

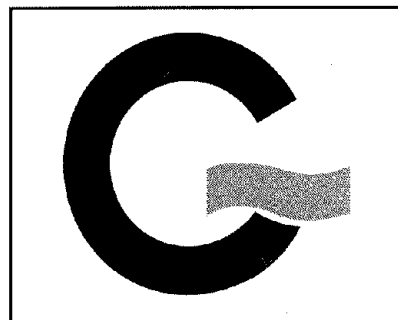
Systemate III

A sealed central heating and mains pressure hot water supply system incorporating a thermal store.

Design, Installation and Servicing Instructions

**PLEASE LEAVE THESE
INSTRUCTIONS ADJACENT TO THE
APPLIANCE.**

**ALL MODELS COMPLY WITH THE
WATER HEATER MANUFACTURERS
ASSOCIATION SPECIFICATION FOR
HOT WATER ONLY THERMAL
STORES.**



GLEDHILL SYSTEMATE III SPECIFICATION

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These instructions should be read in conjunction with the "Installation and Servicing Instructions" issued by the manufacturer of the heat source e.g. the boiler used. Any water distribution systems and central heating installations must be in accordance with the requirements of the relevant regulations and should also comply with the relevant recommendations of the British Standards also listed below:-

Regulations

- Gas (Safety in use Regulations)
- Building Regulations
- I.E.E Wiring Regulations
- Water Regulations

British Standards

BS6798, BS5449, BS5546, BS5440:1, BS5440:2, CP331:3, BS6700, BS5258 and BS7593:1992

A competent person as stated in the Gas Safety Regulations must install the Systemate heating system. The manufacturer's notes must not be taken as over-riding statutory obligations.

The Systemate III is not covered by section G3 of the 1985 Building Regulations and is therefore not notifiable to Building Control.

Although the domestic water supply to the Systemate III is at mains pressure, it is not necessary to fit an expansion vessel, pressure or temperature relief valve. The Systemate III is only suitable for use with sealed primary i.e. central heating

The information in this manual is provided to assist generally in the selection of equipment. The responsibility for the selection and specification of our equipment must however remain that of our customer and any designers or consultants concerned with the design and installation.

Please Note: We do not therefore accept any responsibility for matters of design, selection or specification for the effectiveness of an installation containing one of our products.

All goods are sold subject to our Conditions of Sale, which are set out at the rear of this manual.

In the interest of continuously improving the Systemate range, Gledhill Water Storage Ltd reserve the right to modify the product without notice, and in these circumstances this document, which is accurate at the time of printing, should be disregarded.

The Gledhill Systemate range is a WBS listed product.

THIS PRODUCT IS MANUFACTURED UNDER A BS EN ISO 9002 QUALITY SYSTEM AUDITED BY BSI

DESCRIPTION

INTRODUCTION

The SystemeMate III based heating system is schematically shown in Figure 1.1. The SystemeMate III unit is based on an indirectly heated hot water only thermal store and is supplied with factory fitted controls and equipment as shown schematically in Figure 1.2. The SystemeMate III is designed for use in a sealed primary heating circuit to provide space heating as well as mains pressure hot water at high flow rates and it can be used with any remotely sited boiler suitable for a sealed system. The vented thermal store is indirectly heated by an efficient primary heat exchanger to give very fast recovery. The space heating circuit is standard and the 3-Port valve supplied with the unit is normally configured to function as a flow share valve to heat the thermal store and radiator circuit simultaneously. However this can be configured as a diverter valve with hot water priority if required. The system is controlled by a dedicated electronic control system complete with a programmer to which an external room thermostat can be wired. An important feature of this concept is that hot water can be supplied directly from the mains at conventional flow rates without the need for temperature and pressure relief safety valves or expansion vessels. This is achieved by passing the mains water through a plate heat exchanger (PHE), which is heated instantaneously by the primary water circulated by a pump through the PHE. The outlet temperature of the domestic hot water is maintained by a printed circuit board, which controls the speed of the pump circulating the primary water from the store through the plate heat exchanger. A boiler of up to a maximum of about 30kW (approximately 100,000BTU/hr can be linked to any suitable model of SystemeMate III (see Table 1.1, page 5) and the deciding factor is the space heating and the hot water requirements of a dwelling.

THERMAL STORE

The copper thermal store contains primary water, which is maintained at a temperature of approximately 70°C in winter by the electronic control system. The standard version has a manually filled top up cistern.

An automatic filling version with a ball valve and warning pipe connection is also available and in this case the overflow/warning pipe must be terminated at a suitable location outside the dwelling.

SystemeMate III is efficiently insulated with Rockwool CFC free insulation and finished in a steel case to minimise standing losses.

DOMESTIC HOT WATER

Cold Water Supply

The SystemeMate III units are designed to be fed directly from the mains water supply as shown schematically in Figure 1.3. They fulfil the requirements of Water Bylaw 91, and therefore do not require a check valve to be fitted to the supply pipe. The performance of the SystemeMate is directly related to the adequacy of the cold water supply to the dwelling. This must be capable of providing for those services, which could be required to be supplied simultaneously, and this maximum demand should be calculated using procedures defined in BS6700. SystemeMate will operate at mains pressures as low as 1 bar and this must be available when the local demand is at its maximum, but the preferred range is between 2 and 3 bar. As a general guideline, although a 15mm external service may be sufficient for smaller dwellings with one bathroom, a 22mm service (25mm MDPE) is preferred and should be the minimum for larger dwellings. If a water meter is fitted in the service pipe, it should have a nominal rating to match the maximum hot and cold water peak demand calculated in accordance with BS 6700. This could be up to 50 litres/minutes in some properties.

The unit must be fitted strictly in accordance with the requirements of the Local Water Undertaking who should be consulted prior to the installation. In the event of any difficulty please contact us as the manufacturers. The equipment used in the system should be suitable for a working pressure of 8 bar and approved by the WBS or other relevant standard. If this is not the case a pressure limiting valve will be required which is suitable for the item of equipment with the lowest maximum working pressure.

We recommend that a lockshield pattern gate valve is fitted on the cold inlet to the appliance. This can be used for isolating/maintenance purposes or in areas of high pressure can be used to control the flow through the appliance to 30 litres/minute.

Safety Fittings

It is not necessary to fit control and safety equipment normally associated with mains pressure hot water storage appliances e.g. temperature and pressure relief valves and expansion vessel. SystemeMate is WBS listed and a non-return valve is not required. However if the ancillary equipment fitted in the supply to these appliances require a non-return valve then the valve must be fitted directly after the branch to the drinking water i.e. a kitchen sink, as shown schematically in Figure 1.3.

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Domestic Hot Water Flow Rates

Provided the pipe sizing and the supply pressure is adequate the hot water flow rate should be up to 22 litres/min. for model SM118 and up to 35 litres/min. for models SM144, SM178, SM205 and SM238 (see table 1.1). The domestic hot water outlet temperature is regulated to 52°C by the electronic control system and is not user adjustable.

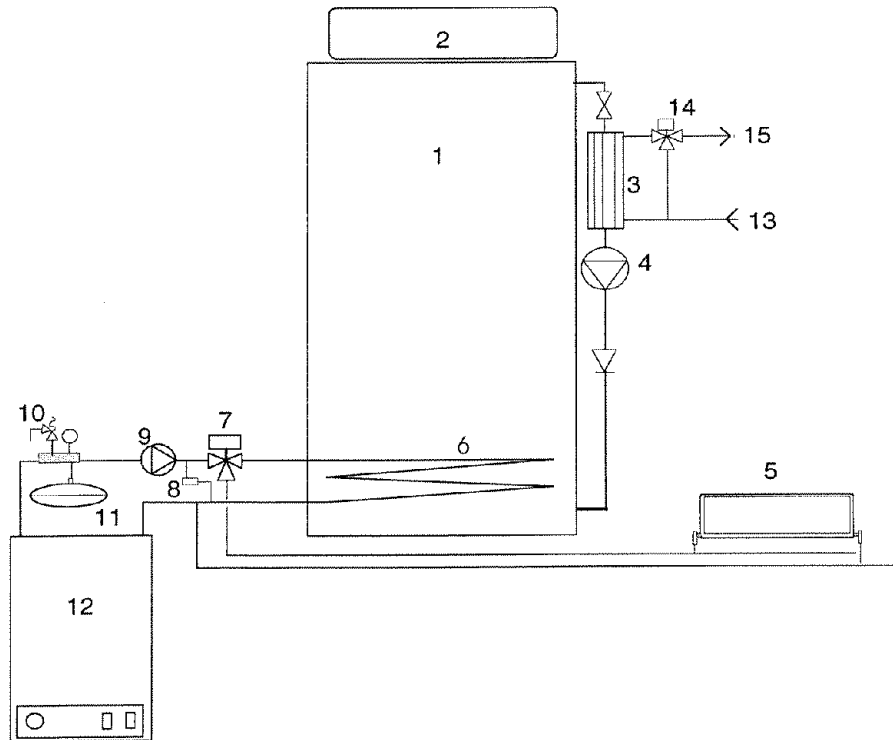
Use in Hard Water Areas

There are two options for the pump speed control. Option 'H' must be used in hard water areas above 200ppm. Option 'S' can be used in soft water areas below 200ppm.

A patented control system within the Option 'H' microprocessor offers a more sophisticated level of pump speed control and will help prevent the formation of scale. Both options ('H' or 'S') prevent domestic hot water from exceeding 52°C for most of the operational times of the appliance.

It is not necessary to fit any form of scale inhibiting equipment in the domestic cold water supply to the Systemate when using option 'H'.

If scale should become a problem the plate heat exchanger is easily isolated and can be replaced with a service exchange unit.



- | | |
|------------------------------|-----------------------------|
| 1 Thermal store | 2 Top up for thermal store |
| 3 Plate heat exchanger | 4 Plate heat exchanger pump |
| 5 Space heating circuit | 6 Primary heat exchanger |
| 7 3-Port diverter valve | 8 Automatic bypass valve |
| 9 System/boiler pump | 10 Pressure relief valve |
| 11 Expansion vessel | 12 Boiler |
| 13 Mains cold water inlet | 14 Mixing Valve |
| 15 Domestic hot water outlet | |

Figure 1.1 A Systemate III Sealed Primary Heating System

DESCRIPTION

PACKAGED CONTROL SYSTEM

Standard Equipment

The standard configuration of the SysteMate III is shown in Figure 1.2 and it is supplied with the following factory fitted equipment: -

- a) Boiler/space heating system pump
- b) Domestic hot water primary (plate heat exchanger) pump
- c) Automatic bypass valve
- d) Appliance controller PCB
- e) 3-Port valve (normally supplied as a flow share valve but can be configured to function as a full diverter valve if required.
- f) Primary i.e. heating circuit expansion vessel.
- g) Primary circuit pressure relief valve.
- h) Primary circuit pressure gauge
- i) System filling loop
- j) Electro- mechanical clock (Figure 1.6) to control the space heating (in conjunction with a room thermostat- if fitted).
- k) Plate heat exchanger.
- l) DHWS flow switch.
- m) DHWS temperature sensor.
- n) Mixing Valve.

The appliance controller PCB mounted inside the appliance controls the operation of the complete heating system. This PCB also acts as a wiring centre for the factory fitted components and any external user controls fitted on site. A typical connection arrangement of the SysteMate III components is shown in Figure 1.4

Optional Equipment

- a) A seven-day digital clock/programmer (Figure 1.6) to control the space heating (in conjunction with a room thermostat if fitted).
- b) A kit to remotely site the clock/programmer shown in Figure 1.6.
- c) A no clock option – to be used with any two channel clock for controlling both the operation of the space heating (in conjunction with a room thermostat if fitted) and the charging of the thermal store.
- d) Feed and expansion cistern ball valve and warning/overflow pipe connection – for automatic fill option only.

ELECTRICAL IMMERSION HEATER

If an electric immersion heater is fitted then it must: -

- a) Be set to operate at 75°C.
- b) Be wired to a separate 13A fused and switchable power supply.
- c) Not be wired into any of the terminals on the appliance printed circuit boards.
- d) Should be 14" long low watts density units with an incolloy 825 sheath and 11" rod thermostat.

This can be supplied and fitted at the time of order as an extra. Replacement immersion heaters should be obtained only from Gledhill Water Storage Ltd.

