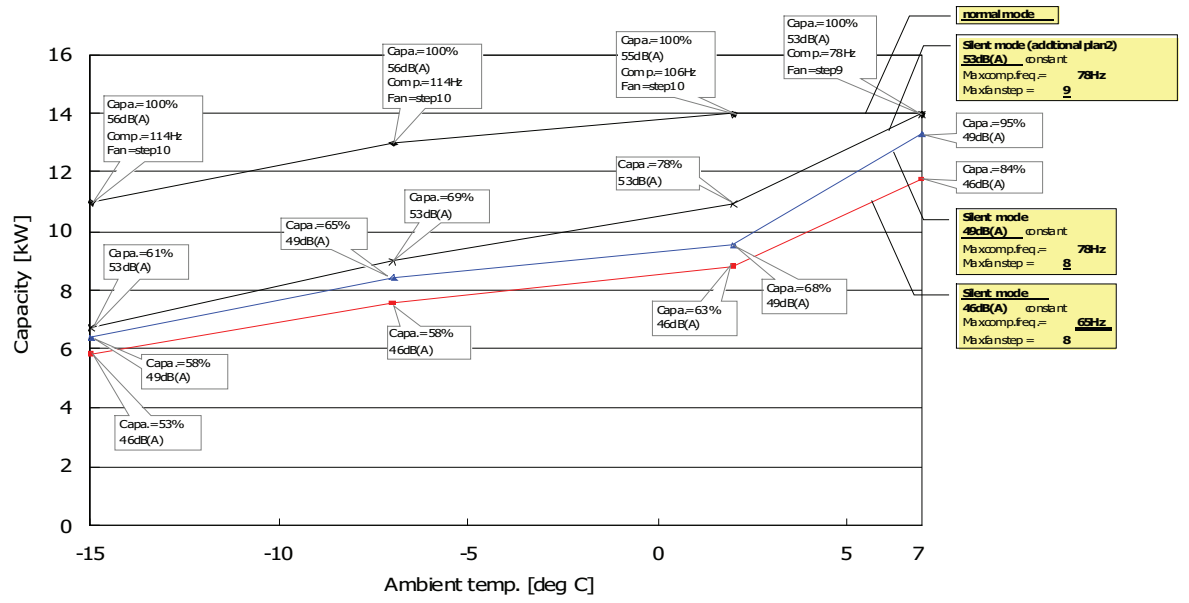


Fig 2.10

Dimensional Drawing: Aerocyl Plus-me

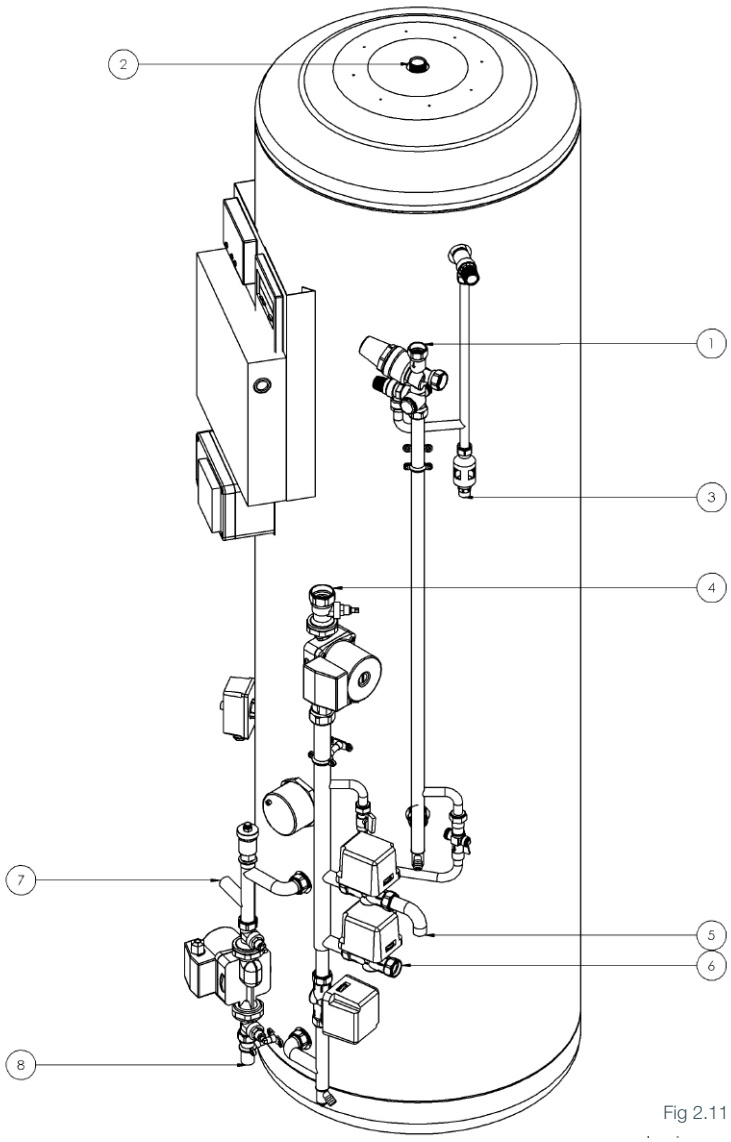


Fig 2.11

Dimension from base (mm)	150L	180L	210L	250L	300L
1. Cold Feed	915	915	1105	1365	1685
2. Hot water draw off	1290	1290	1479	1729	2042
3. Tundish	416	604	792	1042	1355
4. Heat Pump Flow	1151	1151	1151	1151	1151
5. Heating Flow	567	567	567	567	567
6. Secondary Heating Flow (Not 150)	N/A	590	665	665	665
7. Heating Return	414	414	414	414	414
8. Return to Heat Pump	90	90	90	90	90

Table 2.6

Aerocyl Plus-me: HU150CP

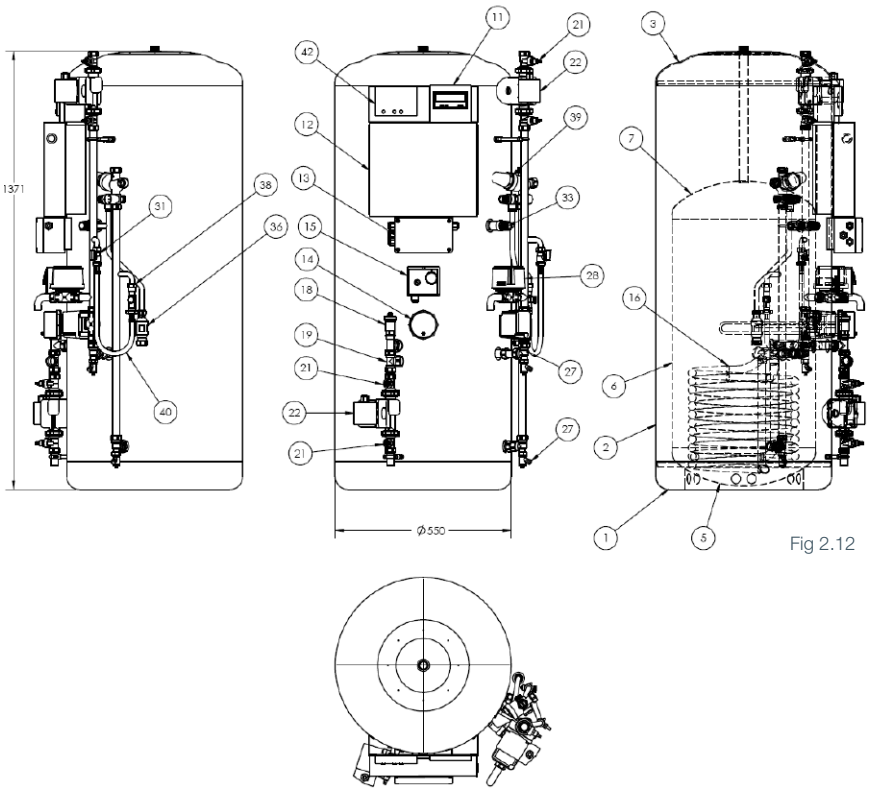


Fig 2.12

Item No.	Brief Description	Description	Qty.
1	Bottom 550	550Ø Bottom-White	1
2	Case 150	Punched 150L Zintec Case-Sheet x 1mm	1
3	Top 550	550Ø Top-White	1
5	Spin 450 Bottom	450 Dome	1
6	Vessel 150L	Copper Cyl-Basic Vessel	1
7	Spin 450 Top	450 Dome	1
9	Pipe 28x410		1
11	Controller		1
12	Controller Panel		1
13	Terminal Box	Immersion Control	1
14	Immersion Heater	Immersion Heater	1
15	Stat	(Not supplied with FTC2)	1
16	HP-Coil		

Item No.	Brief Description	Description	Qty.
18	Bottle-aireliminator		1
19	TEE22		1
21	Gate-Valve		4
22	Pump		2
27	Drain-Cock		2
28	2-Port-Valve		2
31	Flex-hose-tap		1
33	T+P Valve		1
36	Tundish		1
38	Flexi-Hose-Tap2		1
39	TS301-Caleffi	Inlet Control Set	1
40	Flexihose		1
42	RX1-Receiver	Room Stat	1

Table 2.7

For ordering spare parts see page 53.

Aerocyl Plus-me: HU180CP

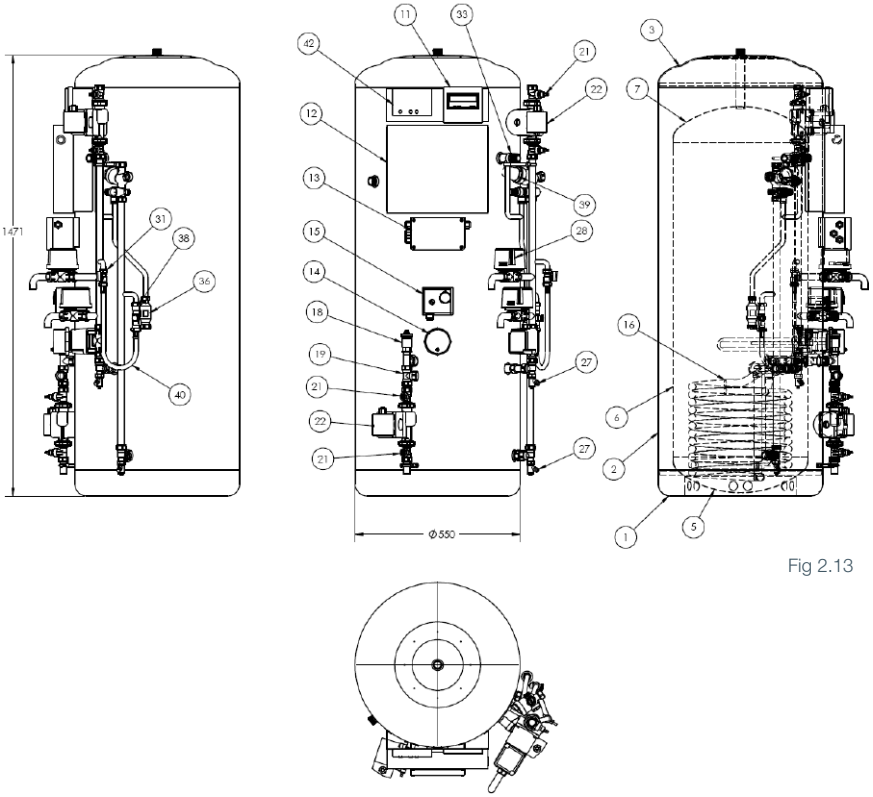


Fig 2.13

Item No.	Brief Description	Description	Qty.
1	Bottom 550	550Ø Bottom-White	1
2	Case 180	Punched 180L Zintec Case-Sheet x 1mm	1
3	Top 550	550Ø Top-White	1
5	Spin 450 Bottom	450 Dome	1
6	Vessel 180L	Copper Cyl-Basic Vessel	1
7	Spin 450 Top	450 Dome	1
9	Pipe 28x180		1
11	Controller		1
12	Controller Panel		1
13	Terminal Box	Immersion Control	1
14	Immersion Heater	Immersion Heater	1
15	Stat	(Not supplied with FTC2)	1
16	HP-Coil		

Item No.	Brief Description	Description	Qty.
18	Bottle-aireliminator		1
19	TEE22		1
21	Gate-Valve		4
22	Pump		2
27	Drain-Cock		2
28	2-Port-Valve		3
31	Flex-hose-tap		1
33	T+P Valve		1
36	Tundish		1
38	Flexi-Hose-Tap2		1
39	TS301-Caleffi	Inlet Control Set	1
40	Flexihose		1
42	RX1-Receiver	Room Stat	1

Table 2.8

For ordering spare parts see page 53.

Aerocyl Plus-me: HU210CP

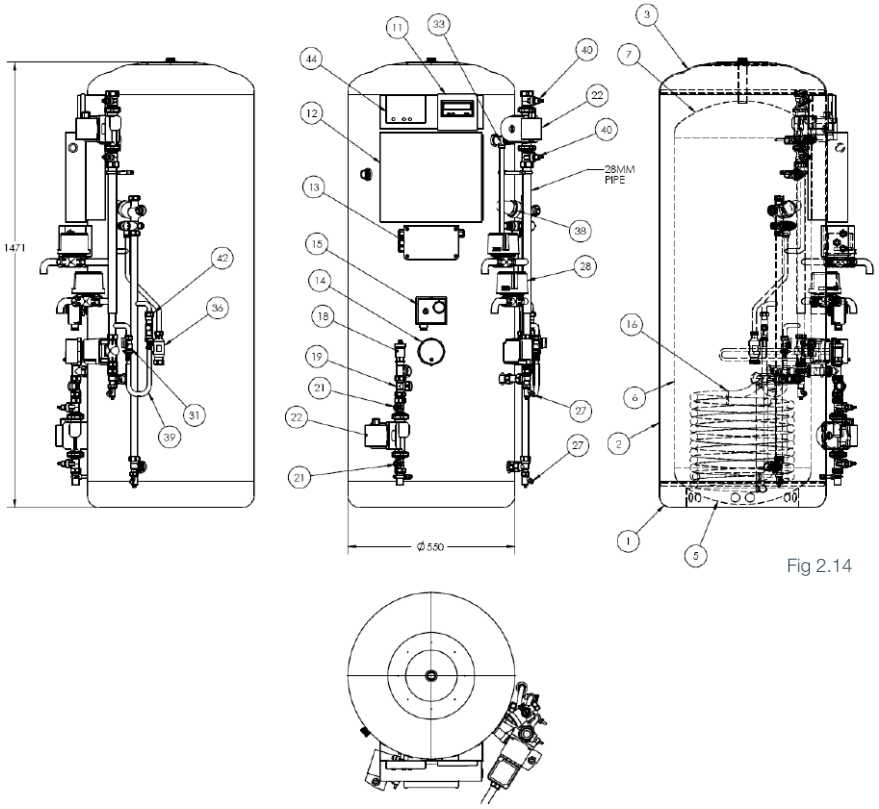


Fig 2.14

Item No.	Brief Description	Description	Qty.
1	Bottom 550	550Ø Bottom-White	1
2	Case 210	Punched 210L Zintec Case-Sheet x 1mm	1
3	Top 550	550Ø Top-White	1
5	Spin 450 Bottom	450 Dome	1
6	Vessel 210L	Copper Cyl-Basic Vessel	1
7	Spin 450 Top	450 Dome	1
11	Controller		1
12	Controller Panel		1
13	Terminal Box	Immersion Control	1
14	Immersion Heater	Immersion Heater	1
15	Stat	(Not supplied with FTC2)	1
16	HP-Coil		

Item No.	Brief Description	Description	Qty.
18	Bottle-aireliminator		1
19	TEE22		1
21	Gate-Valve		4
22	Pump		2
27	Drain-Cock		2
28	2-Port-Valve		2
31	Flex-hose-tap		1
33	T+P Valve		1
36	Tundish		1
38	Flexi-Hose-Tap2		1
39	TS301-Caleffi	Inlet Control Set	1
40	Flexihose		1
42	RX1-Receiver	Room Stat	1

Table 2.9

For ordering spare parts see page 53.

Dimensional Drawing: Solar Aerocyl Plus-me

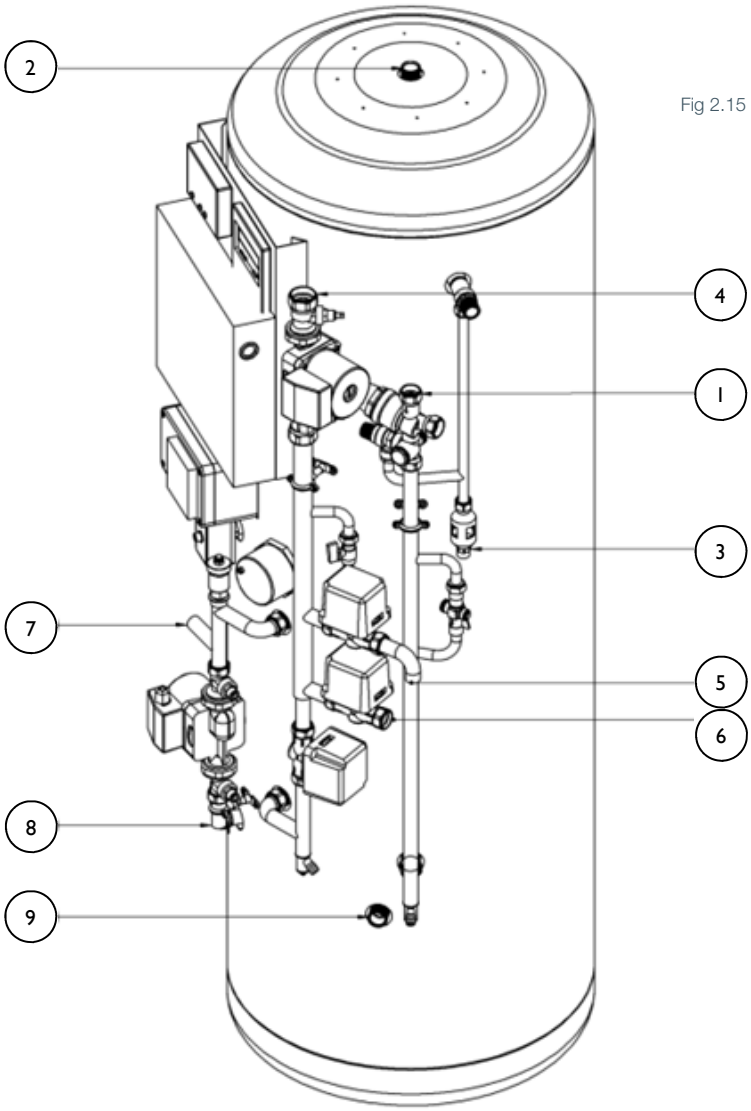


Fig 2.15

Dimension from base (mm)	210L	250L	300L
1. Cold Feed	1170	1370	1680
2. Hot water draw off	1730	1730	2043
3. Tundish	792	1044	1355
4. Heat Pump Flow	1516	1516	1616
5. Heating Flow	892	892	992
6. Heating Flow	796	796	897
7. Heating Return	779	779	879
8. Return to Heat Pump	455	455	555
9. Solar Coil Connection x 2	365	365	365

Table 2.10

Solar Aerocyl Plus-me: HU210CP

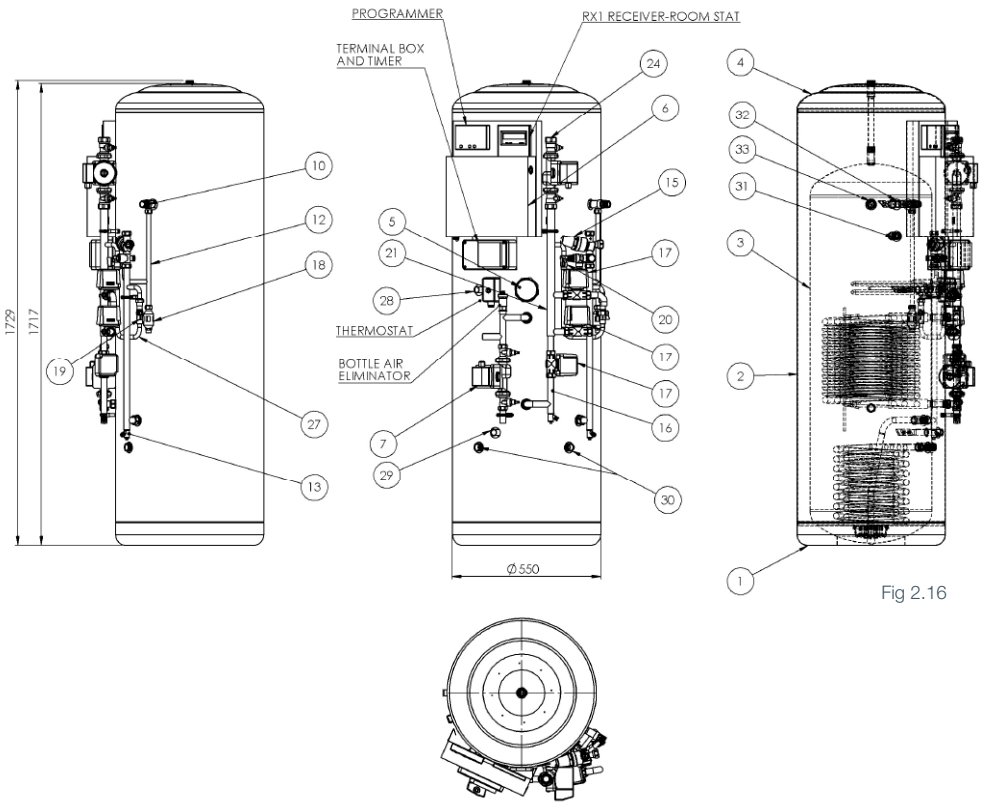


Fig 2.16

Item No.	Brief Description	Description	Qty.
1	Bottom 550	550Ø Bottom-White	1
2	HP-Case-MITSI	Punched Zintec Case-Sheet	1
3	BV-HP-MITSI		1
4	Top 550	550Ø Top-White	1
5	Immersion heater	Immersion heater 1 3/4 inch	1
6	Mitsubishi controls		1
7	Pump assembly		2
10	T&P Valve		1
12	Pipe tundish		1
13	Tundish		1
15	TS301 CALEFFI		1
16	Pipe with drain cock		1

Item No.	Brief Description	Description	Qty.
17	2-port valve		3
18	Pipe Drain Cock		1
19	Flexi hose tap2		1
20	Flexi hose tap		1
21	Pipe pump st		1
24	Gate valve		4
27	Flexihose		1
28	Sensor pocket		1
29	Solar stat pocket		1
30	Solar coil connection		2
31	Secondary return		1
32	Solar stat pocket east		1
33	Solar stat pocket west		1

Table 2.11

For ordering spare parts see page 53.

