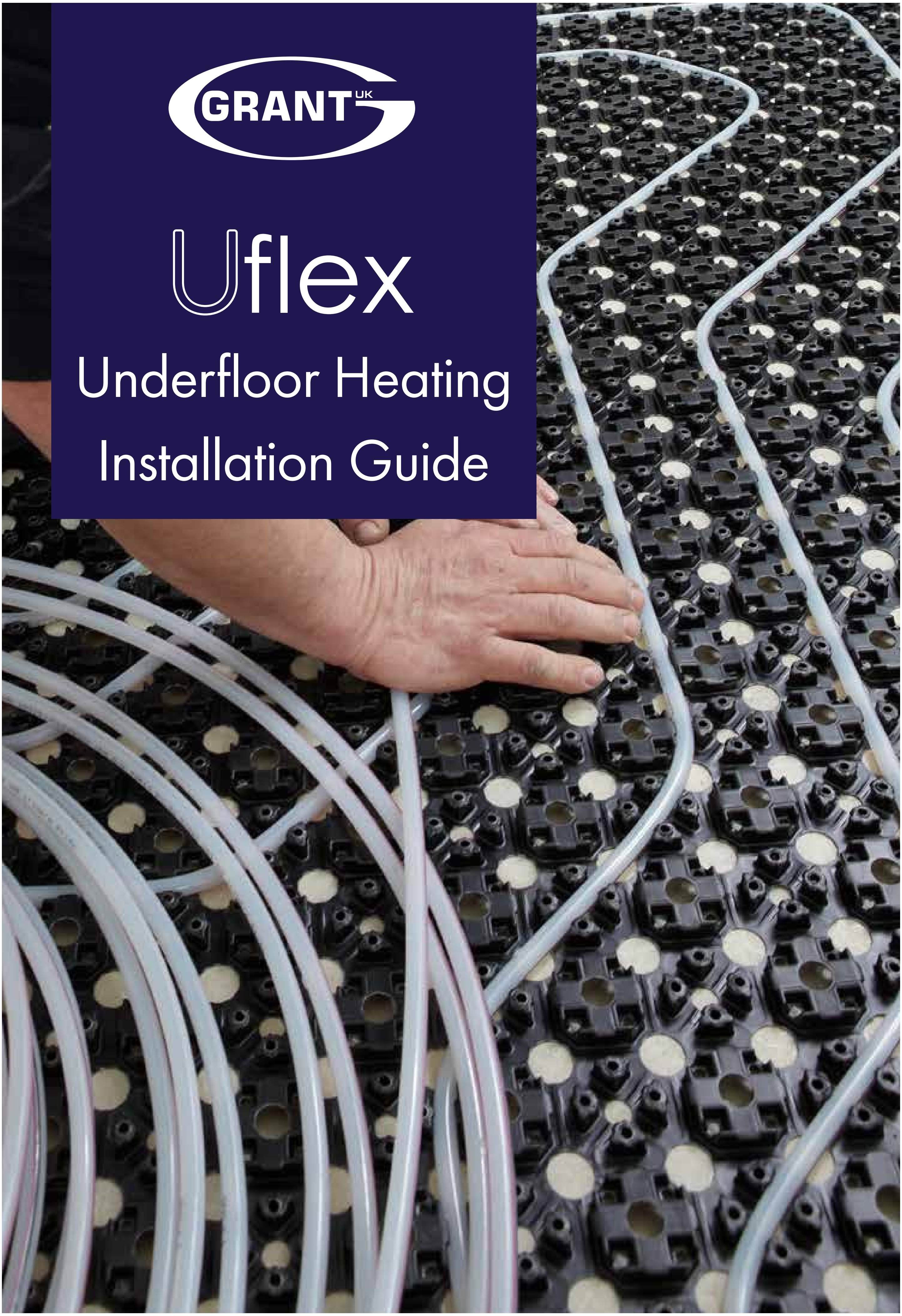
Uflex

Underfloor Heating Installation Guide



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Introduction & Guarantee

Underfloor heating (UFH) systems are 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 guide explains the fundamental principles and design of Grant UFH and also gives installation guidelines for the components and systems.

Heating engineers familiar with installing conventional central heating systems will be accustomed to working with radiators, convectors and copper pipes.

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

1. 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 UFH system.
2. UFH operates with a low water temperature flow and return and therefore requires its own water temperature controls and own pump.
3. 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.

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 Grant Underfloor Heating Systems 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 client to ensure that all relevant information is supplied and to ensure that any design work from Grant is suitable for the particular purpose.

Grant trained installers are available to install the 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.

Guarantee

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.

Underfloor Heating Design Principles

This section provides information about how the underfloor heating (UFH) system is designed and highlights points to consider before the design work commences.

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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.

Principles

The principle of UFH is very simple. 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 - heat pumps are becoming ever more popular due to the potential energy savings. Usually, with boilers 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 UFH system. Controls reduce the water temperature to maintain the correct design temperature and pump the warm water through the UFH pipes.

Heating with UFH

UFH is a true radiant system and heats from floor to ceiling. 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 and the room will still feel more comfortable! Running the system at a lower temperature and reducing the heat wasted at levels above head height makes for significant savings on fuel costs. The exact savings that can be expected are difficult to determine, as there are operational factors that also need to be considered.

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^2. 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.

Heat Requirements & Supplementary Heating

Given the low U-values stipulated in current Building Regulations, it is unusual to require outputs greater than $70W/m^2$, 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 mid-winter conditions.

The heating consultant or engineer should provide heat loss calculations. Heat losses are calculated in the conventional way and the boiler 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.

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 $100W/m^2$.

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.

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.

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.

Calculating Size of UFH Pump

The smooth inner surface of PE-RT and 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.

Pipe Spacing

In solid screed floors and areas of average to low heat loss, Grant will generally recommend standard pipe spacings of 200mm (16mm 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:

Pipe Spacing (mm)	Quantity of pipe (m/m^2)
300	3.4
200	5.0
150	6.7
125	8.0
100	10.0
50	20.0

Important Note:
When calculating your pipe requirement, remember to add the feed/tail pipe lengths, between manifold and room, to your calculations.

Pipe Layout

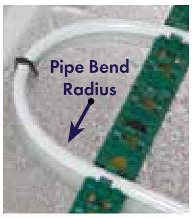
Where possible, the pipe should be laid so that the flow direction is to the coldest area of the room first, e.g. under windows, along outside walls. There are typically two patterns for installation in solid floors, the meander/serpentine pattern (1), or the bifilar/snail pattern (2). With the meander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

Meander pattern (1)

Bifilar pattern (2)

Pipe Bend Radius

The minimum manual bend radius for Grant pipe is;



Pipe	min. Bend Radius
9.9mm PEX	50mm
16mm PE-RT	80mm

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

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 65mm for domestic applications and 75mm for commercial applications as specified in British Standards. Grant recommends that the optimum screed thickness for the Grant Uflex system is 75mm but no more than 90mm, 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 30mm 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 15mm 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 EN 1264 - Part 4 recommends a maximum screed area of 40m^2 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 600m^2. 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 start-up. The underfloor heating MUST NOT be used to speed up the curing process.

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.

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.

Exposed Ground Floors:

Exposed ground floors should be thermally insulated to latest requirements of Building Regulations Part L (England & Wales) and in addition, for UFH systems, should limit downward heat losses to no more than 10W/m^2. 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 1.25m^{2}K/W should be installed above the slab (equivalent to Grant 50mm Rolltec insulation boards), to improve the UFH system response times.

Intermediate Floors:

Intermediate floors, with heated rooms below, should have a separating layer of insulation having a minimum 0.75m^{2}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).

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 0.15mm 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.

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 0.15m^{2}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. However, recent independent testing has shown that against current Building Regulations and reduced heat losses, a combined carpet and underlay TOG value of 2.5 is acceptable when used above a screed floor, although the underlay used should not exceed 1 TOG and must be suitable for use with UFH. 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.

Preparation and Installation Principles

Providing the installer with key elements to check prior to installation and ensuring the project runs smoothly.

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Before Installing

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

1. All the materials and the quantities are correct and on site against the delivery note and against the material schedule.

2. All other trades involved in the installation are fully conversant with 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 (see Heating Room Controls section for further details).

3. Sub-floors are clean, level and are correct for the depth of construction needed to incorporate the underfloor heating.

4. 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.

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.

First Time 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. Place the de-coiler in another room and pull the pipe off as required. (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:
  1. If using PE-RT pipe, gently squeeze the kink/crease with soft pliers and reform the bend away from the kink.
  2. If using PEX pipe, gently heat the kink/crease with a warm air gun (NEVER a naked flame) until the pipe is max 130°C.

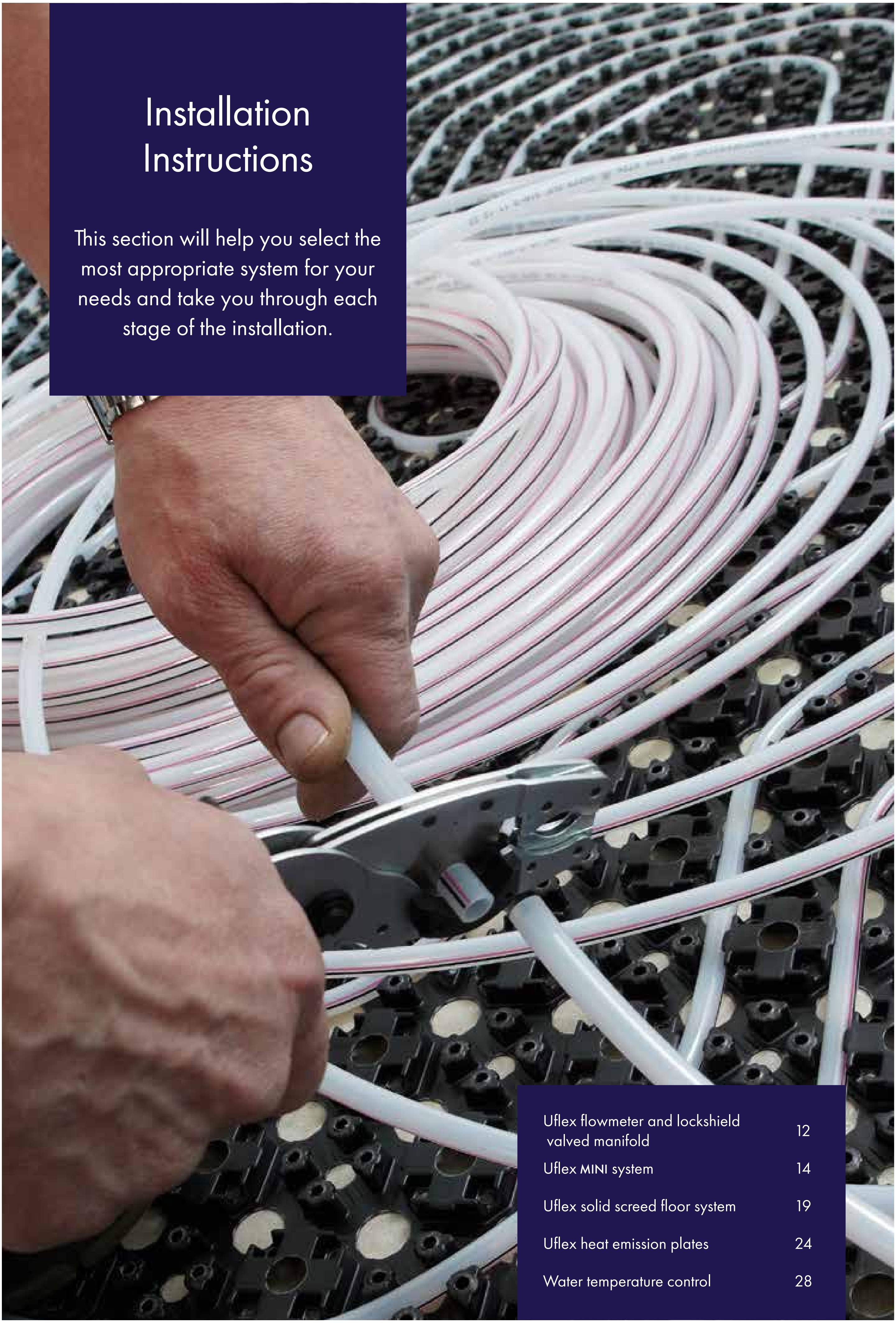
Contact Grant for further technical advice if necessary.

- 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 100mm.

Floor types and recommended tools	Grant Uflex system	Grant Uflex MINI system
Floor type	Screed	Self-levelling compound
9.9mm PEX	x	✓
16mm PE-RT	✓	x
Tools required		
Grant plastic pipe cutter	✓	✓
Drill and necessary drill bits	✓	✓
Suitable wall fixings (for manifold)	✓	✓
Plumbers wrench/grips	✓	✓
Kombi Tacker Gun	✓	x
Stanley knife	x	✓
Vacuum cleaner	✓	✓
Tape measure	✓	✓

Installation Instructions

This section will help you select the most appropriate system for your needs and take you through each stage of the installation.



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Uflex Flowmeter and Valved Manifolds

Pipe Dimensions	9.9mm PEX	✓	16mm PE-RT	✓

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 adapters (supplied separately). Manifolds are supplied in pairs, i.e. a flow and return manifold, together with fixing brackets. Manifold sets are available with between 2–12 outlets with a single loop extension set also available.

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 300mm). 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.

Flow Manifold with Flowmeters

The supply section (top) offers shut off and flow rate control features, via the topmeter on individual loops. The topmeter 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 topmeter to stop any unwanted changes made to the flow rate after commissioning has taken place.

Return Manifold

The return section (bottom) offers valves, including black caps, 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 ‘Heating Controls’ section of this guide.

Fixing Brackets

Fixing brackets are supplied with the manifold. The brackets should be positioned on the wall and then the manifold secured in position. The lower manifold is staggered further out from the wall to allow the pipes from the upper manifold to pass behind. If using a mixing valve/pump, this is assembled onto the manifold prior to fixing on the wall.

Fill & Drain Points

½" Fill & drain points are supplied factory fitted to the flow and return manifolds.

Connecting to the manifold

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 instructions below 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.

Manifold with topmeter, 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) 3.0 m^3/h

Connecting 16mm PE-RT Pipes (Uflex System)

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 (A).

