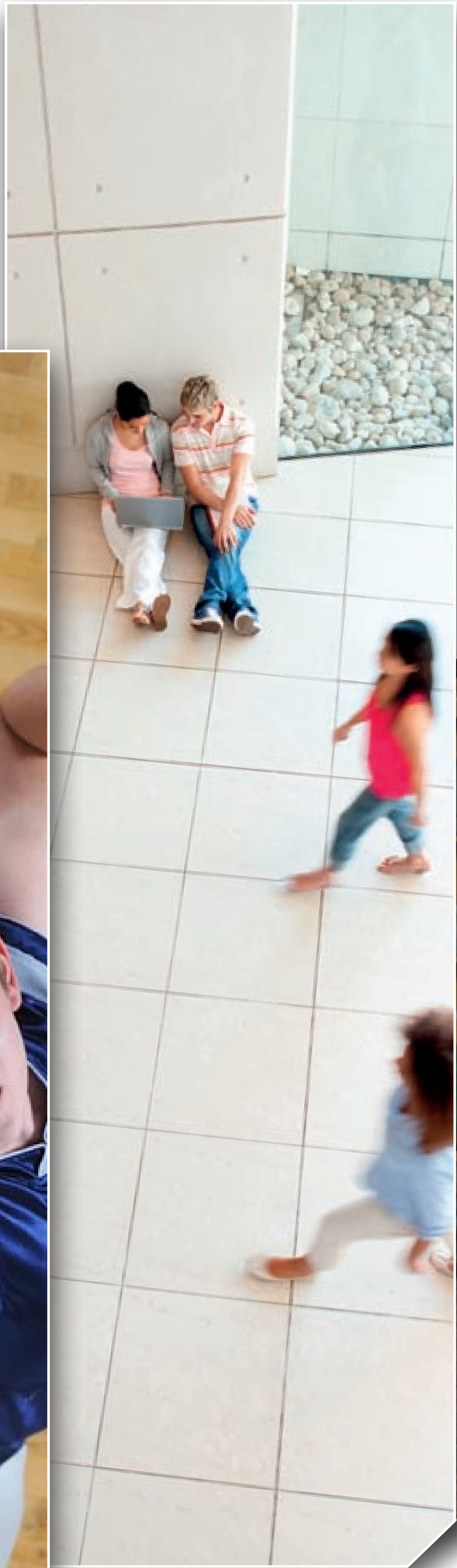
Jan 2010 - Issue 2


Underfloor heating in schools

colleges, universities, sports halls and educational buildings

WARMA FLOOR
UNDERFLOOR HEATING & COOLING

A Warmafloor technical guide

Underfloor heating in schools

colleges, universities, sports halls and educational buildings

This guide has been produced to give an understanding of systems and strategies involved in the successful design and installation of an underfloor heating system within a school, college, university or educational building.

Warmafloor has been instrumental in introducing underfloor heating in schools. Over 1000 installations have been carried out throughout the country with systems having been in operation successfully for over 20 years. Warmafloor specialises in underfloor heating and heating/cooling for schools and colleges and has been selected for school projects because of the specialist knowledge that has been acquired over time. There are a variety of Warmafloor systems that have been installed to cater for numerous different floor constructions; screeded, tiled, carpet, sports halls with timber floors, swimming pool surrounds and changing rooms. Whatever the criteria, a Warmafloor system is designed and installed to suit the clients' requirements.

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WARMA FLOOR

A Warmafloor technical guide

Contents

How we can be of service

We can provide a complete service on any of your projects, from technical assistance to a full design.

For us to provide the best service we would require:

1. Floor plans, by e-mail in AutoCAD.
2. Details of floor constructions- screeded, structural or wooden.
3. Room heat losses if available.
4. Details of your requirements.

We can provide:

1. Advice on technical issues.
2. Advice on manifold locations and zoning.
3. Zone plans detailing manifold positions and zones.
4. Full design and installation by the company.
5. A complete service from concept to commissioning.

Please contact us, we are at your service.

Tel: 01489 581787
Fax: 01489 576444

Email: sales@warmafloor.co.uk
Website: www.warmafloor.co.uk

Design and control strategy

In determining the design and control strategy for underfloor heating, we have drawn up the criteria below based upon our experience in providing underfloor heating installations in thousands of schools and numerous commercial and public buildings along with the feedback from a number of end users.