Solar Aerocyl Plus-me: HU250CP

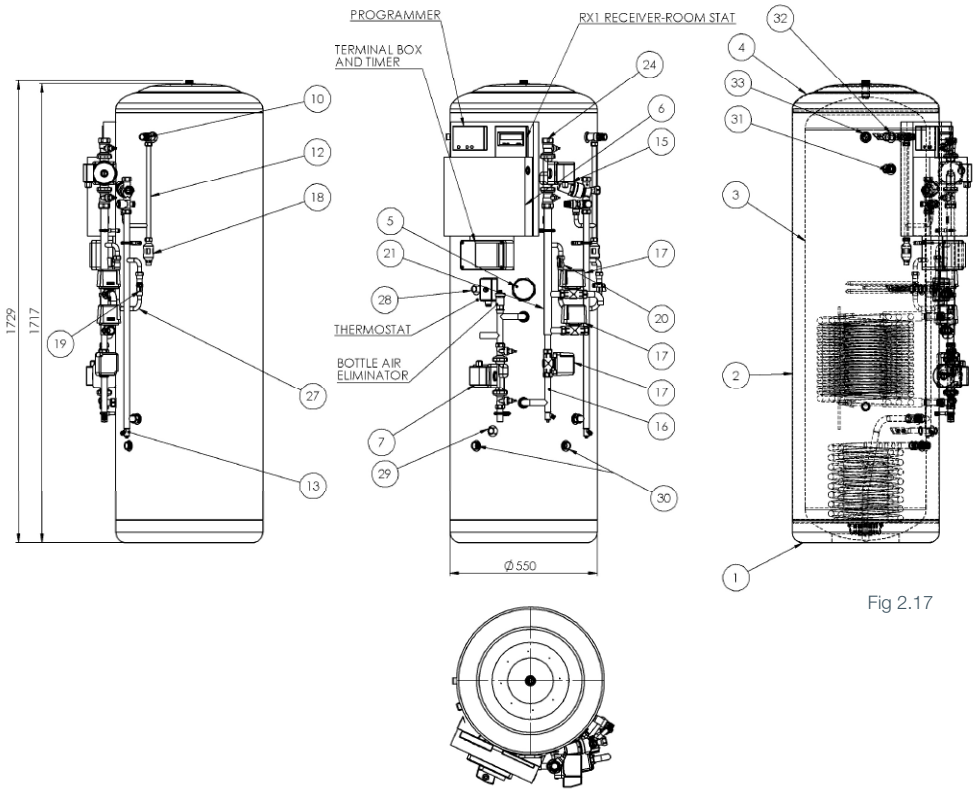


Fig 2.17

Item No.	Brief Description	Description	Qty.
1	Bottom 550	550Ø Bottom-White	1
2	HP-Case-MITSI	Punched Zintec Case-Sheet	1
3	BV-HP-MITSI		1
4	Top 550	550Ø Top-White	1
5	Immersion heater	Immersion heater 1 3/4 inch	1
6	Mitsubishi controls		1
7	Pump assembly		2
10	T&P Valve		1
12	Pipe tundish		1
13	Tundish		1
15	TS301 CALEFFI		1
16	Pipe with drain cock		1

Item No.	Brief Description	Description	Qty.
17	2-port valve		3
18	Pipe Drain Cock		1
19	Flexi hose tap2		1
20	Flexi hose tap		1
21	Pipe pump st		1
24	Gate valve		4
27	Flexihose		1
28	Sensor pocket		1
29	Solar stat pocket		1
30	Solar coil connection		2
31	Secondary return		1
32	Solar stat pocket east		1
33	Solar stat pocket west		1

Table 2.12

For ordering spare parts see page 53.

Solar Aerocyl Plus-me: HU300CP

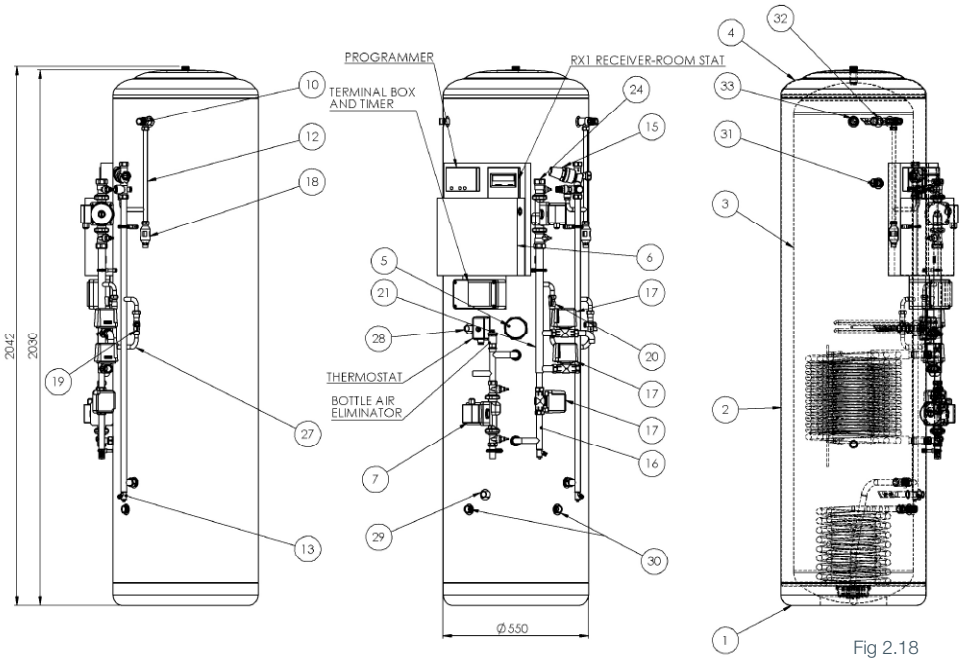


Fig 2.18

Item No.	Brief Description	Description	Qty.
1	Bottom 550	550Ø Bottom-White	1
2	HP-Case-MITSI	Punched Zintec Case-Sheet	1
3	BV-HP-MITSI		1
4	Top 550	550Ø Top-White	1
5	Immersion heater	Immersion heater 1 3/4 inch	1
6	Mitsubishi controls		1
7	Pump assembly		2
10	T&P Valve		1
12	Pipe tundish		1
13	Tundish		1
15	TS301 CALEFFI		1
16	Pipe with drain cock		1

Item No.	Brief Description	Description	Qty.
17	2-port valve		3
18	Pipe Drain Cock		1
19	Flexi hose tap2		1
20	Flexi hose tap		1
21	Pipe pump st		1
24	Gate valve		4
27	Flexihose		1
28	Sensor pocket		1
29	Solar stat pocket		1
30	Solar coil connection		2
31	Secondary return		1
32	Solar stat pocket east		1
33	Solar stat pocket west		1

Table 2.13

For ordering spare parts see page 53.

Aerocyl Plus-me Installation

Connecting to the Cylinder

All of the pipe work connections on the cylinder are 22mm compression and supplied complete with gland nuts and olives, in the Accessory Kit Box. Only connect 22mm copper tube to these connections.

Cut the tube with a pipe cutter and ensure no sharp edges or burrs protrude. Slide both gland nut and olive onto the tube and push tube fully home into the connection, ensuring the tube end fully bottoms on the connection recess.

Smear the outer wall of the olive with plumbing paste and tighten gland nut in the prescribed manner. Upon filling/commissioning, ensure all connections are completely watertight.

Note: No control or isolation valve should be fitted between the expansion relief valve and the storage cylinder. The relief valve connections should not be used for any other purpose.

Cold Mains Pipework

Run the cold main through the building to the place where the Aerocyl Plus-me is to be installed. Take care not to run the cold pipe near hot water or heating pipe work so that the heat pick-up is minimized. Identify the cold water supply pipe and fit an isolating valve (not supplied) A 22mm BS1010 stopcock can typically be used but a 22mm quarter turn full bore valve would be better as it does not restrict the flow as much. Do not use “screwdriver slot” or similar valves. Make the connection to the cold feed of the cylinder and incorporate a drain valve. Position drain valve no higher than the cold inlet to ensure sufficient draining of cylinder when required. Position the inlet control just ABOVE the Temperature & Pressure Relief Valve (TPRV) mounted on the side of the cylinder. This ensures that the cylinder does not have to be drained down in order to service the inlet control set.

Ensure that the arrow points in the direction of the water flow. Select a suitable position for the expansion vessel. Mount it to the wall using appropriate fixings for the wall. Consider the max weight of the vessel when full of water. Connect the expansion vessel to the cold feed pipe work between the inlet control set and the cold inlet. Ensure that the top of the vessel is accessible for servicing.

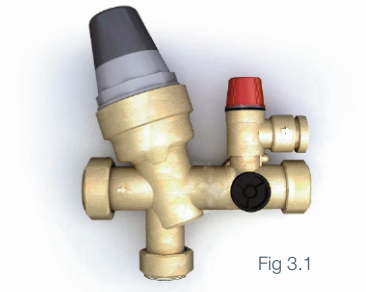


Fig 3.1

Balance Cold Connection

If there are to be showers, bidets or monobloc taps in the installation then a balanced cold supply is necessary. There is a 22mm balanced connection on the inlet control group.

Hot water pipework

Run the first part of the hot water distribution pipe work in 22mm. This can be reduced to 15mm and 10mm as appropriate for the type of tap etc. Your aim should be to reduce the volume of the hot draw off pipe work to a practical minimum so that the time taken for the hot water is as quick as possible. Where monobloc mixing taps and showers are used, these should be installed to comply with the Water Supply (Water Fittings) Regulation 1999. If these devices are supplied with un-balanced supplies there should be single check valves installed at both inlets, to stop over pressurising of either supply. Select a suitable position for the expansion vessel. Mount it to the wall using the bracket provided and connect to the inlet control set with the flexible hose provided. Ensure that the top of the vessel is accessible for servicing.

Primary Coil Connections

Connect the primary connections using the compression connections provided. The primary circuit must be positively pumped. Gravity circulation is not suitable. Either primary connection may be used as the primary flow. Reheat times are identical either way. The primary circuit can be open vented or sealed with up to a maximum pressure of 3.5 bar. If you seal the primary circuit an additional expansion vessel and safety valve is required. The Heat Pump must operate under effective thermostatic control. Uncontrolled heat sources are NOT SUITABLE. Please contact our technical department for guidance. Connect the two port zone valve into the primary flow pipe work. The direction of flow arrow should be towards the primary flow connection. On twin coil solar input cylinders we have provided an extra thermostat boss should you wish to use it.

Secondary Circulation

Aerocyl Plus-me can be used with secondary circulation. An appropriate WRAS approved bronze circulator should be used in conjunction with a non-return valve to prevent backflow. On large secondary circulation systems it may be necessary to incorporate an extra expansion vessel into the circuit to accommodate the increased system water volume. Secondary circulation should be avoided on Direct electrically heated units being used on off peak electricity tariffs. A secondary return boss is fitted as standard on 210, 250 and 300L. On smaller sizes tee into the cold feed pipe above the drain.

Check and tighten all mechanical joints prior to commissioning including any factory made connections. Cap and seal 2nd heating zone valve outlet if not in use to avoid possible leaks on models 180 and above.

Immersion Heaters

Only immersion heaters with a thermal cutout may be used. To help ensure this the immersion heaters have a special 2¼" BSP thread. They are rated at 3kW at 240 V and are of low noise Incoloy construction. They have both a thermostat and a high limit cutout. Please order the correct replacement, fitting non-approved immersions may affect your guarantee. When fitting, ensure the 'O' ring is positioned correctly on the head of the immersion heater and lubricate before fitting. Fit it by hand until almost home then tighten gently as the 'O' rings will seal easily. The electrical supply to each immersion heaters must be fused at 13A via a double pole isolating switch to BS 3456. The cable must be at least 2.5mm^2 heat resistance (85°C HOFR) sheathed flex complying to BS 6141:1981. Do not operate the immersion heater/s until the unit is full of water. Do not operate the immersion heater/s if any sterilisation liquid is in the cylinder as this will cause premature failure. To complete the wiring use the appropriate wiring diagrams on pages 29-30.

Solar Connections

These models are specifically designed to be installed with input from solar thermal panels and the Heat Pump: It is essential the overall installation meets all current legislation including, in particular, the high limit isolation requirements of Building Regulation G3. This document is designed to assist in achieving this aim.

Upper Coil

The upper coil is connected to the Heat Pump as per the instructions on page 23.

Lower Coil

The lower coil is connected to the solar heat source. Either primary coil connection may be utilised as the flow or return. Please follow installation instructions for the solar thermal panel system controls you have purchased.

Discharge Arrangement

Position the inlet control group so that the discharge from both safety valves can be joined together via a 15mm end feed Tee (see diagram above).

Connect the Tundish and route the discharge pipe. The discharge pipework must be routed in accordance with Part G3 of schedule 1 of the Building Regulations. The information that follows is not exhaustive and if you are in doubt you should seek advice. The two safety valves will only discharge water under fault conditions. When operating normally water will not be discharged. The tundish should be vertical, located in the same space as the unvented hot water storage system and be fitted as close as possible to, and lower than, the safety device, with no more than 600mm of pipe between the valve outlet and the tundish.

Any Discharge should be visible at the tundish. The tundish should be located such that any discharge is visible. In addition, where discharges from safety devices may not be apparent, e.g. people with impaired vision or mobility, consideration should be given to the installation of a suitable safety device to warn when discharge takes place, e.g. electronically operated.

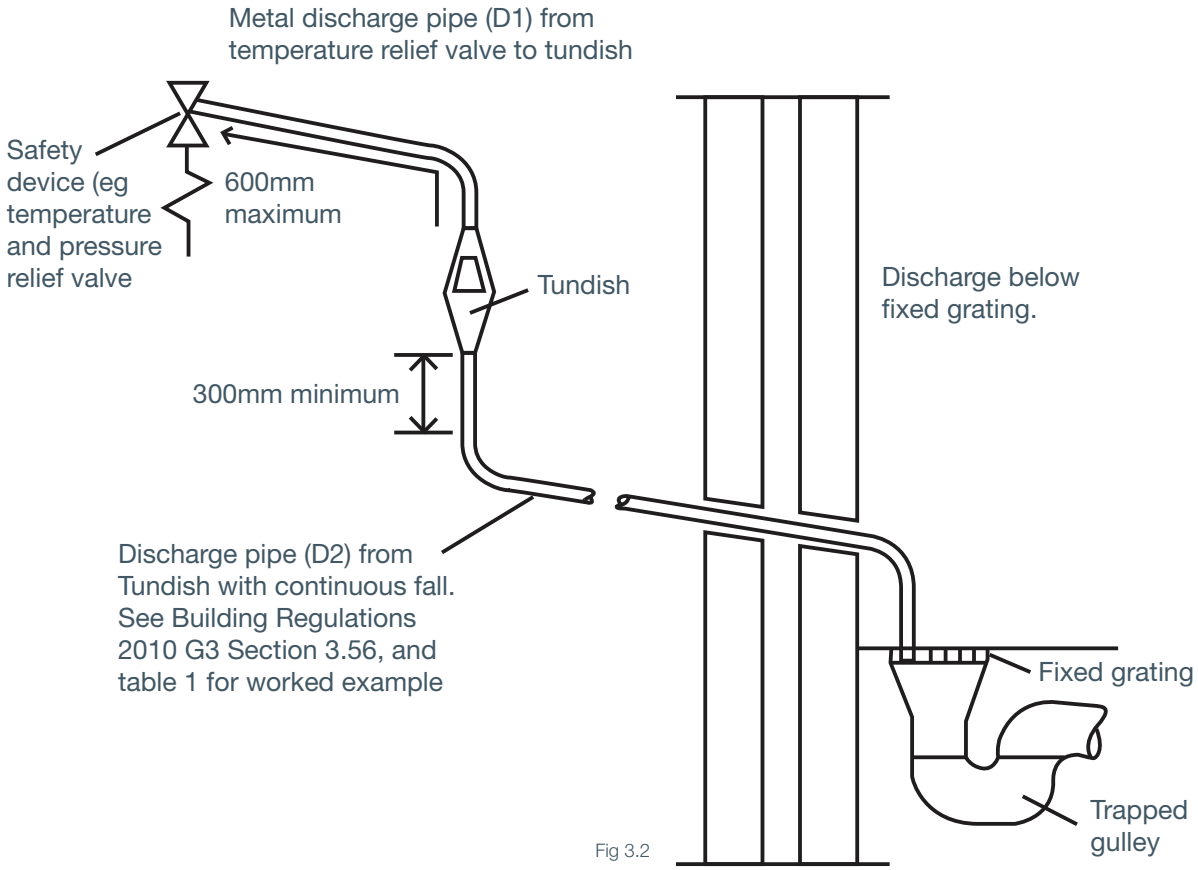


Fig 3.2

Note: The discharge will consist of scalding water and steam. Asphalt, roofing felt and non-metallic rainwater goods may be damaged by such discharges.

Note: D2 pipe from tundish is now allowed to be installed in soil stacks within premises. This activity is not recommended by Kingspan as discharge from T&P may continue for long periods of time. It is the installers responsibility to ensure the discharge pipework can support the discharge for prolonged periods. If used follow guidance on mechanical seal without water trap given in G3 Building Regulations. As discharge can be in excess of 90ºC discharge into plastic pipework is also not recommended.

The discharge pipe (D2) from the tundish should:

A) Have a vertical section of pipe at least 300mm long, below the tundish before any elbows or bends in the pipework.

B) Be installed with a continuous fall of at least 1 in 200 thereafter.

The discharge pipe (D2) from the tundish should be of metal or other material that have been demonstrated to be capable of withstanding temperatures of the water discharged.