1 Line the pipe end up to the threaded port on the manifold (B).

2 Then cut the pipe end square using plastic pipe cutters (C).

3 Measure 10mm from the top of the pipe and mark the insertion depth (D).

4 Hand-tighten the compression adapter fitting onto the manifold outlet thread as shown (E).

5 Insert the pipe into the adapter fitting and push until the pipe comes to a halt as shown (the insertion indicator should no longer be visible) (F).

6 Now tighten the adapter fitting onto the manifold, using an appropriate spanner (G), until the insertion depth mark can be seen again below the nut (H).

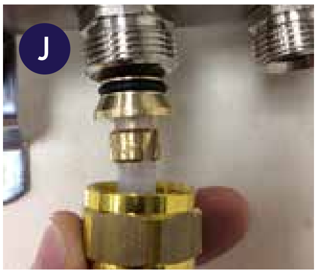
Connecting Grant 9.9mm PEX Pipes (Uflex MINI System)

9 Line the pipe end up with the threaded port on the manifold and cut the pipe end square using plastic pipe cutters.

10 Push the nut and olive onto the end of the pipe. Then push the insert fully into the pipe end in order to get a secure joint (I).

11 Slide both the ring and nut onto the manifold port (J).

12 Tighten the nut by hand. Then tighten a further one and half turns with a spanner (K).



Loop connections

Make loop connections with ¾" male-threaded Eurocone in accordance with DIN V 3838 compatible with Grant PE-RT & PEX pipe adapters.

Observe the torque settings!

9.9 - 16mm: 50 Nm
20mm: 60 Nm

Room Labels

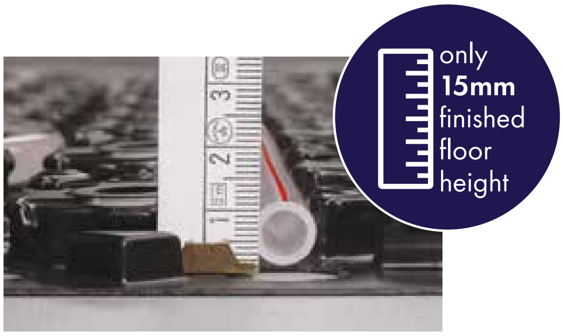
Room labels should be fixed on the manifold to identify the room being supplied, together with loop flow rate/settings.

Loop control at the top meter

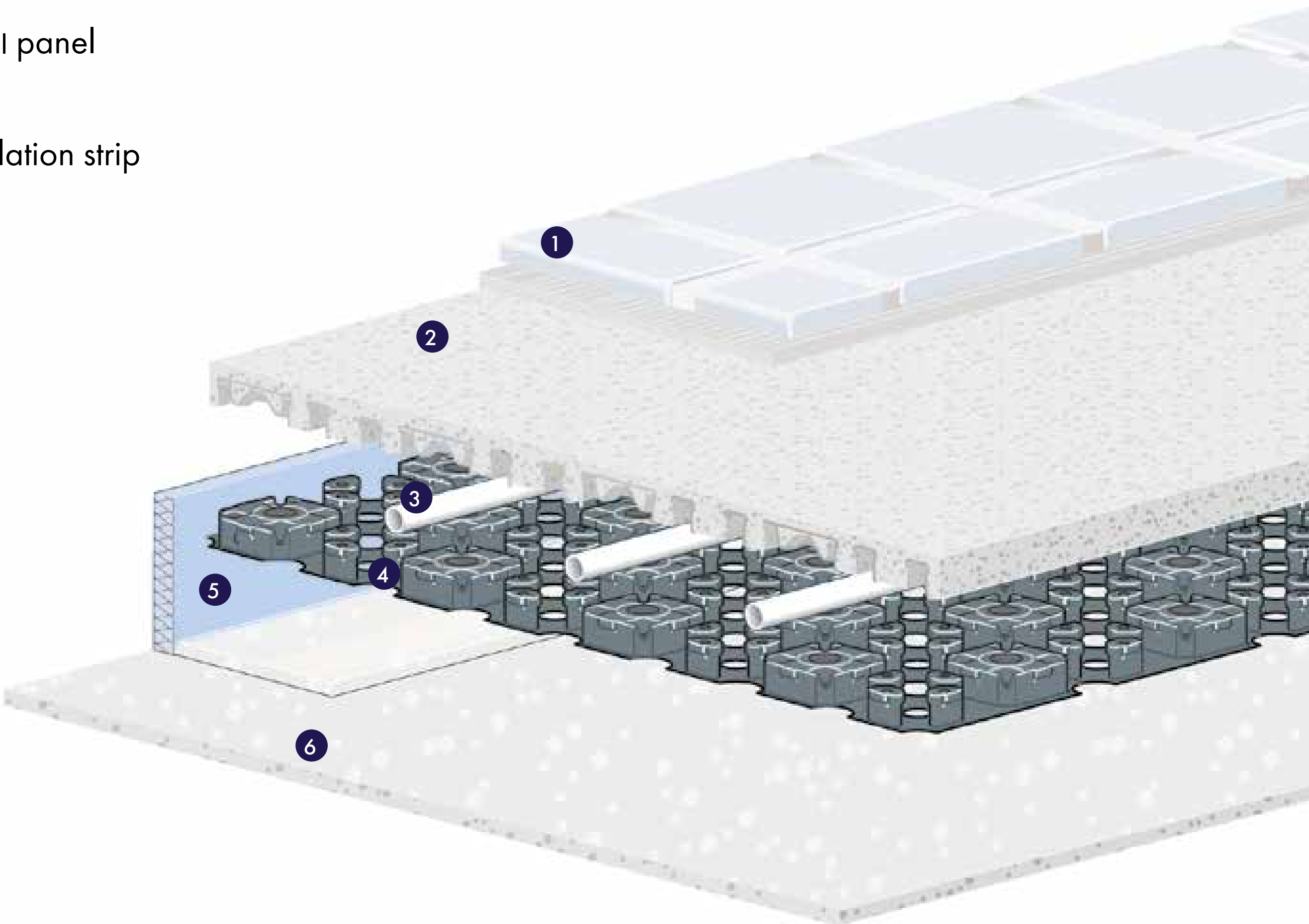
Uflex MINI System

Pipe Dimensions	9.9mm PEX	✓

- 15mm 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



1. Flooring
2. Self-levelling screed
3. Uflex MINI 9.9mm pipe
4. Uflex MINI panel
5. Edge insulation strip
6. Floor



Uflex MINI Components

Uflex MINI panel
The sturdy Uflex MINI panel can be walked on instantly and ensures fast and efficient installation of the PEX 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.

PEX pipe
The flexible PEX pipes 9.9 x 1.1 mm are placed in the prepared grooves of the Uflex MINI panels. 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.

Edge insulation strip
The self-adhesive edging strip with self-adhesive panel allows for a proper seal along the walls and the bottom.

In the first installation step, the edging strip should be glued to the bottom. Then, the Uflex MINI panel on it should be glued along the edge.

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.

Uflex MINI Design Basics

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.

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 ϑ_L as well as the mean radiation temperature ϑ_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.

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)

Standard design room temperatures:

Living rooms	21°C	Bedrooms	18-21°C
Corridors	18°C	Bathrooms	24°C

Performance data

Pipe specification: 9.9mm O/D PEX - Grant Uflex MINI
Floor construction: Solid floor
Screed depth: 15mm Self-Levelling Compound
Screed thermal conductivity: 1.0 W/mK
Water temperature drop [K]: 10

(white)	Suitable for occupied zone
(grey)	Suitable for perimeter zone only

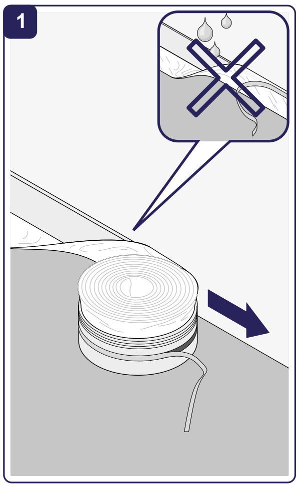
Pipe pitch, Vz (mm)		50			100			150		
		Floor covering resistance, $R_{\lambda,\beta}$ (m² K/W)								
Mean water temperature MWT °C	Design room temperature Rt °C	0.05 W/m²	0.1 W/m²	0.15 W/m²	0.05 W/m²	0.1 W/m²	0.15 W/m²	0.05 W/m²	0.1 W/m²	0.15 W/m²
30	16	82	63	52	71	56	46	61	50	42
	18	69	53	44	60	47	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 Output for Comfort Zone, q_H (W/m²)		95	95	96	85	87	90	76	80	85

Uflex MINI Installation

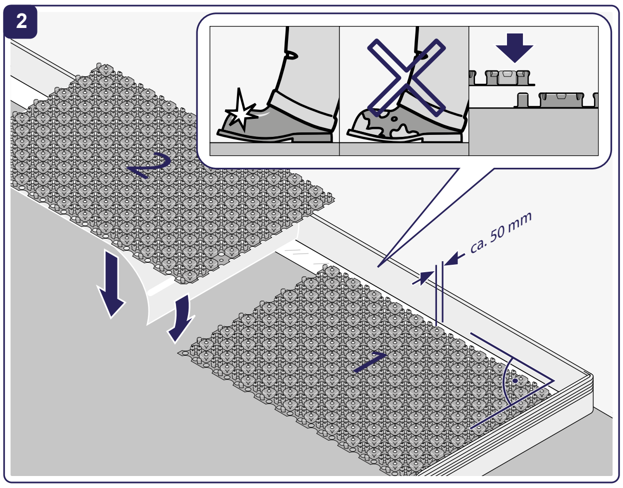
General

Grant Uflex MINI must be installed by competent Installers. Observe the following assembly instructions and additional instructions which are provided with the components and tools.

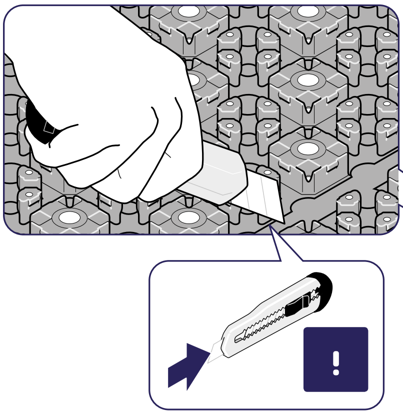
Overview of the installation steps

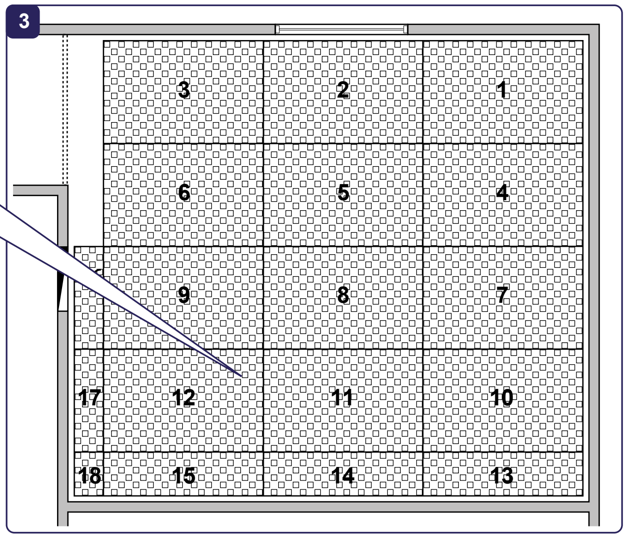


Mounting edge strips

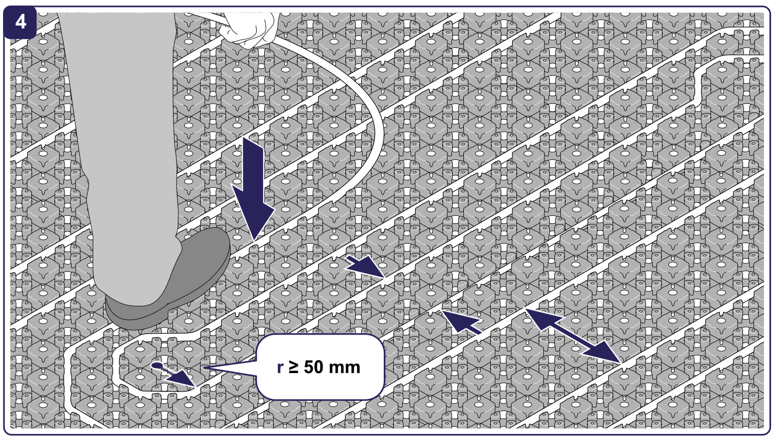


Installing Uflex MINI panel

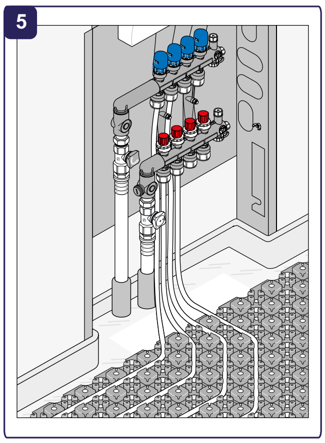




Installation steps for Uflex MINI panel



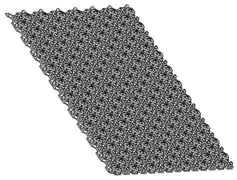
Installing pipes in Uflex MINI panel



Connecting PEX pipes

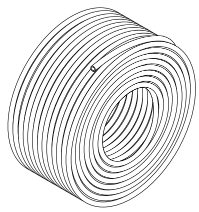
Uflex MINI Technical Data

Grant Uflex MINI panel			
Material	Polystyrene		
Max. traffic load			
(including levelling compound)	5,0 kN/m^2		
Pipe spacing	Vz 5, 10, 15		
Panel dimensions (l x w)	1,120 mm x 720 mm		
Total element height	12 mm		
System type	Wet system*		
Volumetric share of levelling layer (at layer thickness 15 mm)	Vz 5 approx. 12.4 l/m^2	Vz 10 approx. 13.2 l/m^2	Vz 15 approx. 13.5 l/m^2
DIN reg. no.	7F170-F		