TECHNICAL SPECIFICATION

The principal dimensions of the SysteMate III model range and the minimum dimensions for the cupboard are shown in Figure 1.5 and the technical specification of the units is given in Table 1.1.

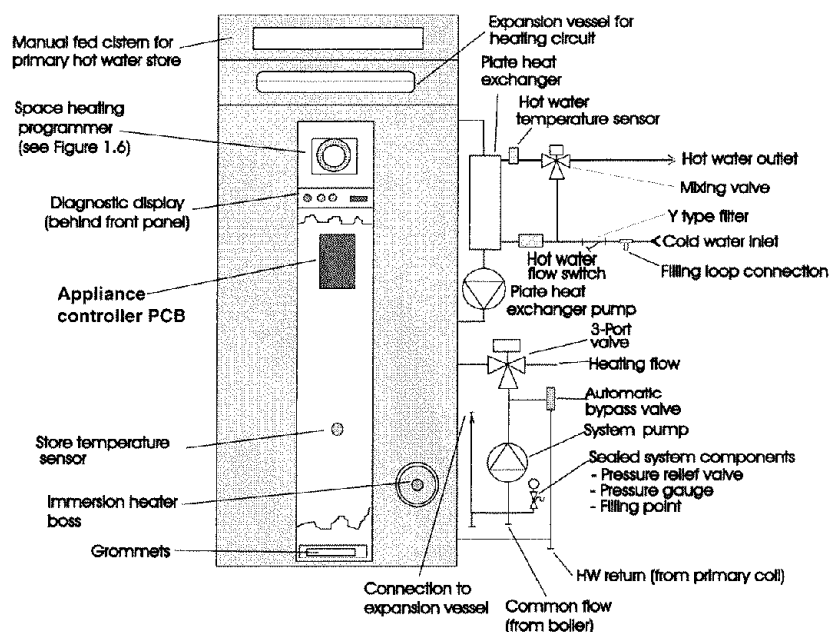


Figure 1.2 Standard SysteMate III Packaged Unit

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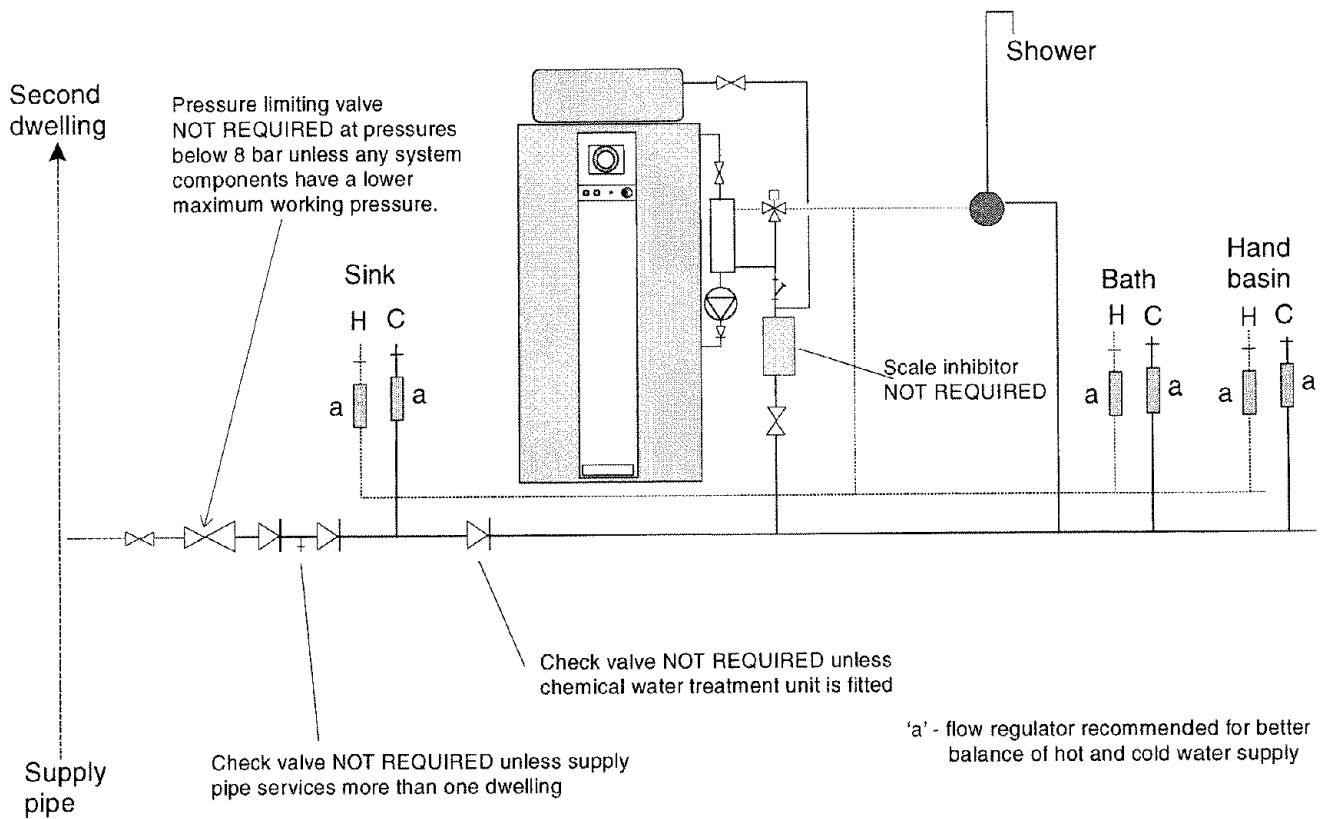


Figure 1.3 Typical hot and cold water distribution network

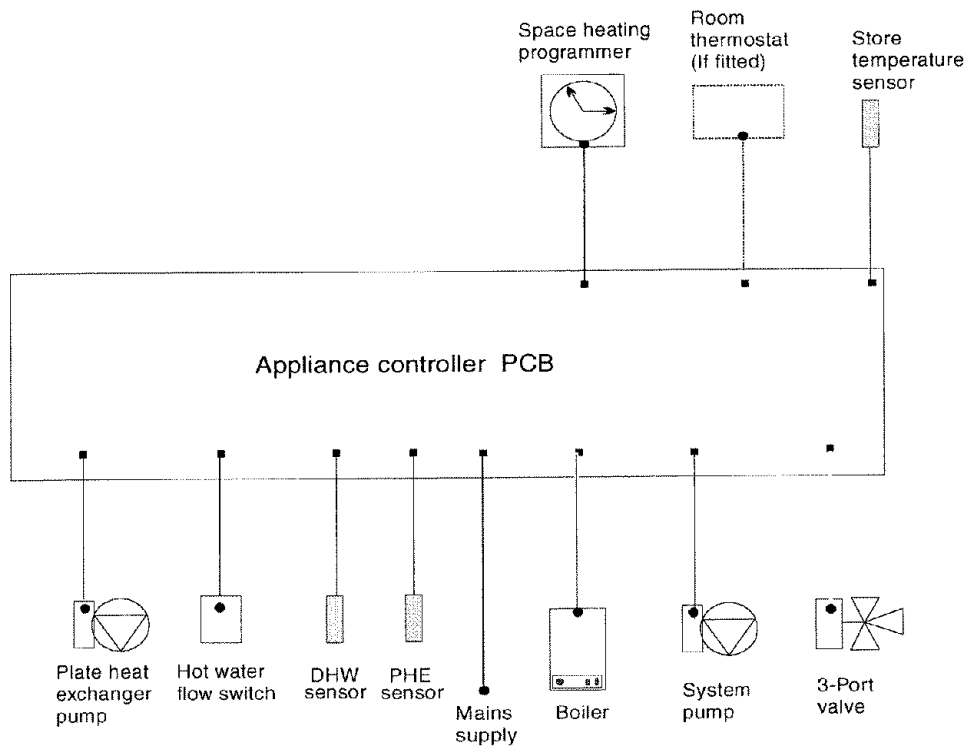


Figure 1.4 SysMate III Standard Control Package

DESCRIPTION

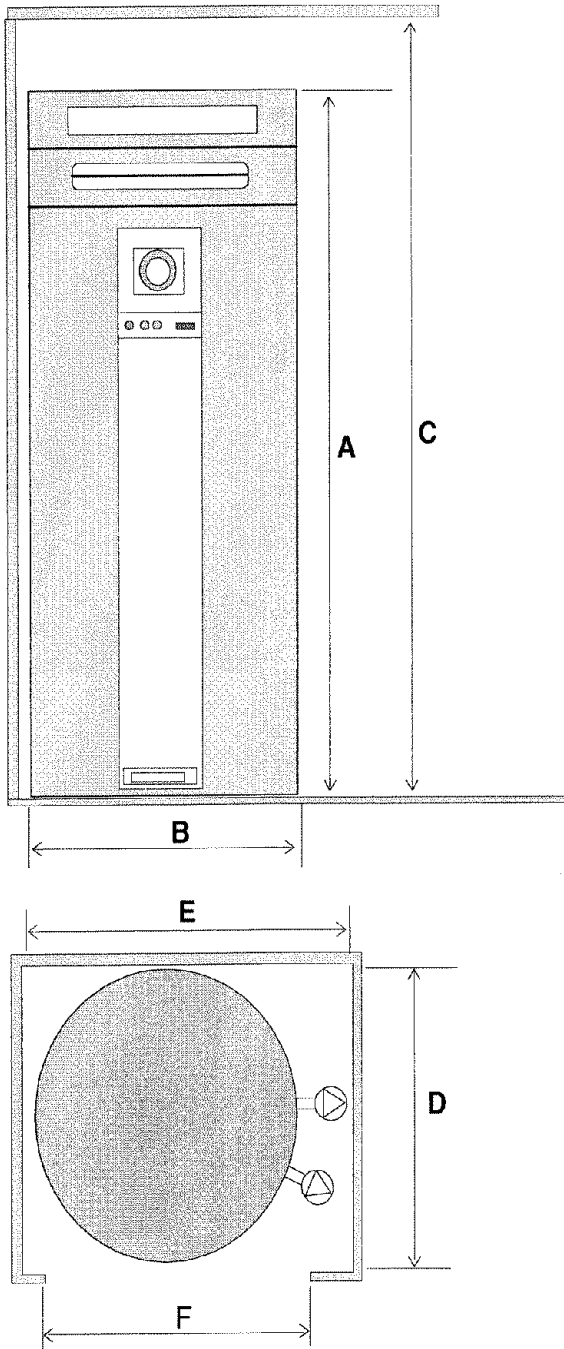
Table 1.1 Technical specification of Systemate III

	SM118	SM144	SM178	SM205	SM238
Overall dimensions of standard unit (Height x diameter)	1475 x 475	1475 x 500	1510 x 550	1690 x 550	1805 x 550
Minimum cupboard size (Width x depth)	700 x 550	715 x 600	770 x 650	770 x 650	770 x 650
Primary store capacity (litres)	100	115	145	175	190
Volume of primary coil (litres)	3.4	3.8	4.5	6.2	7.5
Weight (kg)					
• Empty	48	49	51	54	58
• Full	148	164	196	229	248
Pipe connections	<ul style="list-style-type: none"> • All pipe connections 22mm copper compression fittings • Drain connection : R½" 			<ul style="list-style-type: none"> • All pipe connections 28mm copper compression fittings • Drain: R½" 	
Maximum working pressure	<ul style="list-style-type: none"> • Thermal store 6m – Fitted with integral feed and expansion cistern • Heating circuit 3 bar – Suitable for sealed system only • Domestic hot water 8 bar 				
Pressure relief valve	½" – set to operate at 3 bar				
Expansion Vessel	Nominal volume of the vessel: 10 litres				
P1	P2	Maximum permitted system volume (litres)			
0.5	0.5	120			
	1.0	71			
1.0	1.5	38			
	1.0	91			
	1.5	52			
	2.0	24			
1.5	1.5	64			
	2.0	30			
Pumps	<ul style="list-style-type: none"> • System Grundfos UPS 15-50 • Plate heat exchanger Grundfos UPS 15-50 			<ul style="list-style-type: none"> Grundfos UPS 15-60 Grundfos UPS 15-50 	
3-Port Valve	22mm Danfoss HS3DB22			28mm Danfoss HS3DB28	
Hot water flow rate (litre/min)	22	35	35	35	35
Maximum boiler size (kW)	15	20	20	30	30
Typical dwelling types					
• Bedrooms	1 – 2	2 – 3	2 – 4	2 – 4	3 – 5
• Bathrooms	0	1	1	2	2
• En-suite shower rooms	1	1	2	2	3

NOTES

1. P1= Vessel charge pressure (bar), P2= Initial system pressure (bar)
2. The flow rates are for 35°C average temperature rise and assume normal pressure and adequate flow to the appliance.
3. All standard units are supplied complete with an integral manual fill feed and expansion cistern which is only for the primary water in the thermal store.
4. All units are supplied with a nominal 10 litre expansion vessel for the primary boiler/space heating circuit. If the system requires additional capacity then another expansion vessel should be fitted.
5. All units are supplied with ½" pressure relief safety valve for the space heating circuit.
6. All Systemate III units meet the appropriate requirements of the WMA Specification for 'Hot Water Only' Thermal Stores.
7. 28mm 3 port valve/primaries and 15/60 system pumps are available on the SM118, 144 and 178 models at the time of order as an extra.
8. For hard water areas use Suffix 'H' for soft water areas use Suffix 'S' after the model number eg. SM118/H = Systemate III model 118 for hard water area.
9. Non standard sizes are available to suit smaller cupboard dimensions.
10. If the boiler is fitted with an anti-cycling device we recommend that the size of the appliance used is one size larger than normally recommended by the typical dwelling type column in table 1.1 above.