Today's buildings have lower heat losses - between 30 and 60 watts per sq. mtr. of floor area, dependent upon ventilation rates- therefore the systems now require more effective controls to avoid over or under heating, to save energy and to ensure that heat provided matches the varying energy requirements of the building.

Ideal system design

1. Each room to have a room thermostat/sensor for room control. However, some areas/rooms can be linked to others e.g. single W.C.s, stores, cupboards etc. from adjoining classroom or corridor areas.
2. Weather compensator(s) to be used to vary system flow rate temperatures according to heat loss.
3. Manifolds to be supplied with LPHW with weather compensated flow temperature at a 10°C maximum TD (TD = temperature difference between flow and return pipework) straight from boiler or heating plant.
4. Night Setback thermostats are set 3-4°C below the day setpoint to save energy when unoccupied but also ensure a timely recovery of the room when occupied.
5. If required, different areas operating at different times can be time zone controlled.
6. Any supplementary heating (i.e. radiators) to be sized to operate at the same flow rates and temperatures as required by the underfloor system.
7. Ventilation systems with heat recovery.
8. Integration with BMS and central plant to create a true plant demand philosophy. i.e. only run the boiler plant when a zone (or more) needs it.

Dealing with each item

Individual Room Control

Thermostats/sensors are required by building regulations and enable individual room temperatures to be set. Thermostats/sensors can be tamperproof or room controllable. Adjustable thermostats/sensors can be fully or partially adjustable by the occupant dependent on requirements.

Thoughtful Placement of thermostats/sensors is essential to maintain correct temperature readings. These should be located away from draughts and direct sunlight, and placed within the corresponding controlled heating zone.

If underfloor cooling is being utilised, the room thermostats need to be suitable for underfloor heating/cooling with control wiring to suit this option.

Equipment such as controls, pumps, circuit actuators must be thought about in some detail. Equipment should be readily available and easy to source/replace in the event of a problem or system extension.

Heat source

Water can either be pumped directly through the heat source at the required flow rate and TD or a low loss header can be fitted to the heat source to achieve this TD.

Whatever heat source is used the flow and return temperature difference should always be 10°C or less.

The use of 10°C TD or less is for a number of reasons:

a) Using 10°C TD instead of 15°C or 20°C TD ensures that the system is fully flexible and future proof, in that if the heating plant is replaced at a later date with a heat pump (now being promoted vigorously by the government), there is sufficient flow rate at a low flow temperature for this to operate. The use of a TD higher than 10°C means that the flow temperature is higher to achieve the same mean water temperature. The higher the flow temperature from a heat pump, the lower its efficiency.

b) With the boiler operating at a lower flow temperature it will be more energy efficient.

c) There is a trend to use flow and return temperatures of 80-60°C or 70-50°C. When this is provided to the manifolds, a manifold with pump and thermostatic water mixing valve has to be used to reduce the water temperature. These manifolds have manual setting thermostatic temperature control and therefore can only deliver a fixed water temperature to the underfloor system. Therefore the underfloor flow water temperature cannot vary according to weather conditions and the flow temperature is always at worst case condition.

There are some underfloor designs that run at a 20°C differential, but one must consider that at low heat losses the flow rates are often so low as to make system balancing nearly impossible.

The use of TDs higher than 10°C will mean that pipework sizes are smaller due to the lower flow rates, however this is an artificial installation cost saving compared to the benefits of correct design.

If fixed water temperature control is used it has to be set for worse case conditions and can often cause overshoot to the heating within the room/space with a loss of efficiency.