The discharge pipe (D2) should be at least one pipe size larger than the nominal outlet size of the safety device unless its total equivalent hydraulic resistance exceeds that of a straight pipe 9m long i.e. discharge pipes between 9m and 18m equivalent resistance length should be at least two sizes larger than the nominal outlet size of the safety device, between 18 and 27m at least 3 sizes larger, and so on. Bends must be taken into account in calculating the flow resistance. Refer to Fig 3.2 and the worked example. An alternative approach for sizing discharge pipes would be to follow BS6700 Specification for design installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages.

The discharge pipe (D2) should terminate in a safe place where there is no risk to persons in the vicinity of the discharge. Examples of acceptable discharge arrangements are:

A. To a trapped gully with the end of the pipe below the fixed grating and above the water seal.

B. Downward discharges at a low level; i.e. up to 100mm above external surfaces such as car parks, hard standings, grassed areas etc. are acceptable providing that where children play or otherwise come into contact with discharges, a wire cage or similar guard is positioned to prevent contact whilst maintaining visibility.

C. Discharges at a high level; e.g. in to metal hopper and metal down pipe with the end of the discharge pipe clearly visible or onto a roof capable of withstanding high temperature discharges of water and 3m from any plastic guttering systems that would collect such discharges.

D. Device to warn when discharge takes place.

WORKED EXAMPLE

The example below is for G1/2 temperature relief valve with a discharge pipe (D2) having 4 No. elbows and length of 7m from the tundish to the point of discharge.

From Table 3.1:

Maximum resistance allowed for a straight length of 22mm copper discharge pipe (D2) from a G1/2 temperature relief valve is: 9.0m. Subtract the resistance for 4 No. 22mm elbows at 0.8m each = 3.2m. Therefore the maximum permitted length equates to: 5.8m. 5.8m is less than the actual length of 7m therefore calculate the next largest size. Maximum resistance allowed for a straight length of 28mm pipe (D2) from a G1/2 temperature relief valve equates to: 14m. As the actual length is 7m, a 28mm (D2) copper pipe will be satisfactory.

Sizing of copper discharge pipe 'D2' for a temperature relief valve with a G1/2 outlet (as supplied)		
Size of discharge pipework	Maximum length of straight pipe (no bends or elbows)	Deduct the figure below from the maximum length for each bend or elbow in the discharge pipe
22mm	Up to 9m	0.8m
28mm	Up to 18m	1m
35mm	Up to 27m	1.4m

Table 3.1

Model Selection Data

When checking the suitability of the heat pump it is recommend that a complete heat loss calculation is completed for the external building fabric the ventilation losses under worst case outside temperatures (peak heat losses). This should then be directly compared to the Ecodan® 5kW, 8.5kW or 14kW models. Software is available from Mitsubishi Electric to help with such calculations if required. For new build properties which have had a SAP assessment undertaken it is possible to calculate the peak heat losses by using the SAP report.

Fernox TF1 filter (p58)

A Fernox TF1 filter is provided with the package, this must be fitted internally on the return circuit as close to the heat pump as possible. It should be installed fully in accordance with the manufacturers instructions included later in the manual.

Flow Setter Valve

A flow setter Valve is provided with the package to give an indication of the water flow rate through the primary pipework. Each model of Ecodan® has a minimum and a maximum flow rate shown in table 3.2 which must be achieved for the system to operate correctly.

Anti-Vibration Equipment

Flexible hoses are supplied with the Ecodan® package and should be installed to connect the heat pump to the system pipework. Anti-vibration mountings (i.e. Tico-pad) should be installed under the mountings of the heat pump to prevent excessive vibration. Rubber anti-vibration fix it feet can be purchased from Mitsubishi Electric which have the dual purpose of raising the unit from ground level (useful in snow prone locations) and reducing vibration.

Heating System Bypass

Automatic bypass valves will be required in the heating systems if it is proposed to fit thermostatic radiators valves (TRV's) to all radiators or fit zone valves to control all the separate heating circuits. To meet the requirements of Building Regulations for a boiler interlock, it is recommended that the radiator are where the room thermostat is installed should be fitted with lock shield valves on both connections. By leaving at least 1 radiator with no TRVs you can create an open bypass.

The valve can be installed in either the flow or return pipework to the Ecodan®. A flow rate indication can then be taken from the bottom of the float.

Fig 3.3

Ecodan® required system flow rate		
Model	Minimum Flow Rate (l/m)	Maximum Flow Rate (l/m)
PUHZ-W50VHA-BS	6.5	14.3 *
PUHZ-W85VHA(2)-BS	10	25.8 *
PUHZ-HW140VHA(2)-BS	17.9	40.1 *
PUHZ-HW140YHA(2)-BS	17.9	40.1 *

* To achieve good system efficiencies higher flow rates are recommended.

Table 3.2

Pipework between Ecodan® and Aerocyl Plus-me	
Model	Pipework size
PUHZ-W50VHA-BS	22mm
PUHZ-W85VHA(2)-BS	22mm
PUHZ-HW140VHA(2)-BS	28mm
PUHZ-HW140YHA(2)-BS	28mm

Table 3.3

Electrical Work

All electrical work should be completed as recommended in the relevant Ecodan® installation guide supplied with the heat pump. These are also available to download from www.mitsubishielectric.co.uk/heating

Notes:
1. Wiring size must comply with the applicable local and national codes.

2. Power supply cables and the cables between Interface unit/Flow temp. controller and outdoor unit shall not be lighter than polychloroprene sheathed flexible cables. (Design 60245 IEC 57)

3. Be sure to connect the cables between Interface unit/Flow temp. controller and outdoor unit directly to the units (no intermediate connections are allowed). Intermediate connections may result in communication errors. If water enters at the intermediate connection point, it may cause insufficient insulation to ground or a poor electrical contact . (If an intermediate connection is necessary, be sure to take measures to prevent water from entering the cables.)

4. Install an earth longer than other cables.

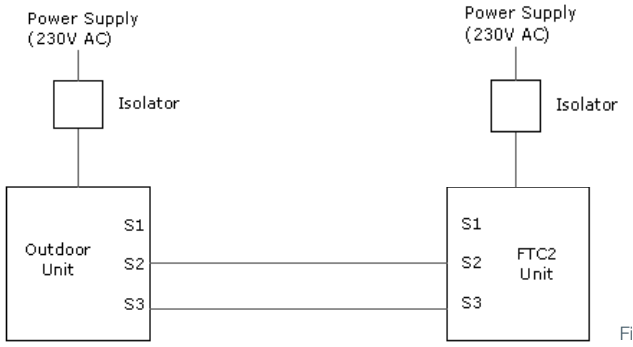


Fig 3.4

Warning:
In case of A-control wiring, there is high voltage potential on the S3 terminal caused by electrical circuit design that has no electrical insulation between power line and communication signal line. Therefore, please turn off the main power supply when servicing.

Electricity Supply
A mains supply rated to suit the capacity of the Ecodan® is required, this must have a means of isolation within 1 metre of the appliance itself. The circuit and heat pump should be protected by a 30mA rated RCD. This appliance MUST BE EARTHED. All external wiring to the appliance must be in accordance with the latest I.E.E. Wiring Regulation, and any local regulations which may apply.

The appliance shall be supplied from a suitably rated double pole isolator with a contact separation of at least 3mm in both poles. In the event of an electrical fault after installation of the appliance, electrical checks must be carried out i.e. Earth Continuity, Short Circuit, Polarity, and Resistance to Earth. The heat pump MUST BE DISCONNECTED BEFORE these tests are carried out.

The 2 core interconnecting cable between the FTC2 and Ecodan® no longer carries 240V potential

Care should be taken not to run communication cables (flow sensor, remote controller cable) close to or with mains 240 volt cables.

Control equipment (pumps, zone valves, thermostats etc) must have a separate circuit from the Ecodan® system and should be protected by the required fuse rating.

Simple Wiring Schematic

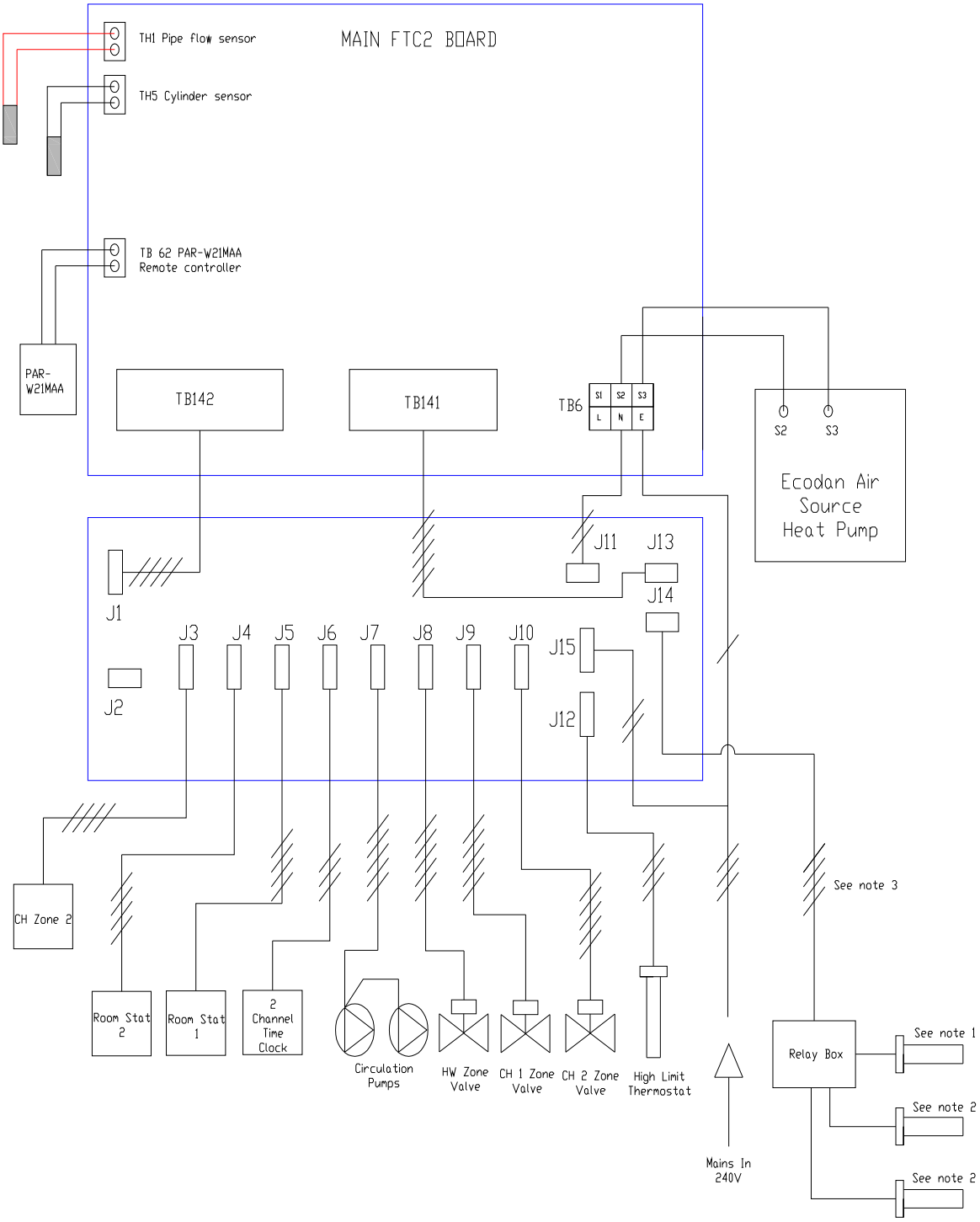


Fig 3.5

Detailed Wiring Schematic

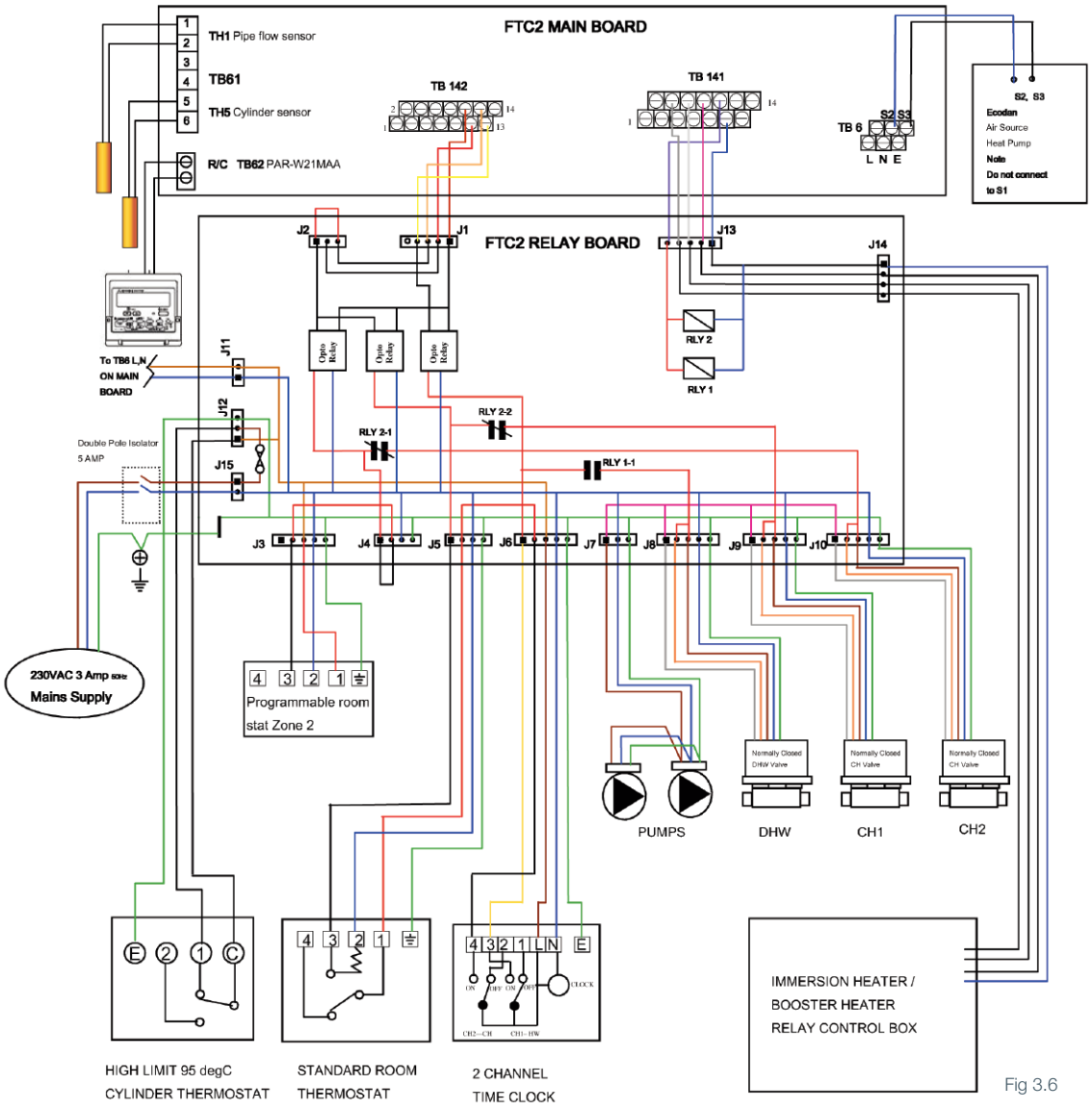


Fig 3.6

Notes:	J ref	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5
2 Channel time clock	J6	DHW	CH1	L	N	E
Time Switch Zone2	J3		CH2	L	N	E
Room Stat Zone 1	J5	S/L	L	N	E	
Room Stat Zone 2	J4	S/L	L	N	E	
Hot Water Valve	J8	S1	S2	L	N	E
Heating Valve 1	J9	S1	S2	L	N	E
Heating Valve 2	J10	S1	S2	L	N	E
Pump	J7	L	N	E		
Mains Power In	J15	L	N			
Tank over temp	J12	S1	S2	E	Short Pins 1-2 = heating only systems	
Heat Eco-Heat	J2	Short Pins 1-3 = Eco-heat , Short Pins 1-2 = Boost Heat				
Immersion/Boost	J14	N	Imm.Heat	Boost 2	Boost 1	

Pin numbers, Square Pin = Pin1

System Wiring Diagram

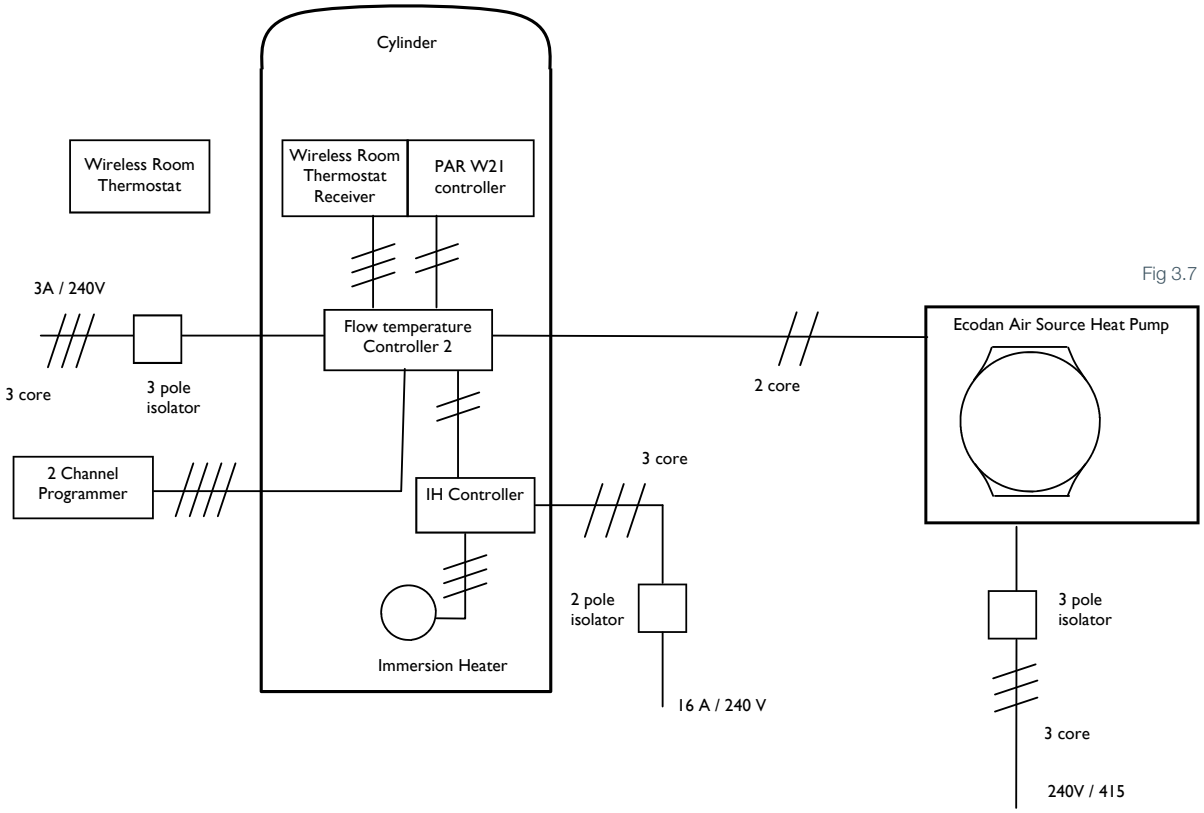


Fig 3.7

Important Note:
Please be aware that if the wiring configuration is used the warning label supplied with the FTC2 must be attached to the front panel of the FTC 2 to indicate the equipment has two sources of isolation in the event of this type of connection (not recommended). See table 3.6 (page 36) for full electrical specification.

Ecodan® Installation Manual

Safety Precautions:-

WARNING:
Precautions that must be observed to prevent injuries or death.

CAUTION:
Precautions that must be observed to prevent damages to the unit. After installation, perform the test run to ensure normal operation. Then explain to your customer the “Safety Precautions” use and maintenance of the unit based on the information in the Operation Manual.

Indicates a part which must be grounded

WARNING:
Carefully read the labels attached to the unit.

WARNING:
The unit must not be installed by the user. Ask an Installer or an authorized technician to install the unit. If the unit is installed improperly, water leakage, electric shock or fire may be caused.