SYSTEM DESIGN



For automatic ballvalve fill models add 65mm to dimension A and 90mm to dimension C in each case.

Model	Dimensions (mm)					
	A	B	C	D	E	F
SM118	1475	475	1675	550	675	600
SM144	1475	500	1675	600	700	625
SM178	1510	550	1710	600	750	675
SM205	1690	550	1920	600	750	675
SM238	1805	550	2035	600	750	675

Note. SystemMate III is normally supplied with the components on the right hand side (as shown) but can be supplied left handed if required.

Figure 1.5 Principal dimensions of SystemMate III (see also Table 1.1)

METHOD OF BOILER SIZING

It is only necessary to calculate the heating requirements in accordance with BS 5449. The allowance for domestic hot water (shown in Table 2.1) depends upon the operating mode selected for the 3-port valve. For example; if the system is designed to operate with priority to domestic hot water then no additional allowance for hot water is required for sizing the boiler.

Model	Allowance for Domestic Hot Water (kW)	
	Diverter valve mode	Flow share mode
SM118	0	2
SM144	0	3
SM205	0	3.5
SM238	0	4
SM178	0	3

The primary pipework connecting the boiler and the thermal store should be sized to achieve a maximum of 11°C rise across the boiler or the maximum temperature rise specified by the boiler manufacturer. But in any instance it should not be less than 22mm copper tube.

Notes:

- (1) There should be no valves or other devices in the pipework connecting the boiler to the SystemMate III which could be accidentally closed.
- (2) The SystemMate III is only suitable for sealed heating systems and is supplied fitted with all the appropriate components.
- (3) Only boilers approved for sealed systems i.e. fitted with overheat thermostat should be used with SystemMate III.
- (4) If the boiler is a condensing type the primary system must be set to operate as a normal 80°C flow 70°C return system.

SYSTEM TEMPERATURES

The heating circuit operates on the normal primary boiler temperatures i.e. 82°C flow and 71°C return. Therefore any traditional hot water radiators or convectors can be used with this system and no special over sizing of the heat emitters is necessary.

SYSTEM LAYOUTS

The SystemMate III is designed to be installed with any boiler, which is suitable for a sealed heating system and the boiler must be capable of delivering hot water at minimum of 80°C. The unit is supplied with a factory fitted and pre-wired package consisting of: -

- a) Boiler/space system heating pump
- b) Domestic hot water primary (plate heat exchanger) pump
- c) Automatic bypass valve
- d) Appliance controller PCB

SYSTEM DESIGN

- e) 3-Port valve. Normally supplied as a flow share valve but can be configured to function as a full diverter valve with hot water priority if required.
- f) Primary i.e. heating circuit expansion vessel (nominal volume 10 litres)
- g) Primary circuit pressure relief valve (set to operate at 3 bar).
- h) Primary circuit pressure gauge (0 – 4 bar)
- i) System filling loop
- j) Electro-mechanical clock (Figure 1.6) to control the space heating (in conjunction with a room thermostat if fitted).
- k) Plate heat exchanger.
- l) DHWS flow switch.
- m) DHWS temperature sensor.

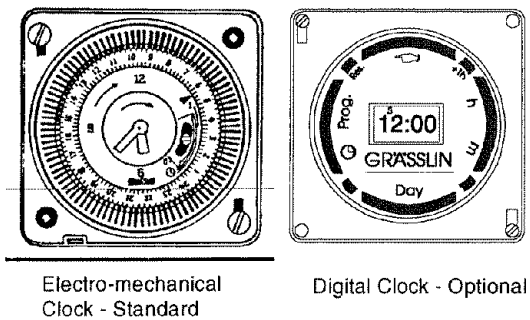


Figure 1.6 Front Panel Mounted Clock Options for Systemate III

Boiler Sited Below the Systemate III Unit

A typical system layout with boiler sited below the Systemate unit and the recommended controls to give the most energy efficient operation is shown in Figure 2.1.

- a) The flow pipe from the boiler to the Systemate must rise continuously and NO part of the flow pipe should contain a valve or other device (which can be accidentally closed), as this forms the safety vent pipe to the pressure relief valve.
- b) The pipework connecting the boiler to the Systemate must not be less than 22mm copper tube (or that specified by the boiler manufacturer).
- c) If the length of the flow pipe connecting the boiler to the Systemate unit exceeds 6m, then the pressure relief safety valve must be removed from the unit and fitted to the boiler or the flow pipe adjacent to the boiler as shown in Figure 2.2.

Boiler Sited above the Systemate III Unit (Dipped Flow & Return)

A typical system layout with boiler sited above the Systemate unit and the recommended controls to give the most energy efficient operation is shown in Figure 2.2.

- a) **The pressure relief valve must be removed from the unit and fitted to the boiler or the flow pipe adjacent to the boiler.**
- b) NO part of the flow pipe connecting the boiler to the Systemate should contain a valve or other device (which can be accidentally closed), as this forms the expansion pipe to the expansion vessel located inside the Systemate III casing.
- c) The pipework connecting the boiler to the Systemate must not be less than 22mm copper tube (or that specified by the boiler manufacturer).
- d) The boiler/Systemate pipe circuit must be designed to prevent gravity circulation between the store and the boiler when the boiler is not firing e.g. a gravity check valve may be fitted in the boiler return pipe as shown in Figure 2.2.

Plastic Pipework

This appliance is suitable for use with plastic pipework as long as the material is recommended for the purpose by the manufacturer and is installed fully in accordance with their recommendations.

We recommend the use of barrier pipe, which will mean the system can have BritishGas service cover in regions offering this service.

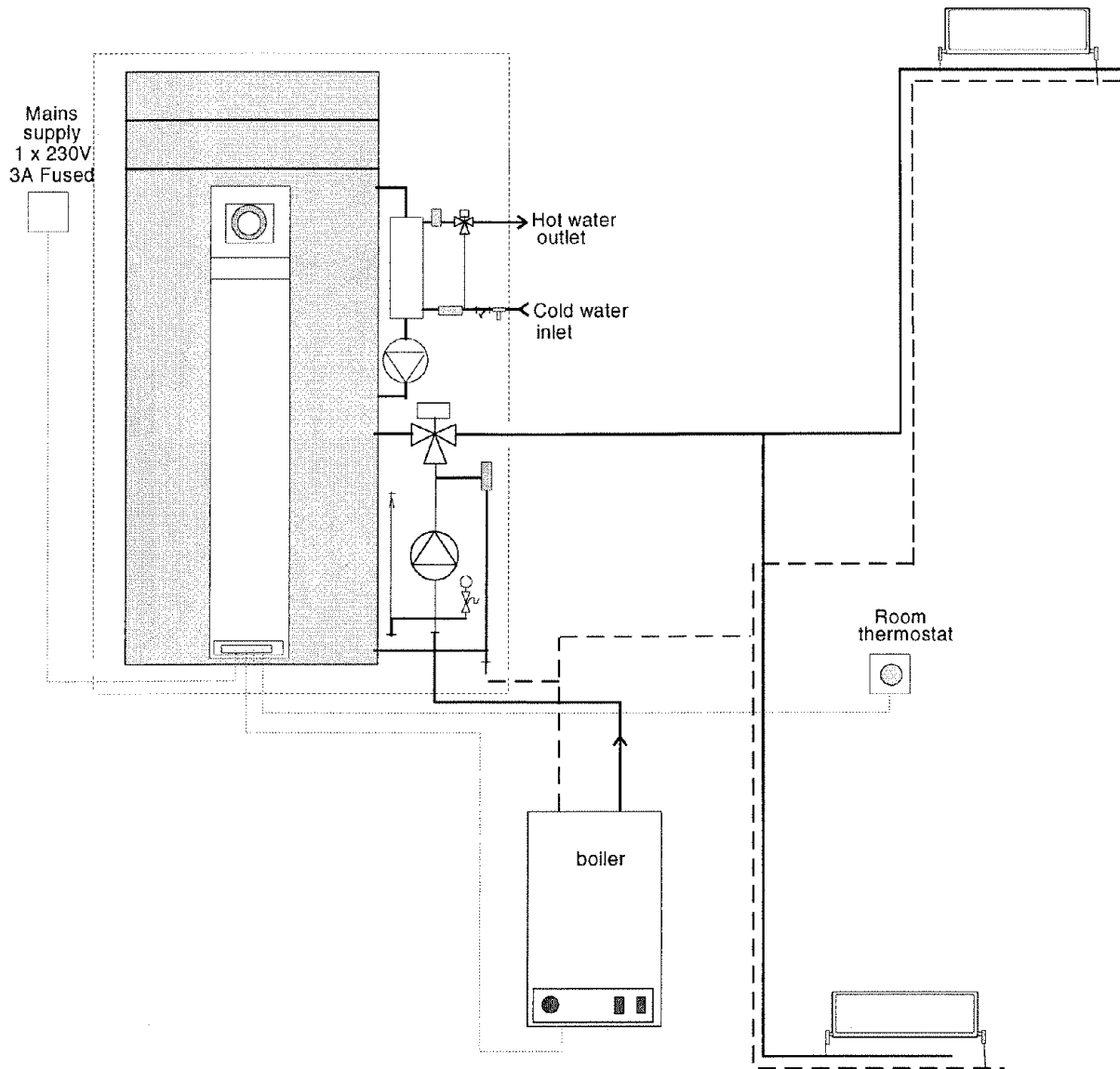


Figure 2.1 A typical Systemate III heating system with boiler below the store (radiators or radiator pipework can be at higher level than the store providing adequate air vents are fitted)