* on existing load distribution layer

PE-Xa pipe	
Pipe dimensions	9.9 x 1.1 mm
SDR (Standard Dimension Ratio)	Value 9 (acc. EN ISO 15875)
S (Pipe Series)	Value 4 (acc. EN ISO 15875)
Material	PE-Xa (acc. EN 16892)
Colour	Natural
Production	According to DIN EN 16892 / DIN EN ISO 15875-2
Oxygen tightness	According to DIN 4726, section 3.5
Density	0.94 g/cm^3 (acc. EN 16892)
Thermal conductivity	0.35 W/mK
Mean thermal linear expansion coefficient at	70 °C: 0.15 mm/m K (acc. EN 16892)
Crystallite melting temperature	133 °C
Building material class	B2
Min. bending radius	50 mm
Pipe roughness	0.007 mm
Water content	0.0465 l/m
Pipe marking	[length] m PE-Xa 9.9 x1.1 oxygen-tight according to DIN 4726 EN ISO 15875 class 4/8 bar [DIN approval mark] 3V279 PE-X
Max. continuous operating pressure (water at 20 °C)	19.1 bar (safety factor SF = 1.25 (according to DIN EN ISO 15875 for 20 °C), for 50 operating years
Max. continuous operating pressure (water at 70 °C)	8.8 bar (safety factor SF = 1.5 (according to DIN EN ISO 16893), for 50 operating years
Application class according to DIN EN ISO 15875	4 (underfloor heating)
At permissible operating pressure	8 bar
DIN CERTCO reg. no.	3V 279 PE-Xa
Pipe couplings Grant	9.9 x 1.1 type couplings
Optimum installation temperature	≥ 0 °C
UV protection	lightproof cardboard box (unused piping must be stored in cardboard box)

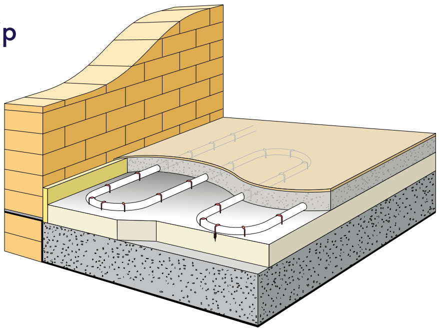


Uflex Screeded System

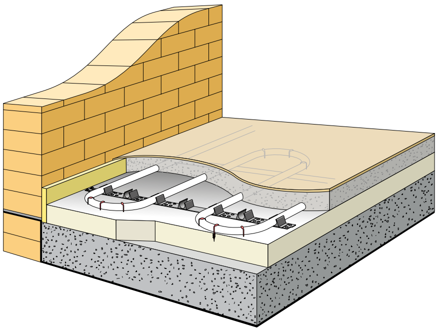
Pipe Dimensions	16mm PE-RT	✓

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.

1. U-Clip



2. Clip Rail and U-clip



Surface Preparation

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

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.

Pipe Centres

When installing onto floor grade insulation, pipes should be spaced away, 100mm (16mm pipes) from the wall edges. Thereafter, in modern well-insulated buildings the UFH pipe is generally installed at standard centres, 200mm (16mm pipes) across the active floor area, unless otherwise specified.

Installation

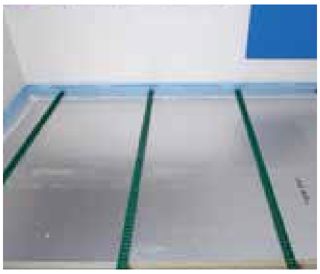
- Fix the edge insulation continuously around all internal and external wall edges, using the adhesive backing. When installed correctly the PE-skirt will be facing out from the wall and the writing will be visible.
  Once the screed has dried and cured, the edge strip can be trimmed down.
- Lay the 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.
- Fix the manifold into position, ensuring there is sufficient room to connect the water temperature controls and flow and return pipework.
- 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 500mm spacing from two opposite wall edges and a maximum 2000mm spacing between clip rails. Ensure the clip rail is at a 90° angle to the coldest external wall.
  Alternatively, if you wish to lay the pipe 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 happy 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 1m use additional U-clips at 500mm 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).

If using the U-Clips to fasten the pipe to the floor grade insulation, clip the pipe at 500mm intervals. More clips may be necessary on the pipe bends. Minimum 35mm 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 (Item no. UFLEX30)

Clip Rail Fixing




U-clip Fixing




Laying the UFH Pipe

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, especially if they are not used to heat the room through which they pass.

- 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 (Item no. 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(Item no. 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.

Installing the Meander Pattern

Once you have entered the room/area to be covered, first lay the flow pipe around the perimeter with a gap, 100mm (for 16mm 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.

Meander pattern

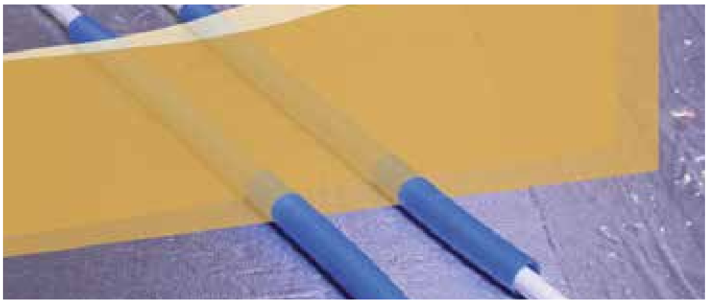
Installing the Bifilar Pattern

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, 100mm (for 16mm 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 200mm centres across the floor area, follow the same route at 400mm 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 200mm 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.

Bifilar pattern

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 200mm either side of the joint.



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.

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 'Filling, Venting and Pressure Testing' section of this guide.

Sand-Cement Screed

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

Uflex Performance Data

Pipe specification: 16mm O/D PE-RT - Grant Uflex
Floor construction: Solid floor
Screed depth: 45mm above UFH pipes
Screed thermal conductivity: 1.2 W/mK
Water temperature drop [K]: 5

	Suitable for occupied zone
(shaded)	Suitable for perimeter zone only

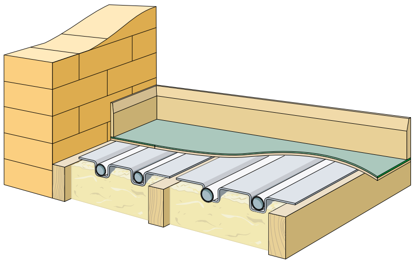
Pipe pitch, Vz (mm)		150			200			300		
		Floor covering resistance, $R_{\lambda,\beta}$ (m^2 K/W)								
Mean water temperature	Design room temperature	0.05	0.1	0.15	0.05	0.1	0.15	0.05	0.1	0.15
MWT °C	Rt °C	W/m^2	W/m^2	W/m^2	W/m^2	W/m^2	W/m^2	W/m^2	W/m^2	W/m^2
30	16	58	47	39	51	42	34	41	35	30
	18	50	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 Output for Comfort Zone, q_H (W/m^2)		97	98	100	94	97	98	82	87	91

Uflex Technical Data

PE-RT pipe	
Pipe dimensions	16x2,0 mm
Coil lengths	120m, 240m, 640m
Material	PE-RT Typ II; 5-layer pipe
Colour	Natural
Production	According to EN22391
Oxygen tightness	According to ISO 17455; DIN 4726
Density	0.941 g/cm³ (acc. EN 16892)
Thermal conductivity	0.35 W/mK
Max operating temperature	60 °C
Max short term operating temperature	70 °C
Min. bending radius (without support)	8x D
Min. bending radius (bent with support)	5x D
Pipe roughness	0.007 mm
Water content	0.078 l/m
Pipe marking	Grant 16x2,0 EN ISO 22391 C PE-RT type II 5 layer Class 4/6 bar, Oxygen diffusion tight/ DIN4726 (Country code, Material code pipe, Material code evoh, Machine, Year, Date, hhminsec) Made in EU
Application class	Class 4 / 6 bar
Pipe connections	compression fittings
Optimum installation temperature	≥ 0 °C
UV protection	opaque packaging (unused piping must be stored in cardboard box)

Uflex Heat Emission Plates

Pipe Dimensions	16mm PE-RT	✓



Heat Emission Plates

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

These heat emission plates are suitable for use with the Grant Uflex 16mm PE-RT pipe only.

Plate details

Number of pipe tracks:	2
Pipe centres:	200mm
Plate width:	380mm
Plate length:	1,150mm

Grant product code: UFLEX47 - 1 pack

Pack quantity:	28 plates
Pack coverage*:	15.3m²

* Equates to approximately 80% floor coverage.

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 re-fitted there is contact with the underside of the floor over the entire area of the plate.

Typically, a minimum 100mm 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).

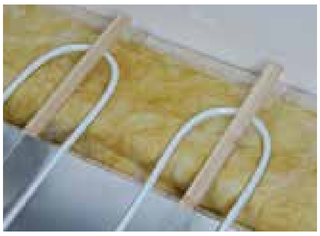
Northern Ireland - Technical Booklets F (Conservation of Fuel and Energy) and G (Sound).

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

Installation of Grant Uflex Heat Emission Plates

Leave enough space between end of plate and wall

Fix plates to joist using staples



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

Heat emitter plates on cross battens

CAUTION:

The plates are for heat distribution only and are 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 or on battens fitted to the top face of the joists, or

b) Running at right angles to the joists, supported on 'cross battens' that are fixed to the top face of the joists

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'.

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.
- If cross battening, this is best achieved using 25mm x 100mm 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 30mm) where the joist centres are less than 400mm.
- 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 300mm 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'.

- Thereafter space the plates out evenly ensuring gaps between plates are at least 10mm but less than 100mm. 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 joists.
- 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

- The plates are scored 1/3 from one end of the plate and at 1/6 from the other and are easily split along these score lines.
- Keep the pipe groove uppermost and sharply break the plate over a straight edge.
- If different 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 joists

CAUTION: The following is for general guidance only. Always check with local building control and/or a structural engineer before notching or drilling any floor joists. Some types of floor joists cannot be notched or drilled.

- If no battens are used (refer to '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 65mm diameter.
- **Example:** for a 250mm joist, the maximum hole diameter is 62.5mm
- 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 4m, span holes must be between 1m and 1.4m 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 35mm.
- **Example**: for a 250mm joist, the maximum notch depth is 31mm.
- These notches can only be made at a distance from the supporting wall of between 0.07 x the span and 0.25 the span.
- **Example:** for a joist of 4m span, the notches must be located between 280mm and 1m from the supporting wall of between X.
- The correct location and size of notches (or holes) in the joists must be taken into account when positioning the heat emission plates.

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 (Item no. UFLEX21).

- 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 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 7mm thick with interlocking joints.
- Chipboard or plywood floor deck should be a minimum of 15mm thick with flued 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 (20mm or 25mm 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.

Uflex Heat Emission Performance Data

Pipe specification: 16mm O/D PE-RT - Grant Uflex
Floor construction: Timber suspended or floating floor with heat emission plates
Floor decking: 18mm chipboard above HEPs
Water temperature drop [K]: 5

	Suitable for occupied zone
(shaded)	Suitable for perimeter zone only

Pipe pitch, Vz (mm)		200		
		Floor covering resistance, $R_{\lambda,\beta}$ (m^2 K/W)		
Mean water temperature MWT °C	Design room temperature Rt °C	0.05 W/m²	0.1 W/m²	0.15 W/m²
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
Maximum heat Output for Comfort Zone, q_H (W/m²)		70	70	70

Pipe pitch, Vz (mm)		200		
		Floor covering resistance, $R_{\lambda,\beta}$ (m^2 K/W)		
Mean water temperature MWT °C	Design room temperature Rt °C	0.05 W/m²	0.1 W/m²	0.15 W/m²
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 Output for Comfort Zone, q_H (W/m²)		70	70	70

Water Temperature Control

Pipe Dimensions	9.9mm PEX	✓	16mm PE-RT	✓

Introduction

Mixing valve/pump 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 correct 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 correct operation of the underfloor system.
- The Grant Uflex and Uflex MINI thermostatic mixing valve/pump unit is designed for controlling the flow and temperature of water in systems with up to 200m^2 of active floor area and maximum 15kW heat load.
- The mixing valve/ pump unit is supplied for fitting to the left-hand end of the manifold (see photo).
- The thermostatic mixing valve has a control head with a temperature adjustment of 30-60°C.
- The maximum boiler flow temperature into the mixing valve is 85°C.
- When using the Grant Uflex and Uflex MINI 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.

Operation

Manifold with mixing valve/pump unit fitted

- **During Heating Demand Periods**
- The mixing valve / pump unit is designed to mix the primary boiler 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 boiler 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 secondary then circulates the water around the underfloor heating loops.
- The mixing valve/pump unit uses a Wilo Yonos Para 25/6 6m pump with a maximum power consumption of 45W and current rating of 0.44A.

Installation

- The mixing valve/pump unit is supplied with two isolation ball valves: one with a red lever for the boiler/ASHP flow and the other with a blue lever for the return to the boiler/ASHP.
- The mixing valve/pump unit is supplied for mounting on the left-hand end of the manifold, using the rubber sealing washers supplied.
- Once the mixing valve/pump unit has been mounted on the manifold, the complete assembly is fixed to the wall using appropriate wall plugs and fixing screws.
- Ensure that the pipework to and from the boiler/ASHP is correctly connected. Failure to do so will result in no heating to the manifold.
- An automatic bypass valve should be fitted between the flow and return pipework, before the mixing valve/pump unit, to reduce any closing noises from the 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 manifold
- 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.

Wiring

- A suitable electrical supply is required.
- For individual room control systems, the manuals heads on the lower manifold are replaced with electro-thermal actuators. Grant UK can supply various wiring/relay control units, including wireless control versions, to simplify the wiring for these types of installations.
- Grant recommends that a 2-port motorised valve is used on the primary flow feeding the UFH manifold, a 'demand' from the UFH system will open the zone valve and the auxiliary switch should be wired to energise the boiler and main system circulator.
- All wiring should be in accordance with the current edition of BS 7671 (the IET Wiring Regulations) and any applicable Local Regulations.

Settings

- The thermostatic head is adjustable to give a mixed water temperature in the flow manifold from 30°C to 60°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 the table of temperature settings.
- The temperature setting can be checked using a calibrated digital thermometer, if required.
- Adjust the circuit flow rates by adjusting the flow regulators (topmeters) - refer to 'Starting up and System Operation' section.
- Pump setting: set to maximum.

