

# Uflex Underfloor Heating

## Installation & Operating Instructions



## IMPORTANT NOTE FOR INSTALLERS

These instructions are intended to guide installers on the installation and commissioning of the Grant Uflex Under Floor Heating. After installing the system, leave these instructions with the user.

## SPECIAL TEXT FORMATS

The following special text formats are quite important and are used in these instructions for the purposes listed below:

### **! WARNING !**

**Warning of possible human injury as a consequence of not following this instruction.**

### **! CAUTION !**

**Caution concerning likely damage to equipment or tools as a consequence of not following this instruction.**

### **! NOTE !**

**Used for emphasis or information not directly concerned with the surrounding text but of importance to the reader.**

## SERVICE

The Uflex Under Floor Heating system should be serviced at least every twelve months and the details entered in the Service Log in the back of the manual.

## CUSTOMER SUPPORT CENTRE

Grant UK provides an online support centre for Heating Professionals and Homeowners to access post-installation care, advice and maintenance support for Grant products. Follow the QR codes below to access your relevant Customer Support Centre.



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Professional



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# 1 INTRODUCTION

## 1.1 GENERAL

The Grant UFH is not difficult to design or to install, but it is important that the guidelines and instructions are carefully followed to ensure that the system performs correctly once installed and has a long service life.

This installation instructions explains the fundamental principles and design of the Grant UFH and also gives installation guidelines for the components and systems.

Installing The Grant UFH is different, although the heat source is often the same, the materials and method of heat distribution are different.

- There is a central distribution point, the **manifold**, which is served by the primary heating source and which distributes warm water to the pipes of the Grant UFH system.
- The Grant UFH operates with a low water temperature flow and return and therefore requires its own water temperature **controls** and own **pump**.
- The Grant UFH uses the whole floor area as the heating medium, replacing radiators or convectors.

The use of Grant pipe systems makes the installers physical task much easier. However, it is vital that the work is done correctly, as once the installation is complete and pipes are embedded in the floor, it would be difficult to make changes.

## 1.2 RESPONSIBILITY

The overall efficiency of the system is inherent in its design. The installer is solely responsible to the client for ensuring that the design and system criteria are followed. The system must be installed in accordance with the design and with other recommendations contained within this guide.

This guide is not intended to override the skills of the individual installer; it is published simply as a guide to installing the Grant UFH and is based on methods and practices developed over many years. It is hoped that it will provide a useful background on installation for those who are not yet familiar with the system.

Words and pictures obviously cannot replace experience. The guide should be read through **BEFORE** attempting the first installation. It is the responsibility of the installer to ensure that all relevant information has been supplied and to ensure that any design work from Grant is suitable for the installation in question.

Grant trained installers are available to install the Grant UFH system. Technical support is available from Grant to help with queries, if others are installing the system. However, it is important to note that the ultimate responsibility for the system operation rests with the installing company.

Grant has a policy of continuous improvement and reserves the right to change any specification without notice.

## 1.3 UFH DESIGN PRINCIPLES

### 1.3.1 SPACE HEATING

Whatever the method used, the purpose of all space heating is to create an acceptable level of human comfort within a defined area. "Comfort" however, is a subjective concept. It will vary from person to person according to their age and activity level. There is therefore no universal ideal design temperature for all occasions - a sheltered housing project may require air temperatures of 21°C, while just 15°C may be adequate in a gymnasium or indoor sports hall.

### 1.3.2 PRINCIPLES

The principle of Uflex Under Floor Heating system (UFH) is that of rather than mount metal panels on walls, pipes are laid in the floor and warm water circulated so that the floor effectively becomes a large radiator.

Because the floor is so large compared to a normal wall-mounted radiator, it needs to run only a few degrees above the air temperature to provide enough warmth to gently heat the whole room.

The primary aim of the floor heating design is to create an even, uniform surface temperature across the entire floor area within the building in order to ensure a consistent comfort level throughout the structure.

When the floor temperature is higher than the air temperature, the floor will emit mainly radiant heat.

The heat output from the floor is directly related to the temperature of the floor and that of the surrounding air.

Loops of pipes are normally installed beneath the whole floor area. These loops are connected to a central manifold, which is supplied with hot water from a suitable heat source - such as a boiler or heat pump.

If using a boiler as the heat source, the central heating water is mixed before it reaches the manifold to reduce the water temperature to that suitable for the Grant UFH system.

A heat pump operates at lower temperatures and as such, depending on the design of the system, the heat pump can be connected directly to the Grant UFH system without the need of mixing down the water temperature.

Controls reduce the water temperature to maintain the correct design temperature and pump the warm water through the Grant UFH pipes.

### 1.3.3 HEATING WITH UFH

The Grant UFH avoids wasted heat at high level and since the whole floor is heated evenly, optimum comfort is achieved everywhere in the room. In fact, the room thermostat can be set 1 – 2 °C lower than a radiator system. Running the system at a lower temperature makes for significant savings on fuel costs.

### 1.3.4 HEAT OUTPUTS

It is the clients responsibility to check that heat losses of the building, carried out by a heating consultant or engineer, are compatible with the outputs given. Generally, the maximum output from an UFH system is often stated at between 70 and 100 W/m<sup>2</sup>.

The actual output achieved is a direct relationship between the difference in floor surface and room air temperatures. The floor construction, floor covering material, pipe size, pipe spacing, and the temperature of water circulating through the UFH pipes are major factors that determine the floor surface temperature.

When designing conventional heating systems it is necessary to know the required heat output to be able to size the heat emitter. However, for UFH the size of the emitter is fixed - it is the floor area. Hence, the heat output is a function of the operating temperature of the floor, the floor area, and room air temperature.

### 1.3.5 HEAT REQUIREMENTS & SUPPLEMENTARY HEATING

Given the low U-values stipulated in current Building Regulations, it is unusual to require outputs greater than 70 W/m<sup>2</sup>, based on a 20°C internal design temperature. It is important to note that poorly insulated buildings, conservatories, areas with high ceilings and rooms with high internal temperature requirements, may require supplementary heating during midwinter conditions.

The heating consultant or engineer should provide heat loss calculations. Heat losses are calculated in the conventional way and the heat source size will be similar whether UFH or other heating system is used. Grant will specify maximum heat outputs for the floor and air temperatures specified. Providing the project complies with current building regulations, particularly with regard to thermal insulation levels, these outputs should be more than adequate to meet heat losses and provide full comfort conditions.

### 1.3.6 DESIGN LIMITS

Establishing the correct operating temperature for the floor surface is a balance between not having the temperature so high that it causes discomfort, but high enough so that sufficient heat output is provided to meet the calculated heat losses. BS EN 1264-2 states that the 'physiologically agreed' maximum floor surface temperature is 9 °C above the room temperature. This results in a maximum floor surface temperature of 29 °C in typically occupied areas with a room temperature of 20 °C. A 9 °C temperature difference will equate to a floor heat output of 100 W/m<sup>2</sup>.

### 1.3.7 FLOOR CONSTRUCTION TYPE

Floor construction is another key factor in the design. Screed floors, suspended wooden floors and floating floors all require individual consideration to ensure optimum performance and an even distribution of heat across the surface of the floor.

The screed or solid floor system relies on the conductivity of the screed or concrete to conduct the heat from the pipe surface to the underside of the floor finish. Because the screed is itself heated to conduct the heat it tends to store considerable amounts of heat and thus provides a slow response when both heating up and cooling down.

Timber floor systems rely on the conductivity of components fitted within the floor to conduct the heat from the pipe to the underside of the floor finish. In order to achieve good results the pipes must transfer their heat evenly to the floor surface.

Inadequate heat dissipation and hot spots can cause unsightly shrinkage, particularly with natural wood boards.

Because the mass of a timber floor structure is less than the mass of a screed floor, the system response of a timber floor system is usually much faster.

### 1.3.8 WATER TEMPERATURE CONTROL

To meet the requirements of BS EN 1264, water temperature control must be provided. This ensures that maximum floor surface temperatures are not exceeded.

All Grant water temperature controls are designed to mix and control the primary heat source flow water temperature with the UFH return water temperature, to a temperature suitable for the UFH system.

### 1.3.9 BOILER/HEAT SOURCE

Traditionally, the primary heat source has been a boiler, producing low temperature hot water for the system. Modern high efficiency condensing boilers are ideal for UFH as the low water temperatures allow the boiler to work in condensing mode.

If the heat source is able to provide and maintain a constant or variable water temperature at the requirement for the UFH, it may not be necessary to have any further water temperature controls.

If there are no services, other than the UFH, being supplied by the boiler and water temperature controls are used, it may be necessary to have a heat sink, such as a towel rail, prior to the UFH mixing valve to prevent the boiler from cycling and cutting out on high limit.

However, ultimately, careful thought must be given when choosing your boiler, as not all units are compatible. Always check the specific application with the boiler manufacturer. More recently, other sources have become available which are ideal for UFH such as ground source or air source heat pumps.

### 1.3.10 CALCULATING SIZE OF UFH PUMP

The smooth inner surface of PE-RT and PEX-AL-PEX pipes reduces the pressure loss, optimising the pipe length that can be used.

The temperature drop across the pipe loop and the maximum required heat emission determines the water flow rate required through the pump.

The Grant mixing valve / pump unit is supplied complete with a suitably sized UFH circulating pump.

### 1.3.11 PIPE SPACING

In solid screed floors and areas of average to low heat loss, Grant will generally recommend standard pipe spacings of 200 mm (16 mm diameter pipe). In areas of high heat loss, the pipe spacing may be reduced to a minimum of ½ the standard spacing to achieve higher heat output. Such areas include: highly glazed areas such as a conservatory, rooms with high ceilings, bathrooms with limited floor area and poorly insulated buildings.

Tighter pipe spacings can also be used within a peripheral zone, which is an area of floor between an external wall and 1 metre in from the external wall. Pipe spacings may be reduced when renewable energy heat source, such as a ground or air source heat pump, is employed.

In this instance, tighter pipe spacings will allow for lower hot water temperatures and result in improved efficiency and lower energy costs. Ensure that there is sufficient pipe length available prior to installing at reduced pipe centres.

Timber suspended and floating floor pipe spacings tend to be fixed by the particular system and the UFH components used. In order to calculate the amount of pipe required, the following guide can be used:

**Table 1-1: Amount of pipe required**

Pipe spacing (mm)	Quantity of pipe (m/m <sup>2</sup> )
300	3.4
200	5.0
150	6.7
125	8.0
100	10.0
50	20.0

## ! NOTE !

**When calculating your pipe requirements, remember to add the feed/tail pipe lengths, between manifold and room, to your calculations.**

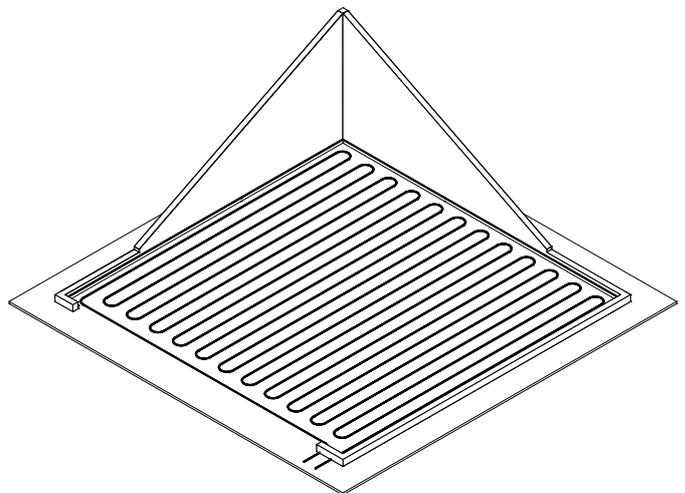
### 1.3.12 PIPE LAYOUT

Where possible, the pipe should be laid so that the flow direction is to the coldest area of the room first, e.g. under windows, along outside walls. There are typically two patterns for installation in solid floors, the meander/serpentine pattern (Refer to Figure 1-1), or the bifilar/snail pattern (Refer to Figure 1-2).

With the meander pattern the flow pipe is first directed towards the window or cold part of the room before returning backwards and forwards across the room at the defined spacing.

The bifilar pattern is where the flow pipe is run at ever diminishing circles until it reaches the centre of the floor area, then it reverses direction and returns parallel to the flow pipe back to the starting point.

Both patterns of installation are acceptable, however the meander pattern is often used against areas of high heat loss, while the bifilar pattern is employed where even floor surface temperature is required.



**Figure 1-1: Meander pattern**

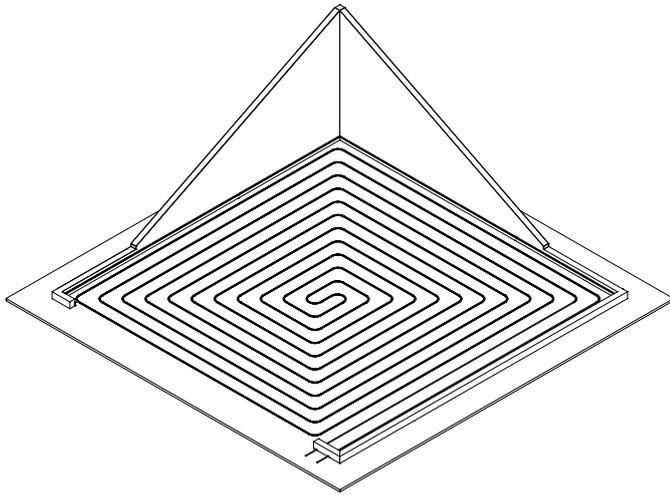


Figure 1-2: Bifilar pattern

### 1.3.13 PIPE BEND RADIUS

The minimum manual bend radius for Grant pipe is:

Table 1-2: Minimum manual bend radius for Grant pipe

Pipe	Minimum bend radius
10 mm x 1.3 mm PE-RT	5 x OD ( $\leq 18$ mm) / 8 x OD ( $> 18$ mm)
16 mm PE-RT	5 x OD ( $\leq 18$ mm) / 8 x OD ( $> 18$ mm)
16 mm PEX-AL-PEX*	Manual bending: 80 mm (5 x OD) Mechanical bending: 49 mm

\*Pipe can be bent manually or mechanically with bending radius of up to 2.5 x OD

**On tight pipe spacing, allow the pipe to balloon at the 180° turns.**

### 1.3.14 SCREED FLOORS

For solid floor construction, a normal sand/cement floor screed can be used. No special additives in the screed are required.

Where the pipe is laid on insulation, the minimum screed depth must be 65 mm for domestic applications and 75 mm for commercial applications as specified in British Standards.

Grant recommends that the optimum screed thickness for the Grant Uflex system is 75 mm but no more than 90 mm, for most applications. Where heavier floor loadings are required, the construction engineer should advise on the screed thickness.

Specialist flow/liquid Screeds, when used with underfloor heating, must provide a minimum 30 mm coverage over a pipe or conduit. The Grant Uflex MINI system can be used with an approved self-levelling compound, e.g. Mapei Ultraplan Renovation Screed 3240 installed over a stable and sturdy floor substrate with minimum 15 mm build height.

Careful consideration must be given to the expansion of heated screed floors. As a guide when using semi-dry cement and sand screeds, BS EN1264 - Part 4 recommends a maximum screed area of 40 m<sup>2</sup> can be laid without expansion allowances.

With Anhydrite screeds much greater areas can be laid without expansion joints; e.g. in Sports Halls up to 600 m<sup>2</sup>. When using an Anhydrite screed always check with the supplier for their requirements.

The screed must be allowed to dry and cure normally, in accordance with the relevant BS Standards and manufacturer and supplier instructions, before initial heating and system startup.

The underfloor heating MUST NOT be used to speed up the curing process.

### 1.3.15 TIMBER FLOORS

There are many types of wood flooring which are considered suitable for use with UFH and, equally, there are several methods of installing timber, which also must be taken into consideration before the system is designed. Particular attention must be paid to the moisture content of wooden floors. Not all timber floors are suitable for UFH and advice should be sought from the flooring supplier or from the trade association TRADA.

### 1.3.16 INSULATION

A layer of insulation should be applied beneath the circuit pipework to prevent downward heat loss, thus maximising the heat output into the room. It is also important to provide edge insulation around the perimeter of the area where UFH is installed, especially on screed floors, to avoid heat transfer/losses into the vertical structure. It also allows for an amount of expansion of the slab.

### 1.3.17 EXPOSED GROUND FLOORS

Exposed ground floors should be thermally insulated to the latest requirements of Building Regulations Part L (England & Wales) and in addition, for UFH systems, should limit downward heat losses of no more than 10 W/m<sup>2</sup>. Supplementary insulation, above the normal Part L requirements, may be required if floor coverings with high thermal resistance are used. If insulation is already fitted below the concrete slab, a recommended minimum insulation thermal resistance of 1.25 m<sup>2</sup>K/W should be installed above the slab (equivalent to Grant 50 mm Rolltec insulation boards), to improve the UFH system response times.

### 1.3.18 INTERMEDIATE FLOORS

Intermediate floors, with heated rooms below, should have a separating layer of insulation having a minimum 0.75 m<sup>2</sup>K/W thermal resistance, to comply with BS EN 1264-4. All floor constructions should be compliant with Building Regulations, including Part E and Part L (England & Wales). It is the responsibility of the architect and/or the builder to ensure that the insulation is adequate for the requirements of the underfloor heating and Building Regulations.

**The relevant Building Standard codes for other countries are:**  
**Northern Ireland - Technical Booklets F (Conservation of Fuel and Energy) and G (Sound).**

**Republic of Ireland - Parts L (Conservation of Fuel and Energy) and E (Sound)**

**Scotland - Sections 6 (Energy) & 5 (Sound).**

### 1.3.19 PROTECTIVE LAYER

It is essential to prevent screed from slipping between the insulation board joints, creating a cold bridge and to inhibit the migration of water during the construction process. This is normally achieved by taping the joints of insulation, such as, PUR or PIR board or alternative foil faced insulating boards, which have the protective layer incorporated within. Alternatively if using an insulation without a protective layer, use a polythene film of at least 0.15 mm thickness over the insulation, prior to laying the floor screed. If using a liquid screed (calcium sulphate), please consult the screed specialist for confirmation of suitable layers to be used above the insulation.

### 1.3.20 FLOOR COVERINGS

Most floor coverings can be laid on UFH systems. The floor covering supplier should be consulted to ensure that any special recommendations are followed, e.g. maximum temperature limits, wood drying conditions, special glues, etc. It is strongly recommended that before any coverings are laid on screeded systems, the UFH system is run for two weeks (after normal screed drying time) and allowed to cool.

In all cases, it is recommended that thick felts, thick underlays, and cork are avoided. For optimum performance Grant advise that a maximum combined thermal resistance, for floor coverings, of 0.15 m<sup>2</sup>K/W is not exceeded, in accordance with the British Standard BS EN 1264, which equates to a carpet and underlay TOG value of 1.5.

We advise, where possible, to have masonry coverings, - e.g. ceramic floor tiles, slate, stone, marble etc. - as this offers little thermal resistance and reduces downward heat losses. After the floor covering has been laid, the UFH system can be "tuned" to match the variations in floor coverings in each room by adjusting the manifold loop flow rates.

## **! NOTE !**

**The Grant UFH is designed exclusively for domestic or semi-domestic purposes. This means that even users without prior experience should be able to operate the Grant UFH controls safely.**

## **! NOTE !**

**Improper installation of equipment or accessories can result in electric shock, short circuit, leakage, fire, or other damage to the equipment. It is important to use only accessories that are made by the supplier and are specifically designed for the equipment.**

# 2 PRE-INSTALLATION CONSIDERATIONS

## 2.1 BEFORE INSTALLATION

Prior to installation, it is important that the installer makes the following checks to ensure the project runs as smoothly as possible:

- All the materials and the quantities are correct and on site against the delivery note and against the material schedule.
- All other trades involved in the installation fully understand the component layout and positioning. For example, for first fix wiring, the electrician should know the positions of the room thermostats, water temperature controls, time clocks, etc (Refer to section 5 - Heating Room Controls - for further details).
- Sub-floors are clean, level and are correct for the depth of construction needed to incorporate the underfloor heating.
- Ensure all other trades not involved with the installation are notified and excluded from the installation area before and during installation.
- It is important to read in full and understand all installation instructions offered before commencing installation.

### 2.1.1 CONNECTION TO PRIMARY CIRCUIT

Each manifold and/or water temperature control station must be served by a flow and return from the central heating source and primary heating circuit. Where the heat source is providing water at the correct temperature for the UFH system, the manifold can be connected directly onto the primary pipework.

When using the mixing valve/pump unit and a single manifold, connections can be made directly to the flow and return connections of the mixing valve/pump assembly.

Unless otherwise specified or requested, Grant does not design or supply the primary supply pipe work.

As a precaution and in accordance with good practise Grant recommends that an automatic by-pass is always fitted in the primary pipework.

### 2.1.2 FIRST INSTALLATION TIPS

For first time installers:

- Laying the pipe needs two people; one person holding the pipe coil and un-rolling it, with the second person, a couple of metres behind, securing the pipe in position. For ease of clipping pipe into insulation we would advise investing in a tacker clip stapler (item no. UFLEX30). Only one person is needed if using a pipe de-coiler (Grant UK offers a pipe de-coiler. Part code: UFLEX29). Place the de-coiler in another room and pull the pipe off as required. (PEX-AL-PEX or PE-RT)
- Check which water temperature controls are to be used and where they are to be positioned to ensure that enough room is allowed for the manifold.
- Check the position of the manifold and fit the manifold before laying the pipe work.
- Ensure that the pipe does not become twisted when handling as it can become awkward to install. The pipe will twist slightly on bends but the print line is a good guide to assist in laying the pipe.
- During cold conditions, installation and handling will be easier if the pipes are stored overnight in a heated room before installing.
- To avoid kinks always pull the pipe to shape rather than bend and try and force into position.
- If the pipe does become kinked, the kink can be removed using one of these two methods, depending on which system is being installed:
  - If using PE-RT pipe, gently squeeze the kink/crease with soft pliers and reform the bend away from the kink.

Contact Grant for further technical advice if necessary.

- Always cut the pipe square and use a plastic pipe cutter ensuring that there are no burrs on the pipe ends. It is important to achieve a clean cut at right angles to the pipe.
- For solid floor, allow a minimum distance between pipe and wall face of 100 mm.

Refer to Table 2-1 for floor types and recommended tools.

**Table 2-1:** Floor types and recommended tools

Floor types	Grant Uflex system	Grant Uflex Mini system
Floor type	Screed	Self-levelling compound
10 mm PE-RT	No	Yes
16 mm PE-RT	Yes	No
16 mm PEX-AL-PEX	Yes	No
Tools required		
Grant plastic pipe gutter	Yes	Yes
Drill and necessary drill bits	Yes	Yes
Suitable wall fixings (for manifold)	Yes	Yes
Plumber wrench/grips	Yes	Yes
Uflex tacker clip stapler	Yes	Yes
Stanley knife	Yes	Yes
Vacuum cleaner	Yes	Yes
Tape measure	Yes	Yes
Adjustable spanner	Yes	Yes

# 3 SYSTEM INSTALLATION

## 3.1 UFLEX FLOWMETER AND VALVED MANIFOLDS

Suitable for:

Pipe Dimensions: 10 mm PE-RT

Pipe Dimensions: 16 mm PE-RT

Pipe Dimensions: 16 mm PEX/AL/PEX

The Grant manifold is made from a high quality stainless steel and is for the distribution of hot water in radiant heating systems. The pipe loops are secured to these manifolds by the compression adaptors (supplied separately).

Manifolds are supplied in pairs, i.e. a flow and return manifold, together with fixing brackets factory assembled. Manifold sets are available with connections for between 2–12 loops. Refer to Figure 3-1.

### 3.1.1 LOCATION

Manifold locations need to be positioned strategically and as central as possible, in order to reduce the amount and length of pipe tails and uncontrolled energy from pipes passing through heated areas en-route to other rooms/areas.

It is important to select the manifold position at the beginning of the design process. If you have received a design and quotation from Grant, manifold locations will be specified on the quotation.

Ensure there is sufficient height available, from the floor level to the lower return manifold, to enable easy connection of the UFH pipework (minimum 300 mm).

Although it is not necessary to have the manifold on show, it should be accessible for maintenance and servicing. Typical locations include; under stairs cupboard, utility rooms, airing cupboards and cloaks cupboards.

The wall on which the manifold is mounted must be flat, sound and capable of carrying the weight of the manifold and the pump and mixing valve (if used).

### 3.1.2 FLOW MANIFOLD WITH FLOW METERS

The flow manifold (Refer to Figure 3.1) offers shut off and flow rate control features, via the flow meter (item D) on individual loops. This flow meter is designed to provide the setting and visual indication (0-5 l/m) of each UFH loop flow rate, by adjustment of the meter.

The black locking ring can be snapped over the top meter to stop any unwanted changes made to the flow rate after commissioning has taken place.

#### Manifold with flow meter, 2-12 way:

- System components are mutually compatible and fully tested
- Range of applications
- Maximum operating temperature: 70 °C
- Maximum operating pressure: 6 bar
- Maximum water flow rate per manifold (12 way): 50 L/min

Table 3-1: Manifold key

Item	Description
A	Mounting bracket
B	Flow manifold
C	Return manifold
D	Adjustable flow meters
E	Loop connections - Flow
F	Loop isolation valves - Return
G	Loop connections - Return
H	Combined air purge & drain valve
J	Combined pressure gauge & drain valve

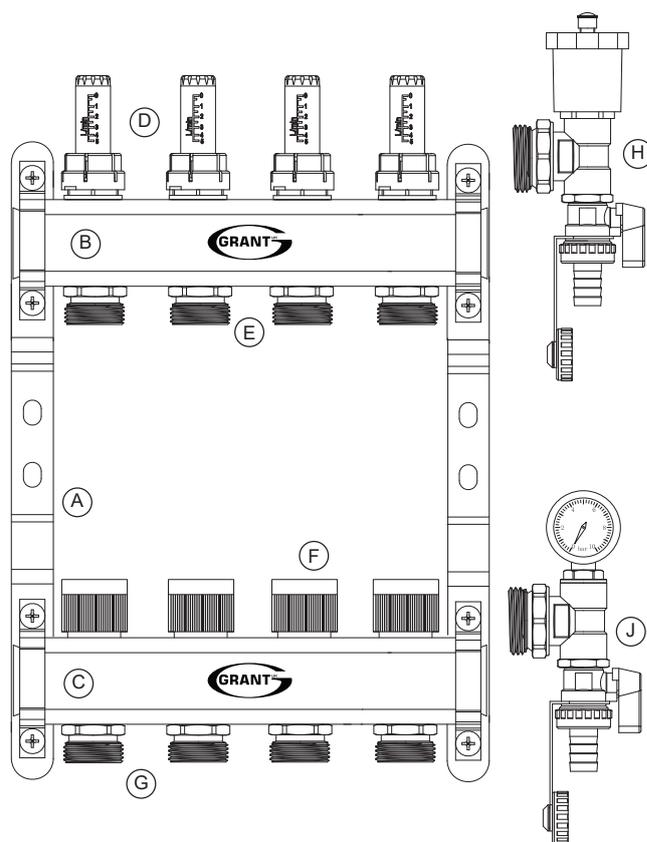


Figure 3-1: Flow and return manifolds fixed to the wall bracket

### 3.1.3 FIXING BRACKETS

Fixing brackets are supplied factory fitted to the manifolds. The lower(return) manifold is staggered further out from the wall to allow the pipes from the upper(flow) manifold to pass behind. If using a mixing valve/pump, it is suggested that this is assembled onto the manifold after fixing to the wall.