Night setback

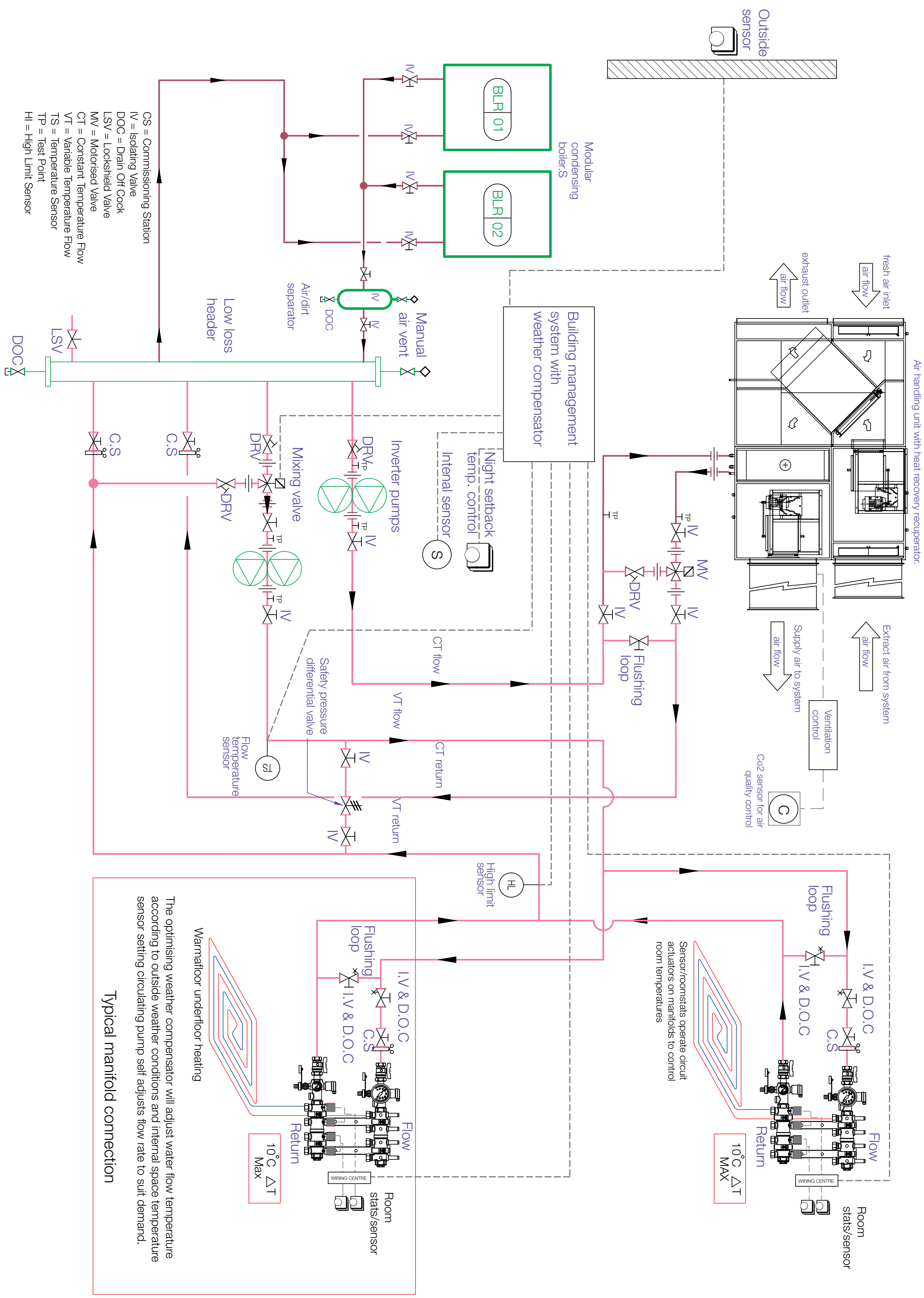
Often educational buildings have shut down times at holidays/weekends etc. During these periods it is better not to have the heating “off”, but to run the building at a lower set back temperature to maintain the fabric temperature and so the building is able to meet temperature requirements easily during occupational times. Research indicates that the cost for this is negligible.

(continued)

Note - There are underfloor systems that promote the use of high temperature hot water through double walled underfloor heating pipe with an air gap between walls. These were developed for adding on to an existing radiator system to run at the same temperature but are now being promoted for complete systems. In our view these systems are inefficient and are unsuitable for modern buildings for reasons as detailed.

Useful contacts

Typical heating schematic



Using heat pumps

Zone Control

In some buildings zone control is required to suit different occupancy times. This can be achieved by the use of a 3 way diverting valve to isolate zones at different times.

Supplementary heating

Sometimes radiators are used as well as underfloor heating. In this situation the radiators are sized at the underfloor flow and return temperatures and run on the same system. Although the radiator will be larger than normal, heat losses are generally much lower than in the past and radiator size should not be an issue. In addition there is the benefit of lower surface temperatures of the radiators.

Ventilation

- Ventilation in schools is covered by government publication - Building Bulletin 101 from DfES

Summer ventilation is often provided by fresh air ventilators such as the Monodraught range, however in winter a different strategy is required.