SYSTEM DESIGN

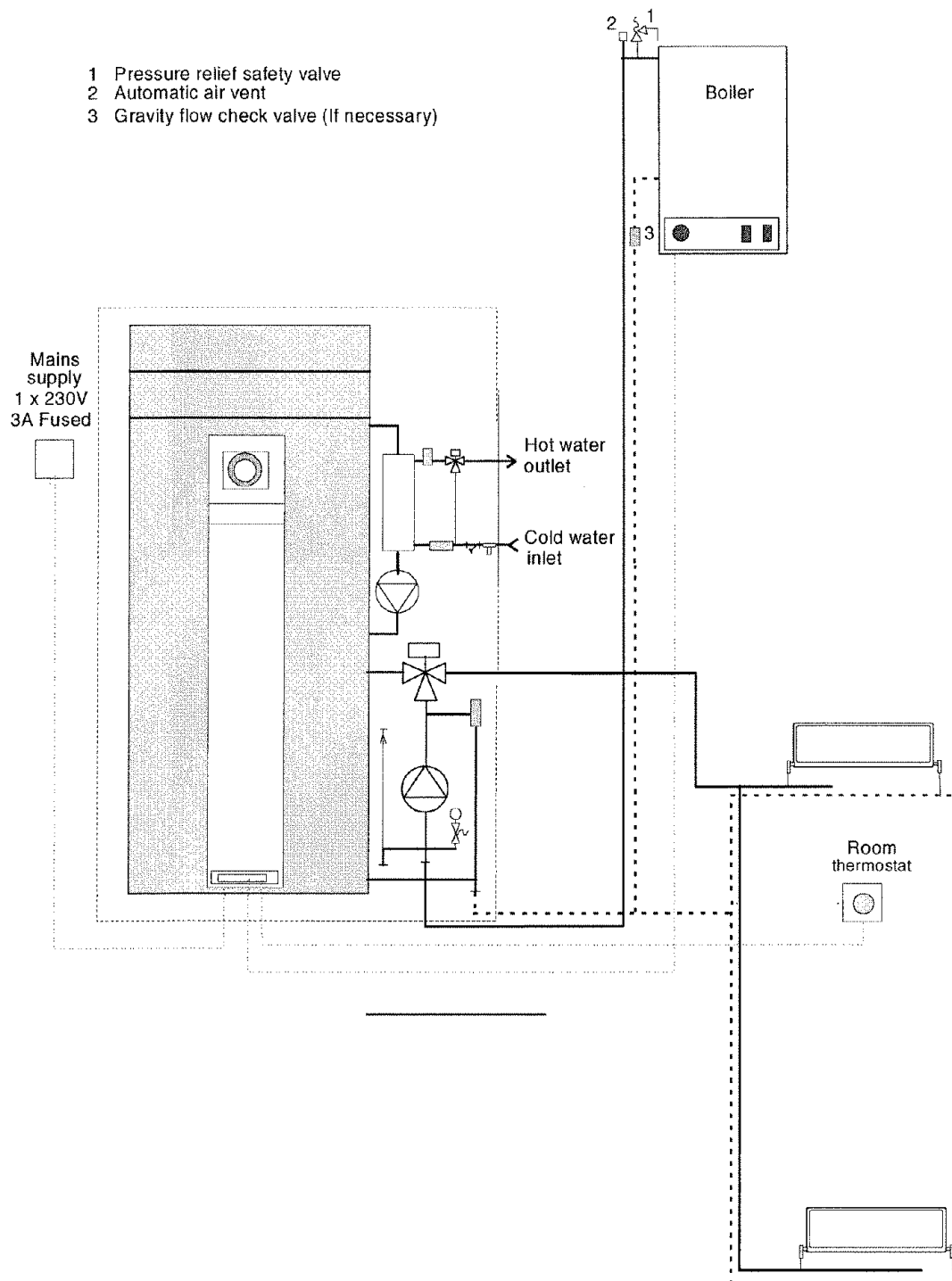


Figure 2.2 A typical Systemate III heating system with boiler above the store (radiators or radiator pipework can be at higher level than the store providing adequate air vents are fitted) (Safety pressure relief valve mounted adjacent to the boiler)

EXPANSION VESSEL REQUIREMENTS

The Systemate is supplied with a 10 litre expansion vessel pre-charged to 1.0 bar. The maximum water content of the heating system (boiler + radiators + connecting pipework + primary coil but NOT store volume) must not be greater than those shown in Table 2.2.

- a) The values presented in Table 2.2 are based on maximum boiler flow temperature of 93°C. The expansion vessel must be suitable to accommodate the change in volume of the water in the system when heated from 10°C to 110°C as specified in BS 5449: 1990 clause 16.2.
- b) Allow the following volumes for the primary heating coil and pipework:

SM118	3.4 litre	SP205	6.2 litre
SM144	3.8 litre	SP238	7.5 litre
SM178	4.5 litre		
- c) In normal circumstances an initial vessel and system charge pressure of 1 – 1.2 bar is suitable for most domestic properties.
- d) The minimum system pressure should not be less than the static head plus 0.5 bar i.e. the height of the highest point in the system above the expansion vessel plus a margin of 0.5 bar.
- e) If the system volume is greater than that shown in Table 2.2 at the selected operating conditions then an additional expansion vessel must be fitted.

Table 2.2 The Maximum Recommended Heating System Volumes

Safety valve setting (bar)	3.0							
Vessel charge pressure (bar)	0.5			1.0			1.5	
Initial system pressure (bar)	0.5	1.0	1.5	1.0	1.5	2.0	1.5	2.0
Maximum permitted system volume (litres)	120	71	38	91	52	24	64	30

SYSTEM DESIGN

GENERAL GUIDANCE NOTES ON SYSTEM DESIGN

HEATING SYSTEM

A schematic layout of the heating system in a typical small dwelling is shown in Figure 2.5

- a) The performance of the system pump and the pressure losses through the Systemate III primary coil circuit are shown in Figures 2.3, 2.3a and 2.4 respectively. The net pump head available for heating circuit can be determined from these figures and this net pump head should be used for sizing the heating circuit pipework.

For example: At 0.5 litres/sec primary flow rate, the pressure loss through the Systemate model SM205 (coil+fittings+3-port valve) is 12kPa (from Figure 2.4). The maximum pump head available at 0.5 litres/sec and setting 3 is 32kPa (3.2m H₂O), therefore 20kPa is available for the boiler circuit.

- b) If the boiler is fitted at a higher level than a Systemate then it may be necessary to fit a gravity check valve in the primary circuit to prevent reverse circulation during dormant period.
- c) All units come complete with their own feed and expansion tank for the primary water in the store, which is used for generating hot water only. The water level in this tank should be adjusted to the level mark.
- d) The Systemate is only suitable for a sealed heating system and therefore heating circuit pipework can run at a higher level than the store e.g. to cross a doorway etc, providing adequate air vents are fitted in the pipework.
- e) With sealed heating systems air is released during the first few weeks of operation. This will need to be vented and the system re-pressurised.
- f) The overflow /warning pipe should be installed in a material suitable for a heating system feed and expansion cistern in accordance with BS 5449.
- g) An automatic bypass is fitted on the Systemate III to compensate for pressure (i.e. flow) rate changes in the heating circuit e.g. when the thermostatic radiator valves close. The system does not require any other bypass valves on the boiler circuit.

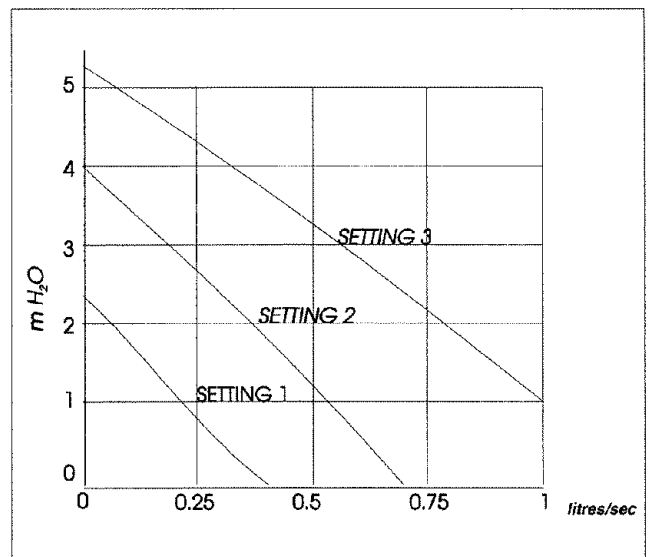


Figure 2.3 Performance Characteristics of Grundfos UPS 15-50 Pump

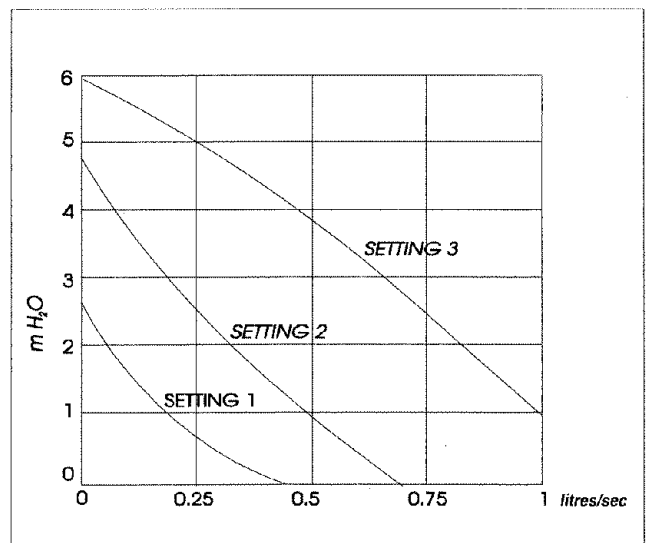


Figure 2.3a Performance Characteristics of Grundfos UPS 15-60 Pump

- h) There shall be no permanent connection to the mains water supply for filling the system, even through a non-return valve without the approval of the Local Water Authority. An approved filling loop is supplied with the Systemate and this should be disconnected after commissioning the system.

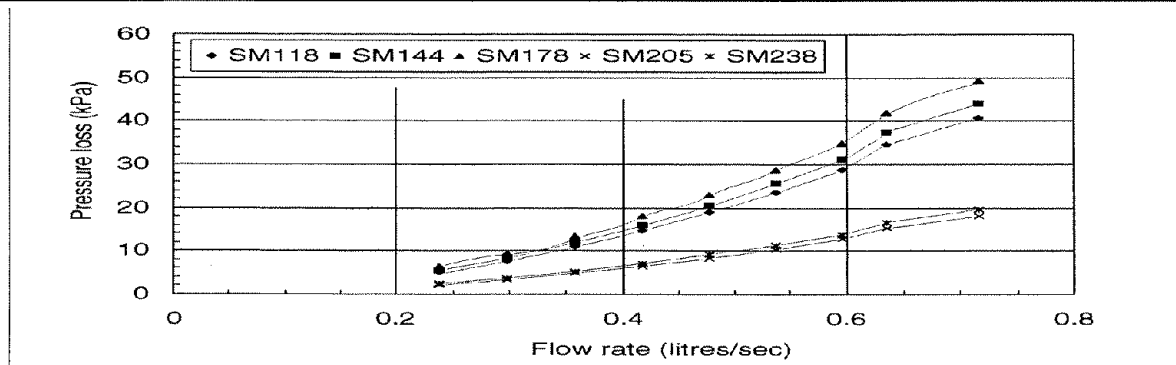


Figure 2.4 Pressure loss through the primary coil, fittings and the 3-port valve fitted to SystemeMate III units

HOT AND COLD WATER SERVICES

A schematic layout of the hot and cold water services in a typical small dwelling is shown in Figure 2.5.

SystemeMate III will operate at mains pressures as low as 1 bar and as high as 8 bar although the preferred range is 2-3 bar. It is also important to check that all other equipment and components in the hot and cold water system are capable of accepting the mains pressure available to the property.

If the mains pressure can rise above the maximum working pressure of any items of equipment or component to be fitted a suitable pressure limiting (reducing) valve will be required.

For properties with a higher supply pressure than 8 bar it is recommended that a pressure limiting valve set at 3 bar is fitted.

Note: Hot and cold distribution pipework should be designed and installed to prevent heating of the cold supply pipes.

Taps and Valves

- Aerated taps are recommended for all mains pressure systems to prevent splashing.

Pipe Sizing

To achieve even distribution of the available supply of hot and cold water, it is important in any mains pressure system that the piping in a dwelling should be sized in accordance with BS6700. This is particularly important in a large property with more than one bathroom. However the following rule of thumb guide lines should be adequate for most typical property types: -

- A 15mm copper or equivalent external service may be sufficient for smaller 1 bathroom dwellings (depending upon the flow rate available), but the minimum size for larger dwellings must be 22mm (25mm MDPE).
- The internal cold feed from the main stop tap to the SystemeMate should be run in 22mm pipe. The hot draw-off should also be run in 22mm as far as the branch to the bath tap.
- The final branches to the hand basins and sinks should be in 10mm and to the shower in 15mm.

- The final branches to taps in existing properties, which are in 15mm, **should be restricted** to balance the flow to each outlet.
- Best results for a balanced system are achieved by fitting appropriate flow regulators to each hot and cold outlet (see Appendix).