### 3.1.4 RETURN MANIFOLD

The return manifold (item C in Figure 3.1) is fitted with valves with blue plastic caps (Item F in Figure 3.1), for manual loop isolation. Caps can be replaced by electric thermal actuators for the provision of automatic room temperature control to individual loops. A suitable Grant control system will be required to drive the thermal actuators. Refer to Section 5 - Controls of this Installation Instructions.

### 3.1.5 AIR VENT/DRAIN VALVE

A 1" air vent/drain (item H) valve is supplied loose with the manifold assembly for fitting to the flow manifold on site before fixing the manifold to the wall.

### 3.1.6 PRESSURE GAUGE/DRAIN VALVE

A 1" pressure gauge/drain (Item J) valve is supplied loose with the manifold assembly for fitting to the return manifold on site before fixing the manifold to the wall.

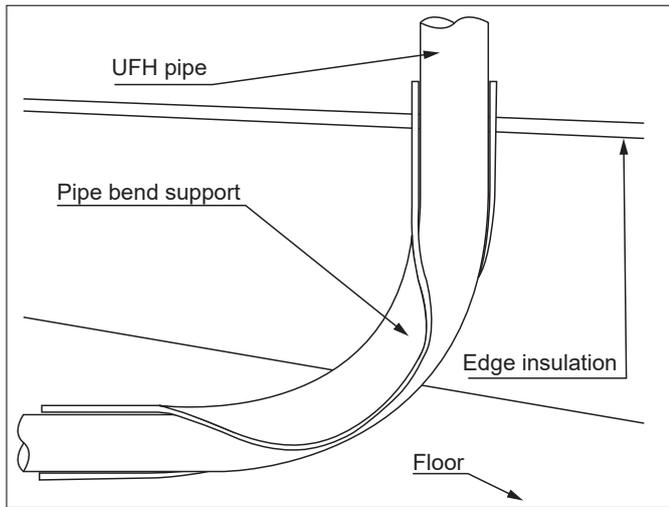
### 3.1.7 CONNECTING THE PIPING LOOPS TO THE MANIFOLDS

When laying the UFH loops, the first pipe end should be connected to the manifold before the loop is laid. Push the pipe-end lying on the outer side of the coil through and behind the return manifold and connect as per the instructions in section 3.1.8 depending on which pipe is being installed.

If insulating the feed pipes with conduit, we advise sliding this over the UFH pipe prior to connecting onto the manifold.

**3.1.8 CONNECTING 16 mm PE-RT OR 16 mm PEX/AL/PEX PIPES**

Before pushing the pipe behind the manifold, carefully bend the pipe to prevent it being damaged. Ensure a pipe bend support is fitted where the pipe exits the floor and turns up to the manifold (Refer to Figure 3-2) - **Not required for PEX/AL/PEX pipe.**



**Figure 3-2:** Pipe bend support

1. Line the pipe end up to the threaded port on the manifold. Refer to Figure 3-3



**Figure 3-3:** Aligning pipe end up to the threaded port

2. Then cut the pipe end square using plastic pipe cutters. Refer to Figure 3-4.



**Figure 3-4:** Cutting the pipes

3. Measure 10 mm from the top of the pipe and mark the insertion depth. Refer to Figure 3-5.



**Figure 3-5:** Measuring from the top of the pipe

4. Hand-tighten the compression adaptor fitting with olive onto the manifold outlet thread as shown. Refer to Figure 3-6.



**Figure 3-6:** Tightening the adaptor fitting

5. Insert the pipe into the adaptor fitting and push until the pipe comes to a halt as shown in Figure 3-7. The insert indicator should no longer be visible.



**Figure 3-7:** Inserting pipe into adaptor

- Tighten the adaptor fitting onto the manifold using an appropriate spanner (Refer to Figure 3-8) until the insertion depth mark can be seen again below the nut (Refer to Figure 3-9).



**Figure 3-8:** Tightening the adaptor onto the manifold using an appropriate spanner



**Figure 3-9:** Insertion depth mark can be seen again below the nut

#### **Connecting Grant 10 mm PE-RT Pipes (Uflex MINI System)**

- Line the pipe end up with the threaded port on the manifold and cut the pipe and square using plastic pipe cutters.
- Measure 12 mm from the top of the pipe and mark the insertion depth.
- Fit the nut and olive onto the end of the pipe. Then push the insert fully onto the pipe end in order to get a secure joint. Refer to Figure 3-10.



**Figure 3-10:** Securing the joint

- Slide both the ring and nut onto the manifold port. Refer to Figure 3-11.



**Figure 3-11:** Sliding ring and nut onto the manifold port

- Tighten the adaptor fitting onto the manifold using an appropriate spanner (Refer to Figure 3-12) until the insertion depth mark can be seen again below the nut (Refer to Figure 3-13).



**Figure 3-12:** Tighten the nut



**Figure 3-13:** Tightening the adaptor onto the manifold

**Loop connections**

Make loop connections with 3/4" male-threaded Eurocone in accordance with DIN V 3838 compatible with Grant PE-RT & PEX-AL-PEX pipe adaptors.

**Observe the torque settings**

In between 10 mm & 16 mm: 50Nm.

**Room Labels**

Room labels should be fixed on the manifold to identify the room being supplied, together with loop flow rate/set.

**Loop control at the flow meter**

Refer to figure 3-14.

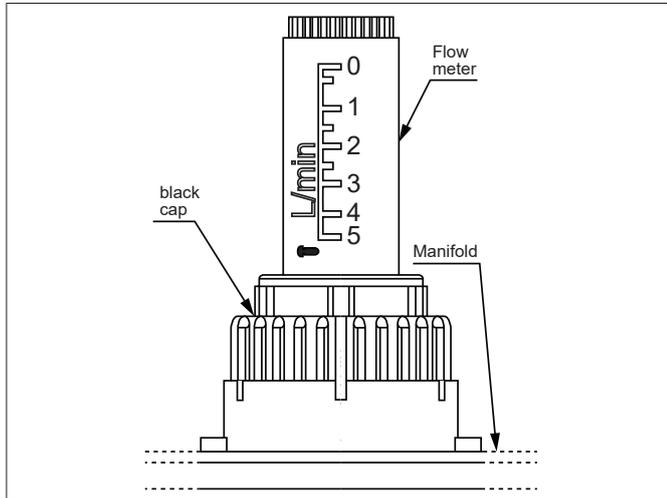


Figure 3-14: Flow meter

**3.2 UFLEX MINI SYSTEM**

Suitable for:

Pipe Dimensions: 10 mm PE-RT

- 15 mm overall build height
- Fast & easy to install
- Bonds directly to sub-floor
- Rapid heat up times
- New build and renovation projects
- Suitable for installation on most existing floors

Refer to Figure 3-15 and Table 3-2 for components.

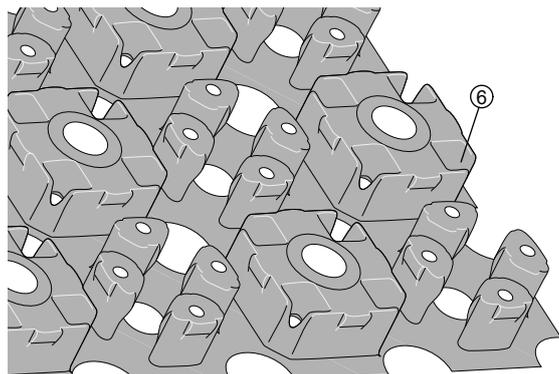
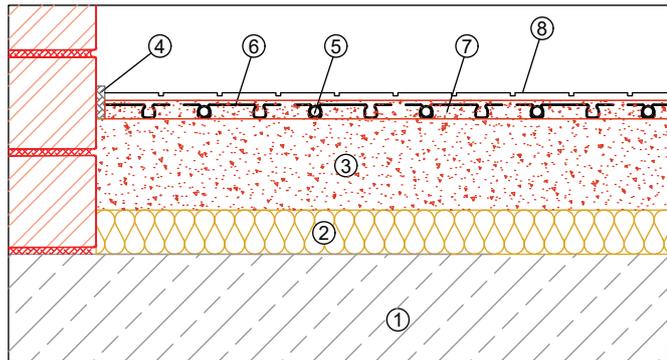


Figure 3-15: Uflex-components

Table 3-2: Key items for Figure 3-15

Item	Component
1	Floor
2	Existing insulation
3	Existing screed/floor boards
4	Edge insulation strip
5	Uflex MINI 10 pipe
6	Uflex Nubfoil
7	Self-levelling screed
8	Flooring

**3.3 UFLEX MINI COMPONENTS**

Refer to Figure 3-15 to see a diagram of the main components.

**3.3.1 UFLEX MINI NUBFOIL**

The sturdy Uflex Nubfoil can be walked on instantly and ensures fast and efficient installation of the 10 mm PE-RT pipes by a single installer.

They are suitable for all room geometries and do not need to be installed right to the edge of the floor. Refer to Figure 3-16.

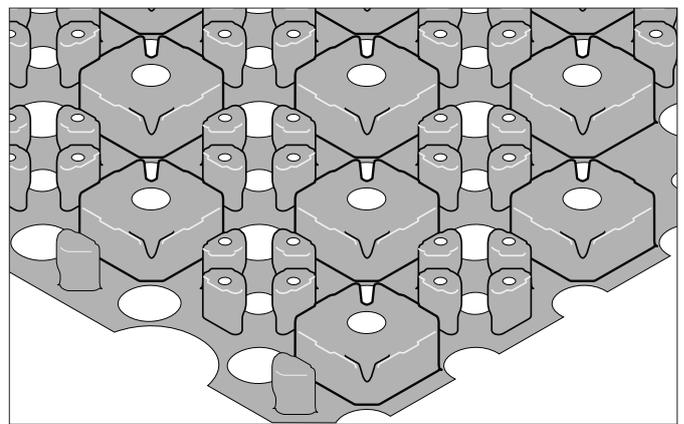


Figure 3-16: Nubfoil

**3.3.2 PE-RT PIPE**

The flexible PE-RT pipes 10 x 1.3 mm are placed in the prepared grooves of the Uflex Nubfoil. They are held in place by the castellations of the panel, ensuring that the installation meets the relevant standards. The panel is equipped with specially designed castellations for the laying of the pipe in 90° and also in 45° bends. Refer to Figure 3-17.

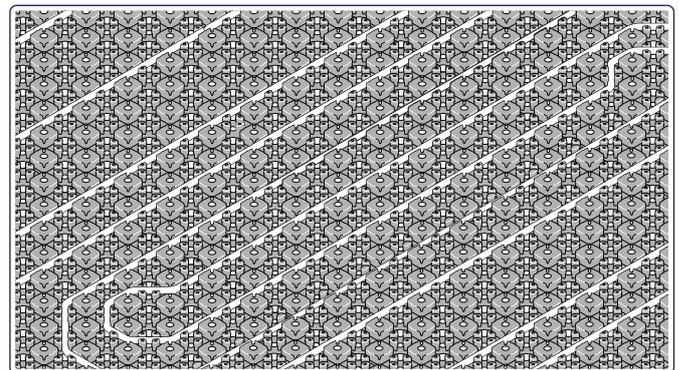


Figure 3-17: PR-RT pipe fitted in Nubfoil

**3.3.3 EDGE INSULATION STRIP**

The edge insulation strip provides a seal between the wall and the floor that allows for expansion.

Fix the edge insulation continuously around all internal and external wall edges, using the adhesive backing. Refer to Figure 3-18. When installed correctly the PE-skirt will be facing out from the wall. The Uflex Nubfoil panels should be positioned on top of the PE- skirt.

Once the screed has dried and cured, the edge strip can be trimmed down.

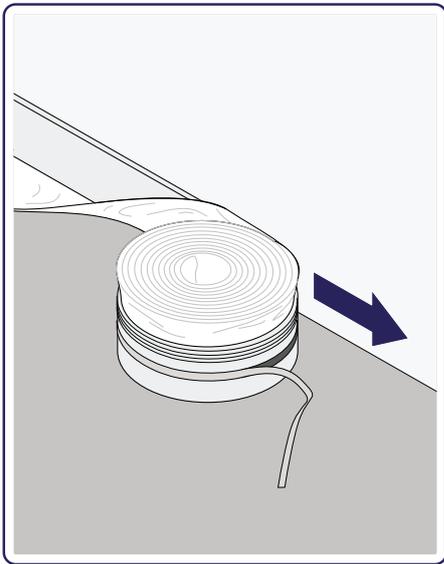


Figure 3-18: Edge insulation strip

### 3.3.4 MOVEMENT JOINT PROFILE

The Uflex MINI system contains all components for proper mounting in doorways and for creating joint profiles for the design shape of individual covering layers. Refer to Figure 3-19.

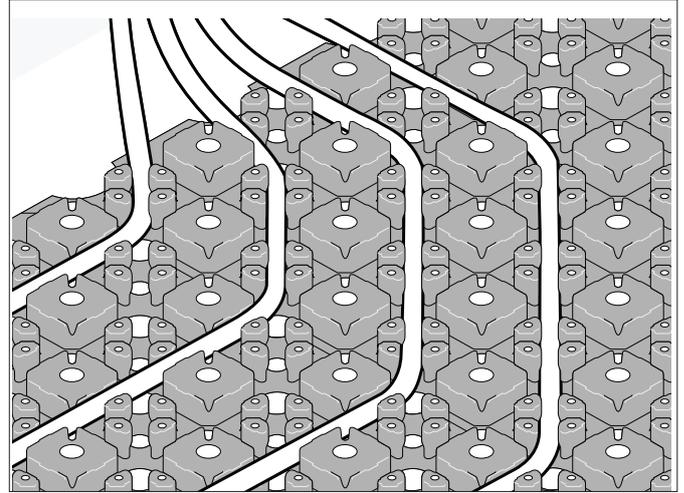


Figure 3-19: Movement joint profile

## 3.4 UFLEX MINI INSTALLATION

Grant Uflex MINI must be installed by a competent installer. Observe Figures 3-20 to 3-22 assembly instructions and additional instructions which are provided with the components and tools.

### Overview of the installation steps

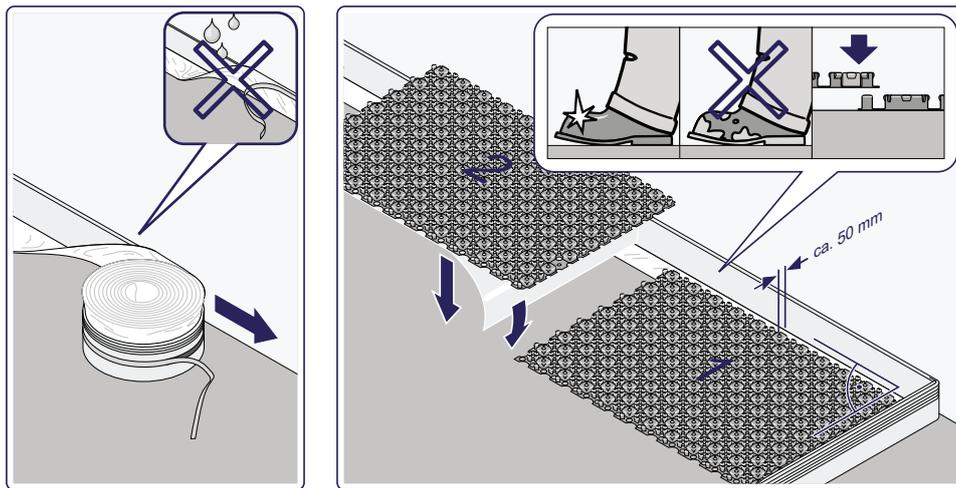


Figure 3-20: Edge strip and nubfoil panels interlocking

The nubfoil panels have a self adhesive coating on the underside and the plastic film must be removed to stick it down to the floor. When fitted the nubfoil panels are overlapped and interlocked together

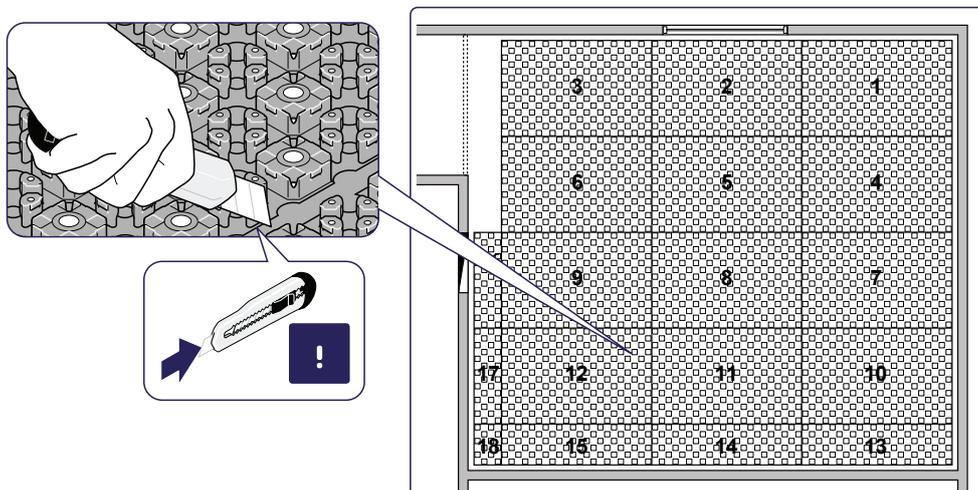


Figure 3-21: Cutting the nubfoil

**NOTE:** To ensure a firm fixing the nubfoil panels can also be fixed to the floor using suitable screws at regular intervals

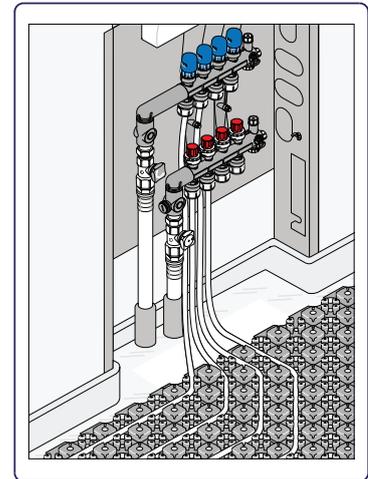
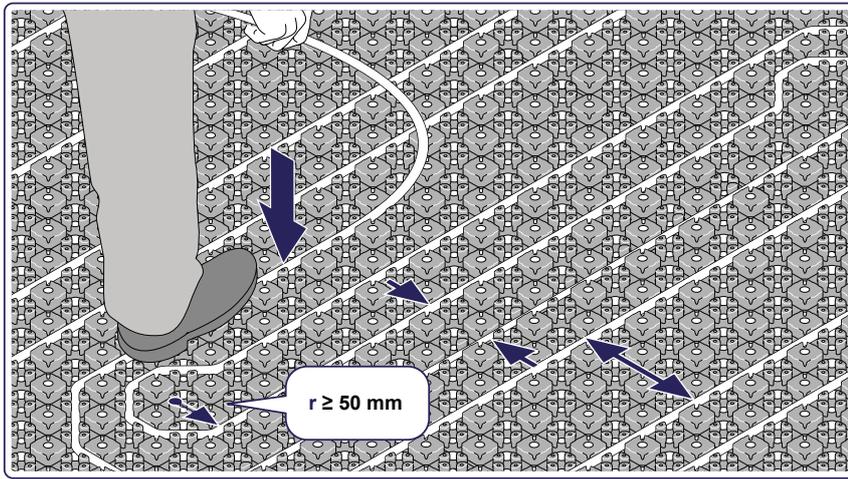


Figure 3-22: Fitting the pipe in the nubfoil

Table 3-3: Performance Data

Pipe pitch, $V_z$ (mm)		50			100			150		
		Floor covering resistance, $R_{\lambda,\beta}$ ( $m^2 K/W$ )								
Mean water temperature MWT °C	Design room temperature $R_t$ °C	0.05	0.1	0.15	0.05	0.1	0.15	0.05	0.1	0.15
		W/m <sup>2</sup>								
30	16	82	63	52	71	56	46	61	50	42
	18	69	53	44	60	47	39	52	42	35
	20	56	43	35	48	38	32	42	34	28
	22	42	32	27	36	28	24	31	25	21
	24	26	20	16	22	17	14	19	16	13
35	16	114**	87	72	98**	77	64	85**	69	58
	18	102**	78	64	87**	70	57	76	61	52
	20	90	68	56	76	60	50	66	54	45
	22	76	59	48	65	51	42	57	46	39
	24	63	48	40	54	43	35	47	38	32
40	16	146**	111**	92	125**	99**	90	108**	88**	74
	18	133**	102**	84	114**	90**	75	99**	80**	68
	20	121**	92	76	104**	82	68	90**	73	61
	22	108**	83	68	93**	73	61	80**	65	55
	24	95**	73	60	82	65	54	71	57	48
Maximum heat Comfort Zone, Output for $q_H$ (W/m <sup>2</sup> )		95	95	96	85	87	90	76	80	85

All values above are suitable for occupied zones except if \*\* indicated  
 \*\*Suitable for perimeter zone only

## 3.5 UFLEX MINI DESIGN BASICS

### 3.5.1 TEMPERATURES

#### Floor surface temperature

Special attention must be paid to the floor surface temperature, taking into account medical and physiological considerations.

The difference between the mean surface temperature of the floor and the design indoor temperature, together with the basic characteristic, form the basis on which the capacity of the heating floor surface is calculated.

The maximum surface temperatures are determined by the limit heat flow density defined in BS EN 1264, which is taken into account as the theoretical design limit in the design tables and diagrams.

#### Max. surface temperatures according to BS EN 1264:

- 29 °C in comfort zone (occupied area)
- 35 °C in edge zone (perimeter area)
- 33 °C in comfort zone (bathroom or similar)

#### Room temperature, perceived temperature and mean radiation temperature.

With radiant heating systems such as the Grant Uflex underfloor heating systems, one can expect significant energy savings compared with less efficient heating systems.

This energy efficiency is mainly due to a better adjusted room temperature and the optimal vertical temperature profile in the room. To feel comfortable, the room air temperature  $\vartheta_r$  as well as the mean radiation temperature  $\vartheta_s$  of the surfaces enclosing the room are relevant factors.

They result in a so called perceived operative temperature. That means that people, living in rooms with underfloor heating, feel more comfortable even when the room air temperature is reduced.

#### Standard design room temperatures:

- Living rooms: 21 °C    Bedrooms 18-21 °C
- Corridors: 18 °C      Bathrooms 22 °C

#### Performance Data

Pipe specification: 10 mm O/D PE-RT - Grant Uflex MINI  
Floor construction: Solid floor  
Screed depth: 15 mm Self-Levelling Compound  
Screed thermal conductivity: 1.0 W/mK  
Water temperature drop (K): 5

**3.6 UFLEX MINI TECHNICAL DATA**  
**3.6.1 GRANT UFLEX NUBFOIL**

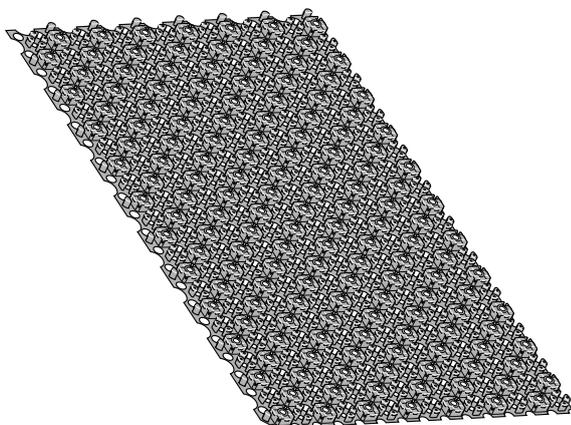
**Table 3-4:** Grant Uflex Nubfoil. (Refer to Figure 3-21).

	Unit	
Material	-	Polystyrol
Max. traffic load (Including levelling compound)	kN/m <sup>2</sup>	5
Reaction to fire (Refer to EN 13501-1)	-	Class E
Pipe spacing	mm	50, 100, 150
Panel dimensions (Length x Width x Thickness)	mm	1.100 mm x 700 mm x 12 mm
Total element height	mm	12
System type	-	Wet system

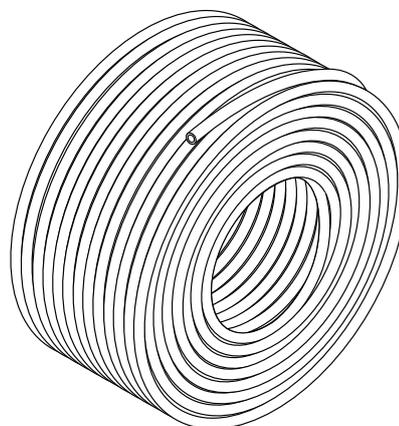
**3.6.2 PE-RT PIPE**

**Table 3-5:** Grant PE-RT pipe. (Refer to Figure 3-22).

	Unit	Values/Description	Standard/Test Method
Material	-	Polyethylene of raised temperature resistance	-
Pipe dimensions	mm	10 x 1.3	-
5-layer oxygen barrier pipe	-	PE - RT type II/EVOH/PE - RT type II	DIN 16833 / ISO 24033 - 21003 - 22391
Heat Conductivity	W/(mK)	0.4	DIN 16833 / ISO 24033
Thermal Expansion Coefficient	K	1.95 x 10 <sup>-4</sup>	DIN 52612-1
Operating Temperature range	°C	20 - 90	ISO 10508 Classes 4 -5 / 6bar
Bending Radius	mm	(5xOD ≤ 18 mm) (8xOD ≤ 18 mm)	DIN 1264
Oxygen permission	g/(m <sup>3</sup> d)	40 °C < 0,1g/(m <sup>3</sup> d)	DIN 4726
Certificate(s)	-	SKZ A666	HR 3.16
		KIWA/KOMO K84463	BRL 5607
Weight	g/m	35	-
Volume	l/m	0.043	-
Packaging	-	Transparent foil wrapping	-



**Figure 3-23:** Grant Uflex Nubfoil



**Figure 3-24:** 10 mm PE-RT pipe

### 3.7 UFLEX SCREEDED SYSTEM

Suitable for:

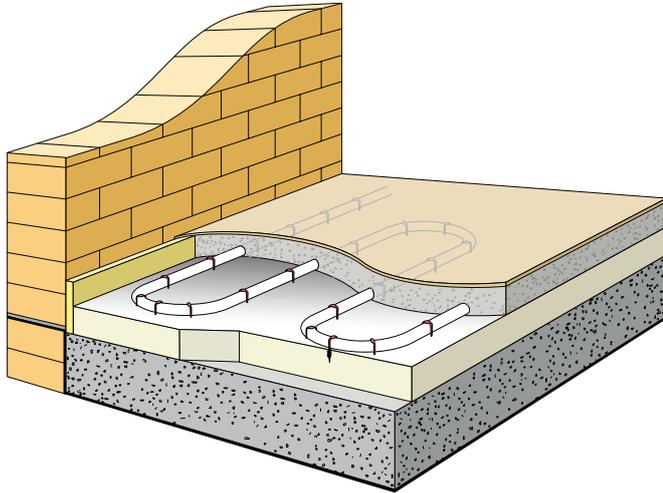
**Pipe dimensions: 16 mm PE-RT**

**Pipe dimensions: 16 mm PEX/AL/PEX**

When installing the Grant Uflex underfloor heating (UFH) system, there are two different methods of fixing the UFH pipe into position, onto and above the floor grade insulation. Refer to section 3.7.1 - Methods for installing the Grant Uflex UFH.