If we consider a typical heat loss for a school of 2,500 sq metre floor area:

Fabric loss	55,000 watts
Infiltration loss	99,000 watts
Total	**154,000 watts**

It can be seen that 64% of the heat requirement is for fresh air ventilation, providing heating to the incoming air.

Generally, fresh air is provided at a rate of 3-8 litres per person per second, or at a given air change rate. This is a hit and miss approach that results in large energy use in heating the incoming air in cold periods. Instead of this method air quality can be measured by CO^2 sensors and only the required amount of fresh air is introduced to maintain air quality.

The ventilation plant can be a heat recovery ventilation system. These systems can recover 80% + of the exhaust air energy; this will drastically reduce the heat requirement and running cost of the building. In the example above if 80% heat was recovered from the ventilation system this would reduce the energy input of the building by (99,000 x 80%) = 79,200 watts - over 50%.

The heat recovery ventilation unit introduces fresh air when the CO2 sensor demands, which means that there is a delayed start to heating of the fresh air until the building has been occupied for a period of time and the air quality has dropped. Also as the building is occupied there are gains from computers, lighting and people etc., which can be recovered from the exhaust air.

A number of projects have been installed in this manner and in a number of cases, it has been found that the same heating flow temperature as provided to the underfloor heating system can be used to supply the heater battery in the ventilation/heating recovery unit; which negates the requirement for a separate water supply temperature to the plant.

Where this is not possible a separate heat pump can be used with the heat recovery unit to heat the incoming air, or even to provide some cooling in summer.

Using heat pumps with underfloor heating

Heat Pumps are now becoming widely used in preference to heating boilers, they are ideal with underfloor heating.

However, they are not suitable for all applications and the following guidance is provided for application and installation. Whilst we all want to be more environmentally conscious, the decision to use heat pumps with the greater expense of installation involved should be carefully considered, bearing in mind the suitability of the building.

Heat pumps coupled with an underfloor heating system are an ideal choice, as the underfloor system can utilise the low water temperatures produced by the heat pumps more efficiently that any other form of heat emitter.

Suitability

1. Lower energy use in buildings relies mainly on the building being constructed with high levels of insulation so that the heat requirements of the building are less. The introduction of new building

(continued)

Note - Current BREEAM guide indicates that underfloor heating is a slow response system. However this is based upon out of date information and reflects the studies carried out prior to the introduction of part 1 regulations when buildings were poorly insulated and did not have today's effective control systems. Today's correctly designed and controled underfloor systems can provide effective responsive heating for any type of building.

regulations in the last few years has necessitated the construction of buildings to have much higher wall, floor and roof insulation in them and to be tested for air leakage.

So whether the heating is from a boiler or heat pump the energy use will be much less in a well insulated, airtight building.

2. Heat pumps are efficient generally only when coupled with low energy buildings, so if the building has a high heat requirement it is more than likely that their use is not suitable. This is particularly important to remember when considering the use of a heat pump in older commercial or domestic buildings.

Types of heat pump:

1. Air to water. This type of heat pump extracts the heat from the outside air and transfers the energy received to water, which is then pumped around the building.

2. Water to water. This type of heat pump extracts energy from natural sources of water by using a heat exchanger. The natural water sources can be a lake, river or sea water etc.

3. Ground source. This type of heat pump extracts energy from the ground. This is achieved by installing boreholes or loops of pipework (called slinkies) in the earth, through which water is circulated. This circulating water picks up the temperature of the earth and circulates it back to the heat pump, which then transfers the energy received into water which is pumped around the building.

Cost

The type of heat pump selected will affect the installed cost. Air to water heat pumps are the least expensive to install, unlike ground source heat pumps, they do not rely on any external piping in the ground or elsewhere to be installed and connected to it, the cost of which can be high. It will pay in all circumstances to check cost against payback time for the different heat pumps, and also to compare it with a gas boiler installation.

Running costs of heat pumps

Whilst it may be thought that ground source heat pumps provide the lowest running costs, recent comparison tests have shown that the running costs of air to water heat pumps are in fact just as good. It can be argued, why use ground source heat pumps at all as the install cost can be 4- 5 times greater than air to water heat pumps. The only benefit of a ground source heat pump is that when used for cooling the running costs will be cheaper.