	Flow/return pipe material	MLC/PEX (mm)		Copper (mm)	
	UFH pipe size	9.9mm	16mm	9.9mm	16mm
Manifod Size	2 loop	16	16	15*	15*
	3 loop	16	16	15*	15*
	4 loop	16	20	15*	15*
	5 loop	16	20	15	22
	6 loop	20	25	15	22
	7 loop	20	25	22	22
	8 loop	20	25	22	22
	9 loop	20	25	22	28
	10 loop	25	32	22	28
	11 loop	25	32	22	28
	12 loop	25	32	22	28

Flow/ return minimum pipe size chart

* This is absolute minimum diameter. Grant recommend using longer pipe diameter.

Setting	Temperature
Minimum	30°C
1	34°C
2	38°C
3	41°C
4	43°C
5	45°C
6	47°C
7	50°C
9	54°C
Maximum	60°C

Thermostatic mixing valve temperature settings

Room
Heating Controls

Individual room controls compatible with both Uflex and Uflex MINI systems

Room controls overview 32

Smatrix Wave Plus 34

Smatrix Base Pro 35

Room Controls Overview

Smatrix Wave Plus (Wireless)	**Smatrix Base Pro (Wired bus)**
Controller for up to 6 thermostats and 8 actuators	Controller for up to 6 thermostats and 8 actuators
Expandable to 12 thermostats and 14 actuators with slave module	Expandable to 12 thermostats and 14 actuators with slave module
Touch screen user interface, controls up to 4 controllers and 48 zones	Touch screen user interface, controls up to 16 controllers and 192 zones
2 thermostat designs	2 thermostat designs
Digital thermostat with backlit display	Digital thermostat with backlit display
Room temperature sensor	Room thermostat
Floor sensor option	Floor sensor option
Heating control	Heating control
Pump and valve exercise	Pump and valve exercise
No manual balancing required	No manual balancing required
Patented "Autobalance" technology independently tested and verified to save up to 20% in energy use	Patented "Autobalance" technology independently tested and verified to save up to 20% in energy use
Micro SD card for data logging, backup and software updates	Micro SD card for data logging, backup and software updates

Room Controls

With underfloor heating (UFH), the basic principles of domestic thermostatic control remain the same. The floor of a room can be considered to be a large low surface temperature radiator, but instead of a self-regulating thermostatic radiator valve to provide room temperature control, a room thermostat is used to open and close a loop(s) on the UFH manifold.
Grant recommends that all UFH systems are equipped with room temperature controls, to optimize operating efficiency of the heating system and provide for the flexibility of independent control to each room or heating zone.

Wireless Control (Smatrix Wave Plus)

Wireless Control is Grant's preferred system for multi-zone installations. Wireless thermostats can be located almost anywhere within the room and easily relocated if necessary. No planning or cost for routing cables to thermostats simplifies the electrical installation. As well as standard wireless thermostats the Wave PLUS system has a touch screen Interface and option for remote connection (U@home) via smart phone, tablet, laptop or smart TV. The Wireless Controller is a wiring centre with in-built relay logic that requires a 230 volt electrical supply and has an on board 230V/24V transformer for connection of 24V thermal actuators. Each room or zone is equipped with a room thermostat, which signals to open/close the thermal actuators fitted to the respective heating loops on the manifold. Up to 6 thermostats and 8 actuators (or 12 thermostats & 14 actuators with addition of slave module) can be connected to each wireless controller. The touch screen interface unit can control up to 4 controllers, giving a maximum of 48 thermostats and 56 actuators.

All controls are supplied with comprehensive installation and setup manuals, it is highly recommended these are thoroughly read before commencing installation. For additional setup and installation assistance contact Grant Technical Support.

Room Thermostat Mounting

Thermostats are generally mounted approximately 1.5m above floor level, away from draughts, direct sunlight or any other direct heating outlet which could affect the reading. If a room is likely, presently or sometime in the future, to be used by a wheelchair user then thermostat mounting height should be lowered to between 1 to 1.2 metres. An advantage of radio thermostats is that they can easily be repositioned within the room to suit any change in room use.

Thermal Actuators

Thermal actuators are fitted onto the UFH manifold and provide for automatic control of individual heating zones. They have an open/ closed indicator and take between 2–4 minutes to completely open.

Integration with Grant Water Temperature Controls

The Grant electronic control systems can easily be integrated with the Grant range of water temperature control sets, including the mixing valve/ pump kit. See electrical wiring details in Mechanical and Electrical Schematics chapter.

Smatrix Wave Plus

Smatrix Wave Plus Controller c/w transformer and Touch Screen Interface (SET)

A wireless radiant heating controller (X-165) and touch screen interface (I-167) set, with the option of remote connectivity via U@home. The controller has six channels and connection for eight 24V actuators. Up to three additional Wave Plus X-165 controllers can be connected providing a 48-zone control platform, if each is fitted with a Wave Slave Module M-160. This controller has a 2-way radio communication via the integral antenna with up to six room thermostats/sensors to control thermal actuators and other heating equipment. Settings and full system information is accessible via the radio touch screen interface. The touch screen interface is designed for displaying system information to the end-user and for programming all relevant system settings for an UFH system when used in combination with the Smatrix Wave PLUS Controller.

Part number UFLEX38

Smatrix Wave Plus Controller c/w transformer (X-165)

A wireless radiant heating controller with six channels and connection for eight 24v actuators. Up to three controllers can be connected to a main controller and interface. This controller sends and receives radio signals to and from room thermostats and sensors to control thermal actuators and other heating equipment via the integral antenna.

Part number UFLEX39

Smatrix Wave Slave Module (M-140)

A 6 channel controller slave module. The controller slave can be added to a Smatrix Wave Plus to expand the available channels from 6 to 12 and actuator outputs from 8 to 14.

Part number UFLEX40

Smatrix Thermostat (T-169)

Battery powered digital wireless single room thermostat with large e-paper display. It shows ambient and set temperature or relative humidity on the display. Temperature settings can be adjusted by +/- buttons on the side. Setpoint range 5 - 35°C. Connection terminals for Smatrix Floor/Remote sensor S-1XX.

Part number UFLEX42

Smatrix Wave Room Sensor (T-161)

Battery powered wireless single room thermostat and RH sensor designed to be as small as possible. Temperature settings can be adjusted via Wave touch screen interface only. Setpoint range 5 - 35°C. Not suitable for connection of Smatrix Floor/Remote sensor S-1XX.

Part number UFLEX43

Smatrix Floor/Remote Sensor (S-1XX)

Enables control over the maximum or minimum floor temperature. This cannot be used in conjunction with the Smatrix Room Sensor T-161.

Part number UFLEX49

Smatrix Wave Plus U@home module (R-167)

The Smatrix Wave Plus U@home module R-167 acts as interface between the Grant Smatrix Wave Plus interface I-167 and your PC, Smart TV or mobile devices (tablet/smart phone).

Part number UFLEX41

Smatrix Base Pro

Smatrix Base Controller c/w transformer and Touch Screen Interface (SET)
A wired radiant heating controller (X-147) and touch screen interface (I-147) set. The controller has six channels and connection for eight 24V actuators. Up to fifteen additional Base x-147 controllers can be connected providing a 192-zone control platform, if each is fitted with a Wave Slave Module M-160. This controller has 2-way communication via the cable connection with up to six room thermostats/ sensors to control thermal actuators and other heating equipment. Settings and full system information is accessible via the connected touch screen interface. The touch screen interface is designed for displaying system information to the end-user and for programming all relevant system settings for a UFH system when used in combination with the Smatrix Base Controller.
Part number UFLEX33

Smatrix Base Controller c/w transformer (X-147)
A wired radiant heating controller with six channels and connection for eight 24V actuators. Up to fifteen controllers can be connected to a main controller and interface. This controller has 2-way communication via the cable connection with up to six room thermostats/ sensors to control thermal actuators and other heating equipment.
Part number UFLEX34

Smatrix Base Slave Module (M-140)
A 6-channel controller slave module M-140. The controller slave can be added to a Smatrix Wave Plus controller to expand the available channels from 6 to 12 and actuator outputs from 8 to 14.
Part number UFLEX35

Smatrix Base Thermostat Digital (T-146)
A wired digital single room thermostat with a large backlit display. It measures and displays the room temperature, transmitting the values to the wired controller. The temperature settings can be adjusted by +/- buttons on the side and it has a setpoint range of 5-35°C. Connection terminatls for Smatrix Floor/Remote sensor S-1XX.
Part number UFLEX37

Smatrix Base Thermostat Standard (T-145)
A wired single room thermostat with scale on dial. It measures the room temperature, transmitting the values to the wired controller. The temperature settings can be adjusted by rotating the dial and it has a set point range of 5-35°C. Not suitable for connection of Smatrix Floor/Remote sensor S-1XX.
Part number UFLEX36

Grant Smatrix Floor/Remote Sensor (S-1XX)
Enables control over the maximum or minimum floor temperature. This cannot be used in conjunction with the Smatrix Room Sensor T-145.
Part number UFLEX49

Smatrix Base Bus Cable (50m)
A 4 core Smatrix bus cable, individually shielded for interference protection.
Part number UFLEX48

Smatrix Wall Frame
Replaces standard thermostat back plate to allow Samtrix thermostats to be mounted on standard UK electrical back box.
Part number UFLEX46

Electrical & Mechanical Schematics

The following section is designed to show the installer how their system is to be wired and plumbed. The electrical and mechanical schematics apply to both PE-RT and PEX systems

ELECTRICAL SCHEMATICS

Smatrix Base Pro 38

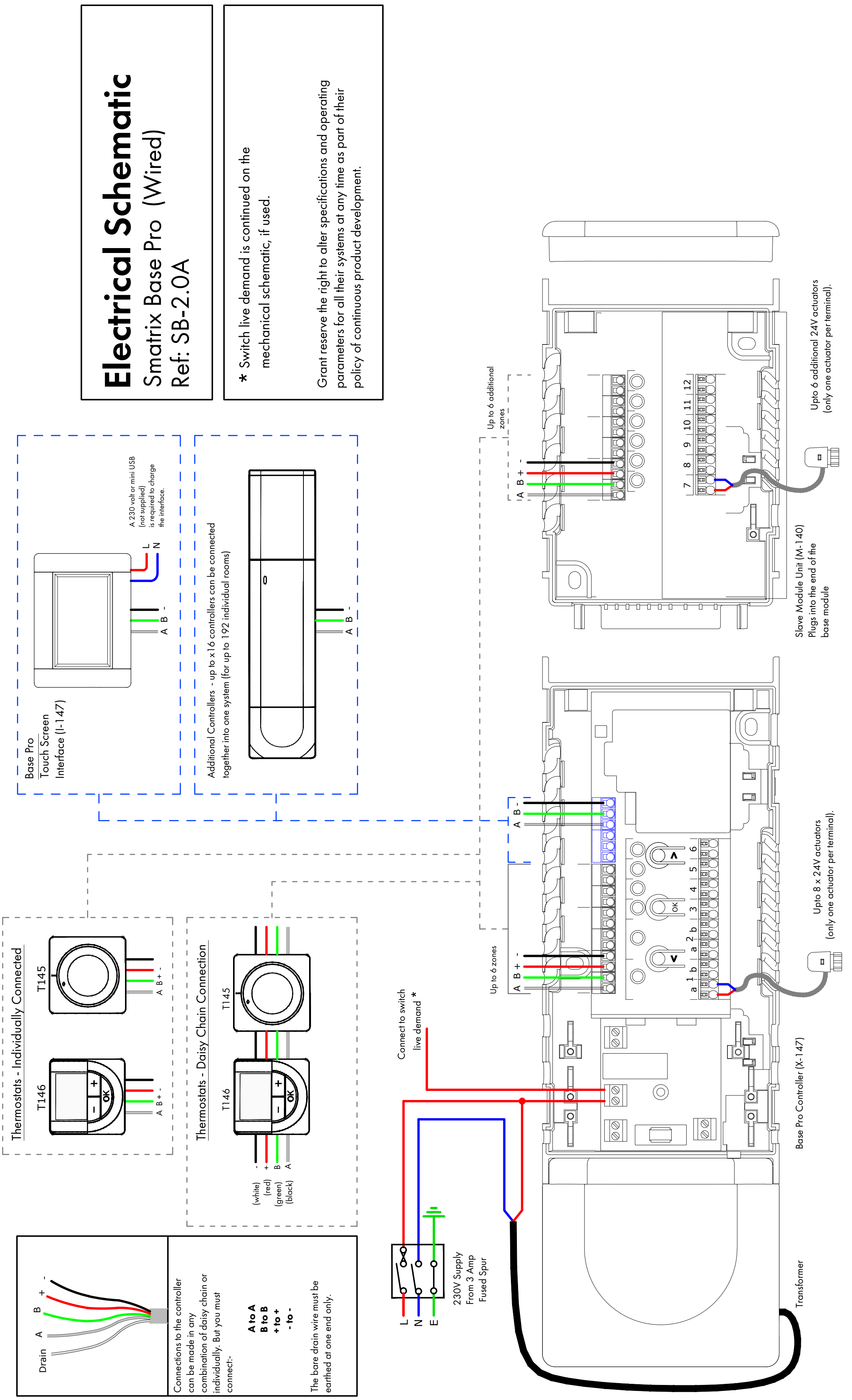
Smatrix Wave Plus 39

MECHANICAL SCHEMATICS

Fixed water temperature control 40

No water temperature control 41

Typical pipe layout 43



Electrical Schematic
Smatrix Base Pro (Wired)
Ref: SB-2.0A
* Switch live demand is continued on the mechanical schematic, if used.
Grant reserve the right to alter specifications and operating parameters for all their systems at any time as part of their policy of continuous product development.
Base Pro Touch Screen Interface (I-147)
A 230 volt or mini USB (not supplied) is required to charge the interface.
L N
A B -
Additional Controllers - up to x16 controllers can be connected together into one system (for up to 192 individual rooms)
Up to 6 additional zones
Up to 6 zones
Upto 6 additional 24V actuators (only one actuator per terminal).
Slave Module Unit (M-140) Plugs into the end of the base module
Upto 8 x 24V actuators (only one actuator per terminal).
Base Pro Controller (X-147)
Transformer
Connect to switch live demand *
230V Supply From 3 Amp Fused Spur
L N E
Thermostats - Individually Connected
T145
T146
Thermostats - Daisy Chain Connection
(white) (red) (green) (black)
Drain A B + -
Connections to the controller can be made in any combination of daisy chain or individually. But you must connect:-
A to A
B to B
+ to +
- to -
The bare drain wire must be earthed at one end only.