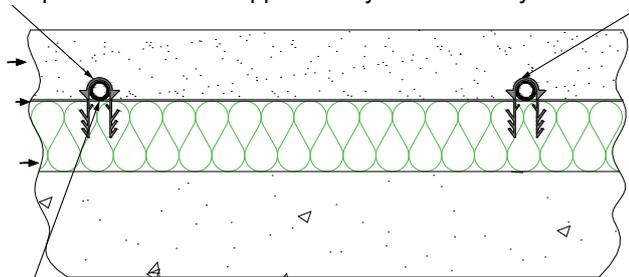
#### 3.7.1 METHODS FOR INSTALLING THE GRANT UFLEX UFH

1. U-Clip. Refer to Figures 3-25 & 3-26.



**Figure 3-25:** U-Clip installation

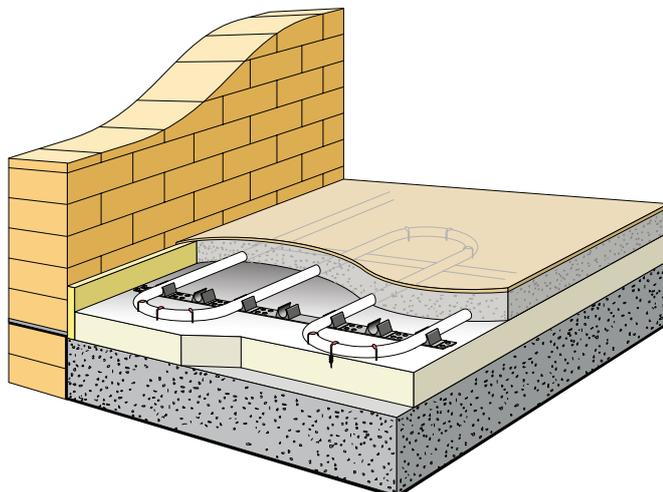
Heating Pipework laid at 200mm centres unless specified in quotation and laid approximately 100mm away from walls.



Tacker Clip for Heating Pipe. Clips should be spaced approximately 500mm apart. Additional clips maybe required on bends.

**Figure 3-26:** U-clip installation section with components

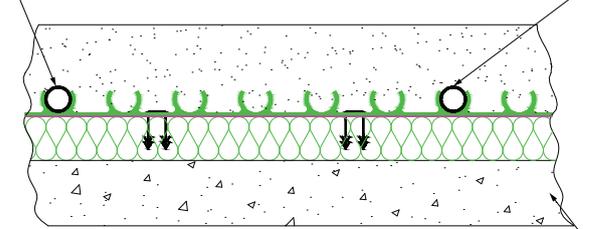
2. Clip rail and U-clip. Refer to Figures 3-27. & 3-28



**Figure 3-27:** Clip Rail and U-clip installation

### Section 3: System installation

Heating Pipework laid at 300mm centres unless specified in quotation and laid approximately 150mm away from walls.



Section of Floor Make Up

**Figure 3-28:** Clip Rail and U-clip installation section with components

#### 3.7.2 SURFACE PREPARATION

The floor must be level and swept clean of dust and debris before laying the insulation.

#### 3.7.3 PIPE BENDS

When laying the pipe, do not force the pipe into bends. It is easier to lay the pipe with a large radius and then gently pull the pipe to the required bend.

It is normal for the pipe to bulge out slightly like a 'light bulb' on 180° turns, especially where pipe centres are closer than the standard pipe spacing.

Do not pull the pipe too tight or it may kink.

#### 3.7.4 PIPE CENTRES

When installing onto floor grade insulation, pipes should space away, 100 mm (16 mm pipes) from the wall edges.

Thereafter, in modern well-insulated buildings the UFH pipe is generally installed at standard centres, 200 mm (16 mm pipes) across the active floor area, unless otherwise specified.

#### 3.7.5 LAYING THE UFH PIPE

- Identify each floor area to be covered by each coil/loop of UFH pipe. If you have had a design prepared by Grant, the rooms to be heated and the coil lengths allocated to each area will be identified on your quotation and/or design layout drawing.
- When installing the pipe it is important to ensure the pipes do not cross over each other, therefore time should be spent, before actually laying any pipe, configuring the route for the feed pipes from the manifold location to their respective area/room to be heated.
- Typically, feed pipes pass through door openings, etc. However, where possible, particularly to areas adjoining the manifold location, feed pipes could be taken directly through partition walls and into their respective rooms. This will also help alleviate any congestion around the manifold location. Ensure all holes drilled are below the screed floor finished level. Also, when threading the pipe through the hole ensure it has been capped off and there are no sharp edges, which could score and damage the pipe. It is recommended that the UFH pipes, when passing through walls, are sleeved with Grant protective conduit (Part code: UFLEX22).
- Once you have a clear picture of the installation, you can begin to install and lay the pipe. Firstly thread the first coil end behind the return manifold and connect onto the manifold flow port. If passing through a partition wall first thread the pipe through the hole and up behind the return manifold.

Pipe bend supports must be fitted on every loop at the point where the pipes rise from the floor/insulation and up to connect to the manifold, i.e. 2 required per loop (Part code: UFLEX21). In all cases, the pipe should be laid so that the flow direction is to the coldest area of the room first, for example, under windows and along external walls.

To assist with installation, the pipe is marked at every metre length. It is good practice to make a note of the starting metre at the manifold and keep referencing how much pipe has been laid whilst installing over the intended floor area.

This will help ensure you leave sufficient pipe to return to the manifold. Each loop should be installed without any joints in the floor.

In order to prevent the floor from overheating directly below the manifold or through doorways, where pipes are congested together, we would advise insulating the pipe using conduit, especially if they are not used to heat the room through which they pass.

### 3.7.6 INSTALLATION

1. Fix the edge insulation continuously around all internal and external wall edges using the adhesive backing. Refer to Figure 3-29 below. When installed correctly the PE-skirt will be facing out from the wall. Refer to Figure 3-30. Once the screed has dried and cured, the edge strip can be trimmed down.



Figure 3-29: Edge strip insulation

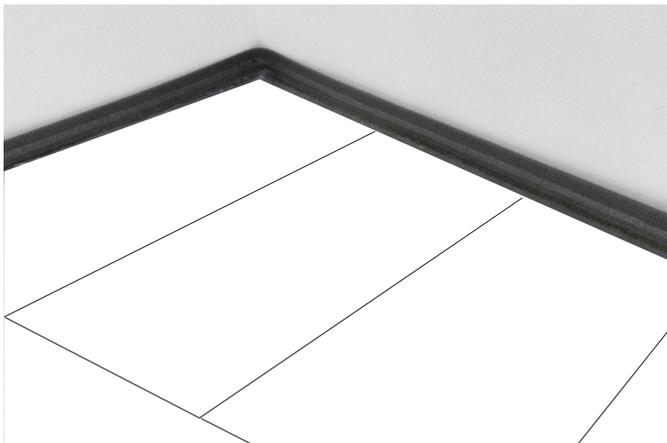


Figure 3-30: Fixing the edge insulation

2. Lay the floor insulation over the entire floor area butting up to the edge strip, ensuring the PE skirt is overlapped and taped onto the floor insulation. If using foil faced insulation board, tape the joints of all adjoining sections of insulation together to prevent screed slipping down between sheets of insulation and creating a cold bridge. Alternatively, lay a protective layer over the insulation. Refer to Figure 3-29.

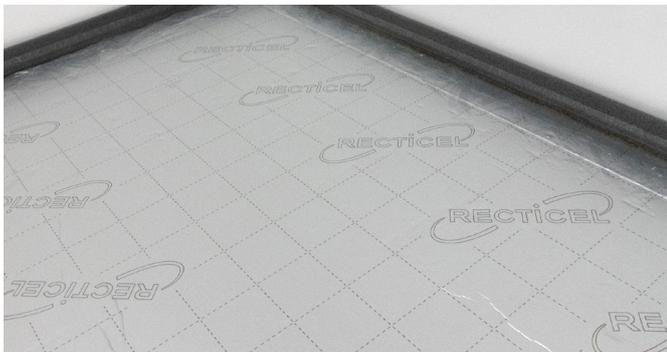


Figure 3-31: Laying the floor insulation

3. Fix the manifold into position, ensuring there is sufficient room to connect the water temperature controls and flow and return pipework.

4. **If using Clip Rail & U-clips:** lay the rail across the floor to create a matrix for the UFH pipe. Use the self-adhesive backing to hold the rail onto the insulation. For meander pattern pipe installation, set the rail out on the insulation at a maximum 500 mm spacing from two opposite wall edges and a maximum 2000 mm spacing between clip rails. Ensure the clip rail is at a 90° angle to the coldest external wall. Refer to figure 3-32 to 3-36.

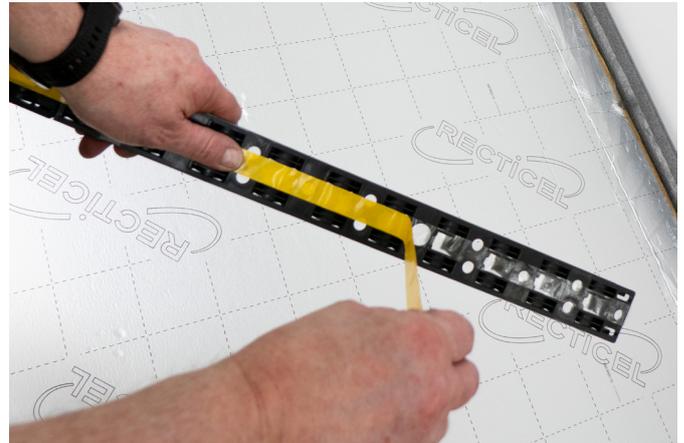


Figure 3-32: Clip rail self-adhesive backing



Figure 3-33: Laying the rail rails on the insulation



Figure 3-34: Layout of rails on the insulation

If the insulation has grid markings, use them to ensure that the clip rails are correctly aligned.

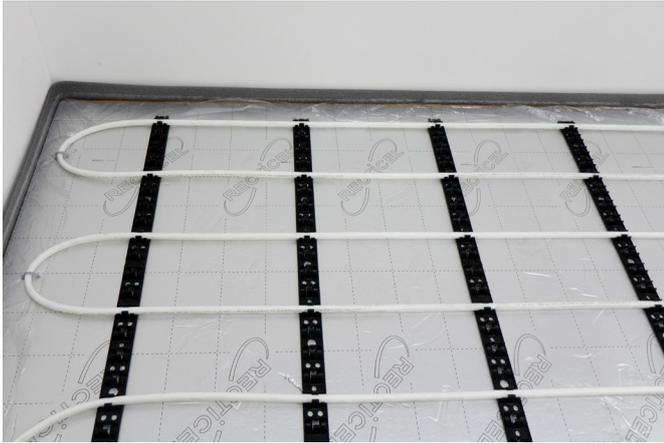


**Figure 3-35:** Fitting pipes in the rails

**If using the U-Clips only:** Fasten the pipe to the floor grade insulation, clip the pipe at 500 mm intervals. More clips may be necessary on the pipe bends. Minimum 35 mm insulation depth is required for the U-Clips. To assist with fixing the U-Clips into the insulation we would advise using the tacker clip stapler (Part code: UFLEX30).



**Figure 3-37:** Using clip stapler to fix pipes onto the insulation



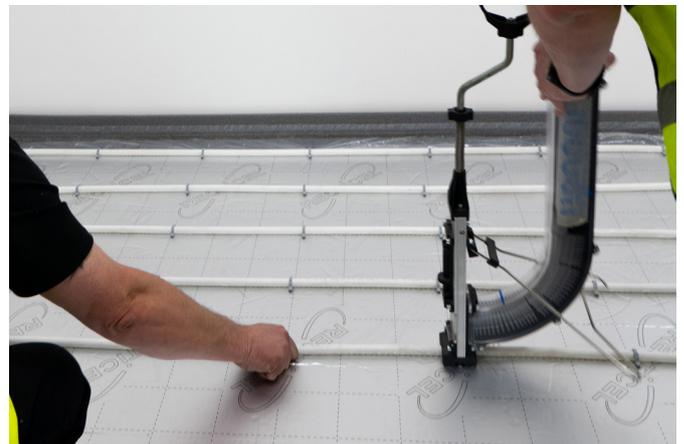
**Figure 3-36:** Clip rail and U-clips installation finished

If using the clip rail and intend to install the pipes in a bifilar pattern, lay the clip rail over the insulation in a cross/star pattern with each clip rail strip converging in the centre of the floor area to be heated.

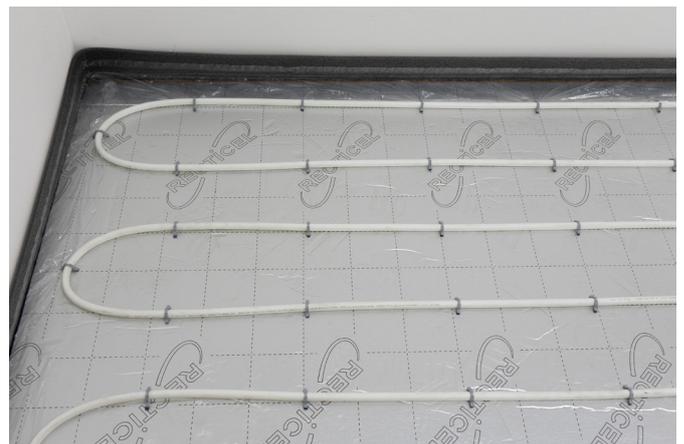
Once you are satisfied with the clip rail layout in relation to your proposed pipe configuration and routes, fix the rail permanently to the insulation by pushing the 'U'-clips through the holes provided in the clip rail at the leading and trailing end of the rail. If the length of rail exceeds 1 m use additional U-clips at 500 mm intervals.

On the actual pipe bends you may wish to use the U-clips directly over the pipe and into the insulation for extra hold. Insert U-clips at a 45° angle to gain maximum hold.

If the floor grade insulation is already installed below the floor slab and the additional insulation laid over the concrete slab is not sufficient to fix U-clips, we would advise fixing the rail directly to the sub concrete floor using suitable floor fixings (screws and plugs).



**Figure 3-38:** Maintain correct pipe spacing using the grid markings on the insulation boards (if present)



**Figure 3-39:** Pipe layout on insulation (meander patten)



Figure 3-40: Pipe Installation finished

### 3.7.7 INSTALLING THE MEANDER PATTERN

When installing the pipe in the room/area to be covered, first lay the flow pipe around the perimeter with a gap, 100 mm (for 16 mm pipes) from the wall to the coldest area and then meander up and down across the floor area back towards the point of entry, following the same route back to the manifold, clipping the pipe as necessary depending on the chosen method of fixing. On returning back to the manifold connect the tail end of the pipe to the corresponding return port on the manifold. Refer to Figure 3-41.

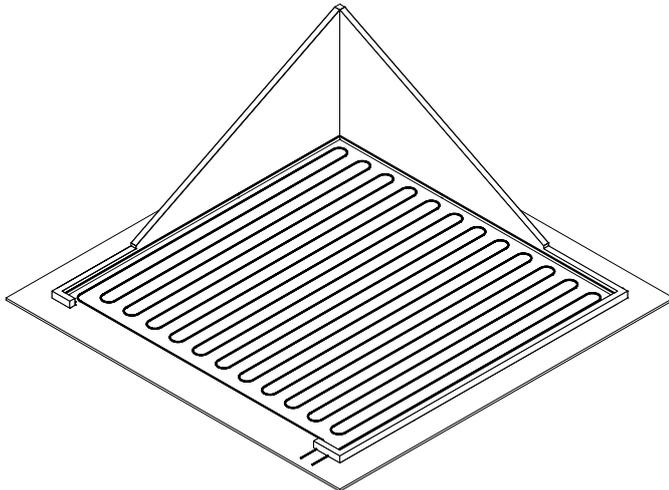


Figure 3-41: Meander pattern

### 3.7.8 INSTALLING THE BIFILAR PATTERN

Once you have entered the room/area to be covered, lay the pipe around the perimeter of the active floor area to be covered, maintaining a gap, 100 mm (for 16 mm pipes) from the wall edge and clipping the pipe as necessary. When you have circled the area and are back at your starting point, follow the same route around, but this time, at two times the design pipe spacing.

For example, if installing at 200 mm centres across the floor area, follow the same route at 400 mm centres. Continue spiralling this way until reaching the centre of the area. At this point turn back on yourself, making a hairpin turn and begin laying the pipe outwards centrally between the pipes already fixed on your inward journey, thus ensuring even 200 mm pipe centres across the whole floor area and more importantly an even floor temperature. On returning back to the manifold connect the tail end pipe to the corresponding return port on the manifold.

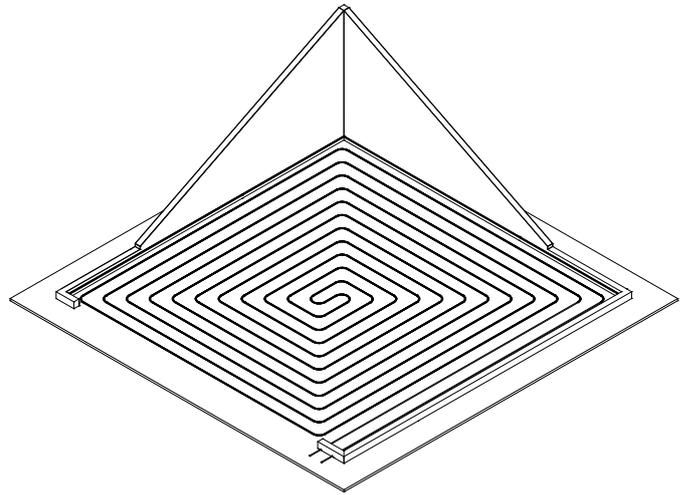


Figure 3-42: Bifilar pattern

### 3.7.9 SCREED EXPANSION JOINTS

Where pipes are to cross over a screed expansion joint, use a small section of conduit over the pipe, up to a minimum of 200 mm either side of the joint.

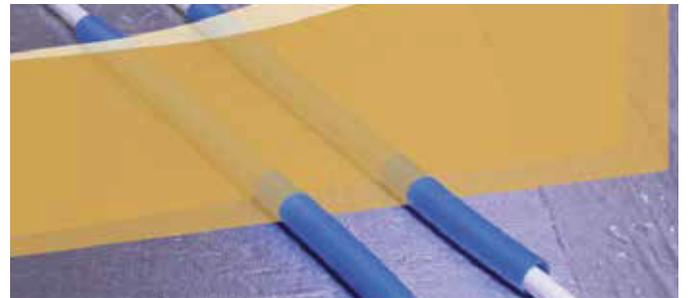


Figure 3-43: Screed expansion joints

### 3.7.10 INSPECTION

Once the pipes have been laid, inspect the system to ensure all is as it should be.

Where used, snip back all sharp edges of mesh that may contact the pipe. Clip down any sections that have lifted to stop the pipe being too close to the finished surface.

### 3.7.11 PRESSURE TESTING

Once all the pipes have been laid and connected to the manifold, fill and pressure test the system as per the instructions given in Section 4 'Filling, Venting and Pressure Testing' section of this guide.

### 3.7.12 SAND-CEMENT SCREED

Lay the screed as soon as possible to protect the pipes. At all times avoid unnecessary foot traffic.

### 3.8 UFLEX PERFORMANCE DATA

#### 3.8.1 16 mm O/D PE-RT

Pipe specification: 16 mm O/D PE-RT - Grant Uflex  
 Floor construction: Solid floor

Screed depth: 45 mm above UFH pipes  
 Screed thermal conductivity: 1.2 W/mK  
 Water temperature drop (K): 5

**Table 3-6:** Performance data for 16 mm O/D PE-RT

Pipe pitch, $V_z$ (mm)		50			100			150		
		Floor covering resistance, $R_{\lambda,\beta}$ ( $m^2 K/W$ )								
Mean water temperature MWT °C	Design room temperature $R_i$ °C	0.05	0.1	0.15	0.05	0.1	0.15	0.05	0.1	0.15
		W/m <sup>2</sup>								
30	16	58	47	39	51	42	34	41	35	30
	18	50	40	34	44	36	31	35	30	26
	20	41	33	28	36	30	26	29	25	21
	22	33	26	22	29	24	21	23	19	17
	24	24	19	16	21	17	15	17	14	12
35	16	80	64	54	70	58	50	56	47	41
	18	71	57	48	63	52	45	50	42	37
	20	63	50	42	55	46	39	44	37	33
	22	54	43	36	48	39	34	38	32	28
	24	46	37	31	40	33	29	32	27	24
40	16	101**	81	68	89	73	64	71	60	52
	18	92	74	62	81	67	58	65	55	48
	20	84	67	57	74	61	53	59	50	44
	22	75	60	51	66	55	48	53	45	39
	24	67	54	45	59	49	42	47	40	35
Maximum heat Comfort Zone, Output for $q_H$ (W/m <sup>2</sup> )		97	98	100	94	97	98	82	87	91

All values above are suitable for occupied zones except if \*\* indicated  
 \*\*Suitable for perimeter zone only

### 3.8.2 16 mm O/D PEX/AL/PEX

Pipe specification: 16 mm O/D PEX/AL/PEX - Grant Uflex  
Floor construction: Solid floor

Screed depth: 45 mm above UFH pipes  
Screed thermal conductivity: 1.2 W/mK  
Water temperature drop (K): 5

**Table 3-7:** Performance data for 16 mm O/D PEX/AL/PEX

Pipe pitch, $V_z$ (mm)		50			100			150		
		Floor covering resistance, $R_{\lambda,\beta}$ ( $m^2$ K/W)								
Mean water temperature MWT °C	Design room temperature $R_t$ °C	0.05	0.1	0.15	0.05	0.1	0.15	0.05	0.1	0.15
		W/m <sup>2</sup>								
30	16	58	47	39	51	42	34	41	35	30
	18	50	40	34	44	36	31	35	30	26
	20	41	33	28	36	30	26	29	25	21
	22	33	26	22	29	24	21	23	19	17
	24	24	19	16	21	17	15	17	14	12
35	16	80	64	54	70	58	50	56	47	41
	18	71	57	48	63	52	45	50	42	37
	20	63	50	42	55	46	39	44	37	33
	22	54	43	36	48	39	34	38	32	28
	24	46	37	31	40	33	29	32	27	24
40	16	101**	81	68	89	73	64	71	60	52
	18	92	74	62	81	67	58	65	55	48
	20	84	67	57	74	61	53	59	50	44
	22	75	60	51	66	55	48	53	45	39
	24	67	54	45	59	49	42	47	40	35
Maximum heat Comfort Zone, Output for $q_H$ (W/m <sup>2</sup> )		97	98	100	94	97	98	82	87	91

All values above are suitable for occupied zones except if \*\* indicated  
\*\*Suitable for perimeter zone only

### 3.9 UFLEX TECHNICAL DATA

#### 3.9.1 PE-RT PIPE - 10 mm x 1.3 mm

**Table 3-8:** Grant PE-RT 10 mm x 1.3 mm pipe. (Refer to Figure 3-21).

	Unit	Values/Description	Standard/Test Method
Material	-	Polyethylene of raised temperature resistance	-
Pipe dimensions	mm	10 x 1.3	-
5-layer oxygen barrier pipe	-	PE - RT type II/EVOH/PE - RT type II	DIN 16833 / ISO 24033 - 21003 - 22391
Heat Conductivity	W/(mK)	0.4	DIN 16833 / ISO 24033
Thermal Expansion Coefficient	1/K	1.95 x 10 <sup>-4</sup>	DIN 52612-1
Maximum Operating pressure	bar	10	BRL 5607 product certified
Operating Temperature range	°C	20 - 90	ISO 10508 Classes 4 -5 / 6bar
Bending Radius	mm	(5 x OD ≤ 18 mm) (8 x OD ≤ 18 mm)	DIN 1264
Oxygen permission	g/m <sup>3</sup> per day	at 40 °C = 0,1	DIN 4726
Certificate(s)	-	SKZ A666	HR 3.16
		KIWA/KOMO K84463	BRL 5607
Weight	g/m	35	-
Volume	l/m	0.043	-
Packaging	-	Transparent foil wrapping	-

### 3.9.2 PE-RT PIPE - 16 mm x 2 mm

**Table 3-9:** Grant PE-RT 16 mm x 2 mm pipe.

	Unit	Values/Description	Standard/Test Method
Material	-	Polyethylene of raised temperature resistance	-
Pipe dimensions	mm	16 x 2	-
5-layer oxygen barrier pipe	-	PE - RT type II/EVOH/PE - RT type II	DIN 16833 / ISO 24033 - 21003 - 22391
Heat Conductivity	W/(mK)	0.4	DIN 16833 / ISO 24033
Thermal Expansion Coefficient	K	1.95 x 10 <sup>-4</sup>	DIN 52612-1
Maximum Operating pressure	bar	10	BRL 5607 product certified
Operating Temperature range	°C	20 - 90	ISO 10508 Classes 4 -5 / 6 bar
Bending Radius	mm	(5 x OD ≤ 18 mm) (8 x OD ≤ 18 mm)	DIN 1264
Oxygen permeability	g/m <sup>3</sup> per day	at 40 °C = 0,1	DIN 4726
Certificate(s)	-	SKZ A666	HR 3.16
		KIWA/KOMO K84463	BRL 5607
Weight	g/m	35	-
Volume	l/m	0.043	-
Packaging	-	Transparent foil wrapping	-

### 3.9.3 PEX/AL/PEX PIPE - 16 mm x 2 mm

**Table 3-10:** Grant PEX/AL/PEX 16 mm x 2 mm pipe.

	Unit	Values/Description	Standard/Test Method
Material	-	Crosslinked polyethylene with intermediate aluminium layer	BS6920 (at 95 °C)
Pipe dimensions	mm	16 x 2	WRAS tested
Oxygen permeability	mg/l	0	
Heat Conductivity	W/(mK)	0.4 to 0.52	
Thermal Expansion Coefficient	1/K	2.6 x 10 <sup>-5</sup>	
Maximum Operating pressure	bar	>10	
Operating Temperature range	°C	-60 to +95	EN ISO 21003-1
Bending Radius	mm	With manual bending: 5 x OD = 80 With mechanical bending Bending = 49	WRAS tested
Weight	g/m	105	
Volume	l/m	0.113	
Packaging	-	Transparent foil wrapping	-

### 3.10 GRANT UFLEX OVERLAY SYSTEM

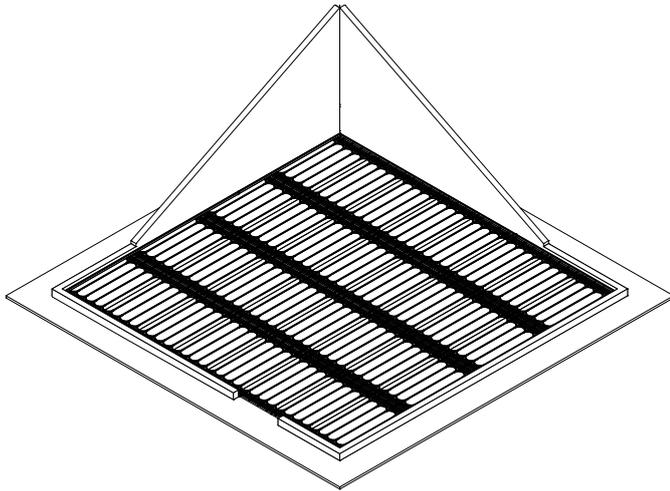


Figure 3-44: Grant Uflex Overlay System

#### 3.10.1 GENERAL

The Grant UFLEX and UFLEX Mini Overlay systems can be laid on almost any new or existing floor surface making it ideal for retrofit UFH systems or for use as an alternative to screeded systems.