Efficiency

Most heat pump quotations show running costs and energy savings likely to be achieved based upon a certain COP (Coefficient Of Performance) rating.

However it should be noted that the COP (efficiency) of the heat pump varies according to the flow temperature of the water from the unit.

Flow temperature °c	COP	
55	3.3	Worse
45	4.2	
35	5.4	Best

Figures provided by a heat pump manufacturer. As can be seen, the lower the flow temperature the greater the efficiency. So to achieve optimum efficiency the water flow temperature has to be as low as possible whilst matching the building heat loss. High heat loss buildings will require a higher flow temperature so the COP (efficiency) and hence running costs, will be higher. So a heat pump may not be the correct choice.

Installation underfloor design

Open loops on the underfloor system

When heat pumps are used it should be noted that whilst larger systems normally operate through a buffer tank, on small systems without a buffer tank there needs to be at least one area of heating (normally the coldest room) where the heat pump thermostat is located, rather than a normal thermostat. This thermostat controls the heat pump's operation and ensures that there is always an open loop of circulation until this thermostat is satisfied and can shut down the heat and circulation pumps in the correct operational manner. This is particularly so on domestic systems and control type should be confirmed by the manufacturer.

Underfloor circuit design

The installation is generally the same as an underfloor heating design. There are a few particular requirements that need to be taken into consideration;

a) The water for the underfloor system comes directly from the heat pump, so the system design relies on central pumping from the heat pump at the required flow temperature. Systems where the use of underfloor manifolds with pump mixers are used are not suitable.

b) Pipe size (dia), length of circuit and spacing will affect the output of underfloor heating at a given flow temperature. When designing the underfloor circuits individual room heat losses (in watts per sq.mtr. of floor area) need to be taken into account so that the spacing is correct. Closer pipework spacings provide a greater output per sq.mtr. at the same flow temperature.

The lower the flow temperature the greater the heat pump efficiency, so the closer the spacings the better - within reason.

Different rooms will have different heating (watts per sq.mtr.) requirements, so different rooms may require different spacings.

Flow 40°c Return 30°c	Room temp	Output Watts/mtr²		
		200mm	250mm	300mm
Mean 35°c	20	68	60	52

An example of different floor outputs at different spacings is as shown based upon the resistance of a tiled floor on screed.

Water flow rates through heat pump

c) The underfloor design flow rates and pressure drops must be calculated early on during the underfloor design and provided to the heat pump manufacturer, who is to check against the design flow rates of the heat pump, and check they are within the capability of the heat pump.

However, if the underfloor design flow rates and pressure drops are greater than the flow rate capability of the heat pump then additional pumps, pipework and controls/wiring will be required. The heat pump manufacturer should advise what is required.

Experience has also shown that heat pump connection requirements vary by manufacturer, so it is most important that the connection and control detail required by the manufacturer is checked and co-ordinated with the underfloor heating requirements.

There is a greater risk of the underfloor heating or heat pump not working correctly, if this information is not checked and confirmed at the design stage.

It should be noted that generally with smaller and domestic heat pumps the circulation pump is provided within the heat pump unit whilst with commercial heat pump units that may not be the case.

Floor coverings

The resistance of the floor covering material will reduce the output of any underfloor system, so the less the resistance the greater the output of the system when running the underfloor pipework at the same temperature. So for the best efficiency, floor coverings should be kept to the minimum resistance. Carpets/underlays and timber coverings all have high resistance, when selecting these, care should be paid to choosing products with low resistance so that flow temperatures and hence running cost are reduced. Some floor coverings have a greater resistance than advised.

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

An example of how the floor coverings affects the floor output. Underfloor pipework at 200 and 300 centres.

Underfloor cooling

Heat pumps can also be used for underfloor cooling in the summer when they run in the reverse cycle to heating. This can provide a very effective/efficient form of comfort cooling especially if ground source or air to water heat pumps are being used.

If underfloor cooling is being utilised, the room thermostats need to be suitable for underfloor heating/cooling with control wiring to suit this option.

Useful contacts

Mitsubishi
Air-to-heat pumps. Heat pump supply and installation.
01707 282 880
www.mitsubishi-aircon.co.uk

Geothermal International
All heat pump types
02476 073 131
www.geoheat.co.uk

CIAT
Water-to-water heat pumps
01932 354 955
www.ciat.co.uk

Floor insulation

All underfloor systems incorporate a layer of floor insulation into or over which the underfloor pipework is installed. It is important therefore to check the architect's floor sections to ensure that this has been allowed for.