The unit must be installed according to the instructions in order to minimize the risk of damages by earthquakes, typhoons or strong winds. An improperly installed unit may fall down and cause damages or injuries. The unit must be securely installed on a structure that can sustain its weight. If the unit is mounted on an unstable structure, it may fall down and cause damage or injury.

All electric work must be performed by a qualified technician according to local regulations and the instructions given in this manual. The units must be powered by dedicated power lines and the correct voltage and circuit breakers must be used. Power lines with insufficient capacity or incorrect electrical work may results in electric shock or fire.
Only the specified cables can be used for wiring, Connections must be made securely without tension on the terminals. If cables are connected or installed improperly, it may result in overheating or fire.
Terminal block cover panel of the outdoor unit must be firmly fixed. If the cover panel is mounted improperly, dust and moisture may enter the unit, and it may cause electric shock or fire. Make sure to use accessories authorized by Mitsubishi Electric and ask an installer or authorized technician to install them. If accessories are improperly installed, it may cause water leakage, electric shock or fire.

Do not remodel the unit. Consult an installer for repairs. If alterations or repairs are not performed correctly, it may cause water leakage, electric shock or fire.

The user should never attempt to repair the unit or transfer it to another location. If the unit is installed improperly, it may cause water leakage, electric shock or fire. If the air to water heat pump needs to be repaired or moved, ask an installer or an authorized technician.

After installation has been completed, make sure that refrigerant does not leak. If refrigerant leaks and comes into contact with a flame, poisonous gases will be released.

Use clean water which meets water quality standards. The deterioration of water quality may result in the system breakdown or water leakage.

Never use anything other than water as a medium. It may cause a fire or an explosion.

Do not use heated water that is produced by the heat pump directly for drinking or cooking. There is a risk to damage your health. There is also a risk that installing the water heat exchanger may corrode if the necessary water quality for the air to water heat pump system cannot be maintained. If you wish to use the heated or cooled water from the heat pump for these purposes, take measures such as to isolate the second heat exchanger within the water piping system.

BEFORE INSTALLATION
CAUTION:
Do not use the unit in an unusual environment. If the heat pump is installed exposed to steam, volatile oil (including machine oil), sulphuric gas, exposed to briny air, or covered with snow, the performance can be significantly reduced and the internal parts can be damaged.

Do not install the unit where combustible gas accumulates around the unit, it may cause fire or explosion. The outdoor unit produces condensate during the heating operation. Make sure to provide drainage around the outdoor unit if such condensate is likely to cause problems such as freezing over in cold weather. When installing the unit within the grounds of a hospital or a building where communication equipment is installed, you may need to take measures to reduce noise and electronic interference.

Inverters, home appliances, high-frequency medical equipment and radio communications equipments can cause the air to water heat pump to malfunction or to breakdown. At the same time, the noise and electronic interference from the air to water heat pump unit may disturb the proper operation of medical equipment, and communications equipment.

BEFORE INSTALLATION (RELOCATION)
CAUTION:
Be fully careful when moving units. The unit must be carried by at least 2 people, as it weighs 60kg or more. Do not hold the packaging bands. Wear protective gloves to unpack and to move or install it, in order to hands being injured by fins or the edge of other parts.

Be sure to safely dispose of the packaging materials. Packaging materials, such as nails and other metal or wooden parts may cause injuries. The base of the outdoor unit must be periodically checked to ensure it is not loose, cracked or damaged. If such defects are left untreated the unit may fall down and cause damage or injuries. Do not wash the heat pump unit. You may receive an electric shock.

BEFORE ELECTRIC WORK
CAUTION:
Be sure to install a circuit breaker. If it is not installed, there may be a risk of electric shock. For the power lines, use standard cables of sufficient capacity. Otherwise, it may cause a short circuit, overheating or fire. When installing the power lines, do not apply tension to the cables. The cables may be cut or overheated resulting in a fire. Make sure to ground the unit. Do not connect the ground wire to gas or water pipes, lightning rods, or telephone grounding lines. If the unit is not properly grounded, there may be a risk to get an electric shock. Make sure to sue circuit breakers (ground fault interrupted, isolating switch (+B fuse), and moulded case circuit breaker) with the specified capacity. If the circuit breaker capacity is larger than the specified capacity, breakdown or fire may result.

BEFORE STARTING THE TEST RUN CAUTION:
Turn on the main power switch more than 12 hours before starting operation. Starting operation immediately after turning on the power switch can severely damage the internal parts. Keep the main power switch turned on during the operating period. Before starting operation, check that all panels, guards and other protective parts are correctly installed. Make sure not to get injured by touching rotating, hot or high voltage parts.

Do not touch any switch with wet hands. There may be a risk of an electric shock. Do not touch the refrigerant pipes with bare hands while the unit is running. The refrigerant pipes can be hot or cold depending on the condition of the flowing refrigerant. There may be a risk to get burn or frostbite. After stopping operation, make sure to wait at least five minutes before turning off the main power. Otherwise, it may cause water leakage or breakdown.

Installation Location:

CHOOSING THE OUTDOOR UNIT INSTALLATION LOCATION
Avoid locations where the unit is exposed to direct sunlight or other sources or heat.

Select a location where the noise emitted by the unit does not disturb neighbours.

Select a location where easy wiring and pipe access to the power source is available.

Avoid locations where combustible gases leak, be produced, flow, or accumulate.

Note that condensate water may be produced by the unit during operation.

Select a level location that can bear the weight and vibration of the unit.

Avoid locations where the units can be covered with snow. As in areas where heavy snow fall is anticipated, special precautions must be taken to prevent the snow from blocking the air intake such as install the unit at higher position or installing a hood on the air intake. As this can reduce the airflow and the unit may not operate properly.

Avoid locations where the unit is exposed to oil, steam or sulphuric gas.

Make sure to hold the handles to transport the unit.

Do not hold the base of the unit, as there is a risk that hands or fingers may be trapped.

When installing the outdoor unit on a rooftop or other location where the unit is exposed to strong wind, do not face the air outlet of the unit directly into the winds. Strong wind entering the air outlet may impede the normal airflow and it may result in a malfunction.

The following shows three examples of precautions against strong winds. Face the air outlet towards the nearest available wall keeping about 50cm distance (fig 3.8) Install an operational air guide if the unit is installed in a location where strong winds such as a typhoon, etc, may directly blow to the air outlet. Position to the unit so that the outlet air can blow at right angle to the seasonal wind direction, if possible.

NECESSARY SPACE TO INSTALL

When installing a single outdoor unit (refer to page 37).
When installing multiple outdoor unit (refer to page 37)

Installation Procedure:

Be sure to install the unit on a solid, level surface to prevent rattling noises during operation. Make sure that the length of the foundation bolt is within 30mm from the surface of the base.Secure the base of the unit firmly with 4 M10 foundation bolts in solid locations.

INSTALLING THE OUTDOOR UNIT

Do not block the vent. If the vent is blocked, operation will be hindered and the unit may breakdown. If additional fixation of the unit is necessary, use the installation holes on the back of the unit to attach wires, etc, with self-tapping screws (Ø5 x 15mm or less).

WARNING:

The unit must be securely installed on a structure that can sustain its weight. If the unit is mounted on an unstable structure, it may fall down and cause damage or injuries. The unit must be installed according to the instructions in order to minimize the risk of damage by earthquakes, typhoons, or strong winds. An improperly installed unit may fall down and cause damage or injuries.

Drainage Piping Work:

Outdoor unit pipe connection. When drain piping is necessary, use the drain socket or the drain pan (option)

*There is no optional drain pan for the PUHZ-HW140VHA(2)/YHA(2).

Table 3.4

Optional Parts Name	Model Name
Drain Socket	PAC-SG61DS-E
Drain pan for 50/85	PAC-SG64DP-E

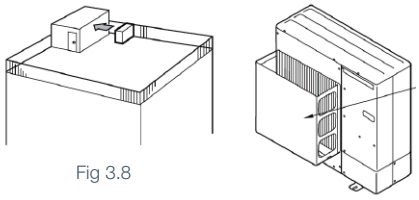
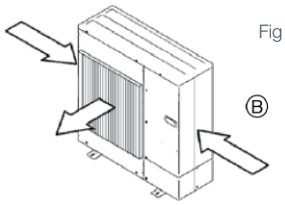


Fig 3.8

Fig 3.9



Foundation Specification	
Foundation bolt	M10 (3/8”)
Thickness of concrete	120mm
Length of bolt	70mm
Weight-bearing capacity	320kg

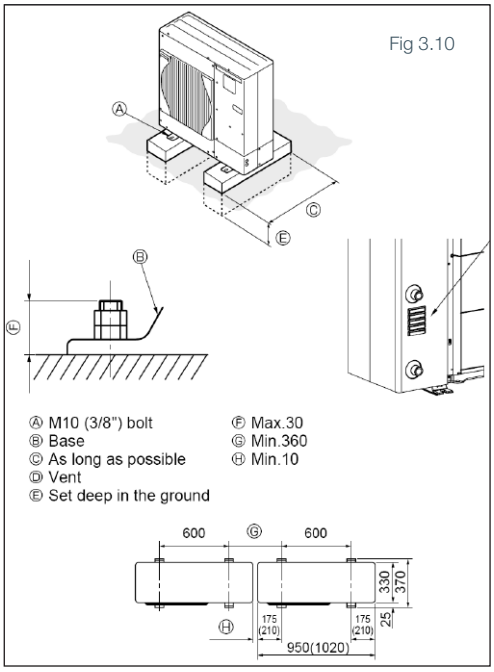
Table 3.5

Water Piping Work:-

WATER PIPING CONNECTION:

Connect the water pipes to the outlet and inlet pipes (ISO 228/1-G1B)
Inlet and outlet pipes position is shown on Fig 3.10
Install the hydraulic filter at the water intake.
Maximum allowance torque at the water piping connection is 50N/m
Check if water leaks after installation.
Inlet water gauge pressure must be between 0-0.3MPa.
Use the inlet water of higher than 5°C and lower than 55°C.

Fig 3.10



Note: The water velocity in pipes should be kept within certain limits of the material to avoid erosion, corrosion and excessive noise generation. Be aware, and take care of velocities in small pipes, bends and similar obstructions that can exceed the values above. E.g.) Copper : 1.5m/s

WATER QUALITY CONDITION:
The water in a system should be clean and with a pH value of 6.5-8.0

The following are the maximum values:
Calcium: 100mg/L
Chlorine: 100mg/L
Iron/Maganese: 0.5mg/L

Note: Make sure to perform the frozen prevention measure for water pipe system. (Water piping insulation, back-up pump system, using of a certain % ethylene glycol instead of normal water). Insulate the water piping properly. The performance can be poor if the insulation is insufficient.

WARNING
A the outlet water temperature can reach 60°C at maximum, do not touch the water piping directly with a bare hand.

Electrical Work:
OUTDOOR UNIT:
Remove the service panel
Wire the cables referring to the Fig 3.12 and the Fig 3.13

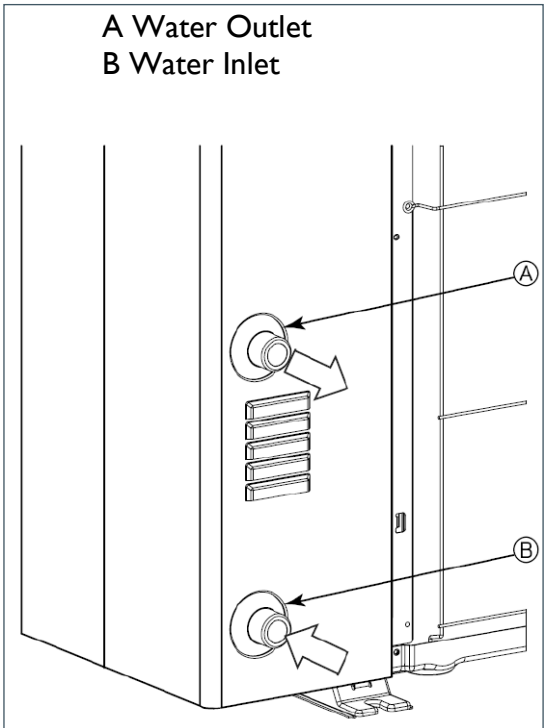
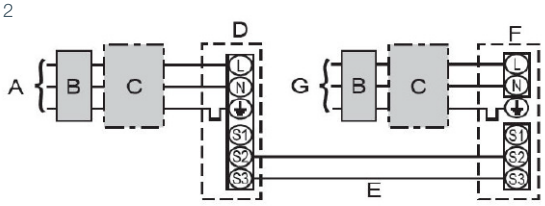


Fig 3.11

Fig 3.12



A Outdoor unit power supply
B Earth leakage breaker
C Wiring circuit breaker or isolating switch
D Outdoor unit
E Interface unit/outdoor unit connecting cables
F Interface unit
G Interface unit power supply

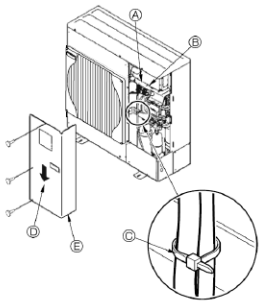
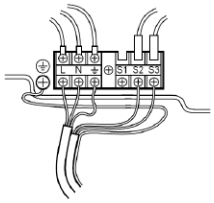


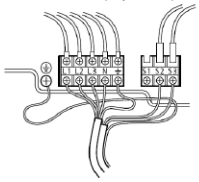
Fig 3.13

Ⓐ Earth terminal
Ⓑ Terminal block
Ⓒ Clamp
Ⓓ Service panel
Ⓔ Wire the cables so that they do not contact the center of the service panel.

■ 50-140V (Single phase)



■ 112-140Y (3 phase)



Outdoor unit model			PUHZ-W50VHA-BS	PUHZ-W85VHA(2)-BS	PUHZ-HW140VHA(2)-BS	PUHZ-HW140YHA(2)-BS
Outdoor unit power supply			~/N (single), 50Hz, 230V	~/N (single), 50Hz, 230V	~/N (single), 50Hz, 230V	3N (3 phase), 50Hz, 415V
Outdoor unit Circuit Breaker Capacity		*1	16 A	25 A	40 A	16 A
Wiring Wire No. x size (mm^2)	Outdoor unit power supply, earth		3 x Min. 1.5	3 x Min. 4	3 x Min. 6	5 x Min. 1.5
	Interface unit/flow temp. controller– outdoor unit	*2	2 x 1.5 (polar)	2 x 1.5 (polar)	2 x 1.5 (polar)	3 x 1.5 (polar)
	Interface unit/flow temp. controller– outdoor unit earth	*2	-	-	-	-
	Remote controller—Interface unit/ Flow temp. controller		2 x 0.3 (non-polar)	2 x 0.3 (non-polar)	2 x 0.3 (non-polar)	2 x 0.3 (non-polar)
Circuit rating	Outdoor unit L-N (single) Outdoor unit L1-N, L2-N, L3-N (3 phase)	*3	AC 230 V	AC 230 V	AC 230 V	AC 230 V
	Interface unit/Flow temp. controller-outdoor unit S1-S2	*3	-	-	-	-
	Interface unit/Flow temp. controller-outdoor unit S2-S3	*3	DC 24 V	DC 24 V	DC 24 V	DC 24 V
	Remote controller-Interface unit/Flow temp. controller	*3	DC 12 V	DC 12 V	DC 12 V	DC 12 V

Table 3.6

*1 A breaker with at least 3.0mm contact separation in each poles shall be provided.
Use earth leakage breaker (NV).

*2 Max. 80m

*3 The figures are NOT always against the ground. S3 terminal has DC 24V against S2 terminal.

Notes

1. Wiring size must comply with the applicable local and national codes.

2. Power supply cables and the cables between Interface unit/Flow temp. controller and outdoor unit shall not be lighter than polychloroprene sheathed flexible cables (Design 60245 IEC 57)

3. Be sure to connect the cables between Interface unit/Flow temp. controller and outdoor unit directly to the units (no intermediate connections are allowed). Intermediate connections may result in communication errors. If water enters at the intermediate connection point, it may cause insufficient insulation to ground or a poor electrical contact. (If an intermediate connection is necessary, be sure to take measures to prevent water from entering the cables.)

4. Install an earth longer than other cables.

WARNING:
In case of A-control wiring, there is high voltage potential on the S3 terminal caused by electrical circuit design that has no electrical insulation between power line and communication signal line. Therefore, please turn on the main power when servicing.

Location Requirements

Minimum Requirements for location of Ecodan®. Figures stated are in mm's, figures in brackets are for PUHZ-HW140 VHA(2)/YHA(2) units.

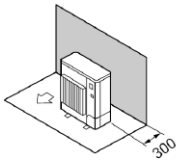


Fig 3.14

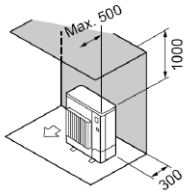


Fig 3.15

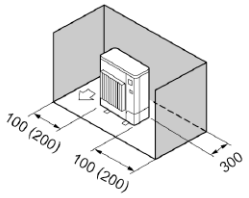


Fig 3.16

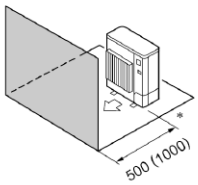


Fig 3.17

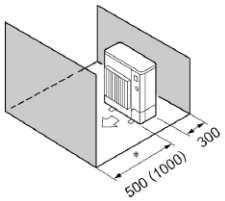


Fig 3.18

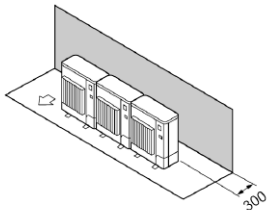


Fig 3.19

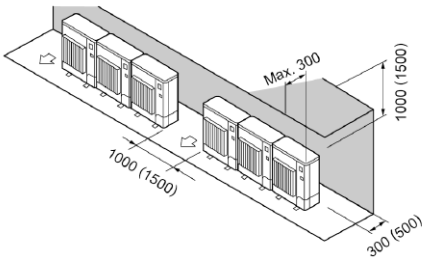


Fig 3.20

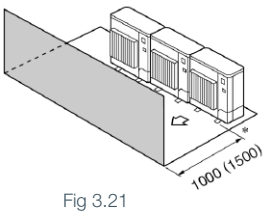


Fig 3.21

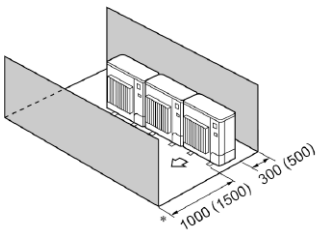


Fig 3.22

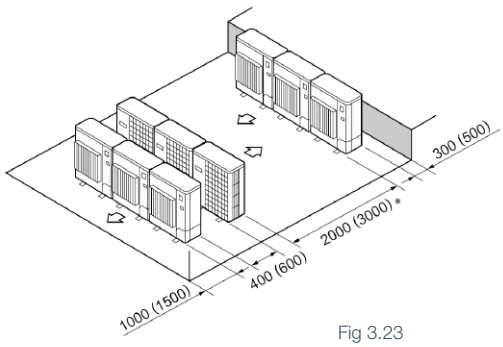
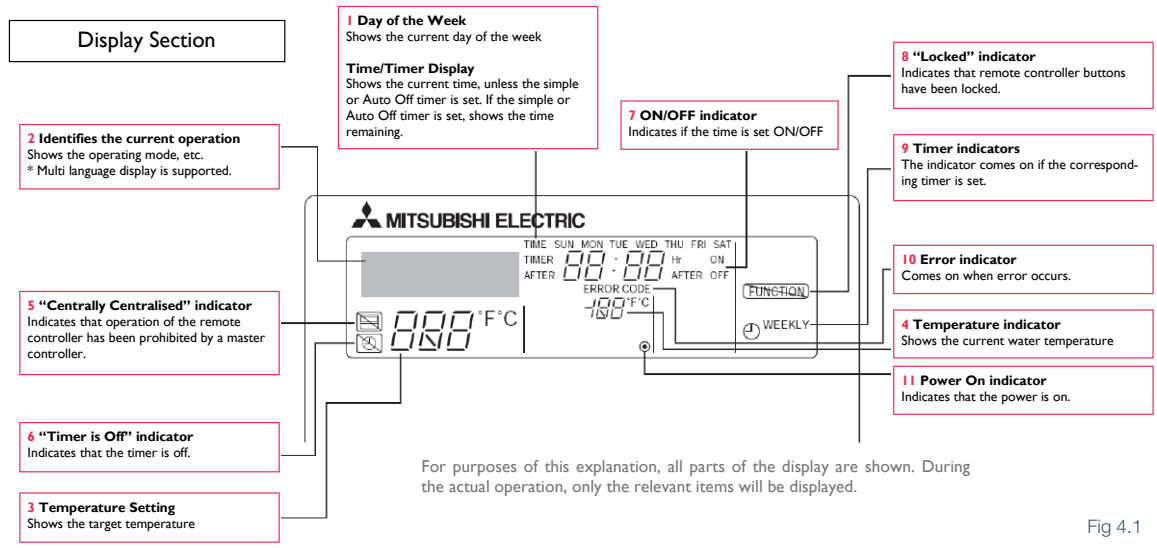


Fig 3.23

System Set-up Procedure

Controller: PAR-W21MAA

The PAR-W21MAA controller is used to optimise the running of the system, set-up the heating parameters and select the available modes. It should not be used for timing purposes instead use the 2 channel time clock. Listed below are all the available buttons and displays on the LCD screen. The following pages explain the setting up of the functions for the Ecodan® Aerocyl-me.