Showers

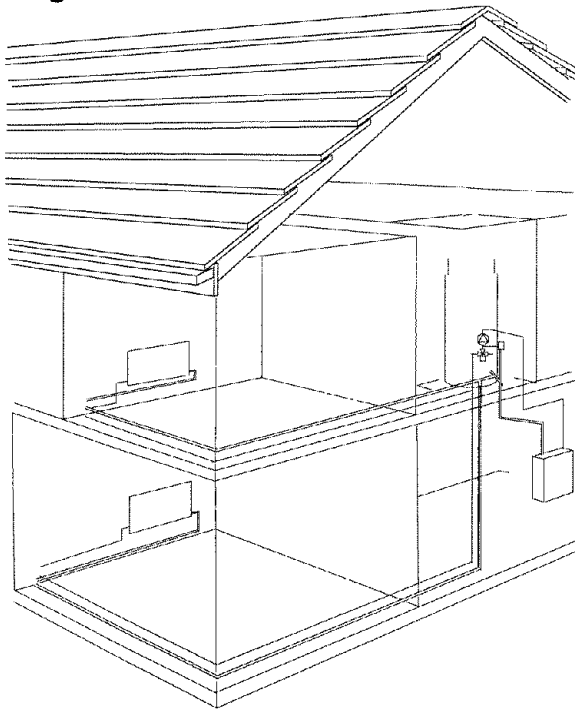
- Any type of shower mixing valve can be used as long as both the hot and cold supplies are mains fed. However **PRESSURE COMPENSATING** shower mixing valves are proven to give better control when more than one fitting are open simultaneously and are therefore **STRONGLY RECOMMENDED**. Thermostatic versions are preferable.
- The hot water supply to a shower mixing valve should, wherever practical, be fed directly from the SystemeMate III or be the first draw-off point on the hot circuit.
- The cold supply to a shower mixing valve should be fed directly from the rising mains via an independent branch.
- Fixed head type showers:** No back-syphonage arrangements are necessary.
- Loose or flexible head type showers:** If a loose head shower with a flexible hose is used over a bath then: -
 - The hose must be fixed so that the head cannot fall closer than 25mm above the top edge of the bath as specified in Model Byelaw 16 of the Water Supply Byelaws.
 Or
 - The shower must incorporate or be fitted with an acceptable means of back-syphonage protection in accordance with the Model Water Byelaws.

Bidets

- The supply of hot and cold mains water directly to a bidet is permitted provided that it is of the over-rim flushing type and that a type 'A' air gap is incorporated.
- It must not include either an ascending spray or provision to attach a hand spray.

SYSTEM DESIGN

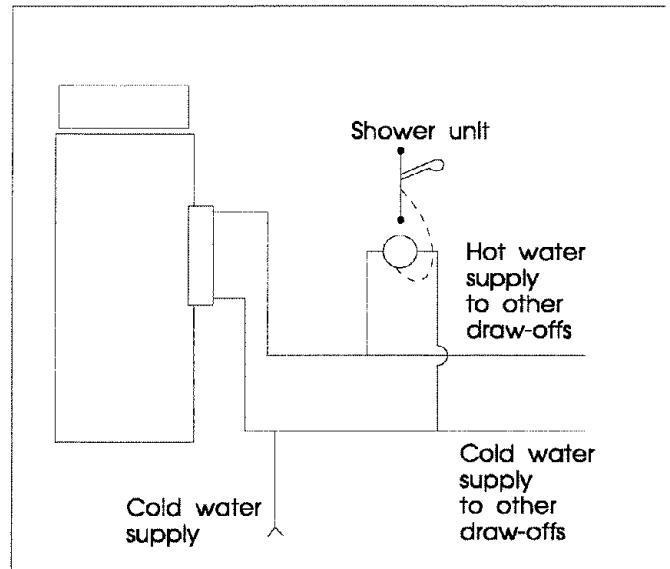
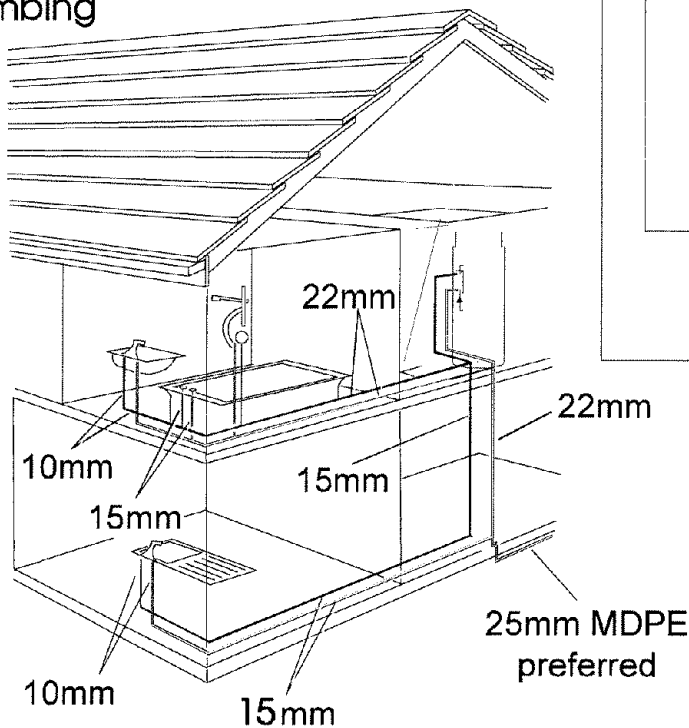
Heating



The flow and return from the boiler run directly to the connections provided on the Systemate III and the flow should rise continuously to aid venting.

— return
 — flow

Plumbing



— cold
 — hot

Figure 2.5 Schematic layout of typical heating and domestic water services

INSTALLATION

INSTALLATION INSTRUCTIONS

IMPORTANT NOTES

- It is important that the appliance is installed on a level and even floor or if raised above the base should be continuously supported. If the support is timber, it shall be marine ply, type C4 chipboard to B.S.5669 or other material which will not deteriorate if exposed to moisture. Details of the appliance weight when full is provided in Table 1.1 of technical specifications.
- Only boilers suitable for sealed i.e. closed heating systems and fitted with additional safety thermostat must be used with SysteMate III.
- For good hot water service, it is important that the boiler selected must be able to deliver hot water at 82°C.
- It is recommended that any surface mounted heating and hot and cold water system pipework in the SysteMate III cupboard **must be insulated** to reduce the standing losses and to prevent unnecessarily high cupboard temperatures. More heat is lost from the first metre of pipework connected to the store than from the store itself.
NOTE It is a requirement of Part L of the Building Regulations that all hot water pipework within 1 metre of a hot water appliance is insulated.
- Notwithstanding the above, the cupboard temperatures are normally higher than in a conventional system and therefore the design of both the cupboard and the door should take this into account.
- The heating system operates on the normal primary flow and return temperatures of 82°C flow and 71°C return of the boiler and should be installed and balanced in exactly the same way as any traditional heating system with an indirect vented cylinder and hot water radiators or convectors.
- SysteMate III models are for sealed primary only.**

Plumbing Connections

- Make all water connections in accordance with the labelling on the thermal store and the associated pipework as shown in Figure 3.1.
- If a boiler is fitted above the thermal store, and there is a risk of gravity circulation, then a gravity check valve should be incorporated in the connecting pipework leading from the SysteMate to the boiler i.e. the boiler return.
- All factory made joints should be checked after installation in case they have been loosened during transit.
- Ensure that the boiler/heating flow and return pipes and the domestic hot water pipes are run such that they do not heat the cold water distribution pipes in a dwelling.

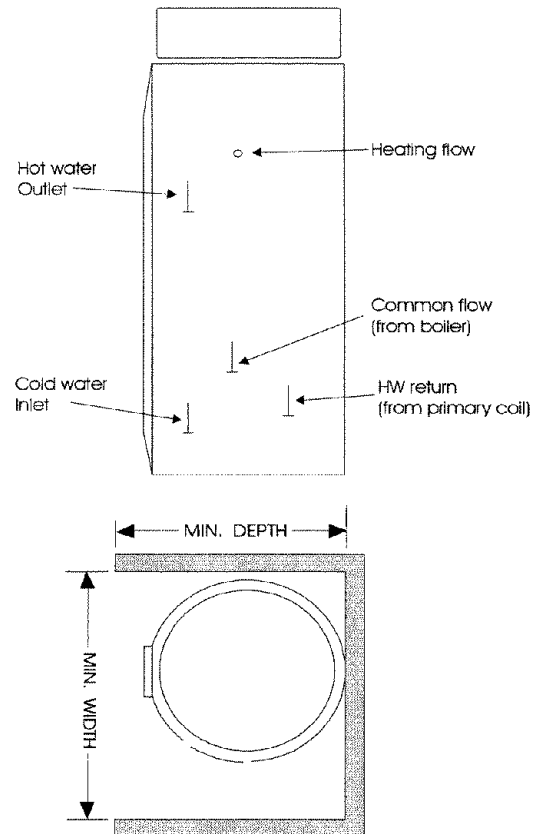


Figure 3.1 SysteMate III Connection arrangement (For minimum cupboard dimensions see Table 1.1)

Thermal Store Feed and Expansion Cistern

- With the manual fill model it is most important to fill with cold water so that the water level is in line with the mark on the inside of the feed and expansion cistern. This is to allow adequate room for expansion, and is marked by a corrugation in the wall of the cistern.
- With the automatic fill model it is important to adjust the ballvalve to the same level as the above.
- Sufficient space should be left above the unit to allow access to the ballvalve for servicing and adjustment. (see Figure 1.5)
- With the automatic fill models a 22mm compression fitting is provided as standard in the feed and expansion cistern for the overflow/warning pipe, which should be no less than 20mm internal diameter.
- The overflow/warning pipe should be fitted to discharge clear of the building and be sited so that any overflow can be easily observed.
- The overflow/warning pipe should be installed in a material suitable for use with heating feed and expansion cisterns in accordance with BS 5449 (such as copper) and should not have any other connections to it.

INSTALLATION

Pressure Relief Safety Valve

The valve should be installed into a discharge pipe which permits the safe discharge of steam and hot water such that no hazard to persons or damage to electrical components is caused. **NOTE.** The valve incorporates plastic components which will be adversely affected by heat. For this reason we recommend the use of compression fittings for joints adjacent to the valve.

Domestic Hot Water Temperature

The electronic control system automatically regulates the domestic hot water outlet temperature to approximately 52°C and no adjustment or setting is necessary during installation.

The Boiler Thermostat

This should always be set to **maximum** to give the best hot water and heating service and to achieve the highest efficiency and reduced boiler cycling by ensuring that the store thermostat will be controlling the boiler.

Pump Settings/ Replacement

- a) The boiler/system pump should be set at the speed at which the temperature difference across the boiler is not greater than 11°C i.e. the nominal design parameters. The performance of the pump is shown in Figures 2.3 and 2.3a.
- b) The domestic hot water plate heat exchanger pump should always be set at maximum speed.
- c) If it is necessary to replace either of the two pumps fitted to the appliance the pump head (motor pack) only should be removed as recommended by the manufacturer (Grundfoss). Assuming it is within warranty this will be accepted by the merchant as being under warranty as long as a complete pump i.e. alleged faulty motor pack and new base is left with the merchant. It is important when a pump has been replaced to ensure that any air is adequately vented.

INSTALLATION IN NINE EASY STEPS

The Systemate III installation is easier and quicker than a conventional vented system because there is no secondary feed and expansion cistern to install and no time is wasted in the planning and installation of the controls and pumps in the cylinder cupboard.

- 1) Inspect the position in which Systemate III is to be fitted and that the width and depth are at least in accordance with the measurements detailed in Table 1.1.
- 2) Plan the pipe connections. Each fitting on the Systemate has its own label. You need to connect the following pipes: -
 - Pumped flow from the connection provided on the Systemate to the radiators.
 - Pumped flow and return pipes from the connections provided on the Systemate to the boiler.
 - Cold mains water supply connections to the inlet side of the plate heat exchanger (and to the ball valve in the F & E cistern if it is the automatic fill model).
 - Domestic hot water supply pipe from the plate heat exchanger outlet to the taps.
 - Overflow warning pipe from the F & E cistern to discharge in a conspicuous position externally (if the automatic fill model).

NOTE: All the radiator return circuits need to be connected together prior to the appliance and the single heating return branched into the hot water return from the appliance to form a common return to the boiler (see Figure 2.1).

- 3) Decide at what stage in your installation work you are going to fit the Systemate. We would suggest that the Systemate should be fitted first and the pipes run from it to the boiler, radiators and domestic hot water supply system subsequently in that order. If the Systemate III is installed as part of the first fix it should be adequately protected or removed and refixed later in the construction process.
- 4) Remember that the automatic bypass is already fitted and no additional bypass should be fitted in the system.
- 5) Carry out the rest of the installation work, i.e. boiler radiators and hot water supply pipework. Connect the cold water supply pipework.
- 6) Fill the Systemate, and fill the radiators, boiler and pipework with water through the filling loop provided. For the standard model, fill manually to the level mark on the inside of the F and E cistern. Adjust the ball valve to fill to the same level on the automatic fill model. Flush the system out, fill and vent again.