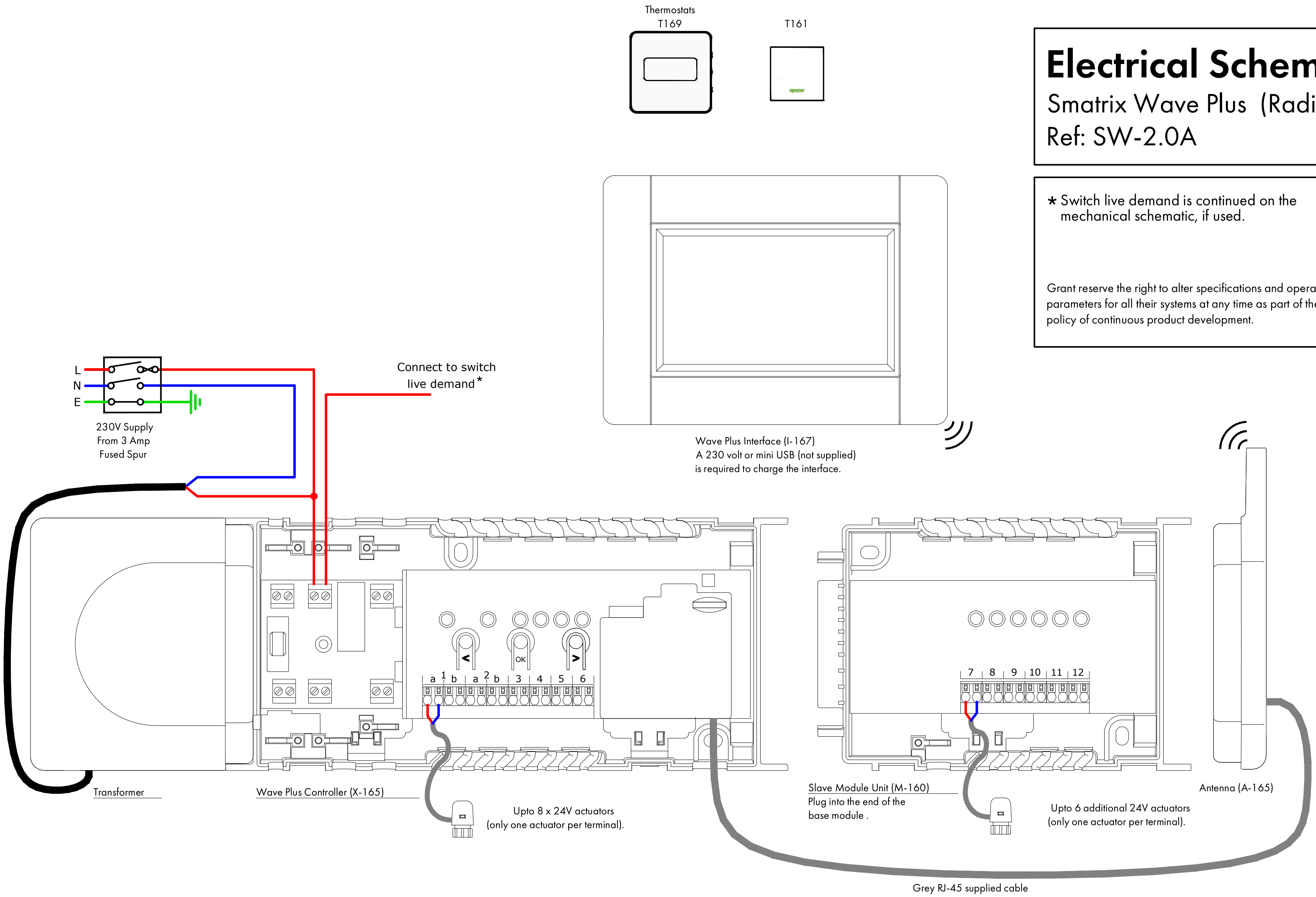
Electrical Schematic

Smatrix Wave Plus (Radio)

Ref: SW-2.0A

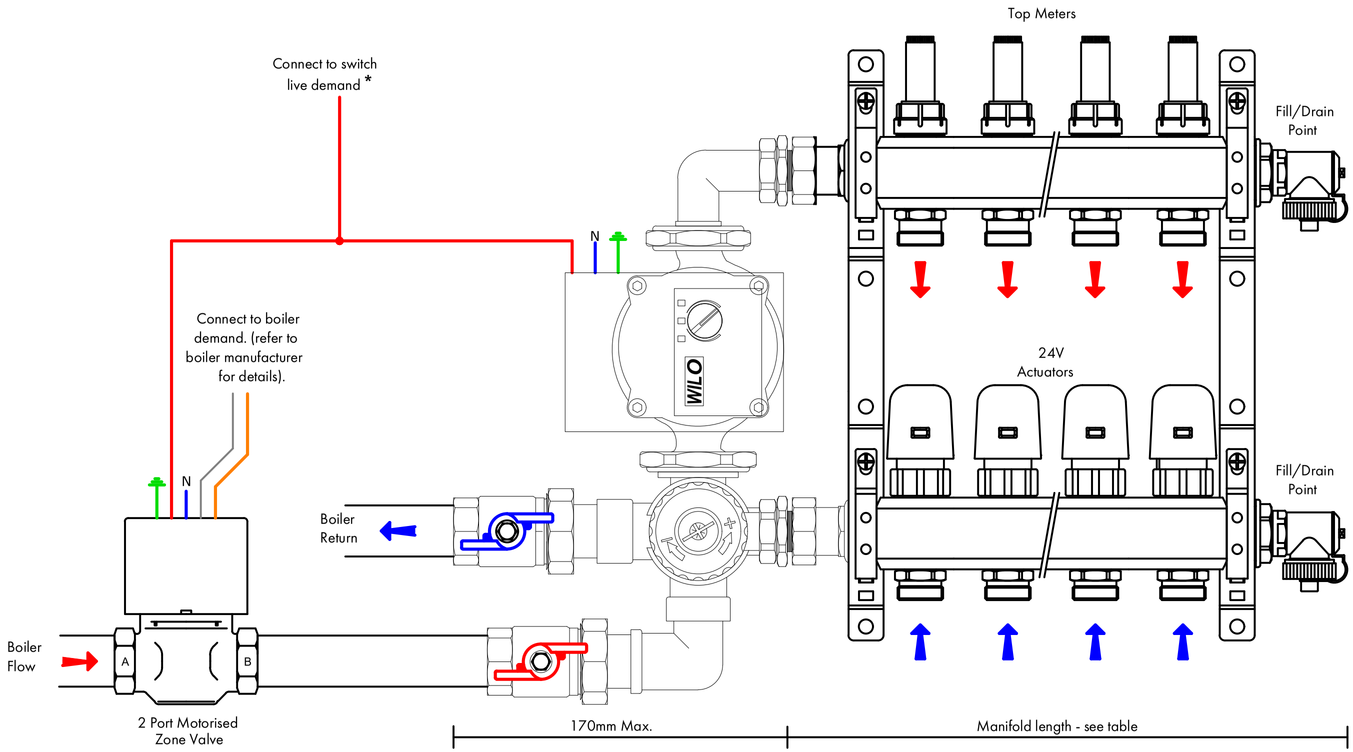
* Switch live demand is continued on the mechanical schematic, if used.

Grant reserve the right to alter specifications and operating parameters for all their systems at any time as part of their policy of continuous product development.



Mechanical Schematic

Fixed Water Temperature Control
Ref: ESO-1.0A



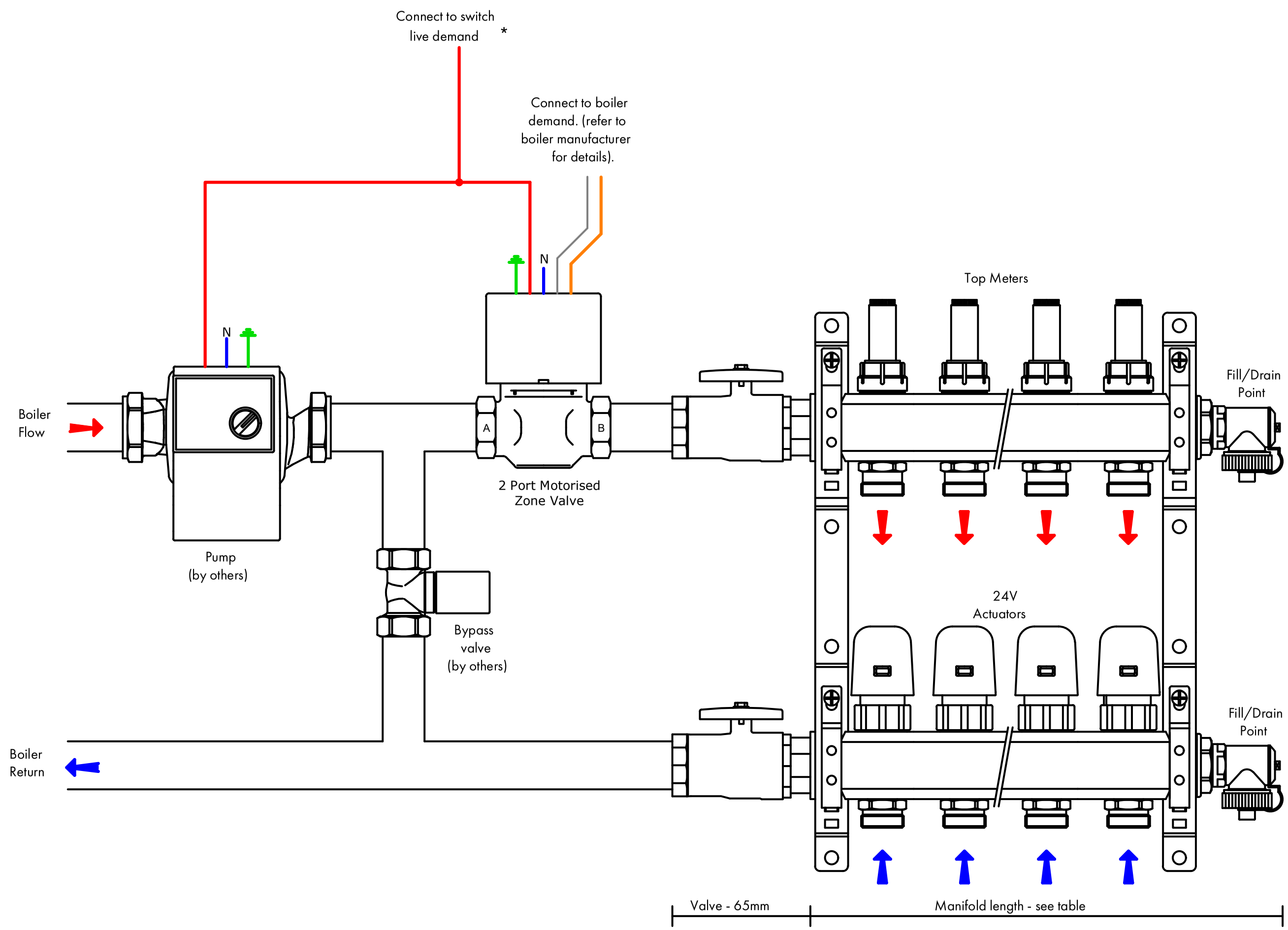
* Refer to air temperature electrical schematic for connection.

Manifold	Length
2 Port	210mm
3 Port	260mm
4 Port	310mm
5 Port	360mm
6 Port	410mm
7 Port	460mm
8 Port	510mm
9 Port	560mm
10 Port	610mm
11 Port	660mm
12 Port	710mm

The height of the manifold is 340mm and needs to be mounted at least 300mm from the floor.

Notes,
1) A bypass is recommended on the primary circuit.
2) The drawing excludes isolating & regulating valves for clarity.
3) All items to be installed in accordance with manufacturer's instructions and current best practices.

Grant reserve the right to alter specifications and operating parameters for all their systems at any time as part of their policy of continuous product development.



Mechanical Schematic

No Water Temperature Control

Ref: NWT-1.0A

* Refer to air temperature electrical schematic for connection.

Manifold	Length
2 Port	210mm
3 Port	260mm
4 Port	310mm
5 Port	360mm
6 Port	410mm
7 Port	460mm
8 Port	510mm
9 Port	560mm
10 Port	610mm
11 Port	660mm
12 Port	710mm

The height of the manifold is 340mm and needs to be mounted at least 300mm from the floor.

Notes,

1) A bypass is recommended on the primary circuit.

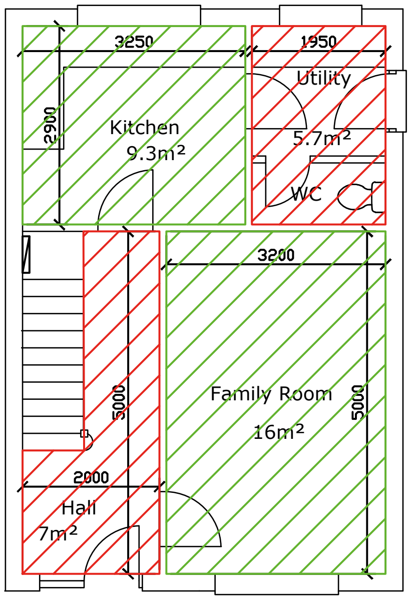
2) The drawing excludes isolating & regulating valves for clarity.

3) All items to be installed in accordance with manufacturer's instructions and current best practices.

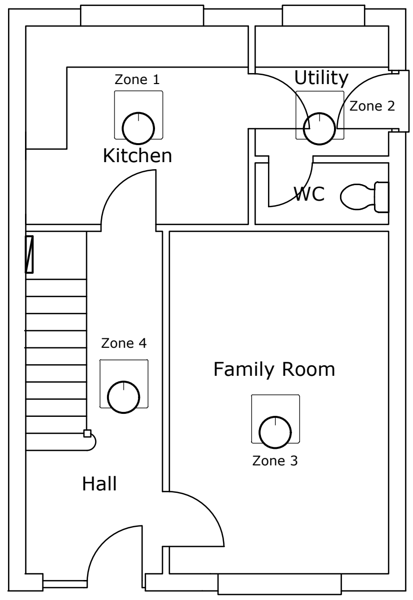
Grant reserve the right to alter specifications and operating parameters for all their systems at any time as part of their policy of continuous product development.