For purposes of this explanation, all parts of the display are shown. During the actual operation, only the relevant items will be displayed.

Fig 4.1

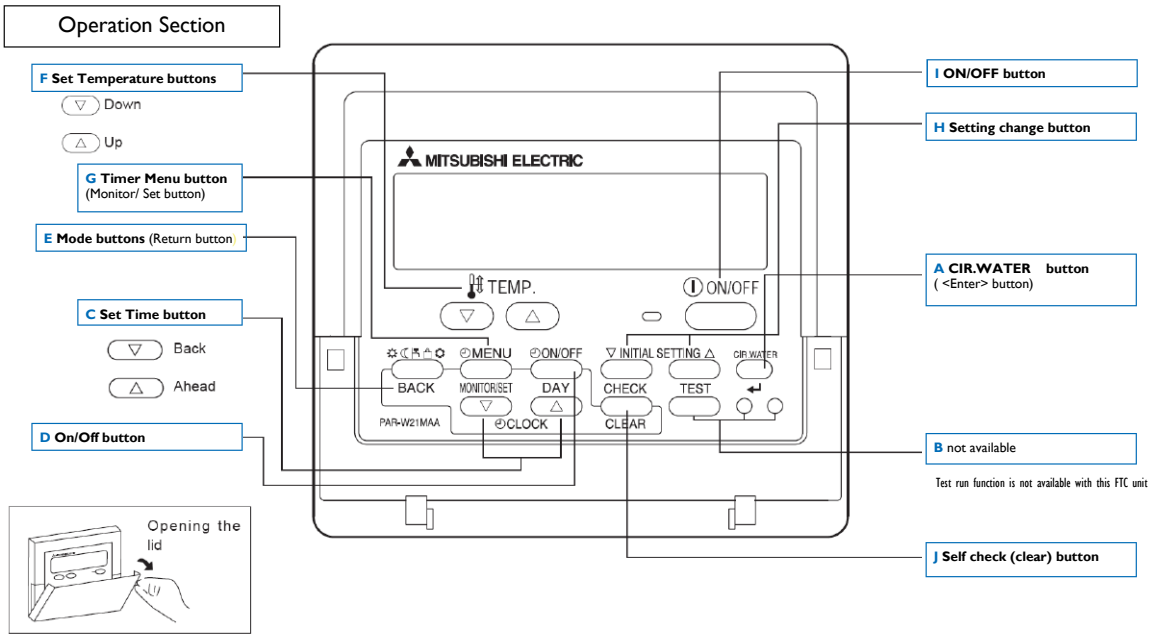
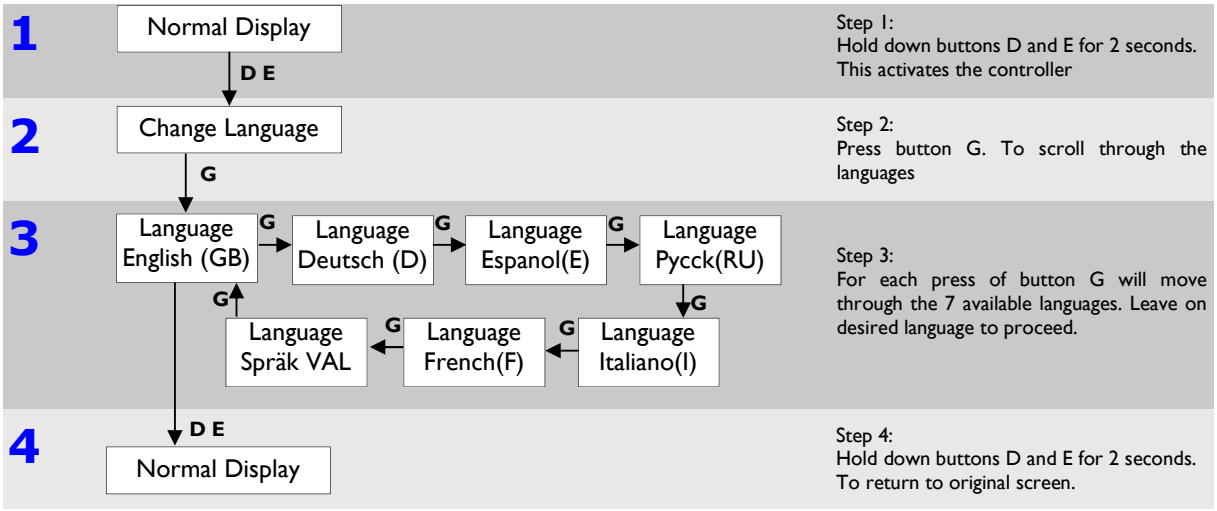


Fig 4.2

This icon is shown when there is no demand for either hotwater or central heating. On the display section it is represented by 5. No flow temperatures will be displayed on the screen.

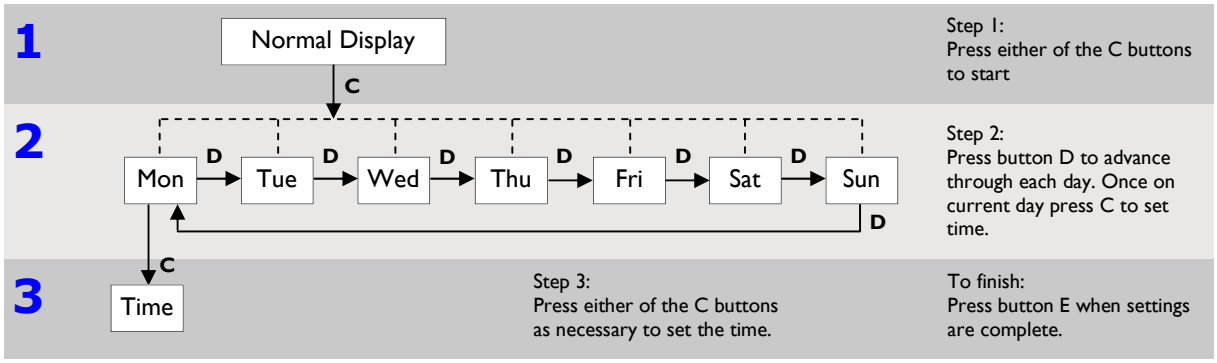
Change Language

The initial language setting is English. If you require to change this follow the 4 steps below. The instructions in this guide use English for the annotated displays, whatever language is selected the sequence combination of the buttons will not alter.



Setting day of the week and time

The day and time will run from the day the system is switched on. To change these settings please following instructions.



As you hold the C button down, the time (displayed at 1) will increment first in one minute intervals, then in ten minute intervals, and then in one hour intervals. This works in either direction.

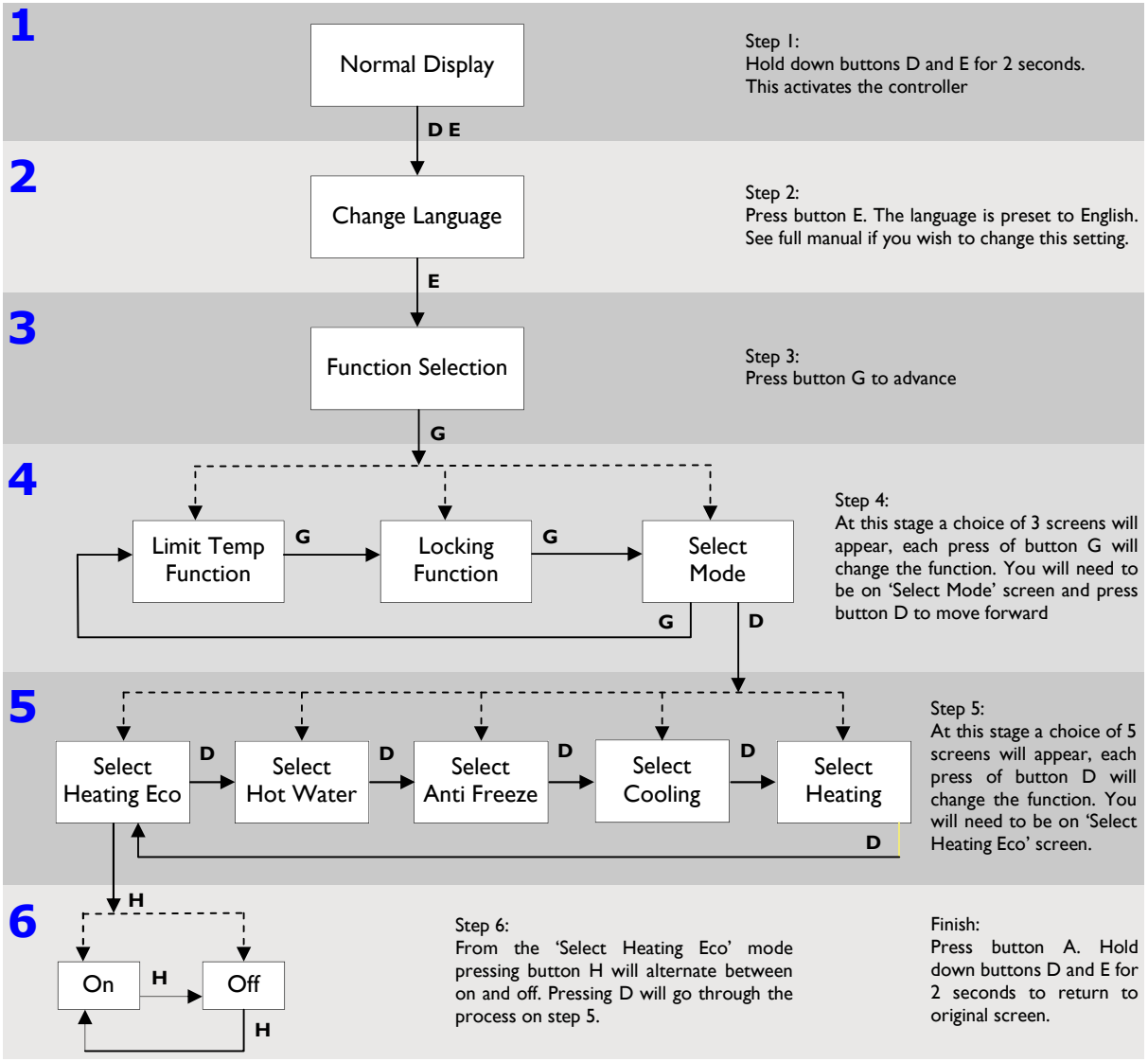
Note:
"PLEASE WAIT" message
This message is displayed for approximately 3 minutes when power is supplied to the FTC2 unit or when the unit is recovering from a power failure

"NOT AVAILABLE" message
This message is displayed if a button is pressed to operate a function that the FTC2 unit does not have, or a function that is not available due to the setting.

Throughout the system set-up buttons on the controller are referenced by letters and displays by numbers ; this key can be found on page 38

Heating Set-up (Heating Eco Mode)

There are two parts to this set-up the first is to make sure the required mode is switched on, the second part is to set the parameters of the heating. Whilst heating a property the 'eco heating' is the recommended mode to use; this setting is a heating function with weather compensation. This function sets the target temperature depending on the outdoor temperature. The recommended temperatures are listed on table 4.3 (page 45).



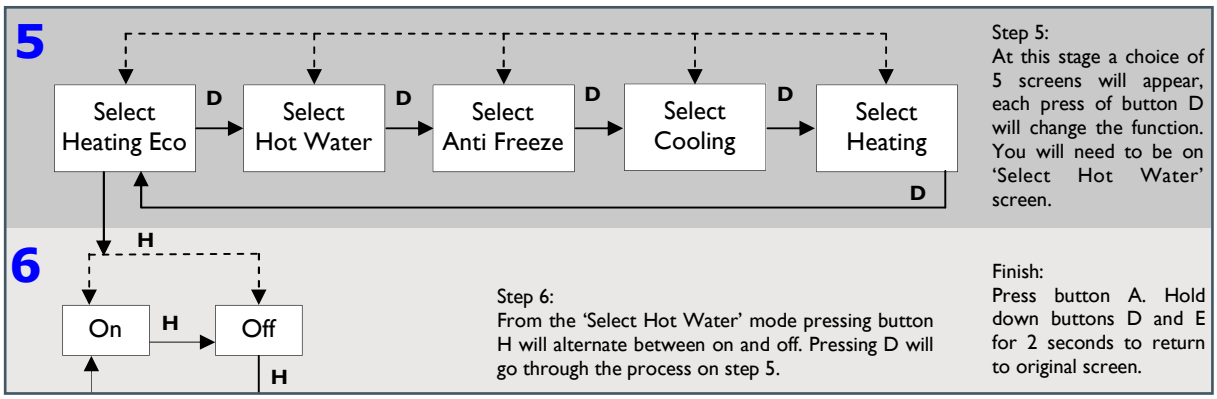
When setting up the controller, pressing button A must be used to memorize the settings.

Throughout the system set-up buttons on the controller are referenced by letters and displays by numbers ; this key can be found on page 38

What is on the screen	Flashing Temp. represents	Keypad selection	Notes
1. Normal mode		Hold down H for 3 seconds	This activates the controller, the display will flash with the words 'loading'
2. Water Temp Heating		Press E	This mode is not necessary and should be skipped
3. Water Temp Eco Heating No.1	Low Ambient Target Flow	Press D	Move up or down to desired temperature. Low ambient flow/ temperature is denoted by No.1
4. Water Temp Eco Heating No.1	Low Ambient Target Flow	Press E	Changes to next temperature variable
5. Water Temp Eco Heating No.1	Low Ambient Outdoor Temperature	Press D	Move up or down to desired temperature
6. Water Temp Eco Heating No.1	Low Ambient Outdoor Temperature	Press E	Changes to next temperature variable
7. Water Temp Eco Heating No.2	High Ambient Target Flow	Press D	Move up or down to desired temperature. High ambient flow/ temperature is denoted by No.2
8. Water Temp Eco Heating No.2	High Ambient Target Flow	Press E	Changes to next temperature variable
9. Water Temp Eco Heating No.2	High Ambient Outdoor Temperature	Press D	Move up or down to desire temperature
10. Water Temp Eco Heating No.2	High Ambient Outdoor Temperature	Press A	This will end the parameters that need to be set. Pressing D will return to step 3.
11. Water Temp Eco Heating No.2	High Ambient Outdoor Temperature	Hold down E	This must be pressed to memorize the settings. The screen will flash 'settings' for several

Hot Water Set-up

To set-up hot water uses a similar process to that of 'heating eco', please follow the first four steps (on the previous page) and continue with the instructions below.



Step 5:
At this stage a choice of 5 screens will appear, each press of button D will change the function. You will need to be on 'Select Hot Water' screen.

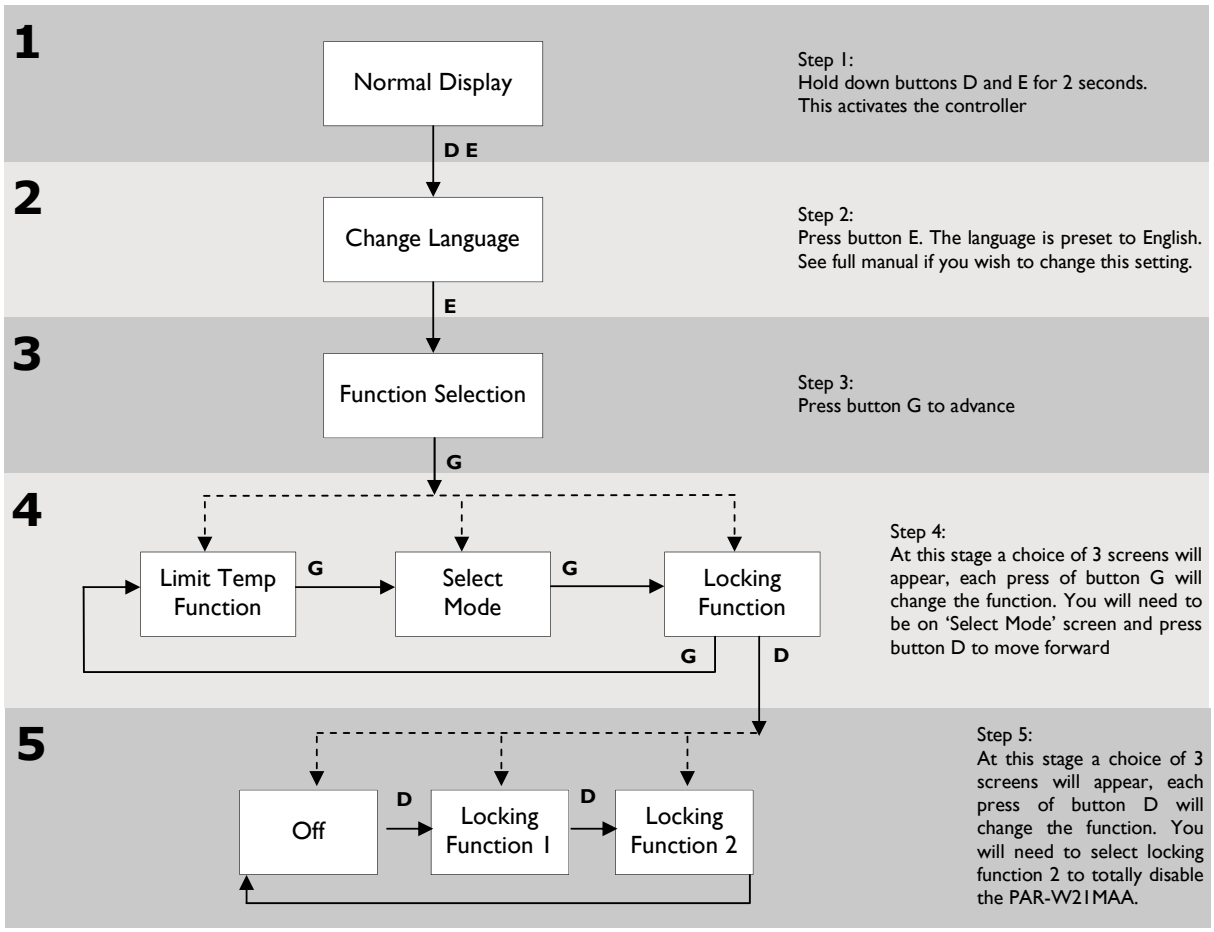
Step 6:
From the 'Select Hot Water' mode pressing button H will alternate between on and off. Pressing D will go through the process on step 5.

Finish:
Press button A. Hold down buttons D and E for 2 seconds to return to original screen.

Throughout the system set-up buttons on the controller are referenced by letters and displays by numbers ; this key can be found on page 38

Locking Function

To ensure that the Ecodan® is only operated by signals from the two channel programmer it is necessary to undertake the following procedure and lock the controller as part of the commissioning stage. When this function is activated it is not possible to unnecessarily operate the Ecodan when there is no demand for either central heating or hot water.



Finish:
Press button A. Hold down buttons D and E for 2 seconds to return to original screen.