- 7) Open the domestic hot water isolating tap and establish flow through the taps etc. Check that the flow through all hot and cold water taps etc. is stopped when the mains water stop valve is closed.
 - 8) The system is now required to be electrically connected.
 - 9) The system is now ready to be commissioned.
- c) Wire the boiler to the Systemate III appliance controller PCB as follows: -
 - Take a 'Live' from the Systemate III PCB terminal '7' to boiler 'Switched Live' terminal.
 - Take a 'Neutral' from the Systemate PCB terminal '5' to the boiler 'Neutral' terminal.
 - Take an 'Earth' from the Systemate PCB terminal '4' to the boiler 'Earth' terminal.
 - If the boiler requires a permanent live other than for a pump over-run, then this should be taken from terminal '6' on the Systemate PCB.

WIRING THE SYSTEM

The Systemate III is pre-wired to a central controller PCB (see page 17), and plumbers are well able to complete the electrical installation provided they adhere strictly to the IEE Regulations.

Note: Do not attempt the electrical work unless you are competent to carry it out to the above standards.

Fused Isolator

- a) Connection to the electrical supply must allow complete electrical isolation by installing a double pole switch having a 3mm separation on both sides.
- b) The isolating switch must only serve the Systemate III space heating and hot water system together with its controls and must be located within 1 metre of the appliance.
- c) The supply to the Systemate III must be fused at 3A.

To Wire the Systemate III

Before commencing, ensure that the power source to which the Systemate is to be connected is isolated. The generic wiring procedure for the Systemate is described below..

- a) Remove the white cover plate (4 screws) and run the external wiring through the grommets provided at the bottom of the white control panel.
- b) Wire the mains power supply from the 3A fused and switched connection unit to the Systemate III storage appliance controller PCB as follows:-

'Live' to terminal '1'
'Neutral' to terminal '2'
'Earth' to terminal '3'

- d) The link between Systemate III PCB terminals '26' and '28' should be removed if a room thermostat is to be fitted.
- e) Remove the link between terminals '22' and '23' if a 'no clock model' has been ordered and it is proposed to fit a remote single channel clock to control the space heating.
- f) The link between the terminals '21' and '22' should be removed if an extra single channel clock or a dual channel programmer is to be fitted for controlling both space heating and hot water .
- g) When the wiring is complete, replace the front cover plate (4 screws).

INSTALLATION

To Wire the Room Thermostat

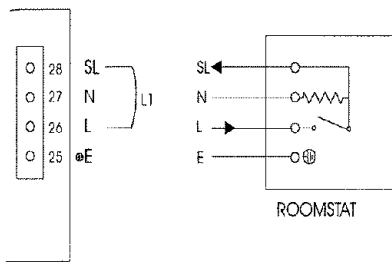


Fig 3.3

1. Remove link L1 from terminals 26 and 28.
2. Connect cables from the room thermostat as shown in figure 3.3.

To wire a single channel space heating clock (no clock option)

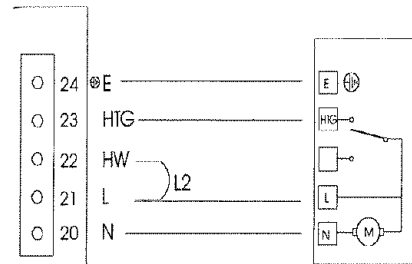
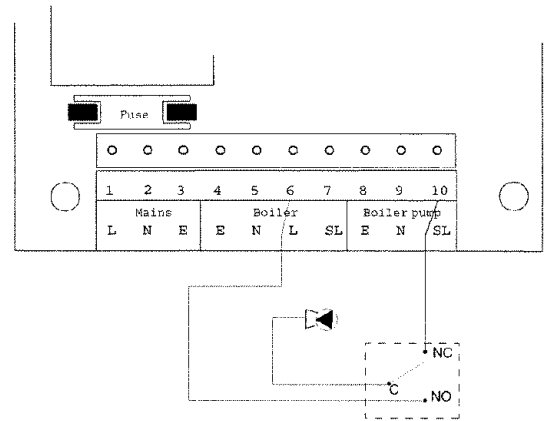


Fig 3.4

- Connect neutral from PCB (term 20) to neutral terminal on the clock.
- Connect live from PCB (term 21) to live terminal on the clock.
- Connect earth from PCB (term 24) to earth terminal on the clock.
- Connect switched live (heating) from the clock to terminal 23 on the PCB.
- Ensure that link L2 between terminals 21 and 22 is inserted.

Frost Protection

1. When frost protection is required for the whole house or where a base temperature is required during cold weather, then a frost thermostat should be wired across SystemMate PCB terminals '21' and '28'.
2. An alternative to fitting a frost thermostat would be to set the programmer to constant during the cold weather period, and adjust the room thermostat to a suitable setting.
3. When frost protection is required for the boiler circuit only a change over type pipe thermostat should be fitted on the primary return pipe adjacent to the boiler and wired into the boiler/system pump live as shown below.



Delay Timer

This facility is provided within the system controller PCB.

OVERNIGHT SHUT DOWN

The most effective service from the thermal storage system (SystemMate III) is achieved when the boiler is on demand for twenty four hours under the control of the store thermostat.

In special circumstances the system can be wired to isolate the boiler overnight using the method described below.

Remote fitting two channel clock

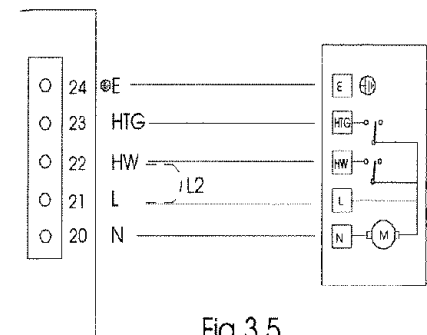
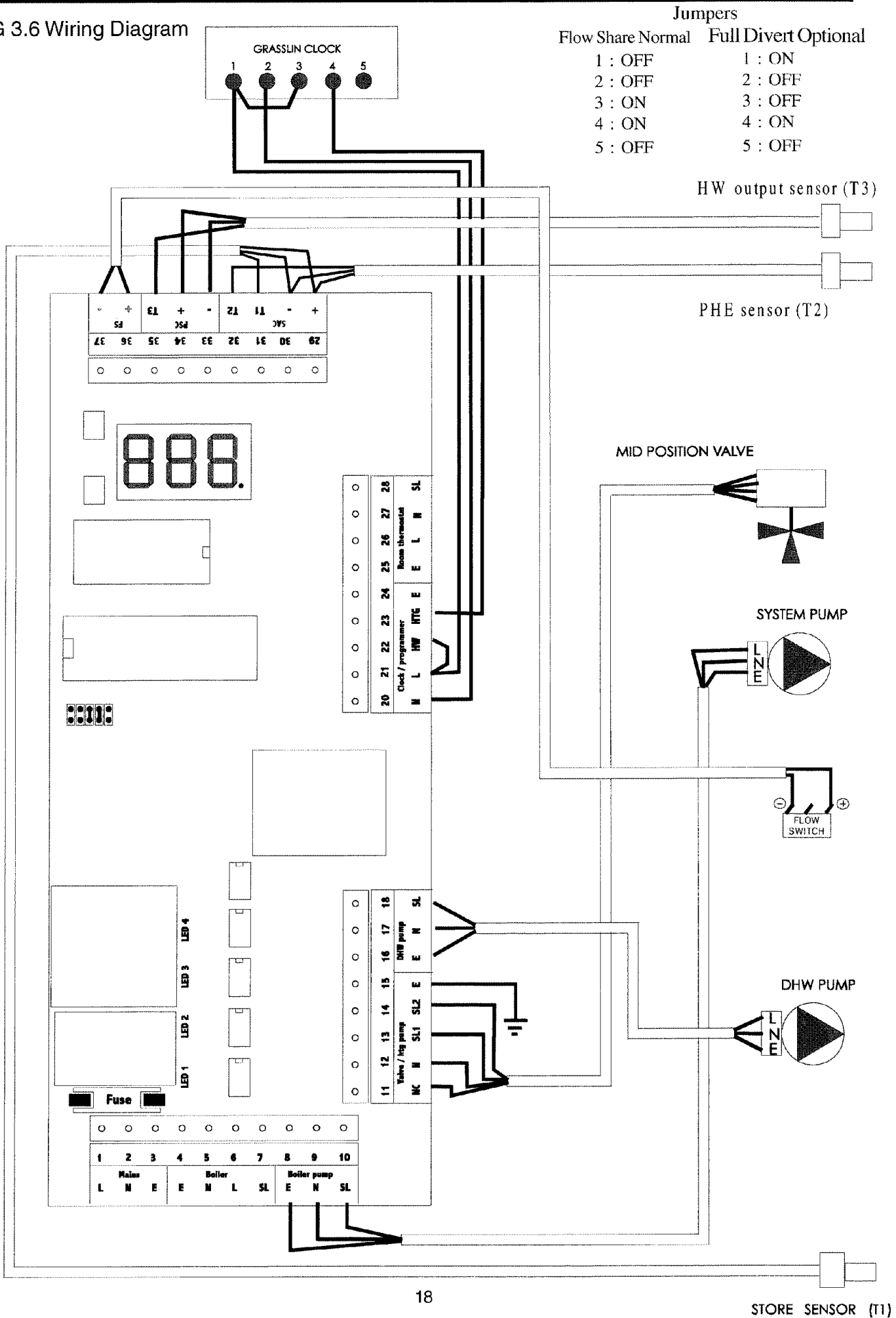


Fig 3.5

- Remove link L2 in PCB terminals 21 and 22.
- Connect N from terminal 20 to clock N terminal.
- Connect L from PCB terminal 21 to clock L terminal.
- Connect E from PCB terminal 24 to clock E terminal.
- Connect HW live from clock to terminal 22 on PCB.
- Connect heating live from clock to terminal 23 on PCB.

INSTALLATION

FIG 3.6 Wiring Diagram



Jumpers

Flow Share Normal	Full Divert Optional
1 : OFF	1 : ON
2 : OFF	2 : OFF
3 : ON	3 : OFF
4 : ON	4 : ON
5 : OFF	5 : OFF

COMMISSIONING

COMMISSIONING THE SYSTEM

It is essential that the system functions properly for optimum performance. To achieve this, the system should be commissioned in accordance with good practice and generally in accordance with the requirements of BS6798, BS5449 and BS7593: 1992.

INITIAL FILLING AND CLEANSING THE SYSTEM

- a) Ensure that the F & E cistern is filled with cold water to the level indicated by the swage line. If an automatic fill model is being used check the ball valve is correctly adjusted to shut off at this level.
- b) Check and adjust the expansion vessel air pressure if necessary to the initial charge pressure of 1.0 bar or to a figure specified by the designer.
- c) Fill the thermal store through the F & E cistern and flush cold.
- d) Open any isolating valves and fill the heating system i.e. boiler and radiator circuits using the filling loop and flush cold.
- e) Refill both the thermal store and the heating system and purge air.
- f) Add a cleanser such as Sentinel X300 or Fernox Superfloc to ensure that flux residues and installation debris are removed from the system.
- g) Commission the boiler.
 - If the boiler is range rated, then adjust it to the **specified** or **maximum** heat input.
 - Set the boiler/system pump speed so that the temperature difference across the boiler is **not more than 11°C**.
 - Set the boiler thermostat to **maximum**.
- h) To ensure full cleansing, the circulation to all parts of the system should continue for a minimum of 1 hour.
- i) Flush both the thermal store and the heating system hot having checked that there is no overflow from the F & E cistern of the Systemate III appliance and that the heating system pressure is not greater than 2.5 bar when the system is up to temperature.

- j) Refill both the systems i.e. thermal store and the heating system.
- k) Switch on and check the operation of the immersion heater (if fitted). **NOTE: Do not switch on the boiler or immersion heater before first checking that the F & E cistern of the thermal store is filled with water.**
- l) With sealed heating systems air is released during the first few weeks of operation. This will need to be vented and the system repressurised.