Ground floors

Insulation is required to the ground floor to meet building regulations part L2, the type and thickness will be calculated by the architect. The P/A ratio formula (perimetre in metres/area in sq metres) is generally used to calculate this. The greater the ratio the thicker the insulation is. In general terms this means that the smaller the building footprint the deeper the insulation has to be.

In most buildings the depth and 'U' value of this insulation alone is suitable for the underfloor heating. No other insulation is required.

First and intermediate floors

Floor insulation is required on all intermediate floors to stop downward heat loss, 25 mm polystyrene floor insulation is sufficient for this.

Floor loadings

As well as having thermal properties, floor insulation comes in compressive strength of various grades. Where higher than normal floor loads are expected, such as atriums where high level access towers may be used, insulation with higher compressive strength than normal may be required.

Floor insulation - BREEAM green guide

BREEAM points ratings based upon energy used to obtain and manufacture. A+ is best rating D is lowest rating.

Floor insulation material	Manufacturers names	Element number	BREEAM summary rating
Cavity blown glass wool insulation - density 17 kg/m³	-	815320036	A+
cavity blown glass wool insulation - density 30 kg/m³	-	815320037	A+
Cellular glass insulation - density 105 kg/m³	Foamglass	815320019	C
cellular glass insulation - density 120 kg/m³	Foamglass	815320020	D
Corkboard insulation - density 120 kg/m³	-	815320021	A
Dry blown recycled cellulose insulation - density 24 kg/m³	-	815320035	A+
Expanded polystyrene (EPS 70) - density 15 kg/m³ (eps	Springvale, Jablite etc	815320022	A+
Expanded polystyrene (EPS 100 - density 20 kg/m³	Springvale, Jablite etc	815320023	A+
Expanded polystyrene (EPS 150) - density 25 kg/m³	Springvale, Jablite etc	815320024	A+
Expanded polystyrene (EPS 200) - density 30 kg/m³	Springvale, Jablite etc	815320025	A+
Extruded polystrene (XPS) (HFC blown) - density 35 kg/m³	Polyfoam,Celecta Sytrofoam etc	815320027	E
Glass wool insulation - denstiy 10 kg/m³	Rockwool	815320005	A+
Glass wool insulation - denstiy 12 kg/m³	Rockwool	815320001	A+
Glass wool insulation - denstiy 24 kg/m³	Rockwool	815320002	A+
Glass wool insulation - denstiy 32 kg/m³	Rockwool	815320003	A+
Glass wool insulation - denstiy 48 kg/m³	Rockwool	815320004	A+
Rigid urethane (pentane blown) - density 32 kg/m³	Celotex, Kingspan, Ecotherm etc	815320017	A
Sheeps wool insulation - density 25 kg/m³	-	815320033	A
Stone wool insulation - density 100 kg/m³	Rockwool	815320011	A
Stone wool insulation - density 128 kg/m³	Rockwool	815320012	B
Stone wool insulation - density 140 kg/m³	Rockwool	815320013	B
Stone wool insulation - density 160 kg/m³	Rockwool	815320014	C
Stone wool insulation - density 33 kg/m³	Rockwool	815320007	A+
Stone wool insulation - density 45 kg/m³	Rockwool	815320008	A+
Stone wool insulation - density 60 kg/m³	Rockwool	815320009	A+
Stone wool insulation - density 80 kg/m³	Rockwool	815320010	A
Straw bale used as insulation	-	815320029	A
Strawboard thermal insulation 420 kg/m³	-	815320034	C
Wet blown recycled cellulose insulation - density 45 kg/m³	-	815320039	A+