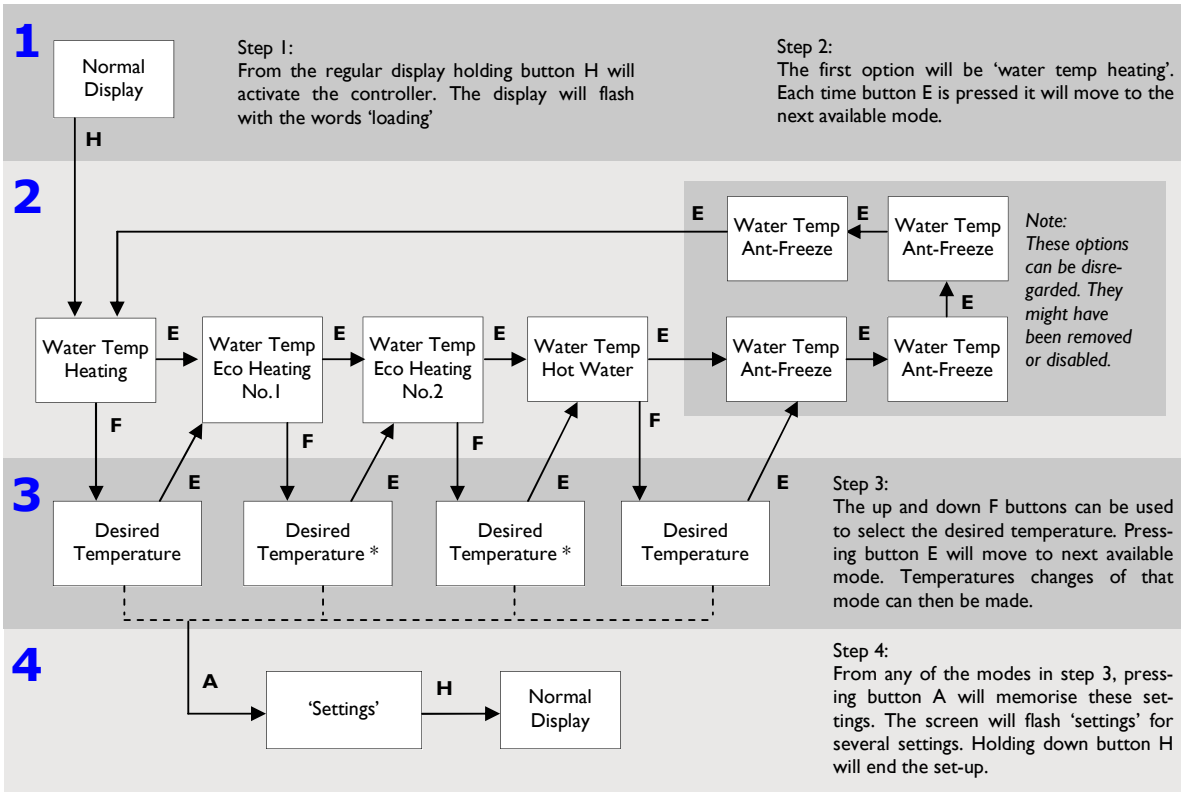
PAR-W21MAA Hot Water mode	Factory Settings	Recommended Settings
	50°C	55°C

Table 4.1

Throughout the system set-up buttons on the controller are referenced by letters and displays by numbers ; this key can be found on page 38

Available Modes

There is a selection of modes on the controller that the end user can choose for set-up purposes; please note that some of these may have been removed or disabled for use with the Ecodan® unit. From the normal display it will always skip progress to 'water temp heating', each press of button E will skip to the next available mode. When setting up the controller, pressing button A must be used to memorize the settings.



* There are two temperatures that need to be set, the target and outdoor temperatures. The up and down F buttons can be used to select the desired temperature. Button D will alternate between the two variables.

How to lock the Buttons

While holding down the button A, press and hold down the button I for 2 seconds. The "Locked" indication appears on the screen (display 8), indicating that the lock is now engaged. * If locking has been disabled in Function Selection of remote controller, the screen will display the "Not Available" message when you press the buttons as described above. If you press a locked button, the "Locked" indication (display 8) will blink on the display

How to Unlock the Buttons

1. While holding down the button A press and hold down the button I for 2 seconds
- so that the "Locked" indication disappears from the screen (display 8)

Fig 4.3

Throughout the system set-up buttons on the controller are referenced by letters and displays by numbers ; this key can be found on page 38

Error Codes Indication

If the ON lamp and display 10 are both blinking: This means that the Ecodan® ASHP is out of order and operation has been stopped (and cannot resume). Take note of the indicated unit number and error code, then switch off the power to the Ecodan® ASHP and call your installer.

If only the display 10 is blinking (while the ON lamp remains lit): Operation is continuing, but there may be a problem with the system. In this case, you should note down the error code and then call your installer for advice. If you have entered contact number to be called in the event of a problem, push the button J to display it on the screen.

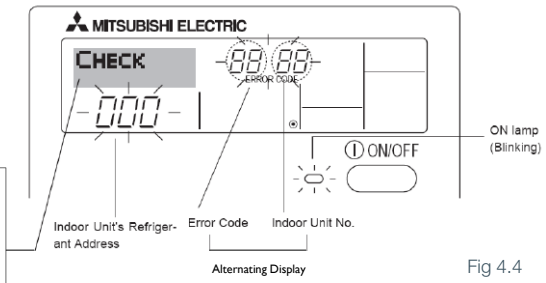


Fig 4.4

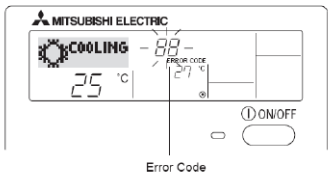


Fig 4.5

When the Check Button is pressed:

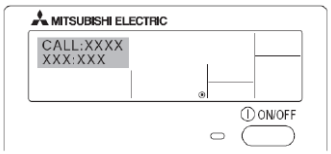


Fig 4.6

Display

The PAR-W21MAAhas many different functions that control the performance of the Ecodan®. Below are the symbols and displays used for each function.

Waiting for start-up		PLEASE WAIT
Operational Mode	Heating	HEATING
	Heating ECO	HEATING ECO
	Hot water	HOT WATER
	Anti-freeze	ANTI-FREEZE
	Stand by (Hot adjust)	STAND BY
	Defrost	DEFROST
Not in use button		NOT AVAILABLE
Check (Error)		CHECK
Test run		TEST RUN
Self check		SELF CHECK
Change language		CHANGE LANGUAGE
Language selection		LANGUAGE ENGLISH(GB)
Display change		DISP MODE SETTING
Temperature display °C/°F setting		TEMP MODE °C/°F

Table 4.2

Water temperature display		WATER TEMP DISP SELECT
Function selection		FUNCTION SELECTION
Operation function limit setting		LOCKING FUNCTION
Mode Skip setting		SELECT MODE
Mode skip	Heating	SELECT HEATING
	Heating ECO	SELECT HEATING ECO
	Hot water	SELECT HOT WATER
	Anti-freeze	SELECT ANTI-FREEZE
	Cooling	SELECT COOLING
Temperature range limit setting		LIMIT TEMP FUNCTION
Temperature range limit setting mode	Hot water	LIMIT TEMP HOT WATER
	Anti-freeze	LIMIT TEMP ANTI-FREEZE
	Cooling	LIMIT TEMP COOLING
Mode selection		MODE SELECTION
Use of clock setting		CLOCK
Setting the day of the week and time		TIME SET ↵:ENTER
Loading		LOADING...

Throughout the system set-up buttons on the controller are referenced by letters and displays by numbers ; this key can be found on page 38

When setting up the controller, pressing button A must be used to memorize the settings. Once these have been set-up, likewise with the heating a temperature needs to be set-up, these instructions are on the following page.

Heating Parameters

The weather compensation feature allows for higher temperatures to be achieved when the outdoor temperature is warmer.

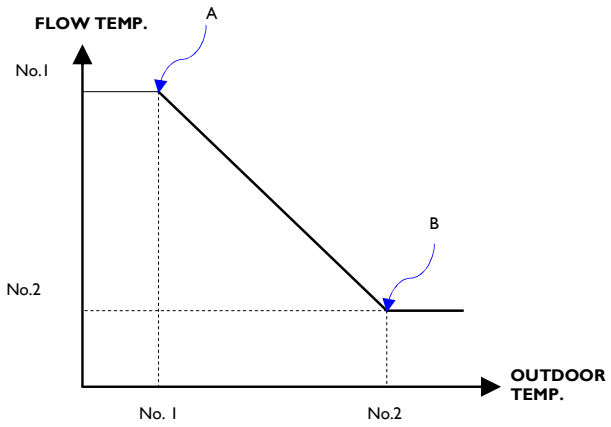


Fig 4.7

Recommended Settings

The controller has settings pre-installed that will provide adequate hot water and heating, but they can be amended using the instructions in the first two sections. The temperatures that should be used are as follows

PAR-W21MAA recommended flow temperatures			*Factory Settings*	*Recommended*
Hot Water			50°C	58°C
Eco Heating	Low Ambient Temperature	Under-floor *	-10°C ~ 38°C	-2°C ~ 40°C
		Radiator		-2°C ~ 45°C
	High Ambient Temperature	Under-floor *	17°C ~ 25°C	15°C ~ 30°C
		Radiator		15°C ~ 30°C

Table 4.3

Higher efficiencies are achieved with lower flow temperatures.

* To avoid damage to timber floors it is advised to check with floor manufacturers flow temperatures. Recommended temperatures are only achievable if the system has been designed for these settings.

Please note the weather compensation temperatures given are for guidance only. The flow temperatures required will vary based upon the design of the radiators or under-floor heating system as well as the heat load of the room/house. The installer should set-up the system to these temperatures but they can be altered later on if required. Fine tuning of the operating conditions of the Ecodan® unit can reduce your energy bills, dropping just the flow temperature 1°C can make a significant difference to the running costs.

Throughout the system set-up buttons on the controller are referenced by letters and displays by numbers ; this key can be found on page 38

System Commissioning Procedure

Ensure that anti-freeze and inhibitor is added to the primary loop at a concentration as recommended by the manufacturer, all pipework must be fully insulated between tank and outdoor unit. The outdoor unit should be left in standby for 12 hours before first time start up to prime the compressor.

Once the above period is over, turn on the power to the control equipment and initiate a constant demand for both hot water and heating modes through the 2 channel time clock, make sure the room thermostat is up fully and the cylinder sensor (TH5) is inserted into the pocket and the target temperature is programmed to no more than 55°C.

Check that the hot-water zone valve is the only one energised and the system circulators are running. With the circulating pumps running check the flow rate on the flow setter valve falls within the requirements for the model shown in table 2.3 (page 11).
The PAR-W21MAA controller should at this point indicate hot-water heating in the top left as shown in Fig. 5.1. It should also show the actual flow temperature as a small figure in the centre and the target temperature to the left Fig. 5.2 in hot water heating this should have been set to 55°C as detailed in the previous section.

As the flow from the heat pump raises in temperature the actual cylinder temperature will slowly increase until it meets the target. Hot-water heating will NOT cease until the cylinder sensor temperature is satisfied.

Once the cylinder thermostat is satisfied make a note of the time period the heat pump has taken to recover the whole cylinder. At this point the hot-water mode indication on the PAR-W21MAA remote will change to “eco-heating” and a lower target flow will be indicated dependent on the ambient temperature Fig. 5.3.

When commissioning the system you can use the boost switch (If fitted) to override eco heating mode and target a higher flow temperature. Once the system is targeting the higher flow temperature you should use the flow setter valve and check that it is within the operating conditions as described on page 27.

The heating system must be correctly balanced to ensure correct flow through every radiators. If the system has two heating zones check that both zone valves operate independently.

Fig. 5.1

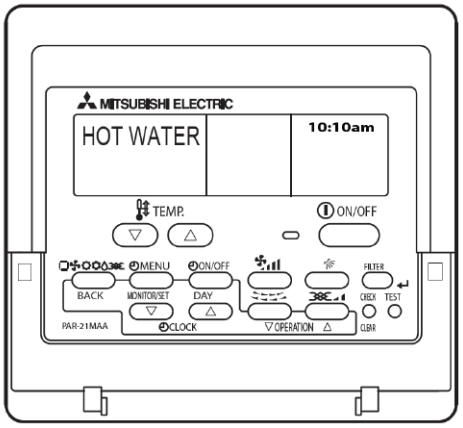


Fig. 5.2

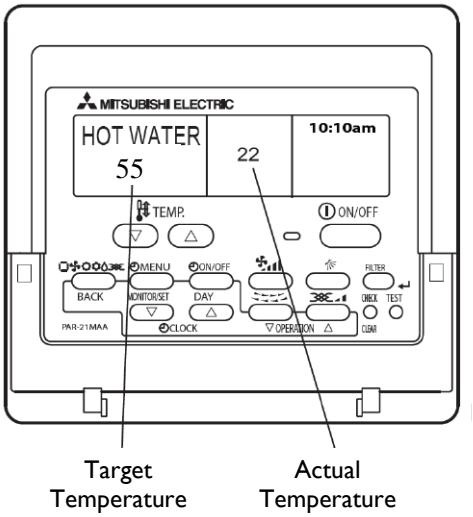
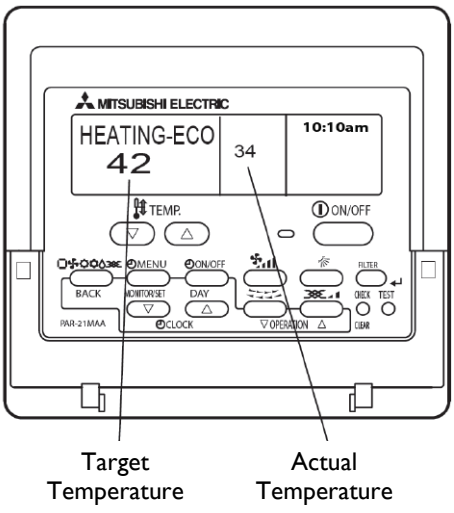


Fig. 5.3



Time Clock Operation Patterns

The Ecodan® system incorporates hot water demand priority this means that if there is a demand for both modes hot water will always occur before space heating.

Due to this the periods when hot water and space heating are programmed to operate are extremely important. The hot water heat up times should be programmed to occur during periods when space heating is not required, this is usually the early hours of the morning or early afternoon. Or the FTC2 system will automatically replenish the cylinder when it falls below a certain temperature, this is determined by DIP switch settings SW2-1. Automatic replenishment occurs when the immersed cylinder sensor reads a temperature drop of either 10oC or 20oC.

Using the hot water recovery time period taken during the commissioning stage ON and OFF times must be programmed by the commissioning engineer into the 2 channel time-clock, for example if the cylinder took 1 hour to reach 55°C then the hot water ON time should be for example 3.00am and the OFF should be 4.15am leaving a 15 minutes additional buffer. After this OFF time space heating will be allowed operate as required.

Important Note - If the hot water demand is left ON continuous operation rather than being time-clocked to switch OFF then the homeowner may experience unnecessary high running costs as heat pump will always be trying to top up hot water.

Economical Time Clock Patterns & Flow Temperatures

To gain the full benefits from the Ecodan® system the target flow temperatures and time-clock patterns need to be configured to suit the actual property demands. The most economical way of operating the system is to have it running at the lowest flow temperature possible to suit the properties thermal losses. To do this the heating demand from the time clock should be left constantly operational and the flow temperatures should be reduced to a point where the property is maintained at the design temperature (usually 21°C) without being switched ON and OFF from the room thermostat or TRV's. 7-day timer clocks with night time set-back can also offer good system efficiencies.

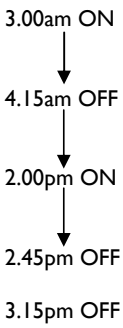
Running Ecodan® in heating at a low flow temperature for longer periods of time will be more economical than running with a high flow temperature for short bursts, providing the property's heat emitters have been correctly sized for a low flow temperature. Important Note - If the heating demand is left on continuous operation and the target flow temperatures are not reduced to their lowest possible then the homeowner may experience unnecessarily high running costs.

Example time-clock patterns

Below is an example of a standard time-clock pattern please note this is for reference only as the inputted times should suit the site environment and the homeowners preferences.

Heating mode - continuous operation with reduced flow temperatures

DHW Mode -



Time clock pattern set-up

Each channel on the time clock should be programmed to meet the demands of the home occupier in the most efficient way.

For example:
If an owner wakes up in the morning and wants a shower at 7am and the property takes an hour to raise to the required room temperature then both channels should be set to 5 am as the cylinder will take approximately 1 hour to achieve temperature before switching to space heating. If they don't require hot water again until later in the evening then the time clock should be programmed to heat up approximately one hour prior. This is the most efficient pattern to use rather than maintaining a high storage temperature constantly.

The most appropriate and cost effective electricity tariff to suit the systems usage should always be sought.

Heat Emitters

Please note that heat pumps provide lower flow temperatures to radiators than a conventional gas or oil boiler, the bestperformance is achieved with lower flow temperatures. Rather than the radiators turning on/off locally as with a fossil fuel boiler, heat pumps provide a more consistent lower flow temperature which allows for more efficiency and greater comfort.

Sizing of Radiators

All heat emitters should be selected in order to overcome the heat losses as calculated for the area to be served by that emitter. In the case of radiators the most important factors which contribute to specific output are the desired room temperature and the MWT or mean water temperature (flow temperature + return temperature / 2). All radiators sold in the UK must have their output verified in accordance with BSEN442, a difference between room temperature and MWT of 50ºC is typically used (bT). A heat pump system will work on a bT of much less than a fossil fuel system, in the case of a flow temperature of 47.5ºC and a return of 42.5ºC for example a MWT of 45ºC will apply.
At these conditions radiators need to be significantly larger than those used for a conventional fossil fuel based system. All radiator manufacturers provide adjustment factors so that the correct radiator may be selected when designing a system to operate at lower flow temperatures, an example of how to use these is given below.

ΔT	Adjustment Factor
5	0.05
10	0.123
15	0.209
20	0.304
25	**0.406**
30	0.515
35	0.629
40	0.748
45	0.872
50	1
55	1.132
60	1.267
65	1.406
70	1.549
75	1.694

Table 5.1

Sizing Example

First the room losses must be established by undertaking a heat loss calculation to the required standard, in this case room losses are assumed.

Room losses = 1200 Watts (at -3°C outdoor and 21°C Indoor)

In the case of a fossil fuel system a radiator may be selected directly from the manufacturer's brochure.

K2 (double panel/double convector) 450mm x 900mm, output = 1268 Watts

For a heat pump system with a MWT of 45°C and a target room temperature of 20°C a ΔT of 25°C will apply, the adjustment table from the relevant manufacturer should be used as below:

In this example the appropriate adjustment factor for 25°C ΔT should be used, in this case 0.406 is selected.

To work out the corrected output for an existing radiator, multiply quoted radiator output by adjustment factor

1268 x 0.406 = 514.8 Watts

This radiator will now produce less than half what is required to adequately heat the room.

To work out the required output as quoted in the brochure for a new radiator running at a lower flow temperature, divide quoted radiator output by adjustment factor.

1268 / 0.406 = 3123.1 Watts

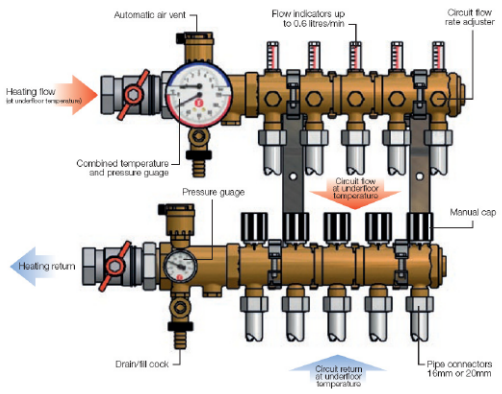
To adequately heat the room using a MWT of 45°C a radiator that achieves an output of at least 3123 Watts in the brochure will be required.

K2 (double panel/double convector) 600mm x 1800mm, output = 3200 Watts (at ΔT 50).
It may not be practically possible to fit a radiator this size in the desired position in which case adding an additional radiator should be considered in order to achieve the required total output.