Primary Water Treatment

- a) Although the standard Systemate has no special water treatment requirements, the radiators and other parts of the circuit will benefit from the application of scale and corrosion inhibitor such as Sentinel X100 or Fernox MBI.
- b) Please remember that if water treatment is applied then it must be introduced separately into the thermal store (via the feed and expansion cistern) as well as being injected into the sealed heating system.

COMMISSIONING

COMMISSIONING THE DIRECTLY HEATED STORE TEMPERATURE SETTING

For maximum system efficiency the store thermostat must be in control of the boiler i.e. the boiler cycles on the store thermostat and not on its integral thermostat. Once the boiler thermostat has been set to maximum the system can be initialised as follows:

Systemate is normally set for flowshare operation. If full divert mode operation is required then the jumpers must be changed as shown in Fig. 3.6 (Page 18) before carrying out the procedure below.

1. Switch off mains
2. Check that jumpers 3 and 4 are on the controller PCB.
3. Press and hold SW1 and SW2
4. Switch on mains

- 1 All segments of LCD display will light
- 2 Segment display will change to indicate program version e.g.

HT
STORE
DHW

The LCD display shows 'U06' in a 3x3 grid. The top row is 'HT', the middle row is 'STORE', and the bottom row is 'DHW'.

- 3 All outputs will be switched ON and then OFF at 5s interval
- 4 Display will change to normal mode

HT
STORE
DHW

The LCD display shows 'Eon' in a 3x3 grid. The top row is 'HT', the middle row is 'STORE', and the bottom row is 'DHW'.

- 5 System will start operating

The appliance will automatically commission itself to match the actual performance of the boiler supplying it. During the commissioning stage the heating should be switched off at the clock. If a two channel clock is fitted the store/hot water channel must be switched on. Once the store thermostat has switched off the boiler operation for heating and hot water systems can be checked.

The temperature settings established during commissioning can be checked using the SW1 and SW2 buttons as follows:-

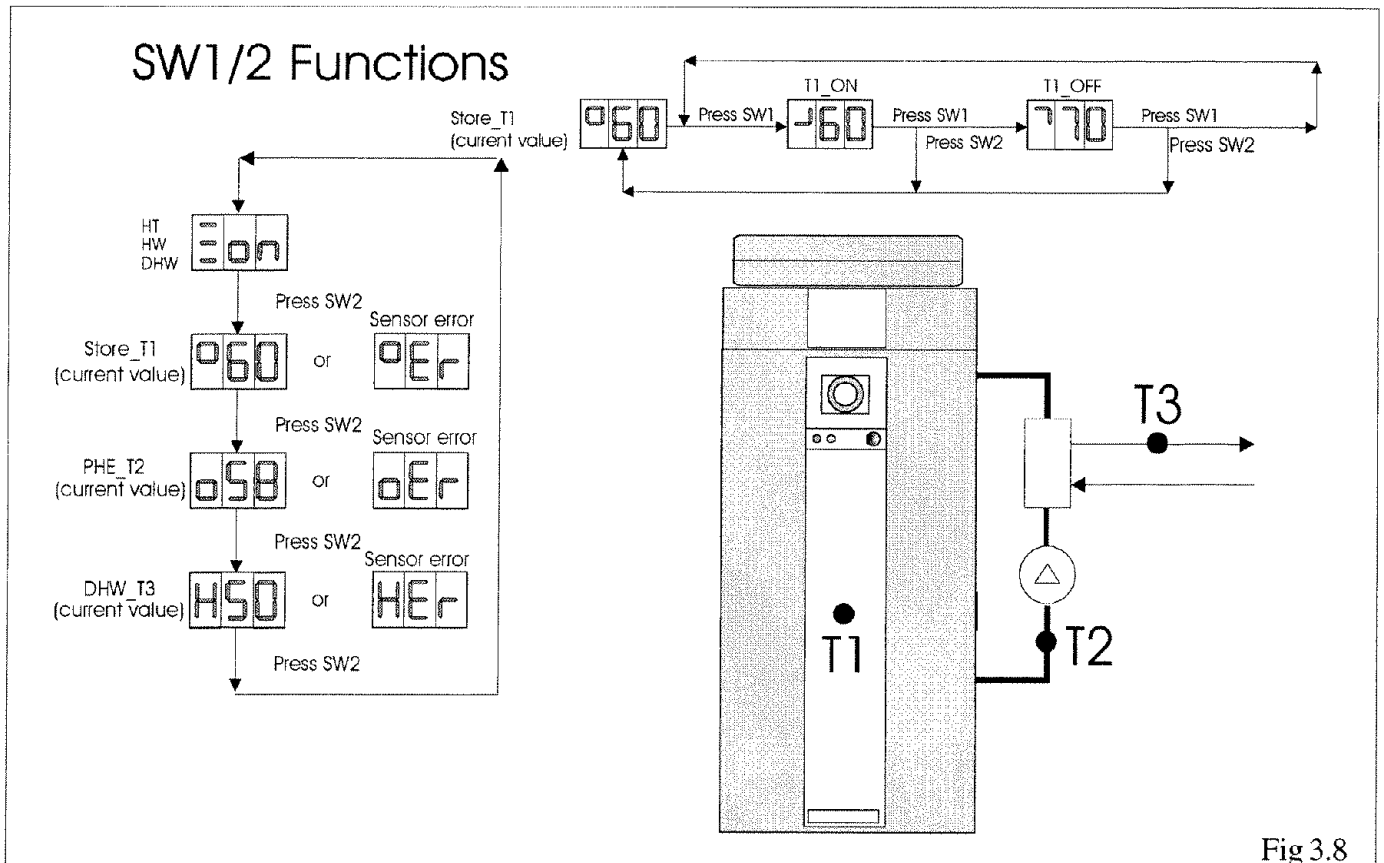


Fig 3.8

COMMISSIONING

Check the functions of the controls as follows:

Space Heating

- (i) Switch on the space heating on the programmer and the room thermostat.
 - a. Horizontal LED bar 1 'HT' will light.
 - b. With pre version 19 program:-
 - i) Green LED 3 on PCB will switch on
 - ii) 3-port valve will move to mid position
 - c. With version 19 onward program if the store temperature is greater than 60°C, then
 - i) Green LED 3 on the PCB will switch on
 - ii) 3-port valve will move to mid position
- (ii) Switch off space heating from the programmer or room thermostat.
 - Horizontal bar 'HT' on the LED display will switch off.
 - Green LEDs 3 and 4 will switch off and the 3-port valve will spring return to normal (hot water) mode.
 - Green LEDs 1 and 2 will switch off if store does not require recharging. The heating will stop circulating the water to the radiator circuit.
- (iii) Turn the hot water tap on and off.
 - When the hot water tap is opened the horizontal bar 'HW' will light, indicating the hot water is running.
- (iv) When the store is charging the green LED's 1 and 2 on the PCB will be lit.

When the store has finished charging, the green LED 1 will switch off, and after about 3 minutes green LED 2 will switch off.

Store Charging

- (i) Switch off the space heating on the programmer and the room thermostat.
- (ii) Switch on hot water if two channel programmer is fitted.
 - Horizontal bar store on LED display will light.
 - Green LEDs 1 and 2 i.e. boiler and boiler pump will switch on.
 - Green LEDs 3 and 4 should be off.
- (iii) When the store is fully charged (or if hot water is switched off on the 2 channel programmer).
 - Green LED 1 i.e. boiler is switched off.
 - Green LED 2 i.e. pump will switch off after about 3 minutes.

IMPORTANT DO'S AND DON'TS

- a) **DO** check the incoming mains water pressure. The preferred range of mains pressure is 2 – 3 bar.
- b) **DO** check that all connections are in accordance with the labelling on the thermal store.
- c) **DO** check the water level is correctly set in the F & E cistern when cold and adjust if necessary
- d) **DO** make sure on the automatic fill models that there is adequate clearance above the F & E cistern to service the ballvalve.
- e) **DO** ensure that any range rated boilers are set at **output** specified by the designer (or maximum).
- f) **DO** ensure that the boiler thermostat is set to maximum.
- g) **DO** insulate any exposed pipework in the Systemate cupboard.
- h) **DO** plumb the overflow/warning pipe in a 20mm internal diameter pipe and ensure it discharges in a conspicuous external position. Ensure it is a material which is suitable for use with a heating F & E cistern in accordance with BS 5449 (such as copper).
- i) **DO** check the pump settings.
 - Adjust the boiler/system pump to give a temperature difference across the boiler of 11°C or less.
 - The hot water plate heat exchanger pump should be set at **maximum**.
- j) **DON'T** use pipework smaller than 28mm between the boiler and the Systemate when the boiler rating exceeds 20kW (about 68,000 Btu/hr).

FAULT FINDING/DIAGNOSTICS

FAULTS AND THEIR CAUSES

Any fault in the system design and malfunction of system components will generate customer complaints. These complaints can be grouped into the following three main categories: -

- a) The system is noisy
- b) Hot water service is unsatisfactory
- c) Space heating service is unsatisfactory

Causes of a 'Noisy' System

- a) Noisy System pump operation
 - Check the pressure in the heating system, which should not be less than 1.0 bar when cold – refill and vent the pump and system if necessary.
 - Check the pump speed setting - reduce if necessary but ensure that the temperature rise across the boiler does not exceed 11°C.
 - If system is noisy when in heating mode – check and adjust if necessary the system bypass valve.
 - Check that the radiator/system is correctly balanced.
 - Check and vent any air in the system and recharge the water pressure if necessary.
- b) Noisy boiler operation
 - Check the flow rate through the boiler at full gas rate by measuring the temperature rise across the boiler. If the temperature rise is 11°C or less then contact the manufacturer. If the temperature rise is greater than 11°C, then increase the pump speed.
 - Check pressure of water in the system – refill if necessary to 1.0 bar when cold.
 - Check and vent the system if necessary.
 - Check and adjust the automatic bypass valve if necessary.
- c) Noise when hot water tap is opened
 - If the plate heat exchanger pump is noisy when the hot water tap is opened, then check the level of the water in the F & E cistern and vent the pump if necessary.
 - Water hammer – loose pipework and/or tap washers.

Causes of 'Unsatisfactory Hot Water Service'

- a) Check boiler thermostat – this should be set at maximum.

- b) Check that the boiler flow temperature before it is switched off by its internal or the store thermostat is adequate – it should not be less than 80°C.
- c) If a separate hot water programmer or a two channel programmer is fitted, then check that the hot water 'on time' periods are set correctly to match the demand pattern in a dwelling.
- d) Check that the store is charging to at least 70°C – if not then check boiler stat setting.
- e) Check that the hot water plate heat exchanger pump stops and starts when the hot water tap is opened and closed.
- f) Check that the plate heat exchanger pump is set at maximum speed.
- g) Check that the hot water outlet temperature does not change significantly when the hot water flow rate is increased from say 5 litres/min to 15litres/min.
- h) Check that the filter before the flow switch is not blocked – clean if necessary.
- i) Check that the space heating and hot water load is not greater than the boiler output and that the Systeme III model is suitable for the type of dwelling.
- j) Check that the primary store is full of water.
- k) If (a) to (j) are correct then it is possible that the performance of the heat exchanger is impaired by scale. If this is the case the hot water flow rate will be reduced. Replace it with a factory exchange unit and re-check hot water performance.

Causes of 'Unsatisfactory Space Heating'

- a) Check boiler thermostat – this should be set at maximum.
- b) Check that the boiler flow temperature before it is switched off by its internal or the store thermostat is adequate – it should not be less than 80°C.
- c) Check the operation and the settings of the heating programmer and the room thermostat.
- d) Check that the 3-port flow share valve is functioning and that the system/boiler pump is circulating the water to the radiator circuit.
- e) If some rooms are not being heated properly, then increase the pump speed and if necessary balance the system.

FAULT FINDING/DIAGNOSTICS

Overflow from Feed & Expansion Cistern

Automatic fill models only

- a) Check that the controlled level of water in the cistern is no higher than the indentation mark. Adjust if necessary.
- b) If a replacement ballvalve is required, then this should be obtained only from Gledhill Water Storage Ltd.

Discharge from the Pressure Relief Safety Valve

- a) Check that the system is not over-pressurised when cold – nominal charge pressure should be about 1.0 bar.
- b) Check that the air pressure inside the expansion vessel is correct – refill with air if necessary to nominal value of 1.0 bar.
- c) Check that the expansion vessel is correctly sized for the system volume.
- d) Check the pressure relief valve seat – replace if necessary.