#### IMPORTANT

To be suitable for the Grant UFLEX or UFLEX Mini Overlay system, all floor surfaces must be dry, flat, level and structurally rigid. Before laying the overlay boards, floors must be clean, i.e. free of any dirt, dust, debris, grease, oil, or damp.

The overlay boards have a bonded aluminium foil heat emitting top surface that is an alternative to systems using separate heat emission plates providing a quicker and easier install option.

The Grant UFLEX and UFLEX Mini Overlay systems are not suitable for laying directly onto joists and must have a supporting floor surface such as plywood, floor grade chipboard or similar.

#### 3.10.1.1 CONSTRUCTION

The Grant UFLEX and UFLEX Mini Overlay system uses lightweight boards, either 16 mm or 20 mm thick, manufactured from a flame-retardant high-density polystyrene, providing excellent impact and compressive strength.

These overlay boards are supplied with a bonded layer of reflective 100 microns thick aluminium foil on the upper surface to enhance the rapid transmission of heat across the floor.

They are designed for use with wood laminate, wood plank, etc. and can also be used with ceramic tiles.

#### 3.10.1.2 BOARD DETAILS

Each board has pre-cut grooves for the pipes, as follows (Refer to Figure 3-45):

- A. Straight grooves – for straight pipe runs
- B. Return bends – for pipe bends
- C. Cross grooves – for transitional pipe runs

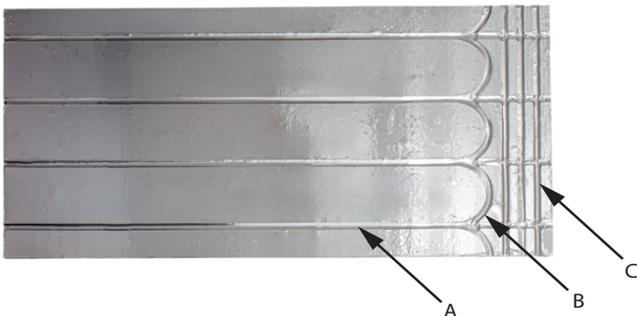


Figure 3-45: Board details

### 3.10.2 TECHNICAL DATA

#### 3.10.2.1 DIMENSIONS

Grant UFLEX Overlay boards are available for 10 mm and 16 mm pipe at 100 mm, 150 mm and 200 mm centres as detailed in the tables below.

#### Grant UFLEX Mini Overlay system - 10 mm pipe

Table 3-11: UFLEX Mini Overlay system - 10 mm pipe

Type	Pipe centres	Board thickness	Dimensions L x W	Part code (single board)
Foiled-faced	100 mm	16 mm	1200 mm x 600 mm	UFLEX127*

Table 3-12: UFLEX Mini Overlay system - 16 mm pipe

Type	Pipe centres	Board thickness	Dimensions L x W	Part code (single board)
Foiled-faced	150 mm	20 mm	1200 mm x 600 mm	UFLEX128*
Foiled-faced	200 mm	20 mm	1200 mm x 600 mm	UFLEX129*

\*Part code for single board only

#### 3.10.2.2 GRANT UFLEX OVERLAY BOARD SPECIFICATION

Table 3-13: UFLEX Mini Overlay board specification

Material	Extruded Polystyrene with aluminium foil
Foil	100 micron (µm) aluminium foil
Overall dimensions	1200 mm x 600 mm
Thickness	16 mm – 10 mm pipe 20 mm – 16 mm pipe
Pipe centres	100 mm – 10 mm pipe 150 mm – 16 mm pipe 200 mm – 16 mm pipe
Thermal conductivity	0.034 W/mK
Water absorption	<0.7% (EN 12087)
Compression strength	500 kPa
Temperature range	-50 °C to 75 °C
Weight (per board)	16 mm thick board - 0.86 kg 20 mm thick board - 1.03 kg
Fire performance	Euroclass E (EN 13501-1)
Moisture absorption	<0.7% (EN 12087)
Sound reduction	BS EN ISO 10140-3 19 dB (6 mm)

#### 3.10.3 INSTALLATION

##### 3.10.3.1 TOOLS REQUIRED

- Metal straight edge
- Marker pen
- Craft knife
- Tape measure
- Work gloves
- Knee protection
- Face mask
- Eye protection
- Hammer
- Timber batten
- Pipe system design drawing

**Also recommended**

- Electric router
- Core box(rounded) router bits - 10 mm or 16 mm to suit pipe diameter used
- Fine tooth saw
- Pipe de-coiler (Part code: UFLEX29)

**3.10.3.2 GENERAL**

Wear suitable footwear when installing or walking on the overlay boards, i.e. flat soled shoes such as trainers, to avoid damage to the boards or pipe.

When cutting or machining (e.g. routing) the boards, use normal respiratory and eye protection.

Before use, ensure that the boards are not damaged, and are dry and free from any dirt, dust, or other contaminants.

**3.10.3.2.1 SURFACE PREPARATION**

All floor surfaces should be dry, flat, level (SR2 Standard as a minimum) and structurally rigid. Floors must be clean, i.e. free of any dirt, dust, debris, grease, oil, or damp, prior to laying the Grant UFLEX or UFLEX Mini Overlay system.

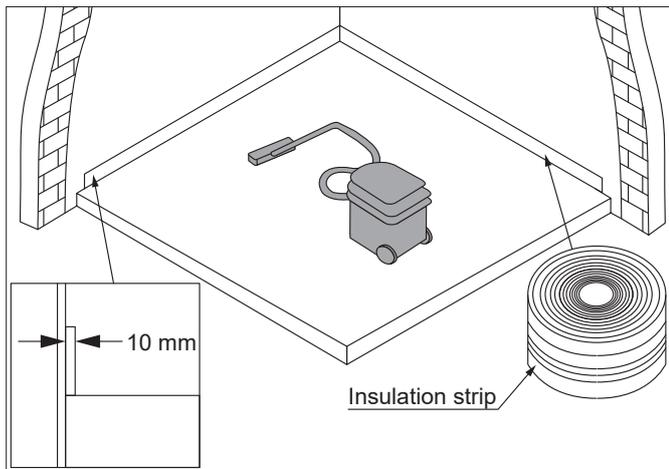
Any projections on the floor must be levelled off to avoid damage to the overlay boards.

If the floor is not flat and level, a self-levelling floor compound should be used before laying the overlay boards.

With wooden floors, ensure that the floor is firm and level and that existing floorboards are flat and in good condition. Secure any loose flooring and replace any damaged, warped, or missing boards, as necessary.

If the flooring to be installed requires a moisture barrier this should be installed after laying the overlay boards. ALWAYS follow the flooring manufacturers guidelines and installation instructions.

**3.10.3.2.2 FITTING OF EDGE INSULATION STRIP**



**Figure 3-46:** Fitting of Edge Insulation Strip



**Figure 3-47:** Fitting of edge insulation strip

This edge insulation strip will allow for expansion in the overlay boards and help reduce heat loss from the floor.

Remove the skirting board and doors from the room. Doors will

have to be trimmed before re-fitting to accommodate the higher floor level after the Overlay system is fitted.

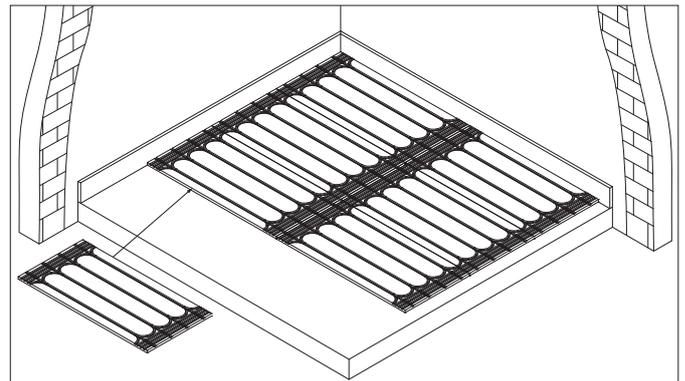
Fit the edge insulation strip continuously around all internal walls, using the adhesive backing. Ensure that it is installed such that the PE-skirt is facing out from the wall with the adhesive strip on the underside.

The height of the insulation strip can be trimmed, but only do so AFTER the overlay system has been installed, and before the skirting boards are re-fitted.

If carpets are to be laid on the finished floor, the carpet grippers used around the perimeter of the room must not be attached to the Grant UFLEX overlay boards. Instead, fit a suitable timber battens 75 mm wide with a thickness to give the same finished height as the overlay board all around the room for fixing the carpet grippers.

When the overlay boards are laid, they should be butted up against these battens.

**3.10.3.2.3 LAYING THE OVERLAY BOARDS**



**Figure 3-48:** Laying the overlay boards



**Figure 3-49:** Laying the overlay boards

Grant UFLEX or UFLEX Mini Overlay boards should be firmly fixed to the floor and in all cases the overlay boards must be tightly butted up against each other.

In many cases bonded to the floor using Tensorgrip H30 type

spray adhesive is sufficient.

However to ensure a firm fixing the Overlay boards can also be mechanically fixed to the floor using suitable screws and large washers:

- For fixing to wood floors: Use 6 mm countersunk screws with M10 x 35 mm stainless steel flat washers
- For fixing to concrete floors: Use 6 mm countersunk concrete screws e.g. 'Easydrive' concrete screws (available from Screwfix) with M8 x 35 mm stainless steel flat washers.
- Ensure that the screws used are of an adequate length to pass through the overlay board and make a secure fixing into the floor below.

In either case, use a minimum of 8 fixings per board with the spacing between 400 mm to 600 mm, i.e. 4 equally spaced down each of the two long sides of each board. Ensure that all fixings are tightened down such that the top of the screw and washer are either flush or just below the upper surface of the overlay board.

**IMPORTANT. Solvent based adhesive products must NOT be used with the Grant UFLEX Overlay system.**

## ! NOTE !

**If the Grant UFLEX Overlay boards are to be over boarded with 6 mm ply (e.g. for Karndean or, Amtico flooring, or for carpet to be used) it is not necessary to fix the overlay boards to the floor with screws at this stage. The screws used to fix the 6 mm ply in place should be of sufficient length to also pass through the thickness of the overlay boards (16 mm or 20 mm) and screwed into the floor below.**

Prior to laying the boards, check the pipework system design drawing to determine the direction of the pipe runs and thus the correct orientation of the overlay boards.

Lay the boards across the entire floor such that the grooves in adjacent boards are aligned with each other to suit the pipework loop layout being used.

Take care when handling the boards to avoid damaging them.

To cover the entire floor area, some standard size boards will need to be cut to the required size using a sharp knife.

Sections of board to provide additional bends, straight pipe runs, and transitional cross grooved sections can be cut from a standard board as required. Keep all offcuts as they may be used elsewhere.

Extra grooves for pipes may also be required. These can be cut by hand using an electric router with either a 10 mm or 16 mm diameter 'core box' (rounded tip) bit depending on the pipe size being used. When cutting bends into the boards ensure that they are the same radius, or greater, than the pre-cut bends in the board.

To maintain an even floor level in areas where the overlay boards are not installed, e.g. under baths or cupboards, use plywood or chipboard panels of the same thickness as the overlay board.

Some flooring, e.g. wood, may have a maximum surface temperature (usually 27 °C). The UFH control system can ensure that this is not exceeded by embedding a floor temperature sensor in the overlay board. This will be wired back to the programmable room thermostat for the room in question.

### 3.10.3.2.4 LAYING THE PIPE

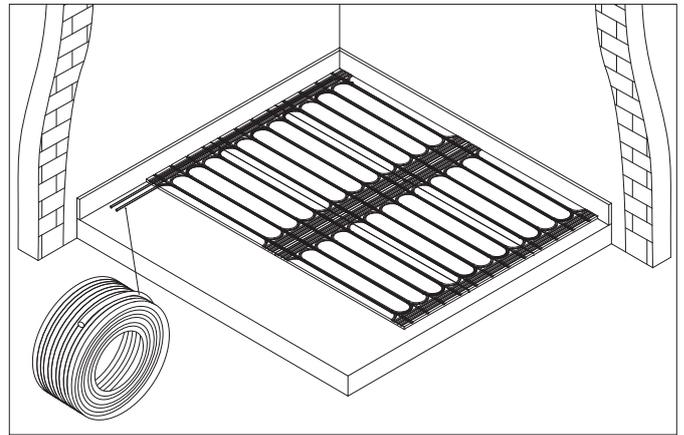


Figure 3-50: Layout of pipes and board



Figure 3-51: Fitting the pipe into the grooves of the overlay boards

Prior to laying the pipe, check the pipework system design drawing and plan where to start and the route for each individual pipe loop.

Whilst the pipework system design drawing will indicate the length of pipe required for each pipe loop, do NOT cut the pipe before laying.

Starting at the manifold, allow a little extra pipe length to make the connection before laying the pipe in the correct groove of the overlay board. Always mark each pipe end (using a permanent marker) to identify it later when making the manifold connections – flow or return, loop number and zone/room name.

Carefully press the pipe fully into the grooves in the overlay boards ensuring that the top of the pipe is flush with the upper surface of the board.

For ease of fitting the pipe, slit the foil with a sharp knife for a short distance at the start of the groove and progressively insert the pipe so the foil is pushed down into the groove when the pipe is fitted.

Once the pipe loop has been laid, allow a little extra pipe length to make the connection to the manifold before cutting the pipe. Ensure that the pipe end is marked (flow or return, loop number) to identify it later when connecting the loops to the manifold.

### 3.10.3.2.5 INSPECTION

Once the pipework is laid, it must be thoroughly inspected to ensure that the installation is correct to the pipework system design drawing, and that the pipes are correctly fitted into the boards and located away from any possible source of damage.

If any pipes are sitting proud of the top surface of the overlay boards, they can be tapped down into the groove until flush using a hammer on a wooden batten laid across the pipes.

### 3.10.3.2.6 PRESSURE TESTING

Once inspected, and the pipework is connected to the manifold, the system must be filled, vented and then pressure tested.

### 3.10.3.2.7 DECKING

The area should be decked with the required floor covering (wood, tiles, etc.) immediately following pressure testing to protect the overlay system and pipework. Alternatively, cover the boards and pipework with boards if it is necessary to walk on the area before the final floor covering is laid.

## 3.10.3.3 FLOOR COVERINGS

### 3.10.3.3.1 WOOD FLOORING

As a natural material, wood is very much affected by environmental conditions and, in particular, the moisture content of the air. This will naturally vary through the seasons of the year and in turn influences the changing moisture content and volume of the wood, and its consequent expansion or contraction.

Underfloor heating will further escalate the expansion and contraction of a wood floor, so it is vitally important that they are installed correctly, in accordance with the manufacturer's installation instructions.

Any wood flooring that has been stored in cold conditions must be allowed to acclimatise to the environmental conditions of where it is to be fitted. It should be kept in the room(s) in question, perhaps for several weeks, in order to dry to a sufficiently low moisture content before it can be installed. Larger wood products (unless kiln dried) may require a longer acclimatisation period. Always check with the flooring manufacturer or supplier for guidance.

Maple and Beech are not suitable woods for use with underfloor heating due to their potentially large seasonal contraction and expansion movement causing the wood to split.

Floating Wood and Laminate floors usually require an underlay to help reduce step noise and allow the floor to move freely when expanding or contracting.

Also, for floating wood floors, flooring manufacturers require some form of vapour barrier to be fitted beneath the floor.

**ALWAYS follow the flooring manufacturers guidelines and installation instructions.**

Flooring manufacturers usually provide guidance on the maximum surface temperature to which the floor material can be exposed, typically 27 °C for wood floors. This floor temperature can be monitored by the UFH control system and prevented from exceeding the maximum temperature by embedding a floor temperature sensor in the overlay board that is connected to the programmable room thermostat for the room in question.

### 3.10.3.3.2 PARQUET FLOORING

Solid Parquets have larger expansion/contraction movements due to moisture content. Laminated Parquets (three layers) has a smaller seasonal range of expansion and contraction.

### 3.10.3.3.3 SOLID WOOD FLOORBOARDS

Solid wood floorboards should be installed with the direction of the grain at 90° to the direction of the underfloor heating pipes.

### 3.10.3.3.4 LAMINATE

As laminates are typically quite thin (7-10 mm thick) they are more thermally efficient than thicker types of wood flooring. Some types are supplied with a vapour barrier or acoustic layer attached to the underside. They are usually fitted by either being clicked or glued together, following the manufacturer's installation instructions.

The resistance of all wood floor coverings should not exceed 2 Tog (or 0.2 m<sup>2</sup>K/W).

### 3.10.3.3.5 KARNDEAN, AMTICO, CORK PLANKS

To provide a smooth, level, and flat surface, use 6 mm ply sheets directly on top of the Grant UFLEX Overlay boards. Secure in place with countersunk screws adequately spaced to ensure the ply is flat once screwed down. Take great care to ensure that the screw positions used avoid the underfloor heating pipework below.

Ensure that the butt joints between the ply sheets do NOT coincide with the joints between the Grant UFLEX Overlay boards below.

As with the overlay boards, ensure that the screws used are of an adequate length to pass through the overlay board and make a secure fixing into the floor below.

**ALWAYS follow the flooring manufacturers guidelines and installation instructions.**

### 3.10.3.3.6 CARPET

As above, to provide a smooth, flat surface for carpet to be laid, use 6 mm ply sheets directly on top of the Grant UFLEX Overlay boards. Secure in place with countersunk screws adequately spaced to ensure the ply is flat once screwed down. Take great care to ensure that the screw positions used avoid the underfloor heating pipework below.

Ensure that the butt joints between the ply sheets do NOT coincide with the joints between the Grant UFLEX Overlay boards below.

As with the overlay boards, ensure that the screws used are of an adequate length to pass through the overlay board and make a secure fixing into the floor below.

The thermal resistance of any underlay and carpet should not exceed 1.5 Tog (or 0.15 m<sup>2</sup>K/W).

### 3.10.3.3.7 CERAMIC TILES

With this type of overlay system, it is vital that each board is firmly fixed such that it is solid and stable in position. Any movement may lead to cracking or de-bonding of the tile layer.

The overlay boards must be secured to the floor below. Refer to Section 3.10.3.2.3 'Laying the overlay boards' for further details.

All pipes should be firmly fixed into the grooves in the boards.

If any pipes are sitting proud of the top surface of the overlay boards, they can be tapped down into the groove until flush using a hammer on a wooden batten laid across the pipes.

Vacuum the entire area to ensure that all debris has been removed from the boards, pipes, and grooves.

Prime the entire upper surface of the boards with a neat undiluted coating of a suitable primer (such as Kelmore PrimeMore Grip) using a roller for the flat surface of the boards and a brush for the pipes and grooves. Always follow the application instructions provided with the primer.

**It is essential that all exposed surfaces including pipes and unused grooves are thoroughly primed and dry before proceeding further.**

Using a straight side trowel, apply a suitable tile adhesive to the overlay boards to fill all unused grooves and any other deep sections cut out of the boards.

Whilst still wet, use a rounded notch floor trowel to apply more of the same adhesive to the entire area and bed the tiles applying sufficient pressure to ensure 100% contact of the adhesive with the back of the tiles. If using large format tiles (i.e. with at least one side 300 mm or greater) ensure that the back of the tile is buttered with the adhesive to ensure 100% contact and a secure bond.

Alternatively, a self-levelling floor compound can be used, if preferred, after the boards and pipes have been primed (as described above) before laying the tiles.

To complete, grout the tiles once adhesive has cured (24-48 hours).

Once grouting has cured hard the floor should remain at ambient temperature, with the underfloor heating OFF, for 7 days. After that, the underfloor water heating temperature is gradually increased at no more than 5 °C per day until the required working temperature is reached. **Failure to follow this gradual process may result in damage to the installation.**

### IMPORTANT

**Solvent based adhesive products must NOT be used anywhere in conjunction with the Grant UFLEX Overlay system.**

### 3.11 GRANT UFLEX HEAT EMISSION PLATES

Suitable for:

Pipe dimensions: 16 mm PE-RT

Pipe dimensions: 16 mm PE-AL-PEX

#### 3.11.1 HEATING EMISSION PLATES

Grant have heat emission plates (HEP's) for use with timber suspended or battened floors with joists/supports at 400 mm centres.

These heat emission plates are suitable for use with the Grant Uflex 16 mm PE-RT and PEX-AL-PEX pipes.

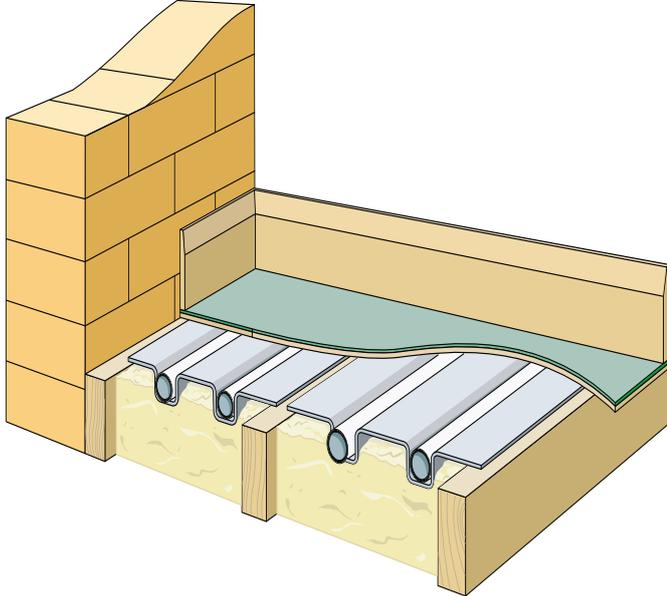


Figure 3-52: Heat emission plates installation

#### 3.11.2 GRANT PRODUCT CODE: UFLEX47S - SINGLE

Pack quantity: 1 plate

#### 3.11.3 PLATE DETAILS

Number of pipe grooves: 2

Pipe centres: 200 mm

Plate width: 390 mm

Area: 0.39 m<sup>2</sup>

Plate length: 1,000 mm

Refer to Figure 3-53.



Figure 3-53: Heat emission plate

#### GRANT PRODUCT CODE: UFLEX47 - 1 PACK

Pack quantity: 28 plates

Pack coverage\*: 13.65 m<sup>2</sup>

\* Equates to approximately 80% floor coverage.

#### 3.11.4 INSULATION

For the system to operate effectively it is essential that insulation, such as mineral wool, is installed between the joists, such that it will be in contact with the underside of the plates.

- Air gaps between the insulation and the plates must be avoided in order that the plates can operate effectively.
- The insulation must be adequately supported to remain in contact with the underside of the heat emission plates.
- One way to achieve this is to fit boards (plywood or similar) between the joists. These can be supported on battens fixed along the inside of the joists at the required distance from the top of the joist.
- It is best if the thickness of the insulation below the plate pushes it upwards, such that when the floor boards are refitted there is contact with the underside of the floor over the entire area of the plate.

Typically, a minimum 100 mm of mineral wool insulation is used, however, where relevant, the insulation used must comply with current Building Standards as follows:

- **England and Wales: Part L and Part E of the Building Regulations.**
- **Scotland - Sections 6 (Energy) & 5 (Sound).**
- **Northern Ireland - Technical Booklets F (Conservation of Fuel and Energy) and G (Sound).**
- **Republic of Ireland - Parts L (Conservation of Fuel and Energy) and E (Sound)**

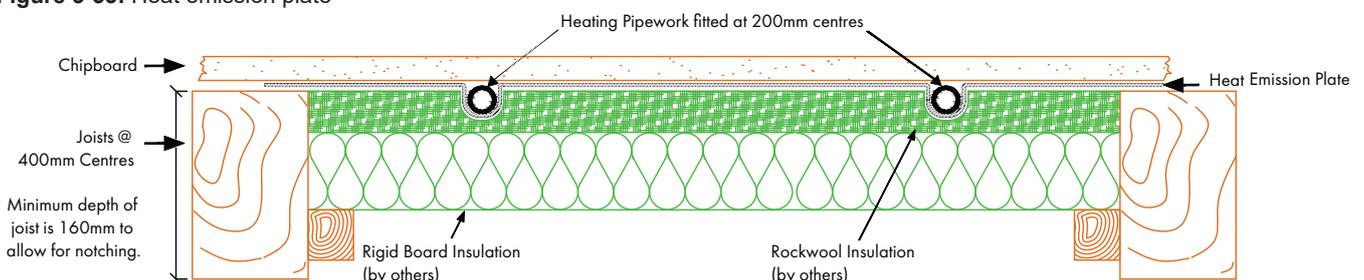


Figure 3-54: Fixing Heat Emission Plates installation section with components

**3.11.5 INSTALLATION OF GRANT UFLEX HEAT EMISSION PLATES**

1. Leave enough space between end of plate and wall. Refer to Figure 3-55.



**Figure 3-55:** Space between end of heat emission plate and wall

2. Fix plates to joist using staples

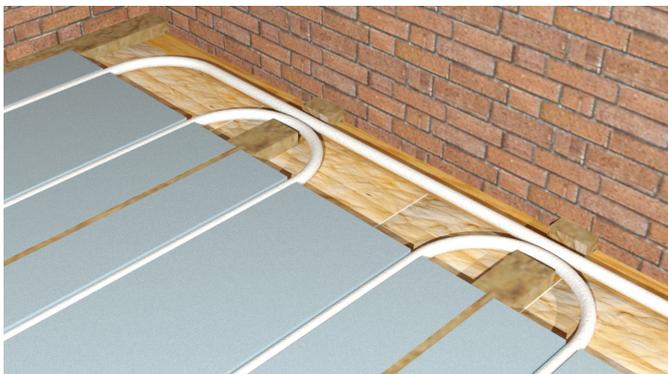


**Figure 3-56:** Fixing heat emission plates to joist

3. Notch or drill the joist to allow the pipe to pass through



**Figure 3-57:** Notching or drilling the joists



**Figure 3-58:** Installing heat emission plates and pipes on battens

4. Heat emitter plates on cross battens



**Figure 3-59:** Heat emitter plate on cross battens



**Figure 3-60:** Position of heat emission plates on cross battens



**Figure 3-61:** Heat emission plates and Uflex 16 mm PE-RT pipe on cross battens

**! CAUTION !**

**The plates are for heat distribution only and not structural. They must NOT be stood or walked on during the installation process. They are easily damaged and it is very important that no other trades are allowed where the UFH is being installed.**

The heat emission plates normally cover approximately 80% of the floor area. Plates should never touch or overlap each other, as they expand when heated and can create noise.

Plates can be installed in two basic ways:

- a. Running parallel with the joists, with the plates resting either directly on the top face of the joists (Refer to Figure 3-57) or on battens fitted to the top face of the joists, (Refer to Figure 3-58) or
- b. Running at right angles to the joists, supported on 'cross battens' that are fixed to the top face of the joists (Refer to Figure 3-59)

Whilst the use of battens will raise the finished height of the floor, it will allow the pipe to be installed without the need to notch or drill the floor joists. Refer to 'Notching and Drilling Joists' below.