Example for Solid Ground Floor in a Small Domestic Property

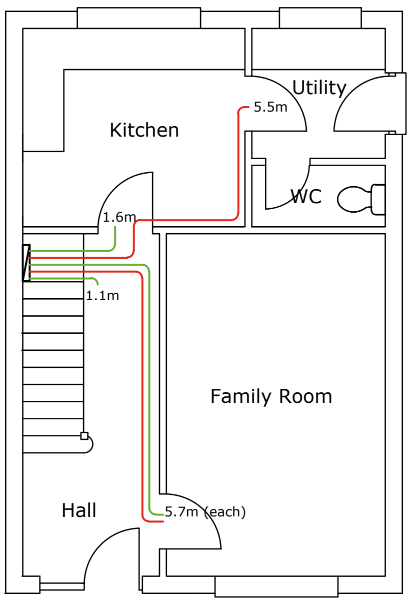
Drawing showing 4 zones for independent temperature control and with UFH manifold centrally located beneath the stairs.



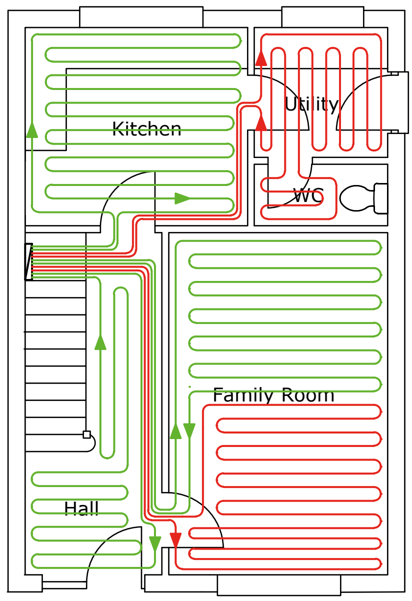
Drawing showing room thermostat locations.



Drawing showing route of pipe tails from UFH manifold to each room.



Drawing showing completed pipe layout.



System details

Floor type:	Solid
Fixing Method:	Uflex tacker pipe clips & fix clamp track
Pipe size and type:	16mm PE-RT
Pipe pitch:	200mm
Max heat output:	70 W/m^2

Tabulated room details

Room or Zone (Number)	Room or Zone (Name)	Floor Area (m^2)	Distance to manifold (m)	No. of Loops (Qty)	Pipe Required (m)	Selected Coil Length
1	Kitchen	9.3	1.6	1	52.7	1 x 75m
2	Utility/WC	5.7	5.5	1	42.5	1 x 50m
3	Family Room	16	5.7	2	108.8	1 x 50m 1 x 75m
4	Hall	7	1.1	1	40.2	1 x 50m

* Please note that Grant recommends laying UFH pipe underneath units.

Heat Pumps

Grant guidance on using heat pumps with an UFH system, and floor heat outputs for different UFH systems with various floor covering resistances

Heat Pumps

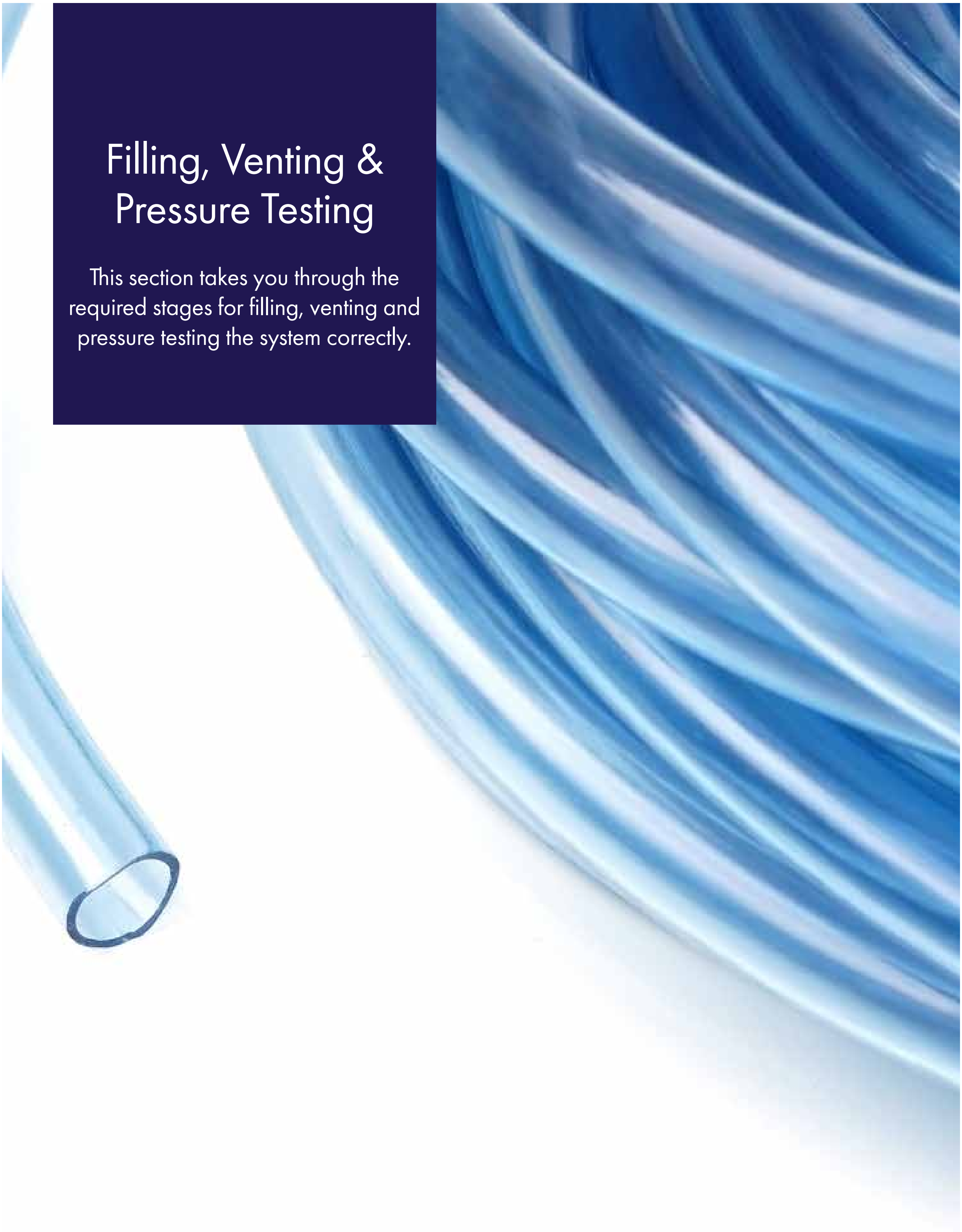
Grant will not normally supply water temperature controls (i.e thermostatic mixing valve/ pump unit) when ground/air source heat pumps are employed. The heat pump's integral controls should be set at a water temperature that satisfies the requirements of the UFH system. If you are using a heat pump and we have quoted the water temperature controls, please omit them from our offer or contact our technical team for advice.

To ensure for adequate water flow around the UFH loops additional circulating pump(s) will normally be required. Circulating pump(s) should be located at the inlet (upstream) of the manifold(s) and to be supplied by others. Grant will be pleased to give advice regarding pump duty.
A buffer vessel is often fitted between the heat pump and the UFH manifold(s), which provides for adequate water circulation through the heat pump at all times when it is running. This also allows for individual room controls to be fitted to each underfloor heated zone, because the primary flow (Heat Pump circuit) is hydraulically separated from the secondary flow (UFH circuits). If a buffer vessel is not incorporated within your system, then sufficient UFH loops should be uncontrolled (open circuit) to allow for adequate water flow rate through the heat pump to eliminate cycling.

Low mass UFH systems should only be used when heat requirements are so low as to allow operation well below the 50 – 55°C mean water temperature normally required.
UFH with renewable energy heat generation should be designed to work on the lowest feasible water temperature to gain maximum energy saving benefits; heat pump coefficient of performance (COP) of 4 or more.
UFH will work with most types of floor coverings. However, it should be understood that coverings with relatively high thermal resistances will need to increase the UFH water temperature to offset building heat losses, and will result in lower COP and therefore higher running costs.
The tables that follow show floor heat outputs for different UFH systems with various floor covering resistances.

Filling, Venting & Pressure Testing

This section takes you through the required stages for filling, venting and pressure testing the system correctly.



Filling the loops	48
Pressure testing	49

Filling and Venting the Loops




Fill ports (hose connections) with integral fill/ vent valves are supplied as part of the Uflex manifold assembly.
Hose unions are required for the 3/4" connections on these fill ports.

Before starting, ensure that the fill port is uppermost, then:

- Ensure all electrical supplies are switched off.
- Remove the fill port caps and washer from both fill ports (A).
- The integral valves in both fill ports must be opened to fill the system. Use the square key in the cap to open the fill / vent port valves (B).
- Connect a hose union to both ports (C)
- Ensure both isolating ball valves on the main flow and return pipes to the manifold are CLOSED (D).
- 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 upper and lower manifold headers.
- Close all underfloor heating loop flow and return valves on the manifold. To do this, rotate all the manual valve heads (black caps) clockwise on the lower (return) manifold (F) until fully closed. Then, close all the topmeters on the upper (flow) manifold by removing the outer black locking rings (G) and turning each topmeter clockwise until fully closed.
- Fit a hose to the lower manifold hose (E) union and run the other end of the hose to a suitable drain point.
- Connect a hose to the upper manifold hose union (E) and connect the other end of the hose to a mains water tap.
- Individual loops need to be purged of air in turn. This is achieved by opening the manual vlalve head (black cap) on the lower manifold (F), then fully opening the corresponding topmeter on the upper manifold (G). To fully open the topmeter, first remove the black locking ring and then turn the topmeter 3 full turns anticlockwise from the closed position.
- Turn on the water tap (H). 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 both the topmeter and corresponding return valve on the flow and return manifolds.
- Repeat this procedure for all UFH loops on the manifold ensuring that the topmeter and return valves are closed on each loop after filling.
- Close the fill/vent valves on the end caps and switch-off the mains water before disconnecting the hoses.
- Important: If using a mixing valve / pump kit unit, please remember to open the pump isolation valve.
- If the UFH is being installed in the winter, anti-freeze can be added to the system water for protection against freezing. If used, then the pipes will need to be fully flushed with cold water prior to running the system.

The system is now ready for pressure testing.




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.

- Isolate both the flow and return manifolds, using the ball valves.
- Ensure that all flow topmeters and return valves on all the UFH loops are fully open.
- Use the pressure gauge on the pressure test kit to monitor the test pressures (A).
- Connect the pressure test kit pump to the fill port on the flow manifold and open the internal fill/vent valve using the end cap (B). Ensure the other fill vent valve on the return manifold fill port is closed.
- Pump up the pressure in the manifold to the test pressure (minimum 4 bar, maximum 6 bar) for at least 1 hour (C). 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 over this period (D).
- Decrease the pressure to the system working pressure. 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 under 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.

Use of Corrosion Inhibitors

Grant Uflex UFH pipes will not be:

- Adversely affected by corrosion inhibitors 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.

Starting-up the System Operation

This section helps you check and start-up the UFH system.

System Start-Up - Manifolds 52

Auto-Balance 54

System Operation & Maintenance 55

Trouble Shooting 56

Starting-up the System

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.
- Check and ensure all electrical controls are wired correctly and in accordance with the latest edition of IEE Wiring Regulations, or ETCI National Rules for Republic of Ireland.
- 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 boiler or heat source is operating in accordance with the manufacturers instructions and set to run with a flow temperature of a minimum 10°C higher than the UFH design flow temperature. If the heat source is directly controlling the design flow water temperature, it should be set to the starting temperature of the system.
- The flow rate for each UFH loop (in litres/min) is regulated by topmeters fitted to the flow header on flowmeter manifolds. Set each loop by using the flow rate and carry out the balancing procedure that follows.

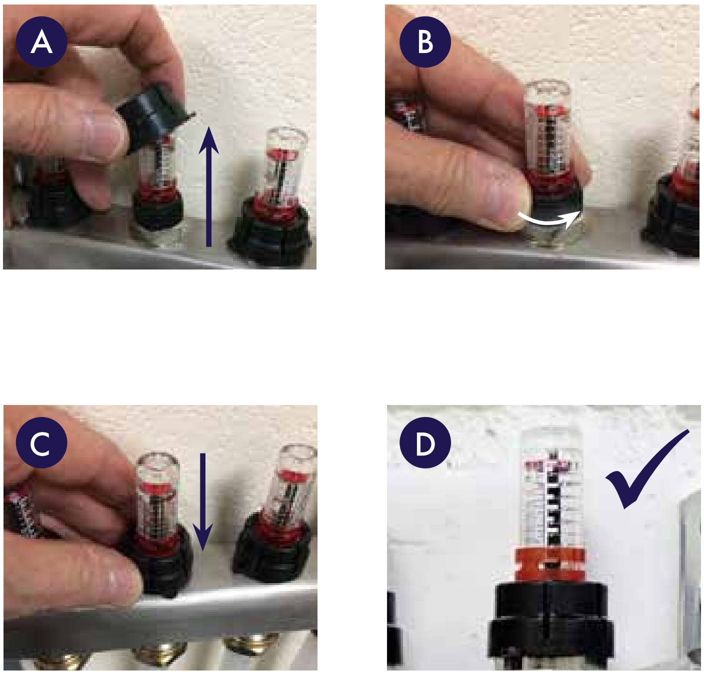
Flowmeter manifold balancing procedure

- Remove the black cover from the topmeter as shown in Fig A. If the topmeter has been opened it needs to be closed by turning it clockwise. All topmeters should be fully closed at the start of the commissioning process.
- Ensure that all manifold return valves are fully closed (remove thermal actuators if fitted and replace with black manual caps).
- Open the return valve on one loop and adjust the setting of the corresponding topmeter, until the design flow rate is reached, by turning the topmeter anticlockwise from its fully closed position as shown in Fig B. It is important that the system and UFH pumps are running. Note, three full turns from shut will fully open the topmeter. It is not possible to adjust the topmeter further than this setting.
- Once the design flow rate is achieved the black locking ring should be refitted over the topmeter as shown in Fig C.
- The topmeter will not turn at all if the black locking ring is fitted correctly. Fig D shows a correctly fitted locking ring.

Important Note:

Manual loop balancing is not necessary if Smatrix controls are used and "Autobalance" is enabled

Flowmeter manifold loop balancing procedure:



- 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 topmeter 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 boiler 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.

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.