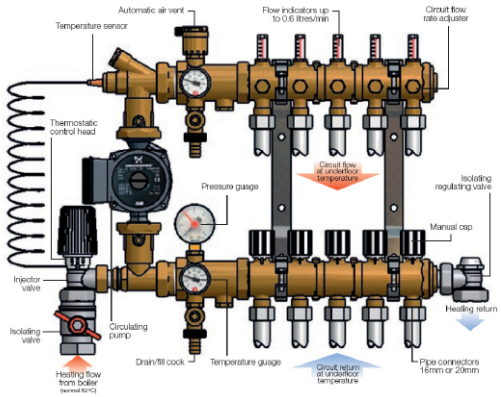
Underfloor Heating

Heat pumps provide lower flow temperatures than traditional gas fired boilers, this means that the installation conditions and heat emitters need to be managed carefully. These lower flow temperatures suit the conditions required for under-floor heating systems and if installed and designed correctly can deliver a more comfortable, consistent temperature whilst also increasing the efficiency. Some points to note when designing the installation are -

- Room by room thermostats ensure adequate control in all rooms
- Temperature difference across the flow and return should be less than 10ºC (5ºC for the Ecodan®)
- Use of night-set back instead of turning the system to off, reduces the desired temperatures by around 3-4ºC from their daytime levels if desired
- However response times from underfloor heating are much slower than radiators and therefore the property will take longer to heat up making this type of system less suitable for timed heating cycles
- Any additional radiators should be sized on the flow temperatures used for the under-floor heating, this negates the need for mixing valves, which are detrimental to the efficiency



Flow temperature set for under-floor



Flow temperature too high, mixing valve required

Fig 5.4

- When specifying under-floor heating there are some important factors to be aware of, as rectifying mistakes will be costly if not impossible.
- Bad placement of thermostats, where they are affected by external sources of heat or cold temperatures will lead to poor temperatures control.
- Under-floor heating circuits can produce high pressure losses. The pumps provided in our packaged systems are capable of providing the necessary flow rates on averagely sized primary circuits, but with the inclusion of under-floor circuits additional pumps will probably be necessary and potentially a low loss header to ensure the flow rates remain high across the heat pump (heating and primary circuits in parallel to allow variable flow rate on heating and constant flow rate on primary).
- The output (W/m2)of under-floor heating is primarily affected by 4 things: pipe diameter, length of circuit, spacing between pipe centres, resistance of floor coverings. If these factors are not considered at the design stage then the output may not be sufficient at the desired flow temperature negating the benefits of using underfloor heating systems.

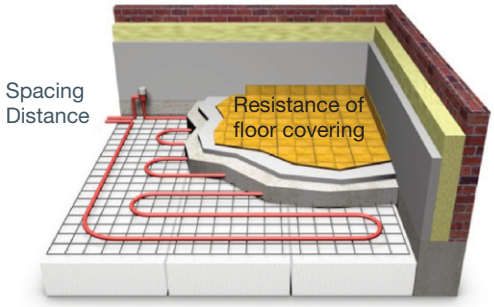


Fig 5.6

Floor covering	Floor covering resistance	Mean water temp	Output @200mm spacing W/m²	Output @300mm spacing W/m²
Tile	0.00	35ºc	68	52
Carpet (light duty)	0.10	35ºc	44	36
Floorboards	0.15	35ºc	38	32

Table 5.2

Commissioning: Aerocyl-me

Check and tighten all mechanical joints prior to commissioning. Cap and seal 2nd heating zone valve outlet if not in use to avoid potential leaks on models 180 and above. Check room thermostat and receiver are working.

Filling the cylinder

Check the pressure in the expansion vessel is 3 bar (45PSI), i.e. the same as the setting of the pressure reducing valve. The valve is of the car tyre (Schrader) type. Check all the connections for tightness including any factory made connections such as the immersion heater and the temperature and pressure relief valve. Before filling open the hot tap furthest away from the Aerocyl-me to let air out. Open the cold main isolation valve and allow the unit to fill. When water flows from the tap allow it to run for a short while to flush through any dirt, swarf or flux residue. Close the tap and open every other hot tap in turn to purge all remaining air. Check the cylinder target temperature programmed on the PAR W21 is set to 55ºC.

Filling the primary circuit

Ensure the lever on the two port valve is set to the filling position. When full, move the lever back. Switch the programmer to Domestic Hot Water (DHW) and allow the unit to start to heat.

Safety Valve Checks

During heat-up there should have been no sign of water coming from either the expansion relief valve or the temperature / pressure relief valve. Now hold both of these safety valves fully open allowing as much water as possible to flow through the tundish. Check that your discharge pipework is free from debris and is carrying the water away to waster efficiently. Release the valves and check that they reseat properly.

Domestic hot water immersion heater

As the Ecodan® can recover a domestic hot water cylinder to 55°C precautions should be made to raise the temperature to 60°C or 65ºC dependant on DIP SW2-6 periodically for pasteurisation.

This is carried out automatically with the immersion heater energised via a relay box which in turn is powered by FTC2. The frequency of the immersion heaters occurrence is determined by DIP switch settings SW2-4 and SW2-5. Please note the larger the temperature rise completed by the immersion heater and the more frequently it occurs the less efficient the system becomes.

Pasteurisation intervals should be programmed in accordance with relevant regulations by changing the DIP SW settings as below.

<table>
<tr><th colspan="2">Dip Switch</th><th>Function</th><th>OFF</th><th>ON</th><th>Default</th></tr>
<tr><td rowspan="3">SW2</td><td>SW2-6</td><td>Legionella set temperature</td><td>60deg C</td><td>65 deg C</td><td></td></tr>
<tr><td>SW2-4</td><td rowspan="2">Legionella mode frequency</td><td colspan="2" rowspan="2"><table>
<tr><th>Operation</th><th>SW2-4</th><th>SW2-5</th></tr>
<tr><td>Activate every DHW operation</td><td>OFF</td><td>OFF</td></tr>
<tr><td>Activate after every 15 DHW operations</td><td>ON</td><td>OFF</td></tr>
<tr><td>Activate after every 150 DHW operations</td><td>OFF</td><td>ON</td></tr>
<tr><td>Activate by external input signal</td><td>ON</td><td>ON</td></tr>
</table></td><td></td></tr>
<tr><td>SW2-5</td><td></td></tr>
</table>

Table 5.3

Service & Maintenance

The Ecodan® Air Source Heat Pump must be maintained on an annual basis. A maintenance check sheet is supplied to all Accredited Ecodan Installers (AEI) who attend the training course and is also available to download from www.mitsubishielectric.co.uk/heating

The basic requirements are:
Clean the external heat exchanger
Visual inspection for oil or leaks
Check the integrity of the pipework insulation
Check for loose electrical connections
Check compressor operating current
Check and record compressor operating period number of ON/OFF's and running current.

Basic Troubleshooting: Ecodan®
Below is a list of basic problems and actions. For a full list of Ecodan fault codes, synopsis and remedial actions please consult the relevant service manual available to download from www.mitsubishielectric.co.uk/heating

Fault	**Solution**
Water does not heat well	• Clean the filter of water piping. (Flow is reduced when the filter is dirty or clogged.) • Check the temperature adjustment and adjust the set temperature. • Make sure that there is plenty of space around the outdoor unit.
Water or vapour is emitted from the outdoor unit	• During the heating mode, water may form and drip from the heat exchanger of outdoor unit • During the defrosting mode, water on the heat exchanger of outdoor unit—evaporates and water vapour may be emitted.
The operation indicator does not appear in the remote controller display	• Turn on the power switch. ◉Will appear in the remote controller display.
appears in the remote controller display.	• This is the normal display, the system is waiting for a signal to operate from the control equipment
When restarting the outdoor unit soon after stopping it, it does not operate even though there is a demand from the control equipment.	• Wait approximately 3 minutes. (Operation has stopped to protect the outdoor unit.)
"PLEASE WAIT" appears in the remote controller display.	• The initial settings are being performed. Wait approximately 3 minutes.
An error code appears in the remote controller display	• Turn power off to outdoor unit for 5 minutes then re-initiate.

Table 6.1

Basic Troubleshooting: Aerocyl Plus-me

Below is a list of basic problems and actions.

Fault	Possible Cause	Solution
Water escaping from the case	Compression fitting on hot draw off not sealing	Check/remake joint with sealing paste
Cold water at hot taps	Direct—Immersion heater not switched on or cutout has triggered	Check / reset
	Indirect—motorised valve fault	Check plumbing / wiring to motorised valve
	Indirect—cut-out in dual stat has operated	Reset and investigate cause
	Ecodan may be at fault	Refer to Table 6.1
Water discharges from expansion relief valve	If continual—pressure reducing valve (part of inlet control set) may not be operating correctly	Check outlet pressure from inlet control set to 3.0 bar
	If continual—expansion relief valve seat may be damaged	Remove cartridge—check seat and renew if necessary
	If intermittent—expansion vessel charge may have reduced / bladder perished	Check pressure in expansion vessel. Recharge to 3 bar if necessary. If bladder perished replace vessel.
	Unit it being back pressurised	With cylinder cold check pressure in cylinder. If this is the same as the incoming mains pressure then you are getting backfeed. Install a balanced cold supply (see page 23).
Water discharges from temperature and pressure relief valve	Unit has overheated—thermal controls have failed	Switch off power to the heat pump and immersion heaters. Leave water supply on. Wait until discharge stops. Isolate water supply and replace if faulty.
Milky / cloudy water	Oxygenated water	Water from any pressurised system will release oxygen bubbles when flowing. The bubbles will settle out.
No hot water flow	Cold main off	Check and open stop cock
	Strainer blocked in pressure reducing valve	Isolate water supply and clean
Noise during hot water draw off typically worse in the morning	Loose airing cupboard pipework	Install extra clips
Hot or warm water from cold tap	If tap runs cold after a minute or so the pipe is picking up heat from heating pipework	Insulate / re-route
Room thermostat does not switch on or enables changes	Wireless room thermostat batteries not working	Replace batteries to wireless room thermostat.

Table 6.2

Aerocyl Plus-ME Servicing

General

Servicing should only be carried out by competent installers and any spare parts must be purchased from Mitsubishi Electric. NEVER bypass safety devices or operate the unit without them being fully operational.

Draining

Isolate from the electrical supply to prevent the immersion heaters burning out. Isolate the unit from the colds mains. Attach a hose to the draining tap ensuring it reaches to a level below the unit (this will ensure an efficient siphon is set-up and the maximum amount of water is drained from the unit). Open the hot tap closes to the unit and open the draining tap WARNING: WATER DRAINED OFF MAY BE VERY HOT!

Annual Maintenance

Aerocyl-me requires an annual service in order to ensure safe working and optimum performance. It is essential that the following checks are performed by a competent installer on an annual basis. Commonly this is done at the same time as the annual Ecodan® service.

1. Twist the cap of the expansion relief valve on the inlet control set and allow water to flow for 5 seconds. Release and make sure it resets correctly. Repeat with the pressure / temperature relief valve. In both cases check that the discharge pipework is carrying the water away adequately. If not check for blockages etc and clear. WARNING: THE WATER DISCHARGED MAY BE VERY HOT!
2. Check that any immersion heaters fitted are working correctly and that they are controlling the water at a temperature between 55°C and 65°C.
3. Check the pressure in the expansion vessel is charged to 2.1 bar. Turn off the water supply to the unit and open a hot tap first. The air valve on expansion vessel is a Schrader (car tyre) type. Air or CO_2 may be used to charge the expansion vessel.
4. Unscrew the head on the inlet control set and clean the mesh filter within.
5. The benchmark log book supplied with this unit should be updated at each service.

Available Spare Parts from Mitsubishi Electric		
Description	Mitsubishi Part Number	Kingspan Part Number
Grundfoss Circulating Pump—6m Head	228185	PUMPUPS02555/1
Grundfoss Circulating Pump—5m Head	228186	PUMPUPS02540/1
12 Litre Potable Expansion Vessel—3 bar	228187	EXPVESB12 ALT
19 Litre Potable Expansion Vessel—3 bar	228188	EXPVESB19 ALT
24 Litre Potable Expansion Vessel—3 bar	228189	EXPVESB24 ALT
3kW Immersion Heater—Twin Stat	228193	IMHTRSS
15mm x 22mm Tundish	228194	TUNDPL15 ALT
Immersion Heater Control Module	232142	HORSTMANN
Flow Setter	228197	MITSIFREEISSUE
Digital Wireless Room Stat and Receiver	228198	STATRX1
3 bar Inlet Control c/w XX bar Relief Valve	228199	CONTSETALT 533
7.0 bar Pressure and Temp Relief Valve	228200	VALVETP1/24
Filling Loop	228202	FLOOP
15mm Drain Cock	228203	PART OF PIPES (WELDED)
Auto Air Vent	228205	AIRVENTBOT 1/2
Programmer FP715 Si	228206	PROGFP715
Zone Valve: Blue Wired	228207	VALVE2PORT DB
Zone Valve: Red Wired	228208	VALVE2PORT DR
Zone Valve: Yellow Wired	228209	VALVE2PORT DY

For ordering spare parts please call **0161 866 6089**

Table 6.3

Guarantee

Legal guarantee to Accredited Installer:
As noted on page 2, all ecodan® Aerocyl Plus-me products are supplied to the purchasing domestic heating Accredited Installer by Mitsubishi Electric Europe B.V in accordance with our Terms and Conditions of Sale. In accordance with Clause 8 of our Terms and Conditions of Sale, our 'Product Guarantee' to the Accredited Installer is the Mitsubishi Electric Domestic Heating 3 Year Warranty Terms and Conditions. Please refer to our current Domestic Heating Partner Programme Pack for full details.

IMPORTANT: Kingspan Aerocyl Plus-me products are subject to special guarantee conditions from Mitsubishi Electric Europe B.V., including certain special exclusions and limitations of guarantee. Accredited Installers should familarise themselves with these special guarantee conditions before making any quotation or placing any order.

Commercial guarantee to the home owner:
Mitsubishi Electric's standard 3 year Home Owner Guarantee is Mitsubishi Electric's commercial guarantee to the home owner. This 3 year Home Owner Guarantee includes ecodan® air source pumps and cylinders and associated interfacing equipment purchased from Mitsubishi Electric by the Accredited Installer. This means Kingspan Aerocyl Plus-me products supplied by Mitsubishi Electric to the Accredited Installer are within the scope of Mitsubishi Electric's standard 3 year Home Owner Guarantee. Failure by a home owner to register an installation within 30 days of commissioning/ occupation if new build limits this commercial guarantee to twelve months only- and the Mitsubishi Electric Domestic Heating 3 Year Warranty Terms and Conditions are limited likewise in such case.

Accredited Installers should always make a copy of Mitsubishi Electric's standard 3 year Home Owner Guarantee available to any prospective home owner customer upon request.

In any event, Accredited Installers should always make clear that Mitsubishi Electric's standard 3 year Home Owner Guarantee is subject to conditions- see the Home Owner guarantee registration card for details.

Mitsubishi Electric's standard 3 year Home Owner Guarantee does not affect any legal rights a home owner may have under applicable national legislation governing the purchase from an Accredited Installer. Mitsubishi Electric's standard 3 year Home Owner Guarantee does not affect a home owner's statutory rights.

Fernox Protector HP-5c

- Concentrated heat transfer fluid suitable for use in Air Source Heat Pumps and underfloor heating systems
- Frost protection from -4°C to -14°C
- Protects against corrosion, limescale and bacterial contamination
- Non-toxic
- Compatible with all materials commonly found in Heat Pump and underfloor heating systems
- pH stable

Fig 7.1

Product Uses

Fernox HP-5c is a concentrated heat transfer fluid capable of frost protection from -4ºC to -14ºC especially formulated for use in Air Source Heat Pumps and underfloor heating circuits. Fernox HP-5c also provides long term protection from damage caused by corrosion, limescale and bacteria and maintains a stable pH across a range of operational temperatures. Fernox HP- 5c is compatible with all materials commonly used in Heat Pumps and underfloor heating systems.

Physical Properties

Composition:	An aqueous solution of monopropylene glycol with specifically formulated inhibitors, stabilisers and biocides.
Odour	Characteristic
Form	Liquid
Appearance	Clear, blue liquid
Density	1.03-1.05
pH	6 - 7

Table 7.1

Application and Dosage

Dilute before use with mains water. In order to ensure adequate corrosion and biocidal protection, the minimum “in-use” concentration of the product is 10%. Maximum “in-use” concentration is 30%. Upon dilution Fernox HP-5C will provide frost protection according to the table below..

Concentration	10%	20%	30%
Frost Protection	-4°C	-9°C	-14°C

Table 7.2

Frost protection level can be checked using a Fernox Refractometer. Existing heating systems should be cleaned of sludge and limescale deposits with a suitable Fernox Heat Pump Cleaner before adding Fernox HP-5c.

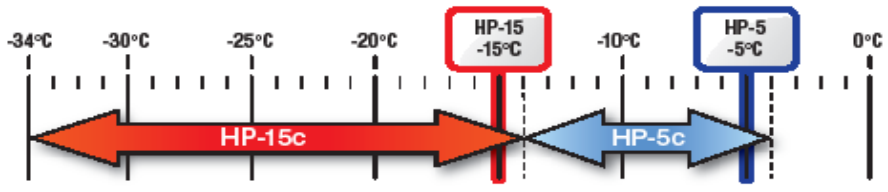


Fig 7.2

Sentinel R600

Fig 7.4

Thermal Fluid for air source heat pump systems
- Effectively controls corrosion and scale
- Suitable for all metals including aluminium
- Effective frost protection
- Low toxicity
- Manufactured under a quality system conforming to ISO9001
- Easy to handle

Application

Sentinel R600 is a multi-purpose inhibited anti-freeze formulated to prevent corrosion and scale in air source heat pump systems including those containing aluminium components. If minimum levels are maintained the product ensures a permanent protection and does not need to be replaced. Sentinel R600 is suitable for use in all waters, both hard and soft. The low toxicity formulation is a clear blue liquid which is easy to handle and dose.

Dosing and feeding

The dosage of the Sentinel R600 will depend on the level of frost protection required. One 20 litre pail of Sentinel R600 added to a typical air source heat pump system will provide the minimum concentration of corrosion and scale inhibitor and also protection from freezing down to approximately –10°C. Two 20 litre pails will provide protection to –30°C. Further information is available upon request.

If there is any doubt above the volume of the system the degree of frost protection achieved by dosing the Sentinel R600 can be checked by using the FrostCheck Test Kit. For best results, it is recommended that systems are cleansed and flushed; new systems and those up to 6 months old with Sentinel X300, existing systems with Sentinel X300, existing systems with Sentinel X400 or Sentinel X800 Jetflo.

To ensure the system is sanitised before the introduction of Sentinel R600 it is advisable to add 1 litre of Sentinel R700 Santiser and Biocide during the initial fill of the system with water to prevent the development of bacteria and fungi and their associated problems. Circulate the system for 30 minutes to ensure complete distribution through the whole system.