Gaps can simply be left in battens fitted along the length of the joists so that the pipe can cross the joist to reach the next row of plates. With 'cross battens' the pipe can simply pass under the battens to reach the next row of plates.

Plates are only laid under straight runs of pipe, as follows:

- Ensure all insulation and the necessary battening work is installed and complete, prior to laying of the plates. See 'Insulation' section - 3.11.4.
- If cross battening, this is best achieved using 25 mm x 100 mm battens.
- Leave the ends of the battens loose so that the pipe loop can be laid beyond the end of or under the cross batten. Fix batten ends before laying floor.
- Lay the heat emission plates across the joists without fixing, leaving a gap between the ends and sides of each plate. Check to ensure appropriate number of plates are evenly spread out across the entire area before fixing.
- If necessary, the width of the plates can be trimmed (by no more than 30 mm) where the joist centres are less than 400 mm.
- Lay the first plates at each end of the room, leaving sufficient distance between the wall and the edge of the plate.

If the plates are supported on battens, leave a minimum of 300 mm between the plate and the wall. If the plates are supported directly on the joists, leave sufficient distance between the edge of the plate and the wall to allow the pipe to bend 180 degrees around and pass through a suitable located notch in the joist. Refer to 'Notching and Drilling Joists' below.

- Thereafter space the plates out evenly ensuring gaps between plates are at least 10 mm but less than 100 mm. Use any sections of plates in the middle of the room.
- When the plates have been laid on the first row of joists, fix these into position using staples. Repeat the process for the remaining emission plates.
- Careful consideration should be given to the location of plates around the manifold area and along feed pipe routes, where the UFH pipes congregate together, cross joists at right angles and are non-standard pipe centres.

#### Cutting Plates

- If shorter lengths are required, score the plate deeply with a Stanley knife and cut along the pipe groove with a hacksaw.
- Clean off the burrs in the pipe groove to prevent damage to the pipe.

#### Notching or drilling joist

- If no battens are used (refer to Section 3.11 'Installation of Grant Uflex Heat Emission plates') the joists will have to be drilled or notched to allow the pipe to pass through to reach the next row of plates.
- With solid timber joists, this must be done correctly to avoid weakening the joist to such an extent that it becomes structurally unsound.
- Holes should only be drilled on the centre line of the joist and must not be larger than 0.24 x the depth of the joist up to a maximum of 65 mm diameter.
- Example: for a 250 mm joist, the maximum hole diameter is 62.5 mm
- These holes can only be drilled at a distance from the supporting wall of between 0.25 x the span and 0.4 x the span.
- Example: for a joist of 4 m, span holes must be between 1 m and 1.4 m from the supporting wall.
- Notches can only be made in either the top or bottom of the joist (not both) and should not exceed 0.125 x the depth of the joist, up to a maximum of 35 mm.
- Example: for a 250 mm joist, the maximum notch depth is 31 mm.
- These notches can only be made at a distance from the supporting wall of between 0.07 x the span and 0.25 x the span.
- Example: for a joist of 4 m span, the notches must be located between 280 mm and 1 m from the supporting wall.

- The correct location and size of notches (or holes) in the joists must be taken into account when positioning the heat emission plates.

## ! CAUTION !

**These indications are for general guidance only. Always check with local building control and/or a structural engineer before notching or drilling any floor joist. Some types of floor joists cannot be notched or drilled**

#### Laying the Pipe

- Where possible, the design will ensure that the flow pipes are directed to the coolest part of the room.
- Identify each floor area to be covered by each coil/loop of pipe. If you have received a design prepared by Grant, the rooms to be heated and coils allocated can be identified on the quotation and/or layout drawings.
- When installing the pipe, it is important to ensure the pipes do not cross over each other. Therefore, time should be spent before actually laying any pipe, configuring the route for the feed pipes from the manifold location to the respective area/room to be heated.
- Typically feed pipes from the manifold go through door openings. However, where possible, to avoid any congestion around the manifold and through rooms adjoining the manifold location, feed pipes can be taken directly through partition walls and into the respective room. Ensure any holes drilled are below floor level.
- When threading the pipe through the hole, ensure it has been capped off and there are no sharp edges which could score and damage the pipe. It is recommended that the UFH pipes, when passing through walls, are sleeved with protective conduit.
- Once you have a clear picture of the installation, you can begin to install and lay the pipe. First thread the first coil end behind the return manifold and connect onto the flow port manifold. If passing through a partition wall, first thread the pipe through the hole and up behind the return manifold.
- Pipe bend supports must be fitted on every loop at the point where the pipe rises from the floor to connect to the manifold, i.e. 2 required per loop (Part code: UFLEX91).
- Lay the pipe, pressing it into the plates grooves by hand. Where possible, take the flow pipe to the coldest section of the room and meander the pipe up and down across the floor area towards the start position.
- It may be necessary to weigh down loop bends (do not use sharp objects), prior to laying the flooring and until the pipe has relaxed.
- Once the loop has been laid, take the pipe back to the manifold, following the same route out and connect the tail pipe to the corresponding return port on the manifold.

#### Inspection

Once the pipes have been laid, it is important to inspect the system before laying the floor to ensure the installation is correct and pipes are held firmly away from any possible damage.

#### Pressure Testing

Once all the pipes have been laid and connected to the manifold, fill and pressure test the system as per the instructions given in the 'Filling, Venting and Pressure Testing' - Section 4 of this guide.

#### Decking

- The area should be decked immediately to protect the system. Foot traffic must be prohibited until this is carried out to protect the pipe and the panels.
- Laminate floor finishes should be a minimum of 7 mm thick with interlocking joints.
- Chipboard or plywood floor deck should be a minimum of 15 mm thick with glued tongue and grooved edges.

- If required, an intermediate layer between the underfloor heating and the finish floor can be installed to minimise the risk of movement/expansion noise; use lightweight flooring cardboard, heavy gauge paper, polythene sheet or finish floor suppliers/manufacturers solution to compensate for uneven and flexible sub-floors.
- As an alternative to laying tongue and groove chipboard flooring over the underfloor heating, 'Fermacell' or 'Knauf' dry flooring element (20 mm or 25 mm depth) can be used as it offers a lower resistance to heat transfer than chipboard and plywood.
- The final floor deck should be installed as per the manufacturers/suppliers instructions.

#### • Pipe Bends

When laying the pipe, do not force the pipe into bends. It is easier to lay the pipe with a large radius and gently pull the pipe to the required bend before pressing into the next plate and insulation board. Do not pull the pipe too tight or it may kink.

### 3.12 UFLEX HEAT EMISSION PERFORMANCE DATA

Pipe specification: 16 mm O/D PE-RT - Grant Uflex

Floor construction: Timber suspended or floating floor with heat emission plates.

Floor decking: 18 mm chipboard above HEPs

Water temperature drop (K): 5

**Table 3-14:** Performance Data

Pipe pitch, $V_z$ (mm)		200		
		Floor covering resistance, $R_{\lambda,\beta}$ ( $m^2$ K/W)		
Mean water temperature MWT °C	Design room temperature $R_t$ °C	0.05	0.1	0.15
		W/m <sup>2</sup>		
35	16	44	39	36
	18	39	35	32
	20	35	31	28
	22	29	27	24
	24	25	23	20
40	16	56	50	45
	18	51	46	41
	20	46	41	38
	22	42	37	34
	24	37	33	30
45	16	67	30	55
	18	63	56	51
	20	58	52	47
	22	53	48	42
	24	49	44	39
50	16	80**	71**	64
	18	74**	66	60
	20	70	62	56
	22	65	58	53
	24	60	54	49
55	16	91**	81**	73**
	18	86**	77**	70
	20	81**	73**	66
	22	77**	69	62
	24	72**	64	58
Maximum heat Comfort Zone, Output for $q_H$ (W/m <sup>2</sup> )		70	70	70

All values above are suitable for occupied zones except if \*\* indicated

\*\*Suitable for perimeter zone only

Pipe specification: 16 mm O/D PEX/AL/PEX - Grant Uflex  
 Floor construction: Timber suspended or floating floor with heat emission plates.  
 Floor decking: 18 mm chipboard above HEPs  
 Water temperature drop (K): 5

**Table 3-15: Performance Data**

Pipe pitch, $V_z$ (mm)		200		
		Floor covering resistance, $R_{\lambda,\beta}$ ( $m^2$ K/W)		
Mean water temperature MWT °C	Design room temperature $R_i$ °C	0.05	0.1	0.15
		W/m <sup>2</sup>		
35	16	44	39	36
	18	39	35	32
	20	35	31	28
	22	29	27	24
	24	25	23	20
40	16	56	50	45
	18	51	46	41
	20	46	41	38
	22	42	37	34
	24	37	33	30
45	16	67	60	55
	18	63	56	51
	20	58	52	47
	22	53	48	42
	24	49	44	39
50	16	80**	71**	64
	18	74**	66	60
	20	70	62	56
	22	65	58	53
	24	60	54	49
55	16	91**	81**	73**
	18	86**	77**	70
	20	81**	73**	66
	22	77**	69	62
	24	72**	64	58
Maximum heat Comfort Zone, Output for $q_H$ (W/m <sup>2</sup> )		70	70	70

All values above are suitable for occupied zones except if \*\* indicated  
 \*\*Suitable for perimeter zone only

### 3.13 WATER TEMPERATURE CONTROL

Suitable for:

Pipe dimensions: 10 mm PE-RT

Pipe dimensions: 16 mm PE-RT

Pipe dimensions: 16 mm PEX/AL/PEX

#### 3.13.1 INTRODUCTION

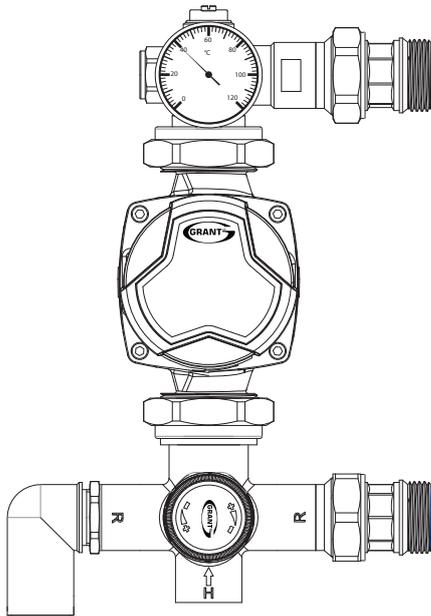


Figure 3-62: Mixing pump/valve unit

- If the heat source supplying the UFH system is a boiler, a thermostatic mixing valve/pump unit will be required to ensure that the temperature entering the flow manifold is sufficiently low enough for safe operation of the underfloor system.
- Similarly, if the heat source is an ASHP, but the heating system is split between UFH and radiators, a thermostatic mixing valve/pump unit will be required to again ensure that the temperature entering the flow manifold is sufficiently low enough for safe operation of the underfloor system.
- The Grant Uflex thermostatic mixing valve/pump unit is designed for controlling the flow and temperature of water in systems with up to 200m<sup>2</sup> of active floor area and maximum 15 kW heat load.
- The mixing valve/pump unit is supplied for fitting to the left-hand end of the manifold but it can be adjusted to fit the right-hand end if required. For further information refer to DOC0213.
- The thermostatic mixing valve has a control head with a temperature adjustment range of 20-55 °C.
- The maximum flow temperature into the mixing valve is 80 °C.
- When using the Grant Uflex mixing valve/ pump unit, the flow temperature from the heat source has to be a minimum of 10 °C above the required designed flow temperature from the UFH manifold.

#### 3.13.2 OPERATION

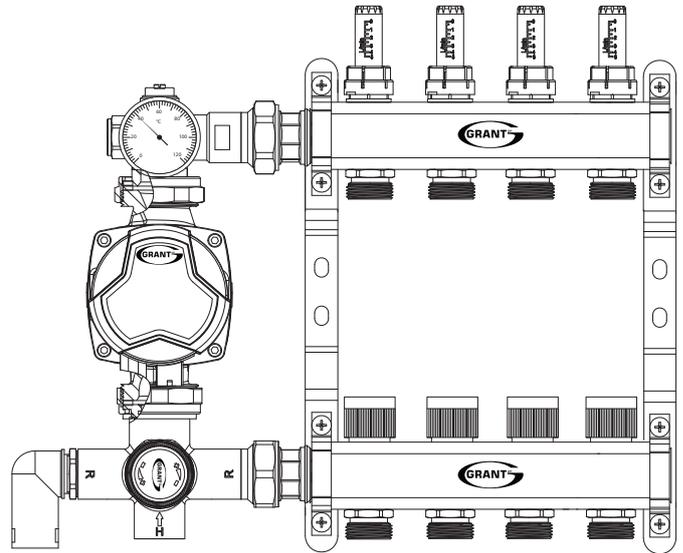


Figure 3-63: Mixing pump/valve unit

#### During Heating Demand Periods

- The mixing valve/pump unit is designed to mix the primary flow water with the underfloor heating return water.
- This is managed via a four-port thermostatic valve which is situated on the junction of the flow and underfloor heating return.
- This allows the higher temperature flow water to be blended with the underfloor heating return water to provide the required water temperature in the flow manifold.
- The pump of the mixing valve/pump unit then circulates the water around the underfloor heating loops.
- The mixing valve/pump unit uses a 6m head pump. Refer to the installation and operating instructions DOC0213 supplied with the mixing valve/pump unit.

#### 3.13.3 INSTALLATION

- The mixing valve/pump unit is supplied with two isolation ball valves: one with a red lever for the heat source flow and the other with a blue lever for the return to the heat source.
- The mixing valve/pump unit is supplied for mounting on the left side of the manifold.
- It can be adjusted to fit the right-hand end if required.
- The mixing valve/pump is fully supported by the manifold when installed.
- Ensure that the pipework to and from the heat source is correctly connected. Failure to do so will result in no heating to the manifold.
- An automatic bypass valve may be required between the flow and return pipework, depending on the hydraulic design of the system, before the mixing valve/pump unit, to reduce any closing noises from the mixing valve.
- Primary flow and return pipes, to supply the UFH manifold, should be sized correctly, based on flow rate, pressure loss and available pump duty.
- However, as a general guide, we suggest the following flow and return pipe sizes based on:
  - a) The flow/return pipe material
  - b) The diameter of the UFH pipe
  - c) The number of UFH pipe loops on the manifoldRefer to Table 3-16.
- Ensure that all system pipework has been thoroughly flushed before connecting it to the mixing valve/pump kit to prevent any system debris from affecting the operation of the mixing valve.

**Table 3-16:** Flow/ return minimum pipe size chart

Flow/return pipe material	MLC/PEX (mm)		Copper (mm)	
	10 mm	16 mm	10 mm	16 mm
UFH pipe size				
Manifold size				
2 loops	25	25	22	22
3 loops	25	25	22	22
4 loops	25	25	22	22
5 loops	25	25	22	22
6 loops	25	25	22	22
7 loops	25	25	22	22
8 loops	25	25	22	22
9 loops	25	25	22	28
10 loops	25	25	22	28
11 loops	25	25	22	28
12 loops	25	25	22	28

**3.13.4 WIRING**

- A suitable electrical supply is required.
- For individual room control systems, the manual heads on the lower manifold are replaced with electrothermal actuators. Grant UK can supply various wiring centres and programmable thermostats, including wireless control versions, to control the operation of these actuators. Refer to Section 5 for details of these controls.
- Some systems may require a 2-port motorised valve to be used on the primary flow feeding the UFH manifold, a 'demand' from the UFH control system will open the zone valve and the auxiliary switch should be wired to energise the heat source and main system circulator. Refer to Section 7 for typical electrical wiring diagrams.
- All wiring should be in accordance with the current edition of BS 7671 (the IET Wiring Regulations) and any applicable Local Regulations.

**3.13.5 SETTINGS**

- The thermostatic head is adjustable to give a mixed water temperature in the flow manifold from 20 °C to 55 °C.
- Set the mixed water temperature by rotating the adjusting knob so that the setting number for the required temperature aligns with the pointer on the valve body. Refer to installation instructions for the mixing valve/pump unit - DOC0212.
- The temperature setting can be checked on the temperature gauge fitted to the UFH manifold and adjusted as required.
- Adjust the circuit flow rates by adjusting the flow regulators (flow meters) - refer to Section 6 - System Starting up and Commissioning of this manual.

# 4 FILLING AND TESTING THE SYSTEM

## 4.1 FILLING AND VENTING THE LOOPS

Fill ports (hose connections) with ball valves are supplied as part of the Uflex manifold assembly. Hose unions are supplied with the manifold for the 3/4" connections on these fill ports although other hose connections can be used if preferred.

**Before starting, ensure that the flow manifold with the filling connection is uppermost, then:**

1. Ensure all electrical supplies are switched off.
2. Ensure both isolating ball valves on the main flow and return pipes to the manifold are CLOSED. Refer to Figure 4-1.



Figure 4-1: Isolating ball valves closed

3. Use hose unions provided or remove to use alternative hose connectors on both fill ports if preferred. Refer to Figure 4-2.



Figure 4-2: Removing hose connector

4. Connect an alternative hose union if preferred to both fill and drain connections. Refer to Figure 4-3.



Figure 4-3: Connecting a hose union to both fill and drain ports

5. If using the mixing valve/pump kit unit, fully close the mixing valve on the circulating pump inlet to ensure that water is forced around the UFH loops when filling and not short-circuiting between the flow and return manifolds. Refer to figure 4-4.



Figure 4-4: Closing the thermostatic mixing valve

6. Close all underfloor heating loop return valves on the manifold. To do this, rotate all the manual valve heads (blue caps) clockwise on the return manifold (Refer to Figure 4-5) until fully closed.



**Figure 4-5:** Closing manual valve heads on return manifold

7. Close all the flow meters on the flow manifold by removing the outer red locking rings (Refer to Figure 4-6) and turning each flow meter clockwise, with the plastic red key provided with the manifold set, until fully closed. (Refer to Figure 4-7).



**Figure 4-6:** Removing the red locking ring



**Figure 4-7:** Closing flow meter using red plastic key provided

8. Fit a hose to the drain connection on the return manifold (Refer to Figure 4-8) and run the other end of the hose to a suitable drain point.



**Figure 4-8:** Fitting a hose to the return manifold

- Fit a hose to the fill connection on the flow manifold (Refer to Figure 4-9) and run the other end of the hose to a suitable tap (Refer to Figure 4-10).



Figure 4-9: Fitting a hose to the flow manifold

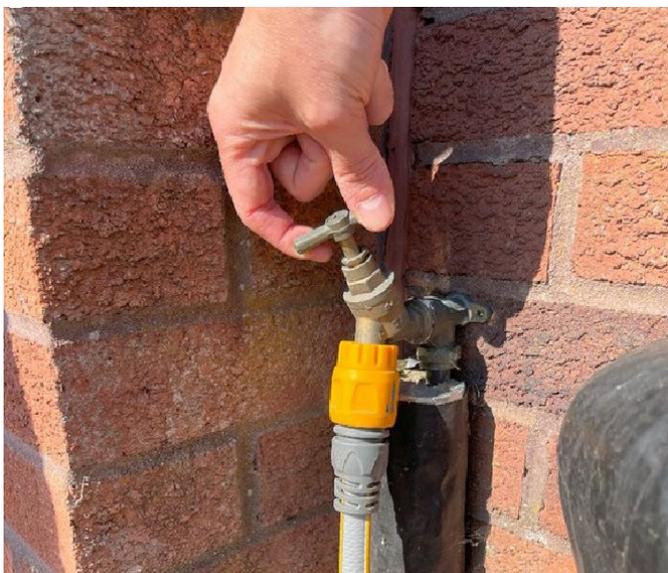


Figure 4-10: Turning on the water tap

- Individual loops need to be purged of air in turns. This is achieved by opening the manual valve head (blue cap) on the return manifold (Refer to Figure 4-5), then fully opening the corresponding flow meter on the flow manifold (Refer to Figure 4-7). To fully open the flow meter, first remove the red locking ring and then turn the flow meter 3 full turns anti-clockwise from the closed position using the red plastic key. Refer to figure 4-7.
- Open the flow meter and the manual valve for the first underfloor loop.
- Open the drain valve on the return manifold.
- Open the fill valve on the flow manifold.
- Turn on the water tap (Refer to Figure 4-10). As the first loop fills with water, air will discharge through the hose to the drain. Once the air stops and there is a steady flow of water, close the fill valve and then close both the flow meter and corresponding return valve on the flow and return manifolds.
- Repeat this procedure for all UFH loops on the manifold ensuring that the flow meter and return valves are closed on each loop after filling.

## ! NOTE !

**IMPORTANT:** If using a mixing valve/pump kit unit, please remember to fully open the thermostatic mixing valve.

- When all loops have been purged, close the fill and drain valves on the flow and return manifolds and switch-off the mains water tap before disconnecting the hoses.
- Remove the hose connectors and fit the sealing caps. Refer to Figure 4-11.

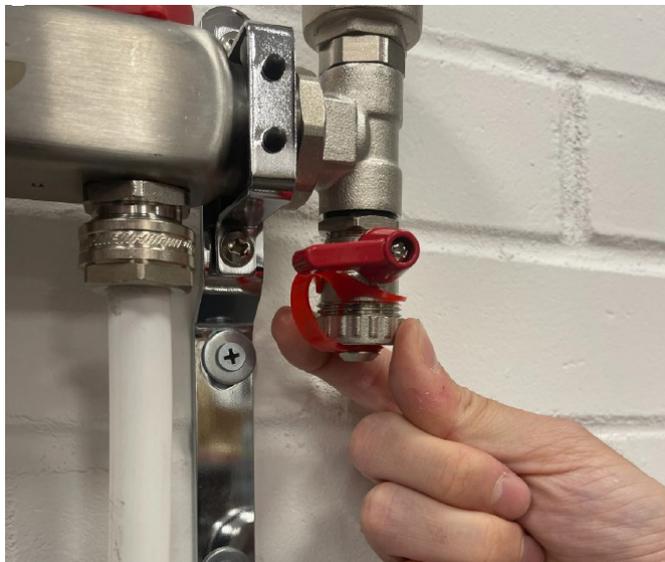


Figure 4-11: Fitting the sealing caps

- If the UFH is being installed in the winter, antifreeze can be added to the system water for protection against freezing. If used, repeat the steps listed previously to purge the loops of antifreeze and replace with water.

**IMPORTANT:** If the system is to be used with Grant aerna 290 heat pump, antifreeze is not to be used.

The system is now ready for pressure testing.

## 4.2 PRESSURE TESTING

Once the UFH pipes have been installed and filled, a hydraulic pressure test must be carried out on all loops prior to laying the screed or covering with the chosen floor coverings.

1. Isolate both the flow and return manifolds, using the ball valves.
2. Remove hose unions (if used).
3. Ensure that all flow meters and return valves on all the UFH loops are fully open.
4. Connect the pressure test kit pump (Refer to Figure 4-12) to the flow manifold fill port and open the valve. Ensure the drain valve on the return manifold is closed.



Figure 4-12: Pressure test kit

Using the pressure test kit pump, increase the pressure in the filled system to the test pressure (minimum 4 bar, maximum 6 bar) and leave for at least 1 hour (Refer to Figure 4-13). The pressure can be monitored on the pressure gauge on the pressure test kit and the return manifold.



Figure 4-13: Pumping up pressure in the system.

After an initial slight drop in pressure as the pipes expand, there should be no further drop in pressure. Check the pressure gauge during this period to ensure that the pressure remains constant.

- Decrease the pressure to the working pressure of 1 bar. The system pressure will initially increase as the pipes contract under the lower pressures and will then stabilise. If the pressure has not fallen below working pressure after 1 hour the system is pressure tight.
- Grant recommends that the system should remain at working pressure whilst the floor is laid so that if any damage occurs to the pipe, the laying of the floor can be stopped and the damage repaired immediately. The floor should be laid immediately after the pressure test.
- Where there is a danger of freezing, suitable measures such as the use of glycol-based antifreeze should be taken, using the correct mixture of water and antifreeze solution.
- However, before start-up, the glycol mixture should be thoroughly flushed out of the system and disposed of carefully.

### 4.2.1 USE OF CORROSION INHIBITORS

Grant Uflex UFH pipes will not be:

- Adversely affected by corrosion inhibitors or biocides normally used in central heating systems.
- Adversely affected by accidental contact with linseed oil based sealing compounds, or soldering flux. However, the latter should not be used for making joints to the pipe.
- Affected by soft, hard or aggressive potable water. The pipe will not be attacked by any constituents of concrete, screeds, mortars, and is fully resistant to attack from micro-organisms.

# 5 CONTROLS

A Grant UFLEX Underfloor heating system can be controlled in many ways depending on the intended system being installed from zoned control (e.g., Room by room, Floor by floor) to fully open-loop.

## 5.1 UFLEX UH8 (WIRED)

### 5.1.1 UFLEX UH8 WIRING CENTRE (PART CODE: UFLEX64)



Figure 5-1: Uflex UH8 Wiring Centre

The UFLEX UH8 is an 8-zone wiring centre for use with both the Grant UFLEX Edge and Grant UFLEX Neostat V3 230V Programmable Thermostats.

A maximum of eight Programmable Thermostats (UFLEX Edge, UFLEX Neostat V3, or a mixture of both) can be connected to the UFLEX UH8 wiring centre – one per zone. Each one being connected to the wiring centre using 3-core and earth cable.

The UH8 wiring centre provides the 230 V AC electrical supply to the UFLEX Edge and UFLEX Neostat V3 thermostats required for them to operate.

In response to a heating demand from the programmable room thermostat, each zone of the UH8 wiring centre provides a 230 V AC output to operate the UFH valve actuators connected to that zone. A maximum of four actuators can be connected to each zone.

When there is a heat demand from one or more of the heating zones the UH8 wiring centre can provide either a 230 V or volt free output, as required, to operate a heat source.

Additional outputs are provided for use with underfloor heating systems including 230 V outputs for both a UFH manifold pump and a UFH zone valve.

The LEDs on the UH8 wiring centre indicate the power supply, the outputs to the heat source, UFH pump/UFH valve, and which heating zones are in operation at any time.

One zone (Zone 8) can be used to control a radiator zone by using the UFH/RAD switch on the wiring centre PCB and a 2-port zone valve (not supplied) connected to the 230 V output from zone 8 on the wiring centre. This function is selected using a switch on the wiring centre PCB.

- **If the switch is set to RAD**  
When the Programmable Thermostat connected to Zone 8 calls for heat, the wiring centre will provide an output to the 2-port zone valve and the heat source but WILL NOT enable the underfloor heating pump/valve output.
- **If the switch is set to UFH**  
When the Programmable Thermostat connected to Zone 8 calls for heat, this zone will operate as an underfloor heating zone providing an output to the UFH valve actuator(s) and enabling the pump/valve and heat source outputs.

Any outputs not needed for a particular installation can be ignored.

### 5.1.2 UFLEX NEOSTAT V3 PROGRAMMABLE THERMOSTAT (PART CODE: UFLEX62)



Figure 5-2: Uflex Neostat V3 Programmable Thermostat

A programmable room thermostat allowing the setting of heating 'On' and 'Off' times and the required air temperatures during the 'On' and 'Off' periods.

The UFLEX Neostat V3 can be used as either a thermostat or a time clock, with the Thermostat mode being the default option.

The UFLEX Neostat V3 requires a 230 V supply that is provided when connected to the UFLEX UH8 wiring centre.