Appliance control board

The SW1/SW2 controls and LED's 1 to 4 can be used to check the operation of the board itself and the connected systems/components in line with the instructions on page 20/21 of this manual.

MAINTENANCE

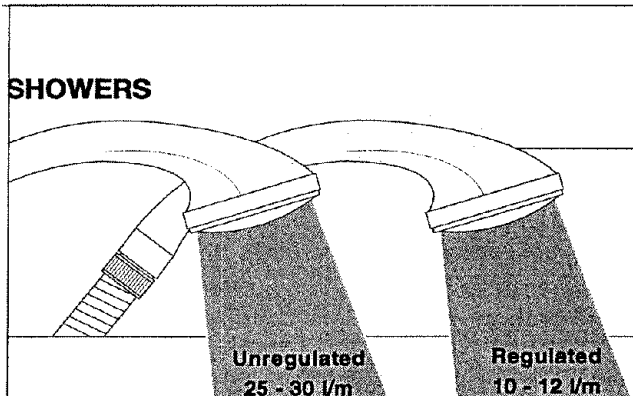
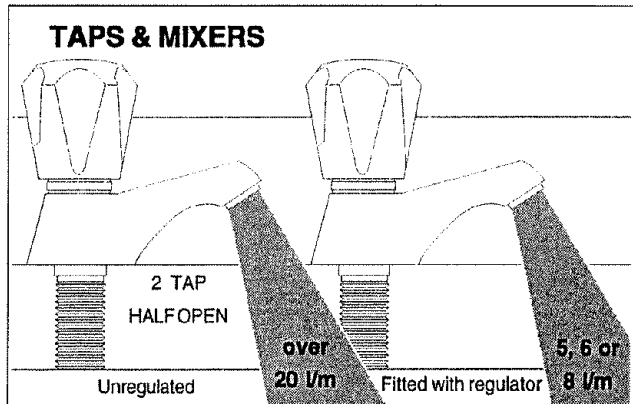
With the manual fill model we recommend that the water level in the Feed and Expansion cistern is checked annually at the same time as the boiler is serviced and water added if required.

APPENDIX

WATER SAVINGS

WATER RELATED COSTS CAN BE REDUCED BY GOOD PLUMBING PRACTICE.

TAPS & MIXERS



Vast quantities of water are needlessly run off to waste due to Taps, Mixers and Showers discharging flow rates far in excess of the rates required for them to perform their duties.

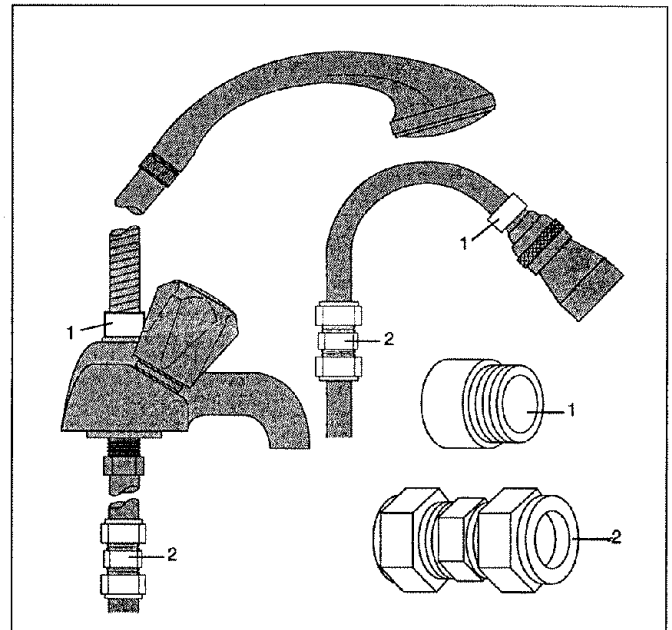
The contrasting flow rates shown on this leaflet clearly illustrate the savings that can be made whilst still providing a good performance.

British made AQUAFLOW REGULATORS provide constant flow rates by automatically compensating for supply pressure changes between 1 bar & 10 bars.

To facilitate installation into the wide range of plumbing equipment which is encountered in the U.K, FOUR FIXING OPTIONS are available:-

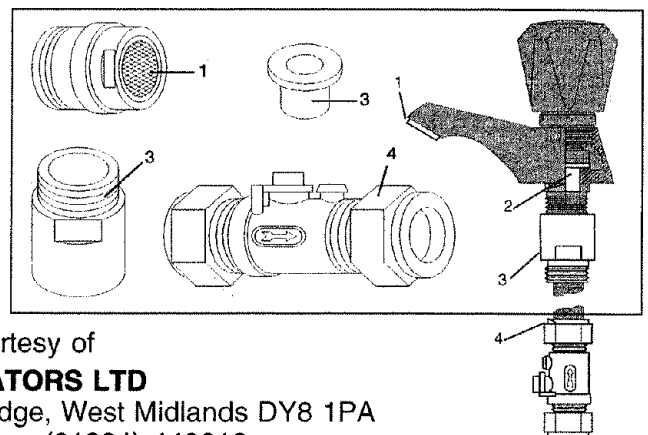
OPTIONS FOR SHOWERS

1. MXF "DW" RANGE - For fitting behind Fixed Shower Heads or onto Flexible Hoses for Handshowers (preferably onto the inlet end when lightweight hoses are used).
2. COMPRESSION FITTING RANGE. "In Line" regulators as in Option 4 for Taps & Mixers.



4 FIXING OPTIONS FOR TAPS & MIXERS

1. MK RANGE - Combined Regulators & Aerators for screwing onto Taps & Mixers with internal or external threads on their noses. Anti Vandal models also available.
2. MR05-T RANGE - Internal Regulators. Push fit into Tap or Mixer seats. Produced in three sizes - 12.5mm (BS1010), 12mm & 10mm, Flangeless models also available for Taps with Low Lift washers.
3. MXF STANDARD RANGE - Screw on tail models for Taps & Mixers. Fix onto the tails before fitting the tap connectors. Available in 3/8", 1/2", 3/4" and 1" BSP.
4. COMPRESSION FITTING RANGE - "In Line" regulators housed in 15mm & 22mm CXC COUPLERS & ISOLATING VALVES. " " UK WFBS LISTED BY THE WATER RESEARCH CENTRE. Isolation valves available for slotted screwdriver operation or with coloured plastic handles. Now available also in plastic bodied push-fit couplers & valves.



Information by courtesy of

AQUAFLOW REGULATORS LTD

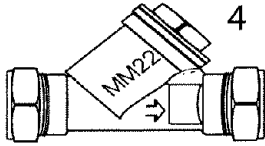
Haywood House, 40 New Road, Stourbridge, West Midlands DY8 1PA

Telephone (01384) 442611 Fax: (01384) 442612

SHORT PARTS LIST

Key Number	Description	G.C. Number	Part Number
1	Ball float	305-038	FT429
2	Ballvalve	E25-993	FT207
3	22mm ball-o-fix valve	E25-995	GT024
4	Y type strainer	E39-178	XB314
5	¾" F/F gravity check valve	E05-681	GT041
6	Grundfos 15/50 pump with 1" connections	E05-723	GT105
7	Grundfos 15/50 pump with 1½" connections	384-288	XB001
8	22mm ball type pump valve	E26-010	XB121
9	28mm ball type pump valve	E26-011	XB122
10	Flow switch	E05-674	GT106
11	Plate heat exchanger	E05-664	GT017
12	Appliance Control PCB	E39-158	GT155
13	Store sensor	E26-022	GT149
14	PHE return sensor	E26-022	GT149
15	Pump speed sensor	E26-024	GT153
16	Grasslin Electro-Mechanical Clock	385-873	XB215
17	Grasslin Digital Clock	385-874	XB216
18	22mm 3 port mid position valve	E26-025	XG130
19	28mm 3 port mid position valve	E26-026	XG142
20	Grundfos 15/60 pump	E00-062	XB241
21	22mm By-pass valve	E39-182	XG156
22	Water mixing valve - Brawa	385-872	XC007

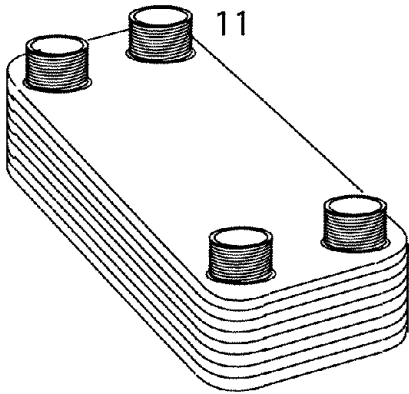
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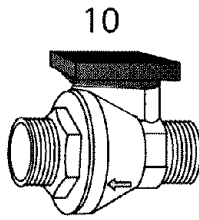
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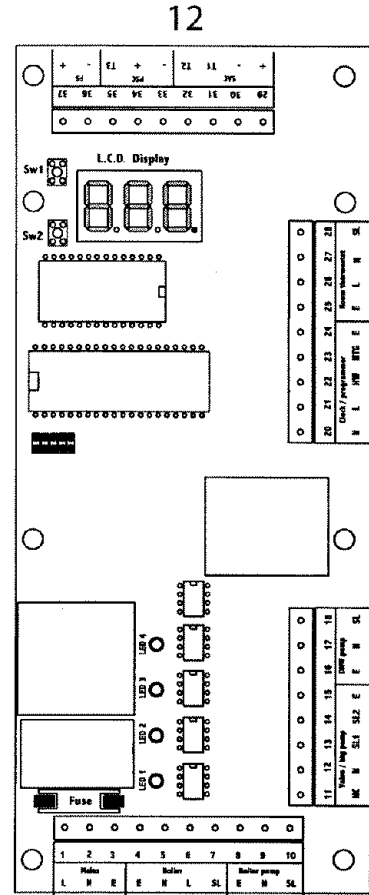
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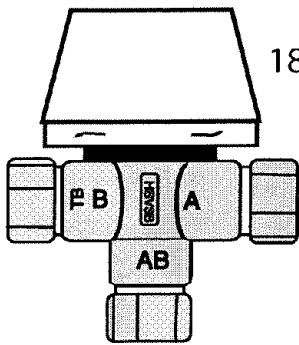
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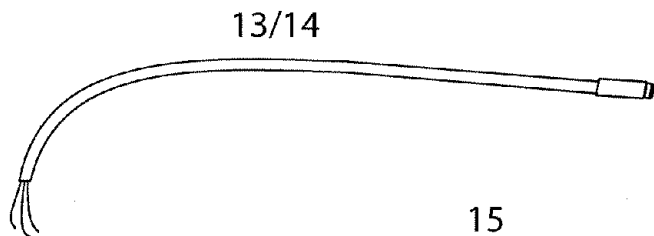
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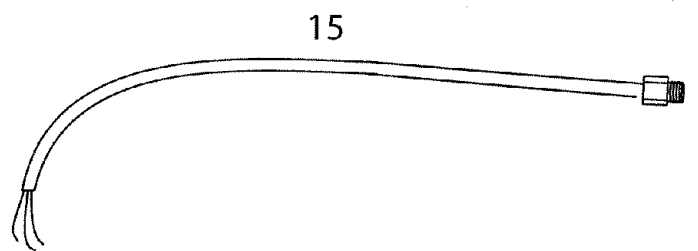
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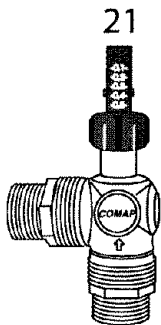
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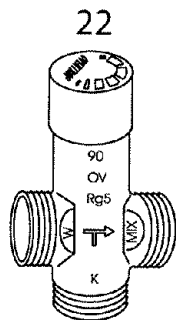
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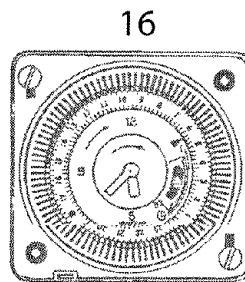
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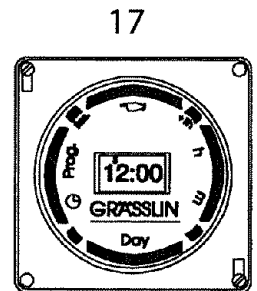
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22



16



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