Physical Properties

Appearance Clear blue liquid
Odour Mild slightly sweet
Specific gravity 1.03 (20°C)
pH in aqueous solution (5%) 7.3 (approx)

Thermal Fluid	A solution of inorganic and organic corrosion and scale inhibitors in propylene glycol.
Health hazards	Not for use in potable water systems. Not considered hazardous to health
Handling	Avoid contact with skin and eyes. Keep out of reach of animals and children. Wash out empty container thoroughly with water before disposal.
Storage	Keep container tightly closed. Store in cool, well ventilated area.
Spillage	Flush spillage with plenty of water and wash to waste. On soil: Absorb on to inert material and dispose of according to Controlled Waste Regulations.
Fire/ Explosion Risks	Non-flammable. Oxides of carbon and nitrogen evolved in fire.
First Aid	Skin Exposure: Wash immediately with plenty of water. Eye Exposure: Rinse immediately with plenty of water. Seek medical attention. Ingestion: Rinse mouth with water. Do NOT induce vomiting. Seek medical attention

Table7.4

Fernox Total Filter TF1 Instructions

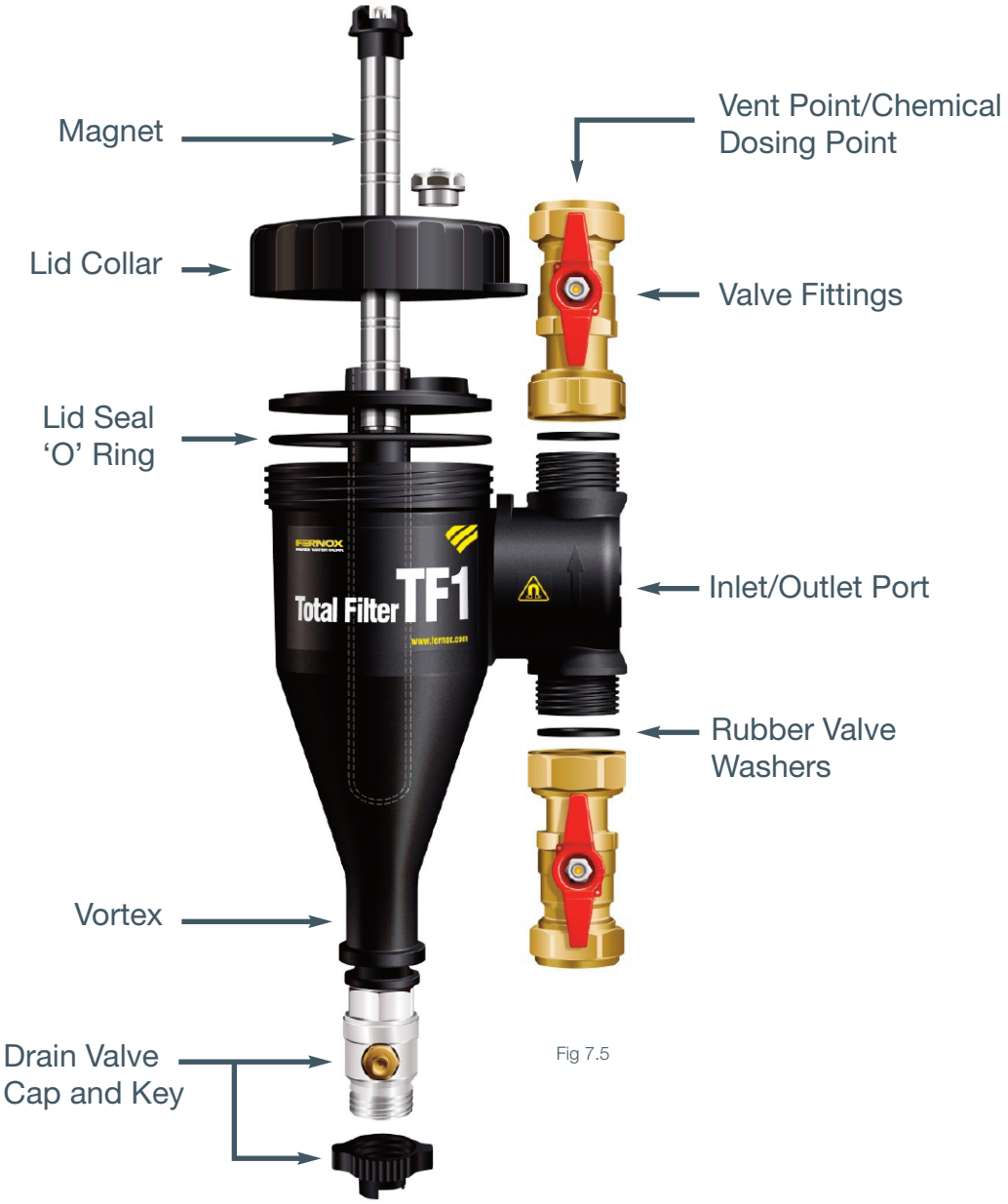


Fig 7.5

Fernox TF1 Filter

Designed to complement Fernox's extensive range of chemical water treatment products, the TF1 filter is a premium quality in-line, high efficiency magnetic filter with patented flux plates developed for use in Formula 1 motor racing. Unlike other conventional or magnetic filters, Boiler Buddy not only traps magnetite to sub-micron levels, it does so without restricting the water flow, even when full. TF1 filter also offers a unique opportunity for condition monitoring of the system. Its transparent housing enables the build-up of debris to be observed; acting as an early warning sign of inherent problems which might result in pumps or valves seizing and ultimate system failure.

Application

The TF1 filter comes ready to install into the vertical pipe work with the system water flowing upward. Install the TF1 in an easily accessible position for servicing ie: the return to the heat pump. Allow adequate clearance above the filter to enable the removal of the magnet assembly and draining. The drain valve is factory fitted and cannot be removed or adjusted.

Installation Options

1. Switch off the Ecodan and drain the system.
2. Measure and remove a section of pipework where the TF1 will be installed. For 22mm pipework, remove a 210mm section (for 28mm pipe work, remove a 220mm section).
3. Connect the valve fittings supplied to the pipe work.
4. Connect the TF1 to the valve fittings ensuring the rubber valve washers are correctly positioned. The filter should be installed so that the direction of flow within the heating circuit follows the directional arrives found on the inlet /outlet port.
5. Tighten all connections. Special care should be taken not to over-tighten the valve flange nuts that connect to the TF1 filter inlet/outlet port.

Installation in other orientations

Fig 7.6

For horizontal pipe work flowing from left to right, add the yellow 'O' ring and black spacer

Fig 7.7

For horizontal pipe work flowing from right to left, add the blue 'O' ring and blue spacer

Fig 7.8

For vertical pipe work flowing from downwards, add the red 'O' ring and red spacer

Installation in other orientations (cont.)

1. Loosen the lid collar to allow the inlet/outlet port to be unscrewed from the main body of the unit.
2. Replace the black sealing 'O' ring fitted in the inlet/outlet port with the appropriate 'O' ring provided in the Fernox TF1 Kit and add the relevant spacer between the main body and the inlet/outlet port before re-tightening.
3. Re-tighten the lid collar using the Fernox lid spanner. Note: The lip of the lid collar must be in-line with the block on the inlet/outlet port. The Fernox lid spanner is required to tighten the lid collar fully.

Commissioning

- Open both inlet and outlet valves to fill the unit. Vent any entrapped air and check for leaks before switching on the Ecodan.
- Complete the TF1 filter maintenance and service label and apply near the filter.
- For continual protection inhibitor levels should be checked annually.
- When adding any component to a heating system, it is the installers responsibility to ensure the system continues to comply with BS7671:2008 guidelines/requirements for electrical installations.

Cleaning the TF1 filter

Option one -fast clean

Cleaning of the filter does not require disassembly.

1. Switch off the Ecodan unit and close both the inlet and outlet valves on the Fernox TF1.
2. Remove the magnet form the centre of the lid to allow trapped magnetite to fall into the base of the vortex. Wait 30 seconds for the magnetite to settle.
3. Remove the drain valve cap and key from the drain valve. Either connect a hose to the drain point on the bottom of the unit using a standard hose tail connector or place a suitable container beneath the filter to collect the discharge.
4. Open the outlet.
5. Carefully open the drain valve using the drain valve cap and key to flush containments from the filter.
6. Close the drain valve and refit the cover. Replace the magnet and open the inlet valve.

Option two -manual clean

Cleaning of the unit can be undertaken in-situ.

1. Switch off the Ecodan unit and close both the inlet and outlet valves on the Fernox TF1.
2. Release system pressure via the vent point. Unscrew the lid collar and remove the lid and magnet assembly together.
3. Remove the magnet and wipe or rinse off the residual magnetite from the sleeve. Note: This method only cleans the material trapped by the magnet assembly. If required, the remaining contaminants can be discharged via the drian point. Good practice is to replace the lid seal after cleaning via this method. Replacement seal kits are available through all good plumbing merchants.
4. Place the magnet back in the sleeve and reassemble the TF1 filter.

The lip of the lid collar must be in-line with the block on the inlet/outlet before switching the Ecodan back on. The Fernox lid spanner will be required to tighten the lid collar fully.

5. Open both the inlet and outlet valves and vent any entrapped air.

After cleaning always check system pressure and adjust as necessary before operating the Ecodan.

Chemical dosing point

The Fernox TF1 can be used to dose any Fernox 500ml, Express and Superconcentrate water treatment products into the system.

1. Switch off the Ecodan and close both inlet and outlet valves.
2. Remove the drain valve cap and key from the drain valve. Either connect a hose to the drain point on the bottom of the unit using a standard hose tail connector or place a suitable container beneath the filter to collect the discharge.
3. After opening the bleed valve to vent the chamber, open the drain valve. Close the drain valve and replace the cap once emptied.
4. Dose the chemical via the vent point either using the screw thread adaptor supplied with all Express or Superconcentrate products, or remove the bleed valve completely and dose 500ml liquid via a funnel.
5. Replace vent pin and bleed valve, if removed.
6. Open both inlet and outlet valves.
7. Vent any entrapped air and check system pressure before switching on the Ecodan.

Spare parts and accessories

- Replacement seal and 'O' rings kit (item No.59288)
- Fernox TF1 Kit (item No. 59786)

Ecodan® / Aerocyl Plus-me Commissioning Report

SITE ADDRESS			
INSTALLING CONTRACTOR		SITE NUMBER	
COMMISSIONING ENGINEER		AEI CERTICATE NO.	
COMMISSIONING DATE		EQUIPMENT PURCHASED FROM	
SYSTEM REFERENCE			
LOCATION			

BEFORE RUNNING THE SYSTEM CARRY OUT A FULL PRE-COMMISSIONING CHECK OF THE FOLLOWING POINTS
• Add anti-freeze (25% concentration or manufacturers guidelines), • Check air charge is in expansion vessels • Pressurise primary circuit to approximately 2.1 bar • Open all isolating valves • Release ALL air from the system using the bleed valves on the Aerocyl Plus-me cylinder and vent at the highest point of the system. Before bleeding the air from the system the zone valves should be manually opened to prevent air lock and possible damage of the circulating pumps.

COMMISSIONING ENGINEERS COMMENTS AND POINTS FOR ATTENTION

COMMISSIONING ENGINEERS SIGNATURE

Pre-Commissioning System and Installation Check List

No	SYSTEM AND INSTALLATION STATUS				REMARKS	NOTES
1	INSTALLATION LOCATION	OUTDOOR UNIT				
		INDOOR UNIT				
2	MAINTENANCE AND ACCESS TO REMOVE COVERS	OUTDOOR UNIT	GOOD	POOR		
		CYLINDER/ INDOOR UNIT	GOOD	POOR		
3	SPACE AVAILABLE FOR AIR FLOW	OUTDOOR UNIT	GOOD	POOR		See Page 37
4	TOTAL PIPING LENGTH	OUTDOOR TO INDOOR		M		
5	HEIGHT DIFFERENCE	OUTDOOR TO INDOOR		M		
6	STANDARD OF PIPEWORK		GOOD	POOR		
7	STANDARD OF INSULATION		GOOD	POOR		
8	STANDARD OF ELECTICAL INSTALLATION		GOOD	POOR		
9	ACCESS TO REMOVE ELECTRICAL COVERS		GOOD	POOR		
10	CONNECTION OF MAINS POWER SOURCE	OUTDOOR UNIT ELECTRIC CABLE	GOOD	POOR		W50-16A/ 1.6mm W85-25A/ 4mm HW140-40A/ 6mm
			TYPE			
			SIZE			
		INDOOR UNITS ELECTRIC CABLE	GOOD	POOR		
			TYPE			
			SIZE			
11	CONNECTION OF CONTROL WIRING	OUTDOOR	GOOD	POOR		
		INDOOR	GOOD	POOR		
		CABLE TYPE 1.5mm 2 CORE	YES			
12	CONNECTION OF OPTIONS		GOOD	POOR		
13	ANTI-FREEZE IS ADDED TO SYSTEM (25% CONCENTRATION)		YES			
14	CHECK AIR CHARGE IS IN EXPANSION VESSELS		YES			
15	PRESSURISE PRIMARY CIRCUIT TO APPROXIMATELY 1.50 BAR		YES			
16	RELEASE AIR FROM SYSTEM		YES			

OUTDOOR UNIT OPERATION STATUS						
17	OUTDOOR UNIT MODEL No.			SERIAL No.		
18	POWER SOURCE (v)	L-N	L-E	E-N		
19	VIBRATION / NOISE	COMPRESSOR			GOOD	POOR
		FAN			GOOD	POOR
20	UNIT MOUNTED ON ANTI-VIBRATION (TICO) PADS AND SECURELY FIXED				YES	
21	PROVISIONS MADE FOR CONDENSATE REMOVEABLE				YES	

NOTE: IF POOR IS ANSWERED TO ANY OF THE ABOVE IT SHOULD BE RECTIFIED DURING THE COMMISSSIONING STAGE

NOTES AND COMMENTS

Maintenance

Contractors Name		**Engineers Name**	
Site Name		**Site Number**	
Warranty Number		**Model Number**	
Aerocyl Plus-me		**Serial Number**	

Mechanical Tasks	**Frequency**	**Records / Notes**
1. With the water supply turned off, remove the screen from the strainer in the combination inlet valve and clean off any dirt.	Major Visit	
2.With the water supply turned off and the hot water taps open, check the expansion vessel charge pressure and top up as necessary (2.1 bar).	Major Visit	
3. With the water supply turned on, open the temperature relief valve and then the expansion valve to check unrestricted discharge into tundish. Check valves for freedom of movement and confirm that the water stops and both valves reseat correctly. Check at a full bore discharge from either valve that there is no back up or discharge over the tundish.	Major Visit	
4. Check that the correct outlet pressure is being maintained by the pressure reducing valve by recording the pressure at the terminal fitting or the tapping provided on the combination inlet valve.	Major Visit	
5. Clean flow regulators (or restrictor/aerators) on each terminal fitting tap// shower as applicable. Check for correct flow rate at terminal fittings.	Major Visit	
6.If necessary de-scale the heat exchangers immersion/heaters in hard water areas.	Major Visit	
7. Check and clean the TF1	Major Visit	
8. Open the primary/heating system safety valve and check that it discharges safely.	Major Visit	
9. Drop the primary/heating system pressure to zero—check and if necessary top up the air side of the expansion vessel (1.5 bar).	Major Visit	
10. Check and if necessary top up the concentration of the heating system Inhibitor 25% minimum	Major Visit	
11. Re-establish the primary/heating system pressure (1.5 bar) and disconnect the filling loop.	Major Visit	
12. Check the primary/heating system pressure does not rise above 2.5 bar and the safety valve does not drip when the system is at full temperature.	Major Visit	
13. Check and release any air from the primary/heating systems.	Major Visit	
Electrical Tasks		
1. Visually inspect, checking for the presence of supplementary bonding and that it is being maintained.	Major Visit	
2. Check correct rating and type of fuse is fitted on the electrical supply.	Major Visit	
Controller Tasks		
1. Check for the correct operation and temperature setting of the thermo-stats.	Major Visit	
2. Check the operation of the zone valves.	Major Visit	

Maintenance

Ecodan® Maintenance			
Model Number		**Serial Number**	

Mechanical Tasks	Frequency	Records / Notes
1. Inspect and clean heat exchanger.	Major Visit	
2. Visually for signs of oil leaks which may indicate a refrigerant leak (check for leaks if necessary).	Major Visit	
3. Check integrity of water pipe work and lagging.	Major Visit	
4. Check all electrical connections including mains isolator.	Major Visit	
5. Check unit operation voltage and record.	Major Visit	

On completion check that the whole system is working satisfactorily.

Frequency of Visits:
Major Visit– Once per year

Mitsubishi Electric recommends that the frequency of maintenance visits to be a maximum of 12 months between inspections.

Frequency of maintenance may increase dependent upon the equipment environment and local water conditions e.g. hard water, scale forming, water containing a high proportion of solids.

Failure to maintain the system to the above minimum recommendations could result in the warranty becoming null and void.

MAINS PRESSURE HOT WATER STORAGE SYSTEM COMMISSIONING CHECKLIST

This Commissioning Checklist is to be completed in full by the competent person who commissioned the storage system as a means of demonstrating compliance with the appropriate Building Regulations and then handed to the customer to keep for future reference.

Failure to install and commission this equipment to the manufacturer's instructions may invalidate the warranty but does not affect statutory rights.

Customer Name ______________________ Telephone Number ______________________

Address ______________________

Cylinder Make and Model ______________________

Cylinder Serial Number ______________________

Commissioned by *(print name)* ______________________ Registered Operative ID Number ______________________

Company Name ______________________ Telephone Number ______________________

Company Address ______________________

______________________ Commissioning Date ______________________

To be completed by the customer on receipt of a Building Regulations Compliance Certificate*:

Building Regulations Notification Number *(if applicable)* ______________________

ALL SYSTEMS PRIMARY SETTINGS (indirect heating only)

Is the primary circuit a sealed or open vented system?	Sealed ☐	Open ☐
What is the maximum primary flow temperature?		☐ °C

ALL SYSTEMS

What is the incoming static cold water pressure at the inlet to the system?			☐ *bar*
Has a strainer been cleaned of installation debris (if fitted)?		Yes ☐	No ☐
Is the installation in a hard water area (above 200ppm)?		Yes ☐	No ☐
If yes, has a water scale reducer been fitted?		Yes ☐	No ☐
What type of scale reducer has been fitted?			
What is the hot water thermostat set temperature?			☐ °C
What is the maximum hot water flow rate at set thermostat temperature (measured at high flow outlet)?			☐ *l/min*
Time and temperature controls have been fitted in compliance with Part L of the Building Regulations?			Yes ☐
Type of control system (if applicable)	Y Plan ☐	S Plan ☐	Other ☐
Is the cylinder solar (or other renewable) compatible?		Yes ☐	No ☐
What is the hot water temperature at the nearest outlet?			☐ °C
All appropriate pipes have been insulated up to 1 metre or the point where they become concealed			Yes ☐

UNVENTED SYSTEMS ONLY

Where is the pressure reducing valve situated (if fitted)?		
What is the pressure reducing valve setting?		☐ *bar*
Has a combined temperature and pressure relief valve and expansion valve been fitted and discharge tested?	Yes ☐	No ☐
The tundish and discharge pipework have been connected and terminated to Part G of the Building Regulations		Yes ☐
Are all energy sources fitted with a cut out device?	Yes ☐	No ☐
Has the expansion vessel or internal air space been checked?	Yes ☐	No ☐

THERMAL STORES ONLY

What store temperature is achievable?	☐ °C
What is the maximum hot water temperature?	☐ °C

ALL INSTALLATIONS

The hot water system complies with the appropriate Building Regulations	Yes ☐
The system has been installed and commissioned in accordance with the manufacturer's instructions	Yes ☐
The system controls have been demonstrated to and understood by the customer	Yes ☐
The manufacturer's literature, including Benchmark Checklist and Service Record, has been explained and left with the customer	Yes ☐

Commissioning Engineer's Signature ______________________

Customer's Signature ______________________

(To confirm satisfactory demonstration and receipt of manufacturer's literature)

*All installations in England and Wales must be notified to Local Authority Building Control (LABC) either directly or through a Competent Persons Scheme. A Building Regulations Compliance Certificate will then be issued to the customer.

benchmark COLLECTIVE MARK
THE MARK OF QUALITY FOR THE INSTALLATION, COMMISSIONING AND SERVICING OF DOMESTIC HEATING AND HOT WATER SYSTEMS

SERVICE RECORD

It is recommended that your hot water system is serviced regularly and that the appropriate Service Record is completed.

Service Provider
Before completing the appropriate Service Record below, please ensure you have carried out the service as described in the manufacturer's instructions.

SERVICE 1 Date

Engineer Name

Company Name

Telephone Number

Comments

Signature

SERVICE 2 Date

Engineer Name

Company Name

Telephone Number

Comments

Signature

SERVICE 3 Date

Engineer Name

Company Name

Telephone Number

Comments

Signature

SERVICE 4 Date

Engineer Name

Company Name

Telephone Number

Comments

Signature

SERVICE 5 Date

Engineer Name

Company Name

Telephone Number

Comments

Signature

SERVICE 6 Date

Engineer Name

Company Name

Telephone Number

Comments

Signature

SERVICE 7 Date

Engineer Name

Company Name

Telephone Number

Comments

Signature

SERVICE 8 Date

Engineer Name

Company Name

Telephone Number

Comments

Signature

SERVICE 9 Date

Engineer Name

Company Name

Telephone Number

Comments

Signature

SERVICE 10 Date

Engineer Name

Company Name

Telephone Number

Comments

Signature

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