It is flush mounted on a wall requiring a 35 mm backbox.

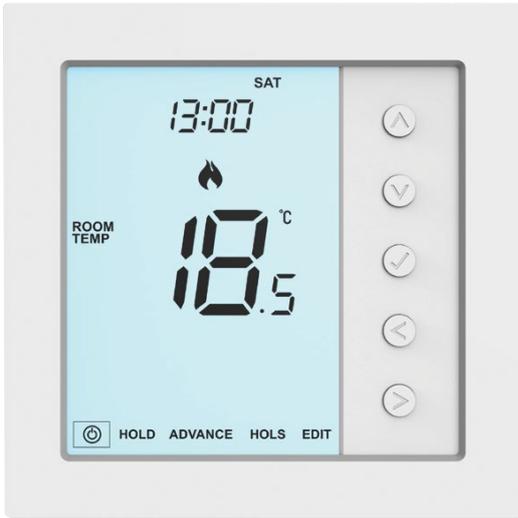
If required, the UFLEX Neostat V3 can be used in conjunction with a remote sensor (Part code: UFLEX65) to monitor/control the floor temperature. This is directly wired to the floor sensor terminals provided on the UFLEX Neostat V3 thermostat.

A second remote sensor (Part code: UFLEX65) can be connected to the UFLEX Neostat V3 thermostat to provide remote air temperature sensing. In this case the wall-mounted Remote Sensor Enclosure (Part code: UFLEX66) can be used to conceal the temperature sensor probe.

Other features include:

- White backlit display with proximity sensor
- Illuminated soft touch keys with proximity sensor
- Automatic white back light (turns off after 30 seconds)
- Wi-Fi connectivity via Neohub and NeoApp
- Using NeoHub creates a mesh network for increased range compared to standard RF thermostats
- User selectable operating modes
- Self-learning optimum start
- 4 or 6 comfort levels per day (selectable)
- Temperature hold facility
- Holiday facility
- Key code facility
- Frost protection

**5.1.3 UFLEX EDGE PROGRAMMABLE THERMOSTAT (PART CODE: UFLEX 63)**



**Figure 5-3:** Uflex Edge Programmable Thermostat

A programmable room thermostat allowing the setting of heating ‘On’ and ‘Off’ times and the required air temperatures during the ‘On’ and ‘Off’ periods.

The UFLEX Edge can be used as either a thermostat or a time clock, with the thermostat mode being the default option.

The UFLEX Edge requires a 230 V supply that is provided when connected to the UFLEX UH8 wiring centre.

It is flush mounted on a wall requiring a 35 mm backbox.

If required, the UFLEX Edge can be used in conjunction with a remote sensor (Part code: UFLEX65) to monitor/control the floor temperature. This is directly wired to the terminals provided on the Edge thermostat.

The UFLEX Edge can be used with single or multiple Wireless Air Sensors (Part code: UFLEX68), that are ‘paired’ directly to the thermostat via an RF signal. When these are used, the average air temperature is calculated making it perfect for larger open plan properties.

The UFLEX Edge can also be used with Wireless Window/Door sensor (Part code: UFLEX69) that automatically switches the heating to standby when the window/door is open, automatically returning to the normal heating mode when the window/door is closed. This is also directly ‘paired’ to the thermostat via an RF signal.

Other features include:

- Automatic white backlit large display
- Modbus connectivity
- User selectable operating modes
- Self-learning optimum start
- 4 or 6 comfort levels per day (selectable)
- Temperature hold facility
- Holiday facility
- Key locking
- Frost protection
- Advance function

**5.2 UFLEX UH8-RF (WIRELESS)**

**5.2.1 HEATMISER UH8-RF WIRING CENTRE (PART CODE: UFLEX118)**



**Figure 5-4:** Heatmiser UH8-RF Wiring Centre)

The UFLEX UH8-RF is an 8-zone wiring centre for use with the NeoAir V4 wireless Programmable Thermostats.

A maximum of eight Programmable Thermostats (NeoAir V4) can be connected to the UH8-RF wiring centre – one per zone. Each one communicating with the wiring centre via an RF signal.

In response to a heating demand from the programmable room thermostat, each zone of the UH8-RF wiring centre provides a 230 V AC output to operate the UFH valve actuators connected to that zone. A maximum of four actuators can be connected to each zone.

When there is a heat demand from one or more of the heating zones the UH8-RF wiring centre can provide either a 230 V or volt free output, as required, to operate a heat source.

Additional outputs are provided for use with underfloor heating systems including 230 V outputs for both a UFH manifold pump and a UFH zone valve.

The LEDs on the UH8-RF wiring centre indicate the power supply, the outputs to the heat source, UFH pump/UFH valve, and which heating zones are in operation at any time.

Any of the eight zones can be used to control a radiator zone by using a 2-port zone valve (not supplied) connected to the 230 V output from that zone on the wiring centre. This function is set on the NeoAir V4 thermostat for that zone when pairing it to the UH8-RF wiring centre.

If this function is selected, when the NeoAir V4 Thermostat connected to the zone calls for heat, the wiring centre will provide an output to the 2-port zone valve and the heat source but WILL NOT enable the underfloor heating pump/valve output.

More than one zone can be used to control a radiator circuit if required.

Any outputs not needed for a particular installation can be ignored.

**5.2.2 GRANT NEOAIR V4 PROGRAMMABLE THERMOSTAT (PART CODE: UFLEX117)**



**Figure 5-5:** Heatmiser NeoAir V4 Programmable Thermostat

A programmable room thermostat allowing the setting of heating 'On' and 'Off' times and the required air temperatures during the 'On' and 'Off' periods.

The NeoAir V4 can be used as either a thermostat or a time clock, with the Thermostat mode being the default option.

The NeoAir V4 can also be used to control hot water heating when used in conjunction with the UH8-RF wiring centres.

The NeoAir V4 is battery powered and requires 4 x AAA batteries. The thermostat display will indicate when these batteries need to be replaced. Rechargeable batteries must NOT be used.

It is surface mounted on a wall, with no wiring required.

Only one remote sensor (Part code: UFLEX65) can be connected to the remote sensor terminals on the NeoAir V4 thermostat.

If required, this remote sensor can be used to monitor/control the floor temperature.

Alternatively, this remote sensor can provide remote air temperature sensing. In this case the wall-mounted Remote Sensor Enclosure (Part code: UFLEX66) can be used to conceal the temperature sensor probe.

Other features include:

- White backlit display
- Illuminated soft touch keys
- Automatic white back light (turns off after 30 seconds)
- Wi-Fi connectivity via Neohub and NeoApp
- Using NeoHub creates a mesh network for increased range compared to standard RF thermostats
- User selectable operating modes
- Self-learning optimum start
- 4 or 6 comfort levels per day (selectable)
- Temperature hold facility
- Holiday facility
- Key code facility
- Frost protection

### 5.3 UFLEX UH8 ACCESSORIES

#### 5.3.1 UFLEX REMOTE AIR/FLOOR SENSOR (PART CODE: UFLEX65)



**Figure 5-6:** Uflex Remote Air/Floor Sensor (Part Code: UFLEX65)

Can be used to monitor and control the floor temperature with either the UFLEX Edge, UFLEX NEOSTAT V3 or UFLEX Neostat V4 thermostats and is directly wired to the floor sensor terminals provided on the thermostat.

This can also be used to provide remote air temperature sensing with the UFLEX Neostat V3 and NeoAir V4 thermostats only and is directly wired to the air sensor terminals provided on the thermostat. In this case the wall-mounted Remote Sensor Enclosure (Part code: UFLEX66) can be used to conceal the temperature sensor probe.

The sensor cable is 3 metres long, but this can be extended up to 20 metres using a suitable 'twisted pair' shielded cable (e.g. Belden 8451).

#### 5.3.2 REMOTE SENSOR ENCLOSURE (PART CODE: UFLEX66)



**Figure 5-7:** Remote Sensor Enclosure

A wall mounted enclosure that can be used to conceal the probe of the Remote Air/Floor Sensor probe when it is used as a remote air sensor in conjunction with either the UFLEX Neostat V3 or NeoAir V4.

#### 5.3.3 UFLEX THIMBLE SENSOR (PART CODE UFLEX67)



**Figure 5-8:** Uflex Thimble Sensor

Used to provide a discrete means of remote air temperature sensing with the UFLEX Neostat V3 or NeoAir V4 thermostats only and is directly wired to the air sensor terminals provided on the thermostat.

The sensor cable is 1.95 metres long, but this can be extended up to 20 metres using a suitable 'twisted pair' shielded cable (e.g. Belden 8451).

#### 5.3.4 UFLEX WIRELESS AIR SENSOR (PART CODE: UFLEX68)



**Figure 5-9:** Uflex Wireless Air Sensor

A wireless air sensor that can be directly 'paired' to the UFLEX Edge thermostat via an 868MHz RF signal. When these are connected the average temperature for the space is calculated, making it perfect for larger open plan properties.

Alternatively, the wireless air sensor can be used in place of the internal temperature sensor of the thermostat, where it is not possible to locate the thermostat in the optimal position. A maximum of 16 Wireless Air Sensors and Window/door sensors can be connected to a single UFLEX Edge thermostat.

The UFLEX Wireless Air Sensor is powered by a single CR2032 3V battery and is attached to the wall by a double-sided adhesive patch supplied with the sensor.

### 5.3.5 UFLEX WIRELESS DOOR/WINDOW SENSOR (PART CODE: UFLEX69)



Figure 5-10: Uflex Wireless Door/Window Sensor

The UFLEX wireless door/window sensor will automatically switches the heating to standby when the door/window is open and will return to normal heating operation when shut.

It can be directly paired to the Uflex Edge thermostat via an 868MHz RF signal, with a maximum of 16 wireless air sensors and window/door sensors can be connected to a single Uflex Edge thermostat.

The wireless door/window sensor requires a single LS14250 3.6V battery to operate.

It should be fitted to a door or window frame using double-sided adhesive patches (supplied).

### 5.3.6 NEOHUB (PART CODE: UFLEX70)



Figure 5-11: NeoHub

This is the gateway to the Neo system providing remote control of all Neostat Thermostats from an iOS or Android device.

The NeoHub connects to a home broadband router via an ethernet cable (supplied with the unit) and wirelessly to the Neostat V3 or NeoAir V4 thermostats installed in the property, creating a mesh network greatly increasing the network range.

Key features include:

- Smart Profiles: Allowing time and temperature settings to be made and then applied to a number of zones as required. Any subsequent changes to the profile will be automatically applied to those zones using that profile.
- Geo-location: Automatically turns the heating off when you leave home and back on when you return.
- Compatible with up to 32 Neo devices.
- Compatible with Smart Home, HomeKit, Google Home, Alexa and IFTTT.
- Automatic Firmware updates for NeoHub and connected devices.
- Clock sync and BST correction.

Push notifications such as:

- High or low temperature alerts
- Low battery warning for wireless sensors

### Remote and Wireless Sensor Compatibility

Table 5-1: Remote and Wireless Sensor Compatibility

Sensor	Uflex Edge	Uflex Neostat V3	Uflex NeoAir V4
Remote Air/Floor Sensor	Yes <sup>1</sup>	Yes <sup>2</sup>	Yes <sup>3</sup>
Thimble Sensor	No	Yes	Yes
Wireless Air Sensor	Yes	No	No
Wireless Door/Window Sensor	Yes	No	No

<sup>1</sup> Only one can be connected – floor temperature sensor only

<sup>2</sup> Two can be connected – either floor temperature sensor or remote air sensor (or both).

<sup>3</sup> Only one can be connected – either as floor sensor or remote air sensor (but not both).

<sup>4</sup> Can be used in place of the remote air sensor.

### 5.3.7 UFLEX LIMIT THERMOSTAT (PART CODE: VBS147)



Figure 5-12: Uflex Limit Thermostat

The Uflex limit thermostat monitors the mixed flow into the Uflex manifold to ensure your installed UFH system does not exceed safe operating temperatures.

It and should be attached to a thermally conductive surface into/ on the flow manifold.

The Uflex Limit thermostat can be connected through the pump live connection or a remote shut down terminal in your heat source to stop flow into the UFH system.

## 5.4 AERONA SMART CONTROLLER

The Grant Aerona Smart Controller consists of a wiring centre and touchscreen display (with an integrated thermostat). Refer to Figure 5-13. Additional thermostats (Grant Wired or Wireless thermostats) can be used in conjunction with the Grant Aerona Smart Controller to manage space heating demands.

The Grant Aerona Smart Controller can manage up to 3 space heating circuits, each with a thermostat assigned either directly or wirelessly connected to the wiring centre.

The Grant Aerona Smart Controller Wiring Centre provides the electrical supply to the touchscreen display, Grant Wired thermostat(s) or the Grant Wireless receiver module.

For further information on the connectivity of thermostats and other compatible controls and devices, Refer to UK DOC0203 (Grant Aerona Smart Controller), UK DOC0217 (Grant QR2 Smart Pre-plumbed cylinder) or UK DOC0205 (Grant QR Smart Pre-plumbed cylinder) as appropriate.



Figure 5-13: Grant Aerona Smart Controller

In response to a heating demand from a circuit thermostat, there will be a 230V output from the terminals assigned for that circuit in the wiring centre. Refer to Table 5-2.

Table 5-2: Circuit output connections

Heating Circuit	Pump/Valve	Mixer
1	H1-P	None
2	H2-P	H2-M
3	H3-P	H3-M

- H1-P, H2-P and H3-P consist of a live and neutral connection with the earth being made to the earth strip within the wiring centre casing.
- H2-M and H3M consist of 2 lives and a neutral, which is used for a dual action motorised actuator to open and close the valve as required for mixing, configurable in the Grant Aerona Smart Controller.

In both cases when there is a DHW demand, the heating zones are deactivated (DHW priority).

Any outputs not needed for a particular installation can be ignored.

## 5.4.1 UFH SYSTEM CONFIGURATIONS

The Grant Aerona Smart Controller can be configured in a number of ways to function with a Grant Uflex UFH installation.

### Open Loop - No Actuators

- Manifold to supply UFH loops to a single controlled circuit e.g. a single storey.
- Loop isolation valves permanently open and no thermal actuators fitted.
- Circulating pump (also controlled by the Aerona Smart Controller) can be fitted if the system design requires it.
- Mixed Emitter types (i.e. radiators upstairs and UFH downstairs) will require a motorised or thermostatic mixing valve to control the flow temperature to the UFH manifold.

### Zoned with Actuators

- Manifold to supply UFH loops for up to 3 individually controlled circuits e.g. single rooms.
- Loop isolation valves fitted with 230 V thermal actuators connected to the circuit output connections in the wiring centre of the Grant Aerona Smart Controller.
- Circulating pump (also controlled by the Aerona Smart Controller) can be fitted if the system design requires it.
- Mixed Emitter types (i.e. radiators upstairs and UFH downstairs) will require a motorised or thermostatic mixing valve to control the flow temperature to the UFH manifold.

### Zoned using UH8/UH8-RF Wiring centre & thermostats

- UH8/UH8-RF wiring centre to manage circuits based on demands from installed compatible thermostats e.g. Uflex Edge or Uflex Neostat.
- UH8/UH8-RF wiring centre to be connected to the Grant Aerona Smart Controller as a thermostat assigned to a circuit via 'Contact' input terminals (T1 or T2) in the Aerona Smart controller wiring centre.
- A circulating pump can be fitted as required and it may be controlled by either the Smart Controller or the UH8/UH8-RF depending on the circuit design.
- Mixed Emitter types (i.e. radiators upstairs and UFH downstairs) will require a motorised or thermostatic mixing valve to control the flow temperature to the UFH manifold.

# 6 SYSTEM STARTING UP AND COMMISSIONING

## 6.1 STARTING UP THE SYSTEM

### 6.1.1 SYSTEM START-UP

- When the system has been connected to the heat source and all pumps, controls, valves and bypasses fitted, the system should be checked and started as follows.
- Where applicable, ensure that the screed has had sufficient time to cure in accordance with manufacturers instructions and relevant British Standards, typically between 21 – 28 days.
- All wiring should be in accordance with the current edition of BS 7671 (the IET Wiring Regulations) and any applicable Local Regulations.
- The system set-up and control arrangement should be checked to ensure that it conforms to Grants' recommendations.
- Check that the system is filled with water and fully vented of air and all isolating valves are fully open. Once this is complete, the pumps should be run for 5 minutes and a final check made to ensure that all air has been vented from the system.
- Check that the heat source is operating in accordance with the manufacturers instructions. If the heat source is directly controlling the design flow water temperature, it should be set to the required flow temperature for the system.
- The flow rate for each UFH loop (in litres/min) is regulated by the flow meters fitted on the flow manifold. Set each loop the required flow rate as calculated and carryout the balancing procedure that follows.

### 6.1.2 FLOWMETER MANIFOLD BALANCING PROCEDURE

- Remove the red cap from the flow meter. Refer to figure 6-1. If the flow meter has been opened it needs to be closed by turning it clockwise. All flow meters should be fully closed at the start of the balancing process.
- Ensure that all manifold return valves are fully closed (remove thermal actuators if fitted and replace with blue manual caps).
- Open the return valve on one loop and adjust the setting of the corresponding flow meter, until the design flow rate is reached, by turning the flow meter anticlockwise from its fully closed position. Refer to figure 6-2. It is important that the system and UFH pumps are running. Note, three full turns from shut will fully open the flow meter. It is not possible to adjust the flow meter further than this setting.
- Once the design flow rate is achieved the red locking ring should be refitted over the flow meter. Refer to figure 6-3.
- The flow meter will not turn at all if the red locking ring is fitted correctly. Refer to figure 6-4 where it shows a correctly fitted locking ring.

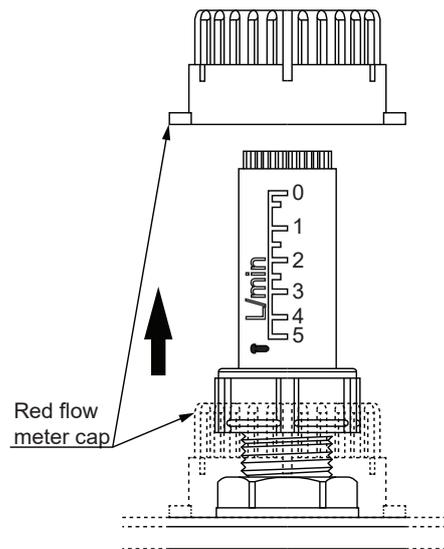


Figure 6-1: Removing red locking ring from the flow meter

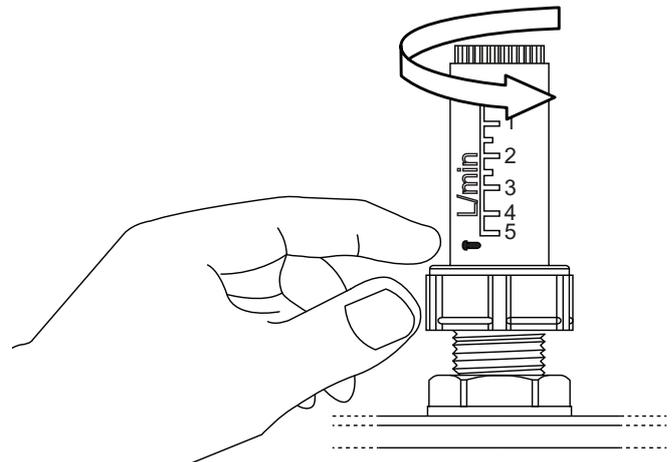


Figure 6-2: Adjusting the setting of the flow meter

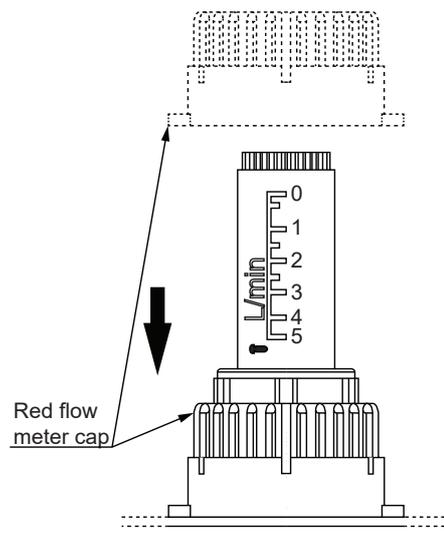


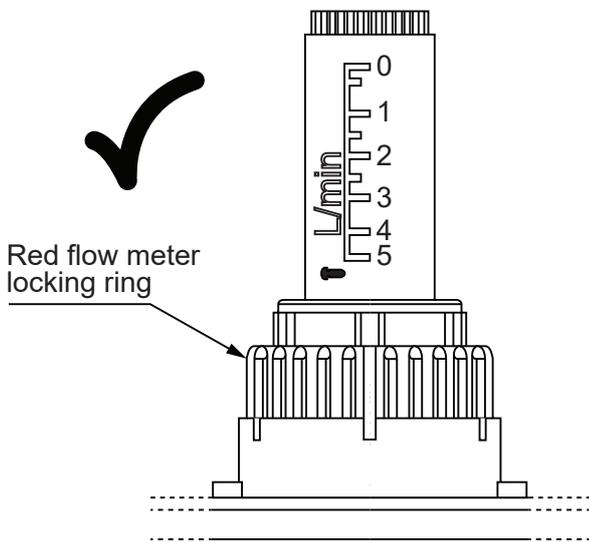
Figure 6-3: Refitting the red locking ring over the flow meter

## ! WARNING !

Do not hold the flow meter by the clear top part when turning it to adjust the flow rate.

## ! WARNING !

Do not turn knob counter-clockwise more than 3 full turns, otherwise the red indicator disk will be out of range when the system is pressurized, and may cause the system to leak.



**Figure 6-4:** Correctly fitted red locking ring

- Repeat the process for each loop, then go back and carry out fine adjustments, because each loop will have a mutual effect on the others. If the valve flow meter is fully open and design flow rate is not achieved adjustment on the pump speed may be necessary.
- If removed, refit all thermal actuators.
- With the electric power off, initially set all room thermostats 5 °C above current room temperature so that they call for heat.
- Set the water temperature control at the lowest possible setting (between 25-30 °C).
- Switch on the UFH system and ensure UFH pumps are running and all relevant valves are open. Remember that the thermal actuators take some time to operate and there will be a 2-4 minute delay before they are fully open.
- If the foregoing procedures have been completed satisfactory, turn all room thermostats down and wait for the system to stop.
- When the system has stopped, turn up one room thermostat at a time and wait for the system to start. Then confirm that the correct circuit (loop) actuator(s) has opened for that particular room and immediately turn the room thermostat down again in that room.
- Wait until the system has stopped and then repeat the process on a room by room basis, ensuring that every actuator is controlled by the correct thermostat and that each one switched the system on and off. This should also include the heat source being switched on and off, providing there are no other user circuits, e.g. radiators and/or hot water primary circuits, calling for heat.
- Run the system at the lowest possible setting for at least 3 days, before raising the water temperature to the maximum design temperature, which should be maintained for at least a further 4 days.
- Set the room thermostats to the required levels and programme the system controls to run as required.
- When running normally, the temperature difference between the manifold flow and return connections may be between 5-10 °C. To help assess the situation strap on thermometers are available. See the main price guide for details.

### 6.1.3 FINAL LOOP BALANCING

When the furnishings have been installed into the building and normal working conditions achieved, the loops may require a final balancing. The system should be run at design temperatures for at least one week before this is done.

### 6.1.4 GENERAL COMMISSIONING

Commissioning is required to enable the system to meet its design specification and comply with the energy efficiency requirements of the Building Regulations. Commissioning should only be carried out after the system has been run gently for adequate time to allow floors to dry out (do not use the UFH to cure the screed). The building work should be complete with all external doors and windows closed.

All safety checks relating to the heat source operation, controls wiring and water connections should have been performed in accordance with manufacturers instructions and with statutory requirements before system commissioning is commenced.

Floor heating systems are typically designed to operate with a water flow temperature of approximately 40-50 °C and a return temperature of 5-10 °C less. There are occasions, mainly concerning floor coverings, when resistance to heat flow is so great that the flow temperature must be increased to raise the floor surface temperature to achieve sufficient heat output.

## 6.2 SYSTEM OPERATION

### 6.2.1 SYSTEM OPERATION

Once the system has been correctly balanced and commissioned, there is very little to concern the client with operating Grant Underfloor Heating systems.

### 6.2.2 AIR THERMOSTATS

These can be adjusted to provide optimum comfort control. Once comfort conditions have been met, further adjustment of the thermostat should not be necessary. When a room thermostat setting is altered to call for more heat, providing the new setting is within the systems capabilities, it may take a while before a higher temperature is felt in the room. The rate of heat build up under most conditions will be fairly constant.

Turning the thermostat up to higher temperature levels than it is desired to achieve cannot increase this rate.

### 6.2.3 WATER TEMPERATURE CONTROLS

The design water temperature should be set when the system is first commissioned and further adjustment is not usually necessary, except when the system is under performing (see Section 8.1 - Trouble Shooting section). Adjustment is either directly on the water temperature control valves or on the Climate Controller.

See specific installation instructions for further details.

### 6.2.4 PUMP SPEED

Increasing the pump speed will increase the flow rate and slightly improve the system response time.

### 6.2.5 MAINTENANCE

Since the heating loops are embedded and the pipe does not corrode, no maintenance is necessary for the pipes.