Final loop balancing is not required if the Autobalance function of the Smatrix controls is operational.

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 boiler 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.

Autobalancing: Continuously Self-Optimising Temperature Controls

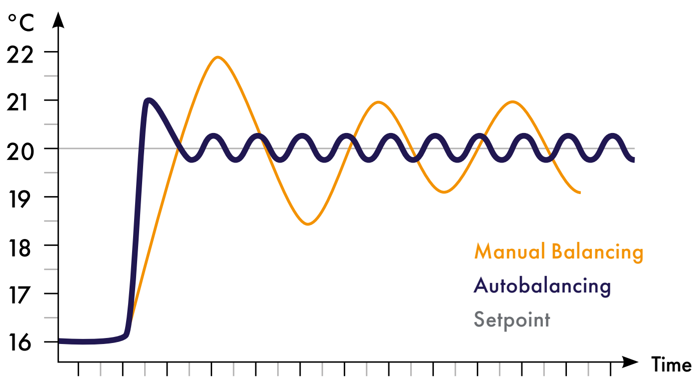
A unique technology that eliminates the need for manual balancing

Autobalancing constantly monitors changes in conditions inside and outside the building. By intelligently adjusting and adapting, the Smatrix controller ensures that just the right amount of energy is used at just the right time.

With traditional controls, radiant heating and cooling needs balancing to fixed design conditions. This is a manual process that needs later adjustment to suit the actual building and occupiers preferences - a time consuming trial and error procedure. Autobalancing not only eliminates this initial commissioning adjustment - periodically the system optimises the circuit of each room, continuously calculating the energy required for your comfort. Even if you change floor coverings, autobalancing will adapt automatically to ensure the right comfort levels with the most efficient energy use.

While the manual hydraulic balancing always considers only the initial conditions, the auto-tuning the temperature constantly adapts every change in to system or space, without complicated recalculation and adjustment by an installer. You save time, energy and money - you gain optimal comfort.

Autobalancing uses the exact amount of energy for optimal comfort



- Retrofit optimises existing installations
- Improved comfort without manual adjustments
- Fully automatic, 24/7
- Up to 25% faster reaction
- Energy saving:
  - Up to 6% compared to other single-zone controls
  - Up to 12% compared to unbalanced systems
  - Up to 20% compared to unbalanced multi-zone systems

Smatrix Controls at a Glance

Features	Smatrix Wave PLUS	Smatrix Base PRO
Wireless	●	
Wired		●
Autobalancing	●	●
Touchscreen interface	●	●
Remote connectivity with U@home	●	
Comfort/Eco setting	●	●
Floor sensor	●	●
Multi-zone	●	●

System Operation

System Operation

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

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.

ECO mode

Eco mode is ideal for UFH because it reduces warm-up times between unoccupied and occupied heating periods throughout the day/week by lowering the desired room temperature by approximately 4°C during unoccupied periods. This ensures that the system response at the next occupied period is faster, because to heat the screed from cold each morning would be impractical (not applicable with wooden or lightweight flooring systems). However, a well insulated screed floor may only lose 1.5-2°C over an 8 hour period, therefore when switched to unoccupied set-back, the UFH system will effectively be off except in cold weather.

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 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.

Pump Speed

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

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.

Trouble Shooting

As described in earlier sections, the UFH system operation is relatively straightforward. Hot water from the primary heat source (boiler) 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 a boiler interlock switch to energise the boiler. 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 boiler is firing
    - the primary pump is fitted
    - the primary pump is working
    - the boiler is of adequate size
    - the primary pipework is sufficiently sized
    - the primary pumps are large enough

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 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 window 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 boiler to prevent short cycling and to ensure that the boiler 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 boiler 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.

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.

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 adapter nut over each end of pipe, together with olive on PEX pipes, 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 practice 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 9.9 PEX pipe:

- 1x Uflex MINI compression coupling (UFLEX51)

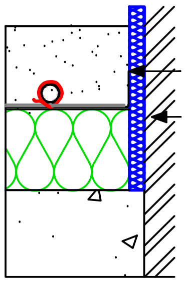
For 16mm PERT pipe:

- 2x Uflex compression adapter (UFLEX26)
- 1x Uflex compression repair connector (UFLEX50)

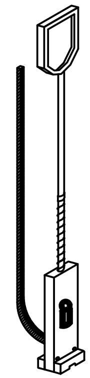
Appendix 1- System Components

Uflex pipe	16mm x 2.0mm PE-RT pipe
120m coil	UFLEX01
240m coil	UFLEX02
640m coil	UFLEX03
Uflex MINI pipe	9.9mm x 1.1mm PEX pipe
120m coil	UFLEX05
240m coil	UFLEX06
640m coil	UFLEX07
Uflex Manifold	Stainless steel manifold fitted with flow meters and valves
2 pairs G¾ connections	UFLEX08
3 pairs G¾ connections	UFLEX09
4 pairs G¾ connections	UFLEX10
5 pairs G¾ connections	UFLEX11
6 pairs G¾ connections	UFLEX12
7 pairs G¾ connections	UFLEX13
8 pairs G¾ connections	UFLEX14
9 pairs G¾ connections	UFLEX15
10 pairs G¾ connections	UFLEX16
11 pairs G¾ connections	UFLEX17
12 pairs G¾ connections	UFLEX18
Uflex MINI Compression Adapter	
G¾FT compression adapter to connect 9.9mm PEX pipe to manifold connections	UFLEX25
Uflex Compression Adapter	
G¾FT compression adapter to connect 16mm PE-RT pipe to manifold connections	UFLEX26
Uflex Ball Valves	
Pair of G1/G1 isolating ball valves for use with the Uflex manifolds	UFLEX19
NOTE: not required if the mixing valve/pump (UFLEX20) unit is used	
Uflex Mixing/ Pump Unit	
Thermostatic mixing valve and circulating pump	UFLEX20
Uflex Multi Bend Support	
Galvanised steel pipe bend support 15-16 for 16mm PE-RT pipe	UFLEX21
Uflex Conduit 28/23	
Black plastic pipe conduit (50m length)	UFLEX22
Uflex Edging Strip	PE self-adhesive edging strip with foil for Uflex screed system
150mm x 10mm (50m length)	UFLEX23
Uflex Tacker Pipe Clip - Long	Pack of 300
55mm pipe clip for fixing Uflex 16mm PE-RT pipe to insulation	UFLEX24
Uflex Fix Clamp Track	Clips at 50mm and 100mm pipe centres
Fixing clip rail with glue for fixing 16mm PE-RT pipe to insulation	UFLEX44
Uflex Heat Emission Plates	Aluminium heat emission plates for Uflex 16mm PE-RT pipe Pack of 28
380mm x 1150mm with 200mm pipe centres	UFLEX 47
Uflex MINI Nubfoil Panel	Pre-formed polystyrene panel with self-adhesive backing for 9.9mm PEX pipe
1120mm x 720mm x12mm (pack of 8 - 6.2m^2)	UFLEX27
Uflex MINI Edging Strip	PE self-adhesive edging strip with foil for Uflex MINI system
80mm x 8mm (20m length)	UFLEX28
Multi Pipe Uncoiler	
For uncoiling both 9.9mm PEX and 16mm PE-RT pipe	UFLEX29
Tacker Clip Stapler	
Tacker gun for rapid and easy fitting Uflex tacker pipe clips	UFLEX30
Multi Pipe Cutting Tool	
Suitable for cutting both 9.9mm PEX and 16mm PE-RT pipe	UFLEX31
Uflex Thermal Actuator	
24V actuator for fitting retrun manifold valves	UFLEX45

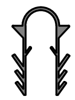
Appendix 2 - Floor Schematic Drawings



Tacker Kombi Gun



Compatible with both the Tacker Clip Short and Kombi Klip Long pipe staples, one tool can be used to install all Uponor underfloor heating pipe to various types of insulation. These guns are recommend for underfloor heating installers and can dramatically reduce installation time.



Tacker Clip Long

The Tacker Clip Long are used for fixing pipework to most types of insulation including plain EPS and foil faced PUR (polyurethane) such as Kingspan or Celotex. The barbs length is 33mm and the clips require a minimum of 35mm insulation depth.

Floor Construction

Screed with Tacker Clips - 16mm

Ref: I11-E

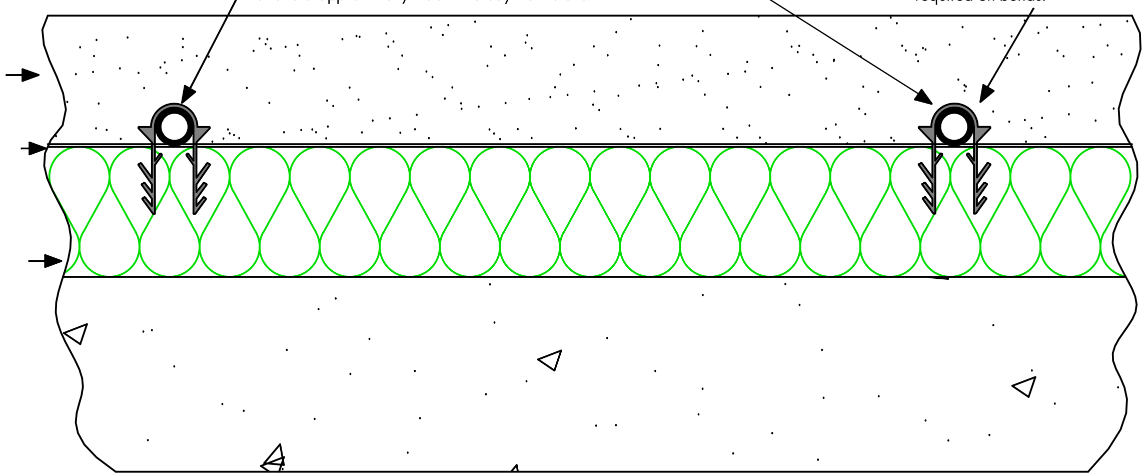
Grant reserve the right to alter specifications and operating parameters for all their systems at any time as part of their policy of continuous product development.

Floor Make-up

- 65-75mm 4:1 Sand/Cement Screed. Additives are not required although if used should not be deterimental to the pipe.
- Protective Layer. It is essential to prevent screed from slipping between the insulation board joints. This can be achieved by taping the joints of the insulation or alternatively by using foil or polythene film.
- Insulation to comply with Part L of the Building Regulations. If insulation is already fitted below the concrete slab a recommended minimum insulation thermal resistance of 1.25m²k/W should additionally be installed above the slab, equivalent to 50mm Rolltec insulation. On intermediate floors with heated rooms below an insulation resistance of 0.75m²k/W is required to comply with BS EN 1264.

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

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



Section of typical floor make up

Appendix 2 - Floor Schematic Drawings

Floor Construction

Screed with Clamp Track - 20mm

Ref: IW12-D

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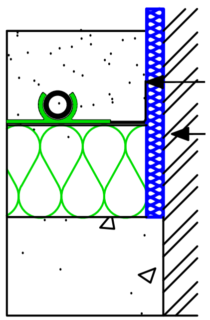
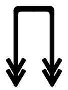
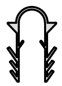


10mm Edge Insulation with self adhesive backing must be positioned around all wall edges to reduce heat loss and take up screed expansion.



U-Clip

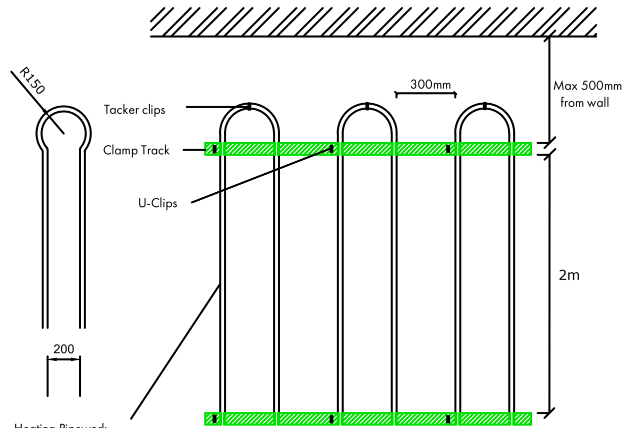
The U-clips are used to fasten Clamp Track or pipework to insulation. The clips require a minimum of 25mm insulation depth to be fitted into.



Tacker Clip Long

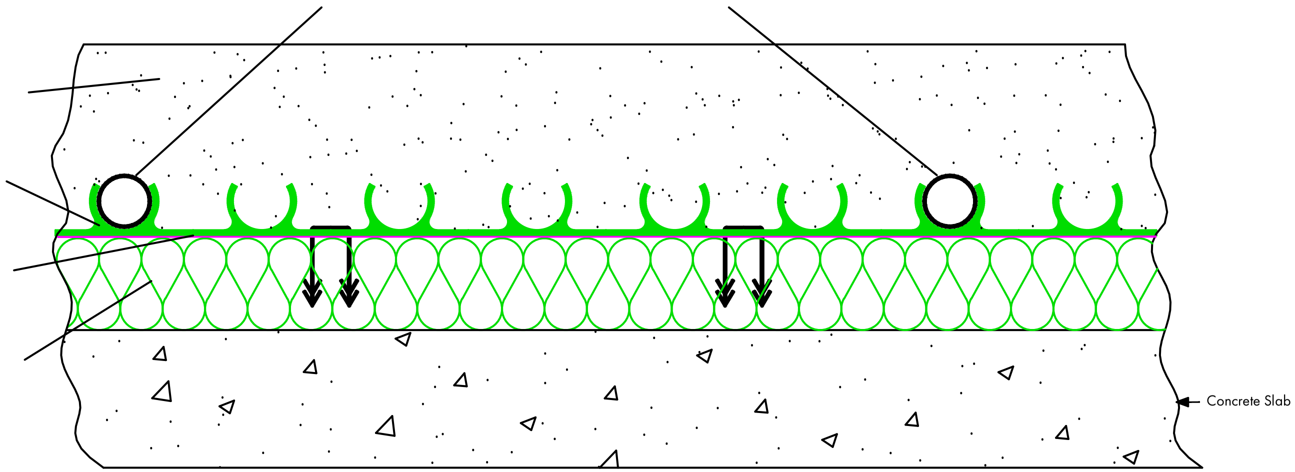
The Tacker clips are used to fasten pipe to insulation. The clips require a minimum of 32mm insulation depth to be fitted into.