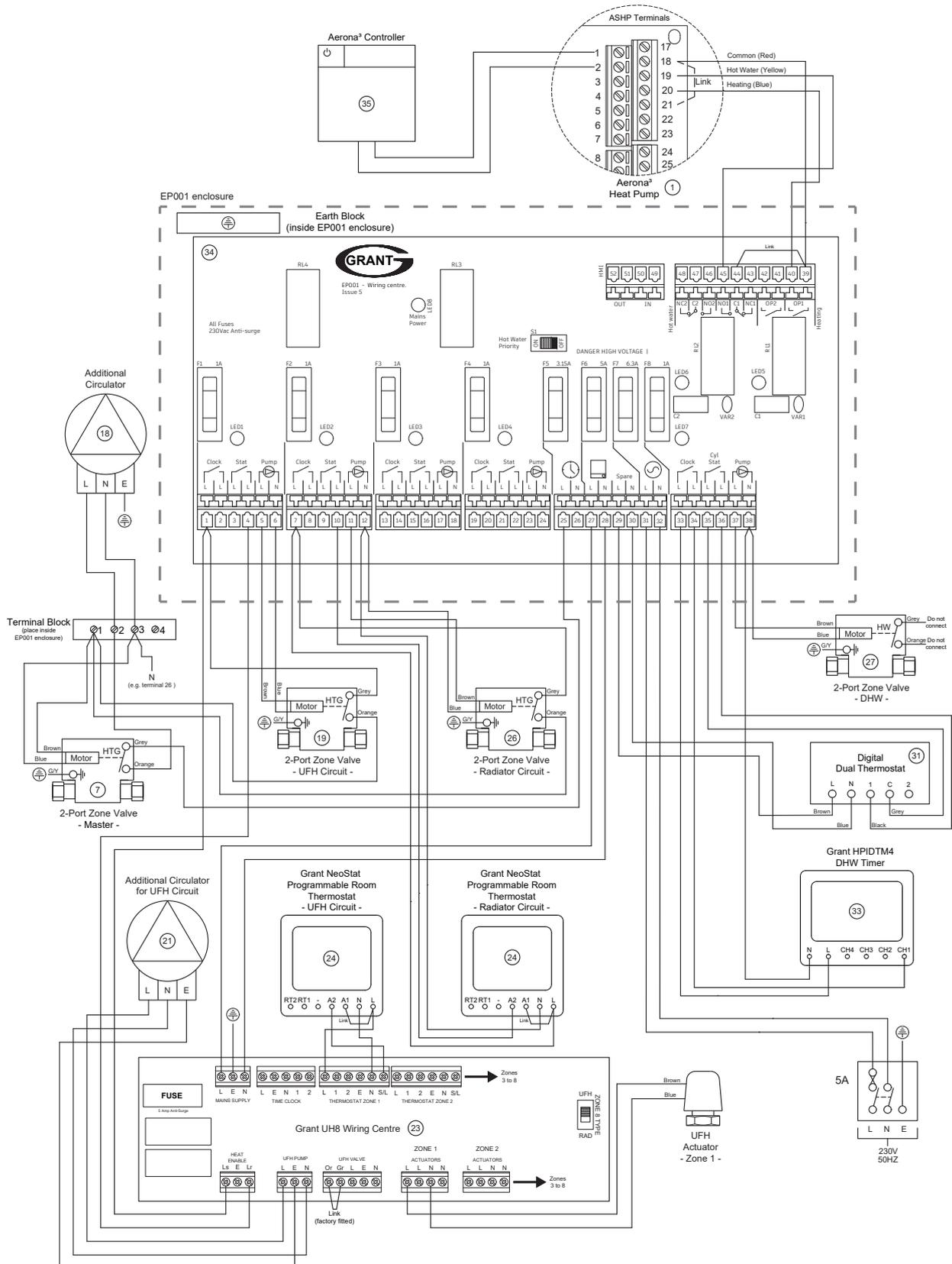
When the UFH system is not in use, e.g. during the summer months, the system should be run for a minimum of 15 minutes each week to exercise the pumps and valves (the Climate Controller has a built-in pump and valve exercise programme). Pumps, valves and controls will require servicing as per the manufacturers instructions.

As for any plumbing joints, all joints at the manifold and flow and return should be checked regularly for any signs of leakage.

In older systems it is advisable to flush the system through with clean water to remove any sediment build-up.

# 7 SYSTEM SCHEMATIC DIAGRAMS

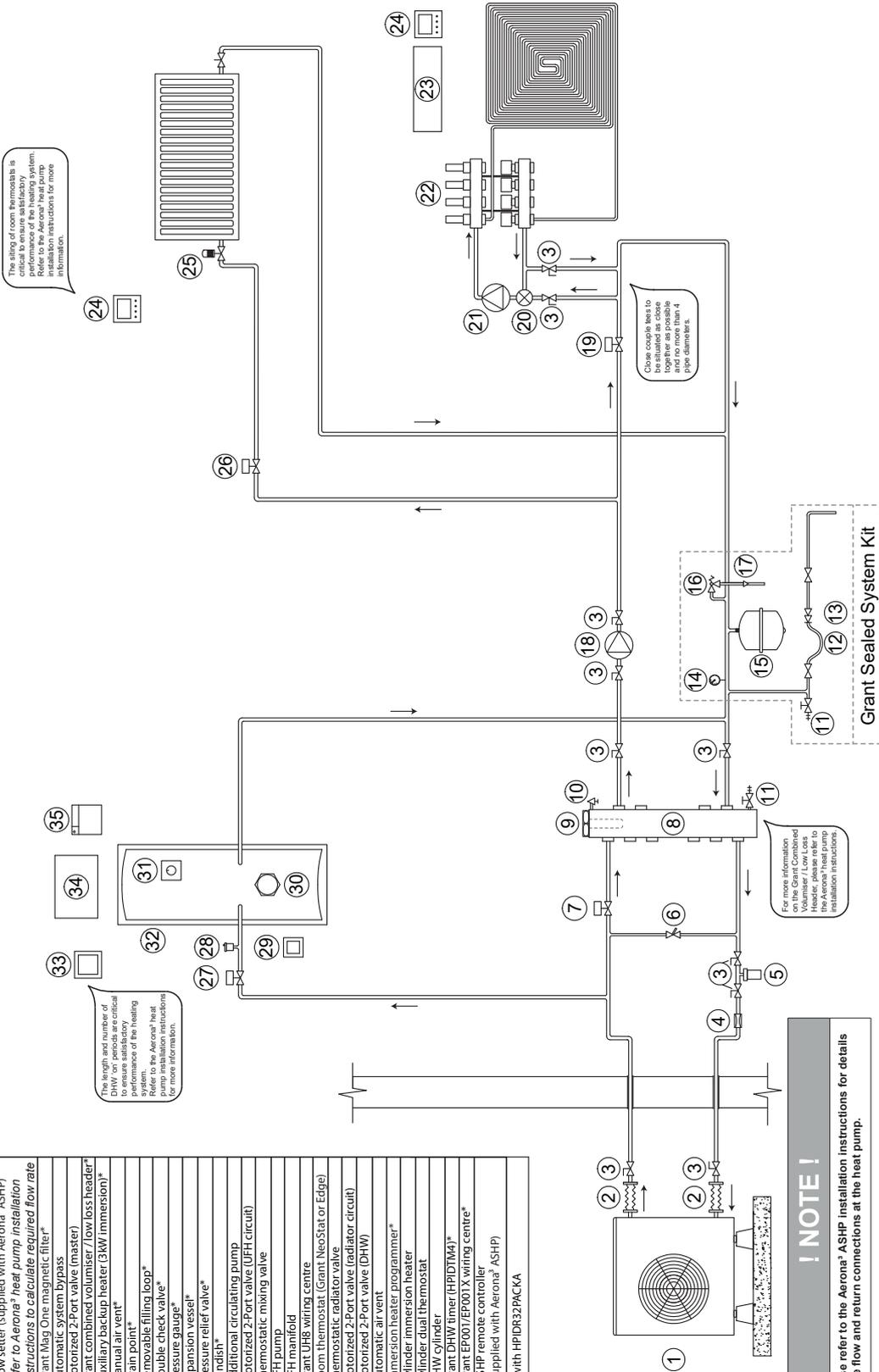
## 7.1 ELECTRICAL CONNECTIONS - PACK A - AERONA<sup>3</sup> - HPCS-A002E Grant UK Drawing Number: HPCS-A002E



7.2 HYDRAULIC CONNECTIONS - PACK A - AERONA<sup>3</sup> - HPCS-A002S  
 Grant UK Drawing Number: HPCS-A002S

Item	Description
1	Aerona <sup>3</sup> ASHP
2	Flexible hose
3	Isolation valve
4	Flow setter (supplied with Aerona <sup>3</sup> ASHP) refer to Aerona <sup>3</sup> heat pump installation instructions to calculate required flow rate
5	Grant Mag One magnetic filter*
6	Automatic system bypass
7	Motorized 2-Port valve (master)
8	Grant combined volumiser (low loss header)*
9	Auxiliary backup heater (3kW immersion)*
10	Manual air vent*
11	Drain point*
12	Removable filling loop*
13	Double check valve*
14	Pressure gauge*
15	Expansion vessel*
16	Pressure relief valve*
17	Lundish*
18	Additional circulating pump
19	Motorized 2-Port valve (U/FH circuit)
20	Thermostatic mixing valve
21	U/FH pump
22	U/FH manifold
23	Grant U/FH wiring centre
24	Room thermostat (Grant NeoStat or Edge)
25	Thermostatic radiator valve
26	Motorized 2-Port valve (radiator circuit)
27	Motorized 2-Port valve (DHW)
28	Automatic air vent
29	Immersion heater programmer*
30	Cylinder immersion heater
31	Cylinder dual thermostat
32	DHW cylinder
33	Grant DHW timer (HPIDTM)*
34	Grant EP001/EP001 X wiring centre*
35	ASHP remote controller (supplied with Aerona <sup>3</sup> ASHP)

\* Supplied with HPIDR32PACKA



The sizing of room thermostats is critical to the performance of the heating system. Refer to the Aerona<sup>3</sup> heat pump installation instructions for more information.

The length and number of flexible hoses should be controlled to ensure satisfactory performance of the heating system. Refer to the Aerona<sup>3</sup> heat pump installation instructions for more information.

Close couple heat to radiators where possible together as possible and no more than 4 pipe diameters.

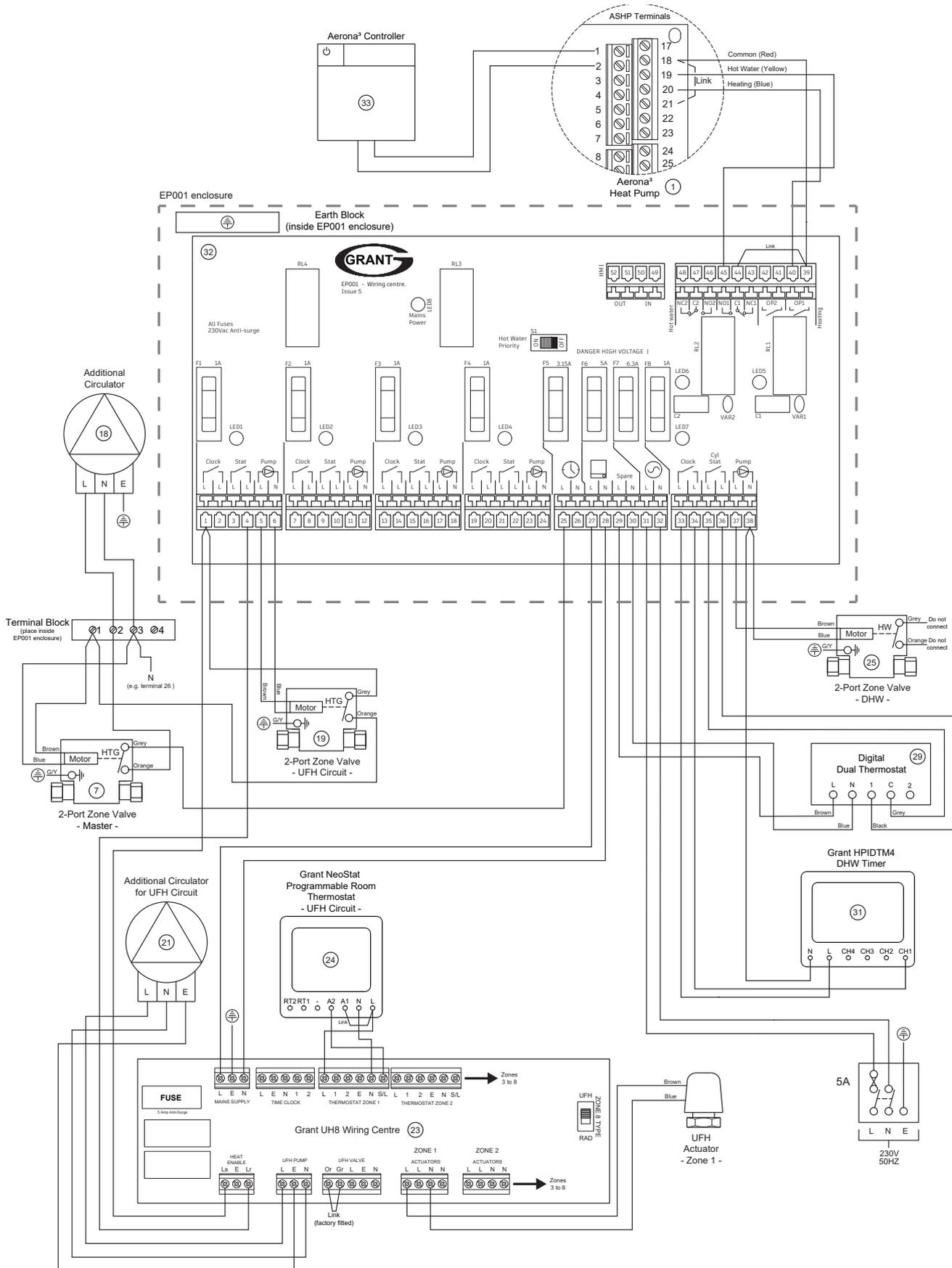
**! NOTE !**  
 Please refer to the Aerona<sup>3</sup> ASHP installation instructions for details of the flow and return connections at the heat pump.

**Grant Sealed System Kit**

**! NOTE !**  
 This system schematic should be read in conjunction with the Aerona<sup>3</sup> ASHP installation instructions and wiring diagram HPCS-A002E.

# 7.3 ELECTRICAL CONNECTIONS - PACK A - AERONA<sup>3</sup> - HPCS-A003E

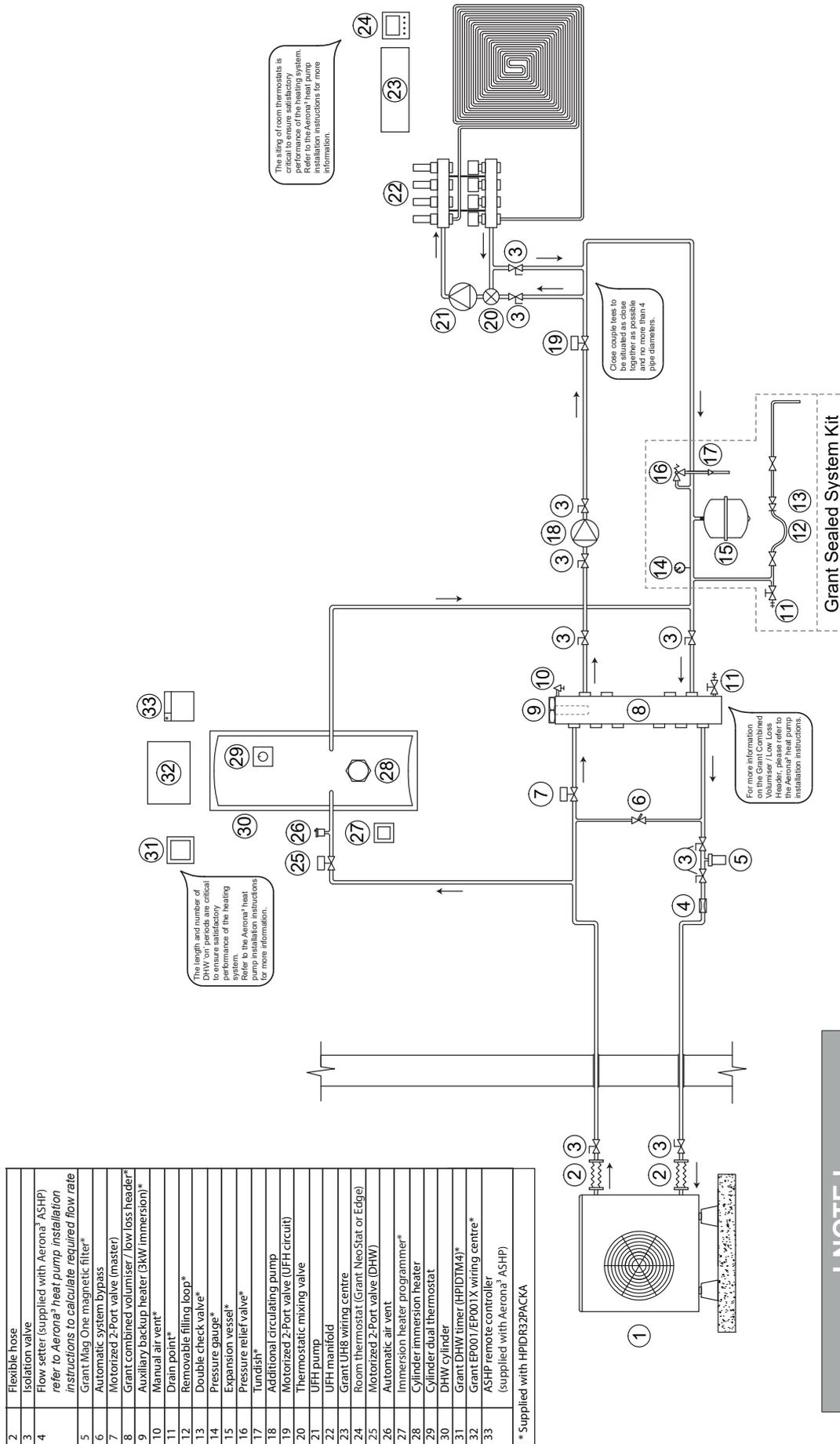
Grant UK Drawing Number: HPCS-A003E



**! NOTE !**  
 This wiring diagram should be read in conjunction with the AERONA<sup>3</sup> ASHP installation instructions and system schematic HPCS-A003S.

7.4 HYDRAULIC CONNECTIONS - PACK A - AERONA<sup>3</sup> - HPCS-A003S

Grant UK Drawing Number: HPCS-A003S



2	Flexible hose
3	Isolation valve
4	Flow setter (supplied with Aeronas <sup>3</sup> ASHP) refer to Aeronas <sup>3</sup> heat pump installation instructions to calculate required flow rate
5	Grant Mag One magnetic filter*
6	Automatic system bypass
7	Motorized 2-Port valve (master)
8	Grant combined volumiser / low loss header*
9	Auxiliary backup heater (3KW immersion)*
10	Manual air vent*
11	Drain point*
12	Removable filling loop*
13	Double check valve*
14	Pressure gauge*
15	Expansion vessel*
16	Pressure relief valve*
17	Tundish*
18	Additional circulating pump
19	Motorized 2-Port valve (UfH circuit)
20	Thermostatic mixing valve
21	UfH pump
22	UfH manifold
23	Grant UHB wiring centre
24	Room thermostat (Grant Neo Slot or Edge)
25	Motorized 2-Port valve (DHW)
26	Automatic air vent
27	Immersion heater programmer*
28	Cylinder immersion heater
29	Cylinder dual thermostat
30	DHW cylinder
31	Grant DHW timer (HPIDTM4)*
32	Grant EP001/EP001X wiring centre*
33	ASHP remote controller (supplied with Aeronas <sup>3</sup> ASHP)

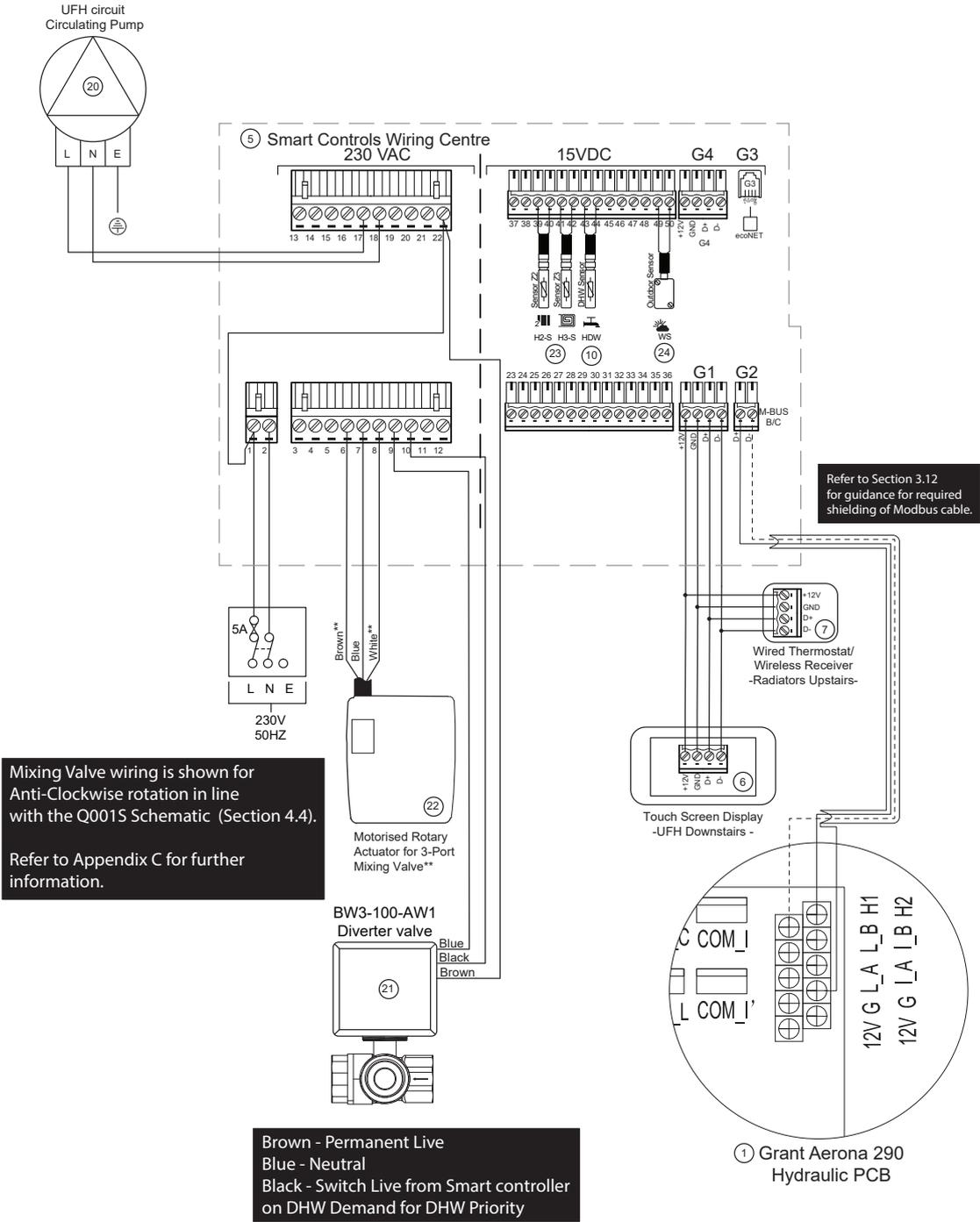
\* Supplied with HPIDR32PACKA

**! NOTE !**  
Please refer to the Aeronas<sup>3</sup> ASHP installation instructions for details of the flow and return connections at the heat pump.

**! NOTE !**  
This system schematic should be read in conjunction with the Aeronas<sup>3</sup> ASHP installation instructions and wiring diagram HPCS-A003E.

7.5 ELECTRICAL CONNECTIONS - PACK Q - AERONA 290 - HPCS-Q001ER290

Grant UK Drawing Number: HPCS-Q001ER290



**! NOTE !**

Cable shielding must be connected to the ground at the heat pump only when connecting the modbus cable.

**! NOTE !**

\*Please ensure that neutrals are derived from the same supply to prevent spurious MCB/RCD trips.

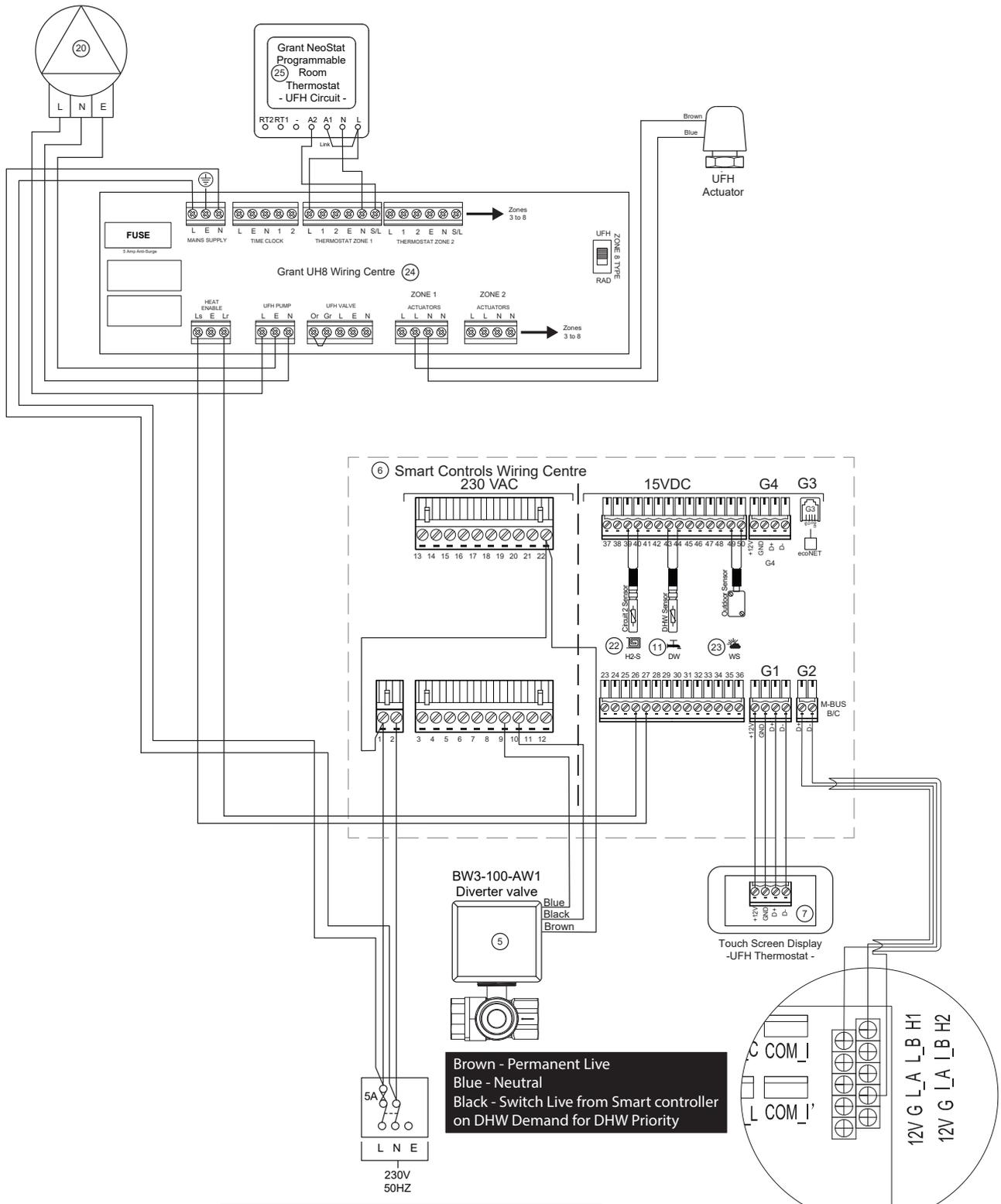
**! NOTE !**

This wiring diagram should be read in conjunction with the Grant AERONA Smart Controls installation instructions and system schematic HPCS-Q001SR32.



7.7 ELECTRICAL CONNECTIONS - PACK R - AERONA 290 - HPCS-R002ER290

Grant UK Drawing Number: HPCS-R002ER290



**! NOTE !**

Cable shielding must be connected to the ground at the heat pump only when connecting the modbus cable.

**! NOTE !**

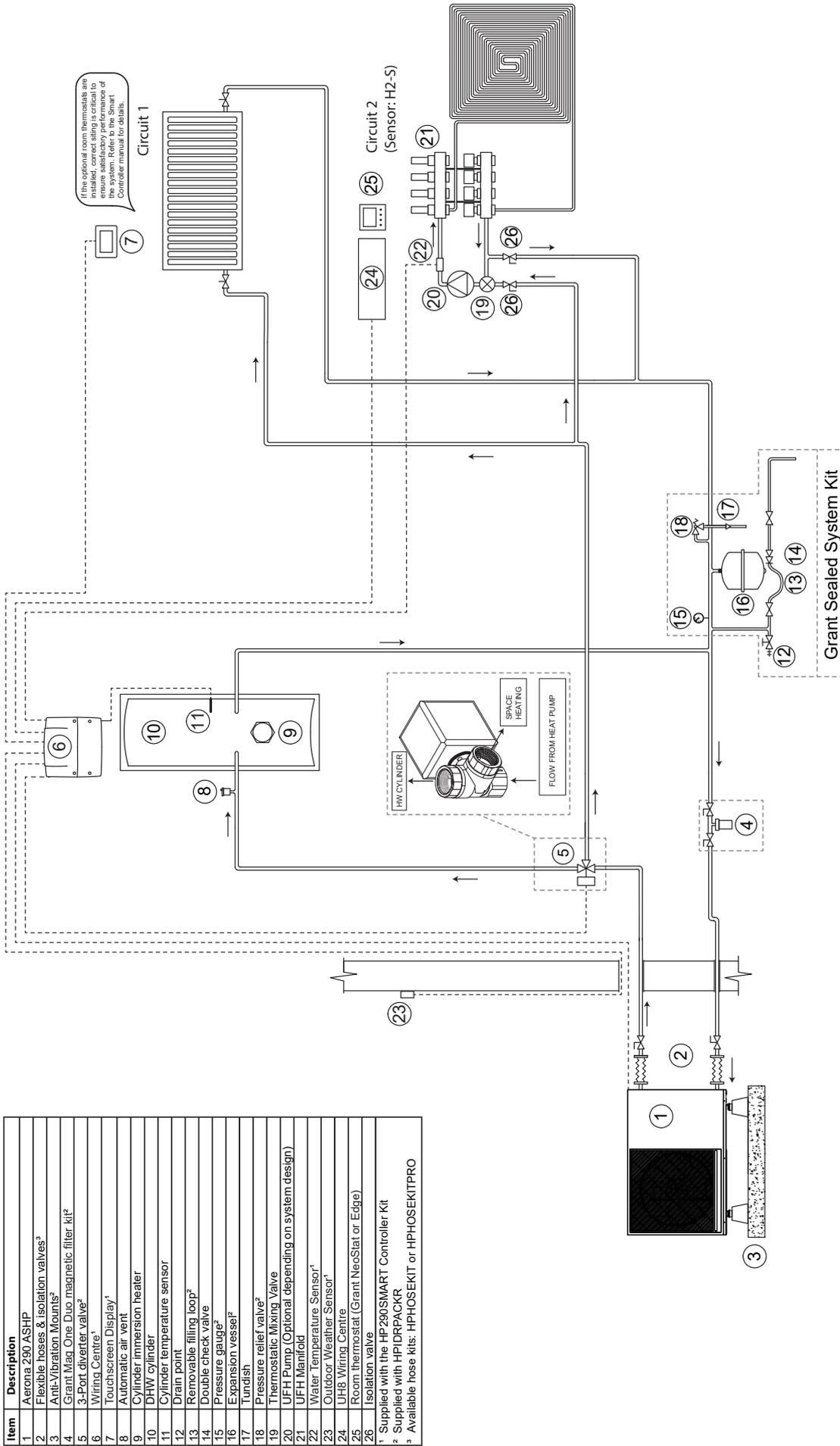
\*Please ensure that neutrals are derived from the same supply to prevent spurious MCB/RCD trips.

**! NOTE !**

This wiring diagram should be read in conjunction with the Grant AERONA Smart Controls installation instructions and system schematic HPCS-R002SR290.

① Grant AERONA 290 Hydraulic PCB

7.8 HYDRAULIC CONNECTIONS - PACK R - AERONA 290 - HPCS-R002SR290  
 Grant UK Drawing Number: HPCS-R002SR290



Item	Description
1	Aerona 290 ASHP
2	Flexible hoses & isolation valves <sup>3</sup>
3	Anti-Vibration Mounts <sup>2</sup>
4	Grant Mag One Duo magnetic filter kit <sup>2</sup>
5	3-Port diverter Valve <sup>2</sup>
6	Wiring Centre <sup>1</sup>
7	Touchscreen Display <sup>1</sup>
8	Automatic air vent
9	Cylinder immersion heater
10	DHW cylinder
11	Cylinder temperature sensor
12	Drain point
13	Removable filling loop <sup>2</sup>
14	Double check valve
15	Pressure gauge <sup>2</sup>
16	Expansion vessel <sup>2</sup>
17	Tundish
18	Pressure relief valve <sup>2</sup>
19	Thermostatic Mixing Valve
20	UFH Pump (Optional depending on system design)
21	UFH Manifold
22	Water Temperature Sensor <sup>1</sup>
23	Outdoor Weather Sensor <sup>1</sup>
24	UHB Wiring Centre
25	Room thermostat (Grant NeoStat or Edge)
26	Isolation valve

<sup>1</sup> Supplied with the HP 290 SMART Controller Kit  
<sup>2</sup> Supplied with HPIDRPACKR  
<sup>3</sup> Available hose kits: HPHOSEKIT or HPHOSEKITPRO

**! NOTE !**  
 This system schematic should be read in conjunction with the Grant Aerona Smart Control installation instructions and wiring diagram HPCS-R002SR290.

**! NOTE !**  
 Please refer to the Aerona ASHP installation instructions for details of the flow and return connections at the heat pump.

# 8 FAULT FINDING

## 8.1 TROUBLESHOOTING

As described in earlier sections, the UFH system operation is relatively straightforward. Hot water from the primary heat source is blended with the return water from the UFH secondary circuit at the mixing valve and distributed, via the secondary UFH pump, to the distribution manifold and into a series of UFH loops/circuits of pipe embedded within the floor. Normally, there is room temperature control, which will open and close a single or series of actuators mounted on the manifold, or prior to the manifold (single zone), depending upon the room requirement. If one or all thermostats are calling for heat, there is an interlock switch to energise the heat source.

The majority of problems are usually simple installation problems, relating to wiring or plumbing, or design problems, with regard to the limitations of UFH and its suitability for the purpose intended.

In all cases where an electrical fault is reported it is always prudent to check the obvious before replacing components.

- Is there an electrical supply?
- Is it switched on?
- Are there any fuses that may have blown and need replacing?
- Are any components overloaded?
- Is everything wired correctly?
- Under no circumstances replace a fuse with a higher rating than stated for that piece of equipment.
- If the water arriving at the manifold (prior to entering the mixing valve) is either cold or below the design temperature, check:
  - the heat source is firing
  - the primary pump is fitted
  - the primary pump is working
  - the heat source is of adequate size
  - the primary pipework is sufficiently sized
  - the primary pumps are large enough

### 8.1.1 FURTHER UFH PROBLEMS:

**If a loop or loops fail to warm, when other zones are working correctly**

**General things to look for:**

- Check that the corresponding manifold valves are open
- Check that there is a demand from the corresponding room thermostat and/or the thermal actuator is open on demand.
- There may be an air lock in the loop, which will require purging. Either shut down all other loops by closing the valves at the manifold or turn down all other room thermostats. This will concentrate all pump pressure to the problem loop and may shift the air blockage. If all else fails the loop can be flushed through with high-pressure water following the instructions detailed in Section 4 - Filling, Venting and Pressure Testing.

**If circulation is apparent but poor, it may be that the regulating control valve on the manifold requires adjustment.**

- Check that all pump isolating valves are fully open.

**If a room fails to warm**

**General things to look for:**

- That the room thermostat fitted is calling for heat and that the valve has opened using the visual indicator on the actuator.
- That the room thermostat is connected to and communicating to the correct actuator(s).
- That the room thermostats are not operating in temperature set-back mode.
- That the flow temperature is correct as it enters the floor loops. Although typical design water temperatures are suggested throughout this guide, there is some element of a learning curve with UFH, as on some occasions the design water temperature may need to be raised after commissioning and once the system has been in operation during a heating season.
- That the primary flow and return connections are installed correctly and not crossed over at the UFH manifold.
- That the primary water temperature is not too low. This needs to be at least 10 °C higher than the UFH system water temperature, especially when using a mixing valve/pump kit.
- Thermal resistance of floor covering is not too high, as this could reduce the floor heat output.

**If the system is too noisy.**

**General things to look for:**

- There is no air in the system
- That all pipes are firmly clipped in place and that the manifold brackets are tight.
- That the UFH pump speed is not too high.
- That excessive pressure from another circulator in the system is not interfering (hence the importance of having a primary bypass).

**If the running costs are high**

**General things to look for:**

- That the UFH system is correctly electrically connected to the heat source to prevent short cycling and to ensure it is not running when it is not required.
- That the room temperatures and thermostat settings are not too high (typical comfort temperatures are 20 °C in living quarters and 18 °C in bedrooms).
- For any open windows or draughts. It is not unknown for windows to be opened in cold weather, as the internal comfort remains constant with thermostatic controls.
- That the heat source is running correctly. Has it been serviced and/or commissioned by an approved engineer.
- That the floor downward losses are high due to inadequate level of floor insulation.

### 8.1.2 THE DESIGN WATER TEMPERATURE IS NOT MET

**General things to look for:**

- Check all control valves are correctly installed in their correct orientation and that any remote sensors are installed and located in a suitable position.
- Check the temperature settings are as per design and adjust as necessary, depending on the water temperature control system used.
- Check the primary water temperature is not too low. This needs to be at least 10 degrees in excess of the UFH system water temperature.

## The system is losing pressure

### General things to look for:

- If the system is losing pressure either during testing and/ or after the system has been filled, but the flooring has not been laid, simple visual/manual checks around the manifold and along each loop of pipe should identify the problem area.
- If there are no clear visual signs, each loop/circuit may require a separate pressure test to identify the exact location.
- If the floor has been laid, identification of the fault can be traced through signs of a wet patch around the leak.
- Obviously to make the repair, the floor will have to be raised. In screed floors, excavate carefully in the centre of the wet patch.
- Any leaks on the manifold are generally due to the connection and any loose nuts and unions will require tightening.

### 8.1.3 REPAIRS

To make a repair to the pipe, follow the processes below;

#### Repairing the pipe:

- Isolate the damaged pipe loop at the manifold.
- Cut out the damaged section of pipe.
- Prepare both ends of pipe using the pipe cutter. On panel systems, remove a small section of the floating panel or fixed tracked panel, to accommodate the compression fittings.
- Slide the compression adaptor nut over each end of pipe, together with split olive, prior to inserting the insert/sleeve into each end.
- Offer both ends of pipe/inserts to the compression coupler and tighten both nuts.
- Ideally, the joint will require an inspection chamber in case further maintenance is required. However, in reality this is often not practical, and the fitting is wrapped in suitable tape before burying in the screed (ensure approval with the building inspector is sought prior to doing this).
- Pressure test the system again before laying the floor covering.

#### Items Required

- Plastic pipe cutter
- Denso tape (for solid floors)

#### For 10 mm PE-RT pipe:

- 1 x Uflex MINI compression coupling (UFLEX51)

#### For 16 mm PE-RT pipe:

- 1 x Uflex compression repair connector (UFLEX50X)

#### For 16 mm PEX-AL-PEX pipe:

- 1 x Uflex compression repair connector (UFLEX50X)

# 9 SPARE PARTS

## 9.1 GRANT PRODUCT GUIDE - ONLINE RESOURCES

For information about spare parts, please refer to the Grant product guide using the following QR code

## 9.2 UFH PART LIST

QR CODE	DESCRIPTION
	Download the Grant UK product guide for UFH where you can find the spare part list for UFH.

# 10 SERVICING & MAINTENANCE

## 10.1 SERVICING AND MAINTENANCE

The maintenance and servicing of UFH systems is essential to ensure they continue to function properly and efficiently.

- **Water pressure**  
The system should maintain a certain pressure level, which is usually between 1 and 2 bar. If the pressure drops significantly, it could indicate a leak or air in the system. If you're noticing a pressure drop, contact a Underfloor heating specialist or Grant Engineering UK for further advice on checking for leaks.
- **Air in the system**  
Over time, air can get trapped inside the pipes, which reduces the efficiency of the system. This is typically done by using air vents or bleed valves. If you notice any hot or cold spots on the floor, it might be a sign of trapped air. A technician can also carry out a more thorough air purge if needed.
- **Circulating pump (if installed)**  
This ensures that the water circulates through the pipes. If you hear unusual noises or notice that certain areas of the floor aren't heating as effectively, the pump might not be working properly. Regular inspection of the pump and its components is necessary to ensure that it continues to function as it should.
- **Manifolds**  
These should be checked to ensure that they are not obstructed and are distributing the water evenly. A professional can inspect and clean the manifolds if necessary to ensure the even flow of water through the system.

In terms of cleaning, sediment buildup inside the pipes may occur. Over time, this can decrease the flow of water, affecting the heating performance. Flushing the system regularly is crucial to prevent this. The water in the system can be flushed through the pipes to remove any dirt or buildup.

Regular maintenance by a professional is generally recommended at least once a year. This will not only ensure that your system remains efficient, but it will also help prevent potential problems from becoming larger issues down the line.

Refer to your supplied Installation and operating instructions for installed pumps, manifold and ancillary devices for further details.

# 11 HEALTH & SAFETY INFORMATION

## 11.1 GENERAL

Under the Consumer Protection Act 1987 and Section 6 of the Health and Safety at Work Act 1974, we are required to provide information on Control of Substances Hazardous to Health (COSHH Regulations 1988).

Adhesives, sealants and paints used in the manufacture of the product are cured and present no known hazards when used in the manner for which they are intended.

## 11.2 MATERIALS

### 11.2.1 PIPES

#### 11.2.1.1 GRANT UFLEX PE-RT PIPE

**Material type:** Crosslinked polyethylene resin.

**Description:** 5-layer oxygen barrier type II of crosslinked polyethylene resin (PE) with an internal layer that can operate at raised temperatures (RT)

**Known Hazards:** In the normal cutting and bending of the pipe, it does not pose any significant health issue/hazard.

**Approved to be used with usable drinking water:** No

**Protection:** None

**First Aid:** None

#### 11.2.1.2 GRANT UFLEX PEX-AL-PEX

**Material type:** Crosslinked polyethylene resin.

**Description:** 5-layer oxygen barrier type II of crosslinked polyethylene resin (PE) with an intermediate aluminium layer that can operate at raised temperatures (RT)

**Known Hazards:** In the normal cutting and bending of the pipe, it does not pose any significant health issue/hazard.

**Approved to be used with usable drinking water:** Yes

**Protection:** None

**First Aid:** None

#### 11.2.1.3 INCORRECT APPLICATIONS

These products must never be used in the following cases and for the following purposes:

- Use with drinking water (PE-RT pipe)
- Use with adherent, corrosive or flammable fluids
- Operation in systems with temperatures exceeding 100 °C (for example, Solar thermal systems)
- Hazardous area (EX)
  - If the product is operated in hazardous areas, sparks may cause a fire or explosion.

### 11.2.2 UFLEX OVERLAY BOARD

**Material type:** High-density extruded polystyrene.

**Description:** UFH insulation boards with CNC grooved channels for UFH pipes

**Known Hazards:** None

**Protection:** None

**First Aid:** None

### 11.2.3 PERIMETER EDGE STRIP

**Material type:** Extruded closed cell polyethylene foam

**Description:** High performance perimeter edge strips, offering a thermal break on the perimeter of each heated floor and also allowing for contraction and expansion of all types of screeded floor finishes.

**Known Hazards:** None

**Protection:** None

**First Aid:** None

### 11.2.4 UFLEX HEAT EMISSION PLATES

**Material type:** Aluminium

**Description:** Highly reflective pre-grooved aluminium spreader plates are laid between floor battens or timber joists

**Known Hazards:** None

**Protection:** None

**First Aid:** None

### 11.2.5 UFLEX NUBFOIL SYSTEM

**Material type:** Polystyrol

**Description:** Pipe fixation perforated panel with overlap on both sides with triangular studs for installation between levelling compound and structure with self-adhesive back for proper fixture to screed and tiled floors.

**Known Hazards:** None

**Protection:** None

**First Aid:** None

### 11.2.6 SCREED SELF-LEVELLING COMPOUND\*

**Material type:** Portlant cement, Cr(VI) < 2 ppm

**Description:** Fibre reinforced self levelling compound

**Known Hazards:**

Eye Dam. 1 - Causes serious eye damage

Skin Sens. 1B - May cause an allergic skin reaction

Hazard statements:

H317 - May cause an allergic skin reaction

H318 - Causes serious eye damage

**Protection:**

P261 - Avoid breathing dust.

P280 - Wear protective gloves/clothing and eye/face protection.

P305+P351+P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P310 - Immediately call a POISON CENTRE or doctor/physician.

P333 - P313 - If skin irritation or rash occurs: Get medical advice/attention

P362 - P364- Take off contaminated clothing and wash it before reuse

P501 - Dispose of contents/container in accordance with applicable regulations.

Prolonged exposition and/or intensive inhalation of respirable free crystalline silica (average diameter less than 10 micron in accordance with ACGIH) can cause pulmonary fibrosis commonly referred to as silicosis.

This preparation contains cement. Contact between cement and body fluids (e.g. sweat and eye fluids) may cause irritation or burns.

## ! NOTE !

\* These are suggested products that would be used in a typical Grant UFH installation but not supplied by Grant UK. Ensure to check and follow all instructions provided with these products.

### First Aid:

In case of skin contact:

- Immediately take off all contaminated clothing.
- Areas of the body that have - or are only even suspected of having - come into contact with the product must be rinsed immediately with plenty of running water and possibly with soap.
- OBTAIN IMMEDIATE MEDICAL ATTENTION
- Wash thoroughly the body (shower or bath).
- Remove contaminated clothing immediately and dispose of safely.

In case of eye contact:

- After contact with the eyes, rinse with water with the eyelids open for a sufficient length of time, then consult an ophthalmologist immediately.
- Protect uninjured eye.

In case of Ingestion:

- Do not induce vomiting, get medical attention showing the SDS and the hazard label.

In case of Inhalation:

- Remove casualty to fresh air and keep warm and at rest.

### 11.2.7 PRIME MORE-GRIP\*

**Material type:** Primer in liquid form.

**Description:** Ready to use, one coat, bond promoting primer for non-porous internal wall and floor backgrounds.

**Known Hazards:** The product is not classified as hazardous according to UK CLP Regulation SI 2019/720 and UK SI 2020/1567.

Supplementary information: EUH208 Contains 1,2-Benzisothiazol-3(2H)-One, 5-Chloro-2-Methyl-2H-Isothiazol-3-One and 2-Methyl-2H-Isothiazol-3-One. May produce an allergic reaction.

#### Other hazards:

This substance/mixture does not meet the PBT criteria of REACH regulation, annex XIII.

This substance/mixture does not meet the vPvB criteria of REACH regulation, annex XIII.

#### Protection:

Hand protection: Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products.

Body protection: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product

#### First Aid:

General First-aid measures: Get medical advice/attention if you feel unwell.

First-aid measures after inhalation: Remove person to fresh air and keep comfortable for breathing. If you feel unwell, seek medical advice.

First-aid measures after skin contact: If skin irritation occurs get medical advice/attention. Remove contaminated clothing and shoes.

First-aid measures after eye contact: Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes.

First-aid measures after ingestion: Get medical attention immediately. Call a poison centre or physician. Wash out mouth with water. Do not induce vomiting unless directed to do so by medical personnel.

**If using an alternative primer, ensure to follow the safety instructions provided by the supplier.**

### 11.2.8 TENSORGRIP RUBBER SPRAY ADHESIVE\*

**Material type:** Mixture of Isonpentane, acetone and dimethyl ether in spray form.

**Description:** Non-chlorinated, high solids synthetic rubber spray grade multi-purpose adhesive designed to bond fibrous insulation materials and fabrics.

#### Known Hazards:

Causes serious eye irritation.

Repeated exposure may cause skin dryness and cracking.

May cause drowsiness or dizziness,

Toxic to aquatic life with long lasting effects.

Risk of explosion if heated under confinement.

Contains gas under pressure; may explode if heated.

May be fatal if swallowed and enters airways.

Extremely flammable gas.

#### Protection:

Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

Use only outdoors or in a well-ventilated area.

Avoid breathing gas.

Avoid release to the environment.

Wear protective gloves, protective clothing, eye protection and face protection.

Wash all exposed external body areas thoroughly after handling.

#### First Aid:

If this product comes in contact with the eyes:

- Wash out immediately with fresh running water
- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids
- Seek medical attention without delay; if pain persists or recurs seek medical attention
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel

If skin contact occurs:

- Immediately remove all contaminated clothing, including footwear.
- Flush skin and hair with running water (and soap if available).
- Seek medical attention in event of irritation

If fumes or combustion products are inhaled:

- Remove from contaminated area:
- Lay patient down. Keep warm and rested.
- Prosthesis such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures
- Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary
- Transport to hospital, or doctor, without delay

## ! NOTE !

**\* These are suggested products that would be used in a typical Grant UFH installation but not supplied by Grant UK. Ensure to check and follow all instructions provided with these products.**

If skin contact occurs:

- Do **NOT** induce vomiting
- If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
- Observe the patient carefully.
- Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious
- Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink
- Seek medical advice
- Avoid giving milk or oils
- Avoid giving alcohol
- If spontaneous vomiting appears imminent or occurs, hold patient's head down, lower than their hips to help avoid possible aspiration of vomitus.

**If using an alternative adhesive, ensure to follow the safety instructions provided by the supplier.**

### **11.3 QUALIFICATION OF PERSONNEL**

Only appropriately trained persons who are familiar with and understand the contents of these operating instructions and other product documentation should install or work on the products in the Grant Uflex range.

These persons must have sufficient technical training, knowledge and experience and be able to foresee and detect potential hazards that may occur when using products in the Grant Uflex range.

All persons working on and with the products in the Grant Uflex range must be fully familiar with all directives, standards and safety regulations that must be observed to carry out such work.

### **11.4 PERSONAL PROTECTIVE EQUIPMENT**

Always wear the required personal protective equipment. When carrying out work on or with the product, take into account that hazards may be present at the installation site which do not directly result from the Grant Uflex product itself.

### **11.5 MODIFICATIONS TO THE PRODUCT**

Only perform work on and with the product which is explicitly described in these instructions. Do not make any modifications to the product which are not described in these instructions.

# 12 DECOMMISSIONING

## 12.1 TEMPORARY

If the UFH system is to be taken out of use – either temporarily or for a longer period with the possibility of recommissioning, the following procedure should be followed.

1. Switch off the heat source(s) to the Uflex Manifold and manually close any isolation valves or open 2-port valves.
2. Isolate the electrical supply to the Uflex circulating pump (if used) and disconnect any control systems installed.
3. Isolate all installed loops on the manifold. (If actuators are fitted remove and attach screw caps).

## 12.2 PERMANENT

If the system is to be taken out of use permanently, in addition to the steps described in section 12.1, you will need to:

1. Disconnect thermostat panels and the Uflex circulating pump from wiring centre.
2. Remove all associated UFH heating controls.
3. Dismount the Uflex circulating pump from the Uflex manifold (if used) or remove flow and return pipework from the Uflex manifold.
4. Disconnect all loops from flow and return manifold connections.
5. Remove Uflex manifold from the wall by loosening off the screws and lifting the manifold off. Remove the screws and plugs from the wall.
6. If leaving the pipes in the existing floor, cut and cap the pipes close to the floor.
7. Otherwise the laid floor (screed or self levelling compound) will need to be broken up & disposed of safely.

## 12.3 DISPOSAL

The disposal of waste produced during the decommissioning of the UFH system should be completed in accordance with all local bylaws.

Any electrical should further fall under Directive 2012/19/EU of 4 July 2012 on waste electrical and electronic equipment (WEEE).

## 12.4 DIRECTIVE WEEE 2012/19/EU

Purchased product is designed and made of materials of the highest quality.

The product meets the requirements of the Directive 2012/19/EU of 4 July 2012 on waste electrical and electronic equipment (WEEE), according to which it is marked by the symbol of crossed-out wheeled bin meaning that product is subjected to separate collection.

Responsibilities after finishing a period of using product:

- Dispose of the packaging and product at the end of their period of use in an appropriate recycling facility,
- Do not dispose of the product with other unsorted waste,
- Do not burn the product.
- By complying with the above obligations of controlled disposal of waste electrical and electronic equipment, you avoid harmful impact on the natural environment and threats to human health.

# 13 GUARANTEE

You are now the proud owner of a Grant Uflex underfloor heating system from Grant Engineering (UK) Limited which has been designed to give years of reliable, trouble free operation.

Grant Engineering UK Ltd ("Grant") guarantees [to the original purchaser/customer] that pipes and fittings sold by it are free of defects in materials or manufacture under normal conditions of use for a period of 25 years and in case of electrical and mechanical products for 2 year from the date of installation. This guarantee only applies to the products stored, installed, tested and operated in accordance with the fitting instructions issued by Grant and valid at the time the products were installed.

Where a claim is made during the guarantee period and products are proven to be defective in materials and/or manufacture at the time of delivery, Grant will supply replacement products free of charge. This is the exclusive remedy under this guarantee.

Grant disclaims any warranty or guarantee not expressly provided for herein, including any implied warranties of merchantability or fitness for a particular purpose.

Grant further disclaims any and all responsibility or liability for losses, damages and expenses, including special, direct, indirect, incidental and consequential damages, whether foreseeable or not, including without limitation any loss of time or use or any inconvenience arising from the ownership, installation or use of the products sold hereunder.

This guarantee does not affect the statutory rights of the consumer.

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# ONLINE RESOURCES

## GRANTUK PRODUCT SUPPORT

QR CODE	DESCRIPTION
	<p>Grant UK product support page.</p> <p>Follow the QR code for a link to the Grant UK product support page.</p> <p>For further information or queries please contact <a href="mailto:into@grantuk.com">into@grantuk.com</a> or your local sales representative.</p>

# APPENDIX A - LEAK & PRESSURE TEST FORM

Date	
Customer Name	
Customer Address	
Company Name	
Company Address	
Engineer Name	
System Tested	
Test pressure (bar)	
Time period (hours)	
Working pressure (bar)	
Temperature (°C)	
Comments	
Engineer Signature	
Customer signature	

# SERVICE LOG

Service 1	Date
	Engineer
	Company name
	Telephone number
	Comments
	Signature

Service 5	Date
	Engineer
	Company name
	Telephone number
	Comments
	Signature

Service 2	Date
	Engineer
	Company name
	Telephone number
	Comments
	Signature

Service 6	Date
	Engineer
	Company name
	OFTEC Technician number
	Comments
	Signature

Service 3	Date
	Engineer
	Company name
	Telephone number
	Comments
	Signature

Service 7	Date
	Engineer
	Company name
	Telephone number
	Comments
	Signature

Service 4	Date
	Engineer
	Company name
	Telephone number
	Comments
	Signature

Service 8	Date
	Engineer
	Company name
	Telephone number
	Comments
	Signature

Service 9	Date
	Engineer
	Company name
	Telephone number
	Comments
	Signature

Service 13	Date
	Engineer
	Company name
	Telephone number
	Comments
	Signature

Service 10	Date
	Engineer
	Company name
	Telephone number
	Comments
	Signature

Service 14	Date
	Engineer
	Company name
	Telephone number
	Comments
	Signature

Service 11	Date
	Engineer
	Company name
	Telephone number
	Comments
	Signature

Service 15	Date
	Engineer
	Company name
	Telephone number
	Comments
	Signature

Service 12	Date
	Engineer
	Company name
	Telephone number
	Comments
	Signature

Service 16	Date
	Engineer
	Company name
	Telephone number
	Comments
	Signature



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