Note
Where pipes are spaced at 200mm centres the pipe should be "light bulbed" to a minimum radius of 150mm.



Plan View of Heating Pipework

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



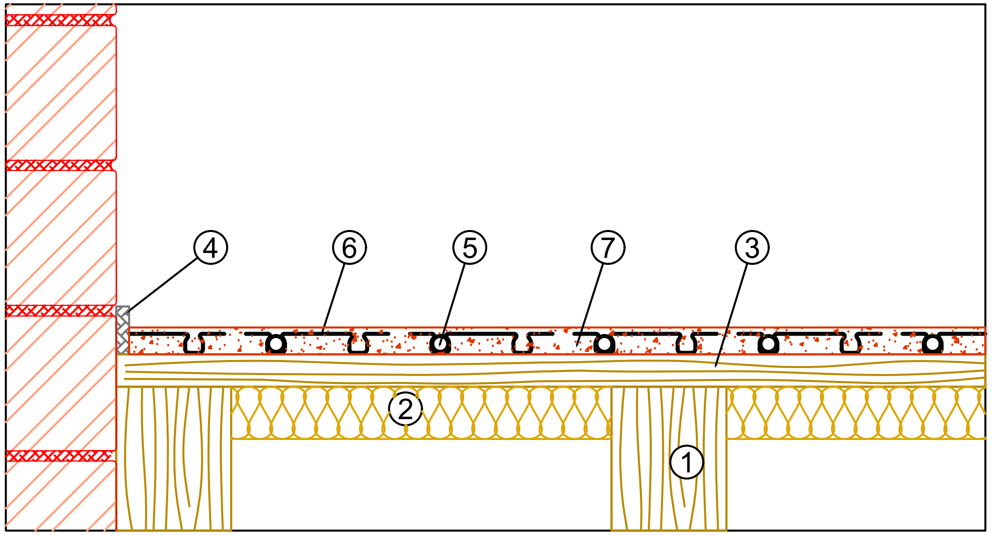
Section of Floor Make Up

Floor Make-up

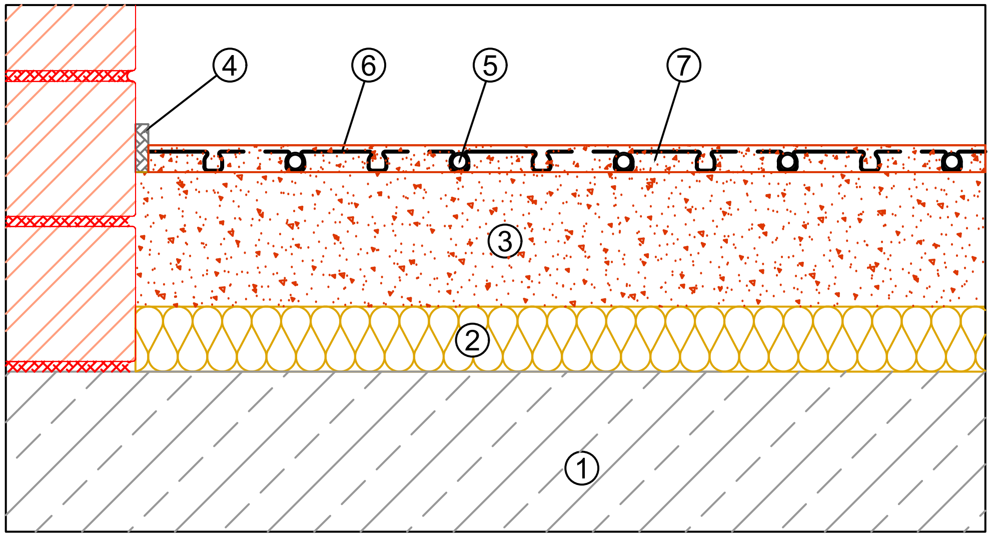
- 65-75mm 4:1 Sand/Cement Screed. Additives are not required although if used should not be detrimental to the pipe.
- 1m Length of Clamp Track positioned 1m apart with double sided tape for locating. Once Clamp Track is laid in position it is to be secured with pipe fixing clips.
- Protective Layer. It is essential to prevent screed from slipping between the insulation board joints. This can be achieved by taping the joints of the insulation or alternatively by using PE Foil or polythene film.
- Insulation to comply with Part L of the Building Regulations. If insulation is already fitted below the concrete slab a recommended minimum insulation thermal resistance of $1.25m^2k/W$ should additionally be installed above the slab, equivalent to our 50mm Rolltec insulation. On intermediate floors with heated rooms below an insulation resistance of $0.75m^2k/W$ is required to comply with BS EN 1264.

Appendix 2 - Floor Schematic Drawings

Typical existing joisted floor



Typical existing solid floor



Floor Construction

Uflex MINI

Ref: I110-A

Grant reserve the right to alter specifications and operating parameters for all their systems at any time as part of their policy of continuous product development.

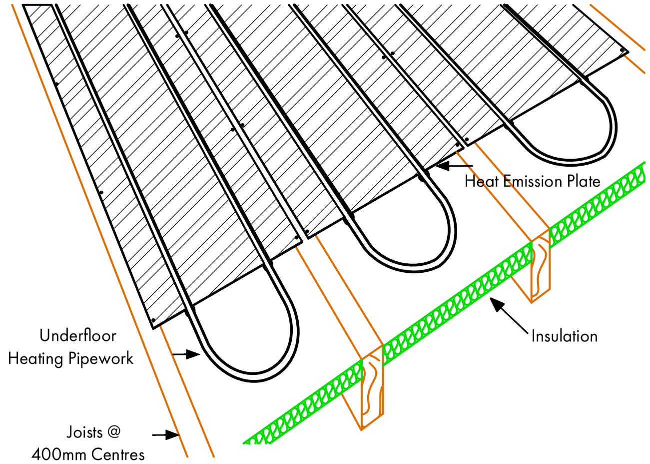
Key:

1. Joists / Sub floor.
2. Existing insulation.
3. Existing screed / floor boards.
4. Uflex edge isolation profile with sealing skirt.
5. Uflex PE-Xa 9.9mm x 1.1mm pipe.
6. Uflex MINI mounting board.
7. Minimum 15mm levelling compound.

General notes:

- If the existing floor is not level, apply a thin layer of levelling compound prior to installing the Uflex MINI panels.
- If the joisted floor is unstable, fix plywood panels to the floor boards to stabilize the floor.
- The existing floor should be primed prior to fitting the Uflex MINI panels.
- The levelling compound can be laid to a maximum of 30mm.
- Suitable levelling compounds include:-
  - Knauf Alphadur 430
  - Mapei Ultraplan Maxi
  - Mapei Renovation Screed
- Uflex MINI can be installed with a propriety flow screed, which would normally require 30mm cover **above** the top of the pipes.

Appendix 2 - Floor Schematic Drawings



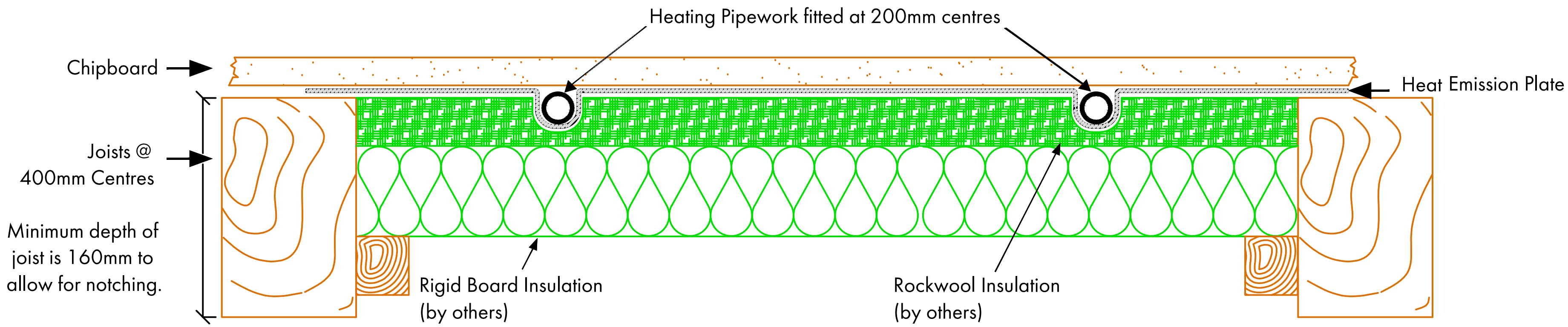
Insulation
It is essential that insulation is fitted between the joists, as close to the underside of the plates as possible, even on intermediate floors. The insulation should satisfy the requirements of Part L and Part E of the Building Regulations.

Heat Emission Plates
These plates are only for heat distribution and are not structural. They are easily damaged and it is very important that no other trades are allowed where the UFH is being installed. The plates should be laid accross the floor before fixing. They should only be laid on the straight runs and should be installed with a 10mm minimum gap between plates.

Decking
The area should be decked out immediately after completeing installation to protect the system. Temporary sheets of ply are acceptable. If necessary, the floor can be marked to show the pathway of the pipe runs to assist the floor layer fixing down the floor.

Floor Construction
Timber Suspended with Heat Emission Plates - Ref: I22-C

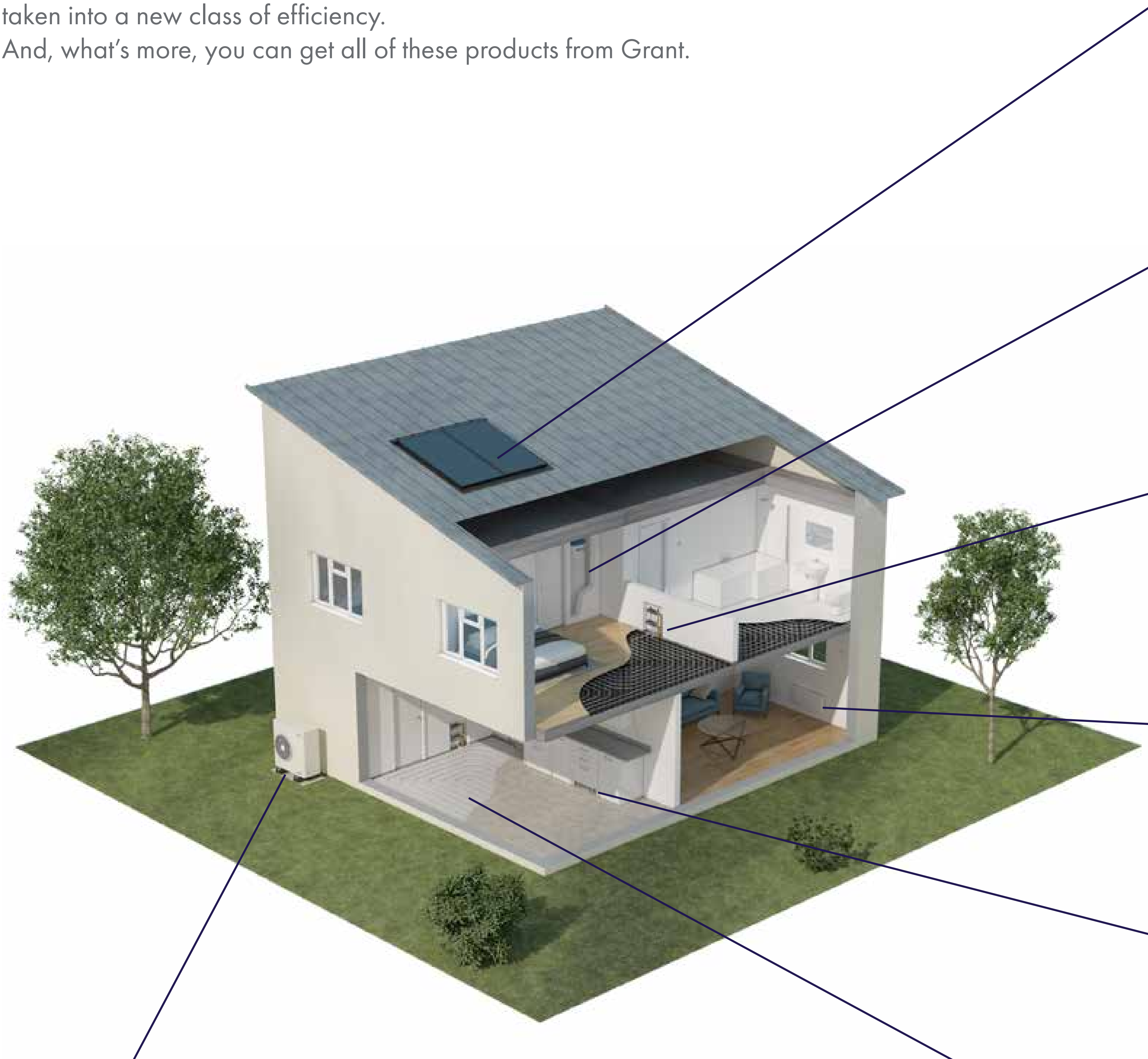
Grant reserve the right to alter specifications and operating parameters for all their systems at any time as part of their policy of continuous product development.



Notes

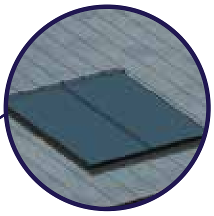
Multiple Package Solutions. All From Grant.

A heating system's overall efficiency can be significantly improved by combining multiple technologies. By installing an air source heat pump alongside a high performance cylinder and effective heat emitters, a home's heating system can be taken into a new class of efficiency.
And, what's more, you can get all of these products from Grant.



Aerona³ R32 air source heat pumps

- Exceptional SCOP's sustainable at low temperatures
- MCS approved
- Factory fitted weather compensation control



Sahara solar thermal
- On roof, in-roof & flat roof mounting options
- Solar Keymark approved
- Simple ordering process

Wave high performance cylinders
- Pre-plumbed, single & twin coil options
- Fast recovery stainless steel coils
- Sizes between 125 - 500 litres

Uflex MINI underfloor heating
- Very low profile (15mm finished floor height)
- Suitable for ground & first floor installation
- Quick installation & drying time

Solo fan convectors
- Flexible zone & temperature control
- Low energy consumption
- Small & slim in size

Solo Hideaway fan convectors
- Under cabinet plinth heater
- Low energy consumption
- Adjustable temperature control

Uflex underfloor heating
- Quick reaction time
- Ideal for new builds or extensions
- Highly efficient

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