Floor insulation - properties

Floor insulation material	Expanded polystrene	Expanded polystrene	Expanded polystrene	Platinum expanded polystrene	Extruded polystrene	Extruded polystrene	Polyurethene
Grade	EPS 70 (SDN)	EPS 100 (HDN)	EPS 150(EHDN)	EPS 100	200	350	PUR/PIR
Green guide	A+	A+	A+	A+	E	E	A
Trade Names	Jablite, Springvale etc	Jablite, Springvale etc	Jablite, Springvale etc	Jablite, Springvale etc	Styrofoam, Polyfoam etc,	Styrofoam, Polyfoam etc	Celotex, Kingspan, Ecotherm etc
ODP (Ozone depletion potential)	0	0	0	0	0	0	0
CFC Free	yes	yes	yes	yes	yes	yes	yes
Compressive Strength	70 kpa	100 kpa	150 kpa	100 kpa	200 kpa	350 kpa	150 kpa
Bending Strength	115 kpa	150 kpa	205	150 kpa	400 kpa	601 kpa	200 kpa
Thermal conductivity W/mk	0.038	0.035	0.034	0.030	0.029	0.029	0.023
Resistance of floor insulation at different thicknessses (R values) (Thermal Resistance m²K/W)							
Thickness (mm)	R Value	R Value	R Value	R Value	R Value	R Value	R Value
20	0.526	0.571	0.588	0.667	0.690	0.690	0.870
25	0.658	0.714	0.735	0.833	0.862	0.862	1.087
30	0.789	0.857	0.882	1.000	1.034	1.034	1.304
35	0.921	1.000	1.029	1.167	1.207	1.207	1.522
40	1.053	1.143	1.176	1.333	1.379	1.379	1.739
45	1.184	1.286	1.324	1.500	1.552	1.552	1.957
50	1.316	1.429	1.471	1.667	1.724	1.724	2.174
60	1.579	1.714	1.765	2.000	2.069	2.069	2.609
65	1.711	1.857	1.912	2.167	2.241	2.241	2.826
70	1.842	2.000	2.059	2.333	2.414	2.414	3.043
75	1.974	2.143	2.206	2.500	2.586	2.586	3.261
80	2.105	2.286	2.353	2.667	2.759	2.759	3.478
90	2.368	2.571	2.647	3.000	3.103	3.103	3.913
100	2.632	2.857	2.941	3.333	3.448	3.448	4.348
110	2.895	3.143	3.235	3.667	3.793	3.793	4.783
120	3.158	3.429	3.529	4.000	4.138	4.138	5.217

GWP and ODP. All insulations above have zero ODP and GWP less than 5

Technical Terms

Thermal Conductivity - Thermal conductivity is the rate of heat that flows through a 1 mtr depth of material of 1 sq metre area at 1 degree K (Kelvin) difference in temperature. Different materials have different rates.

Thermal resistance (R Value) - Thermal resistance is the rate of heat flow through a material at a specific thickness.

U value - The U value is 1/R value. The U value of any depth of insulation above is calculated as U =1/R Value. Therefore 'U' value of 50 mm EPS70 (SDN) is 1/1.316 = 0.7598. The 'U' value of a floor is the combined sum of all the floor materials at there own thicknesses added together.

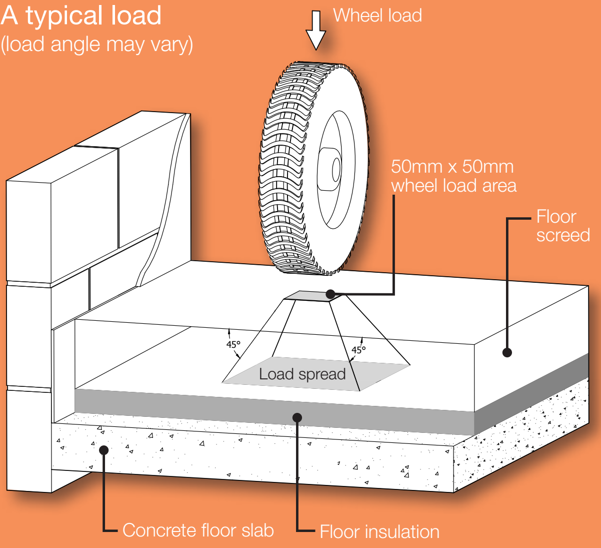
Useful contacts

Springvalve
(polystyrene)
0845 769 7452
www.springvalve.com

Ecotherm
(PUR/PIR)
01702 520166
www.ecotherm.co.uk

Floor point loadings

A typical load
(load angle may vary)



Wheel load = (wheel load / number of wheels)

Theoretical calculation to determine the effect of point loads through screeds on floor insulation layer.

Any load put upon a screeded floor is initially carried by the floor finish and screed. This load-spreading layer, disperses the point load across the floor area. The load is also born by the underfloor heating insulation layer below the screed.

If the load upon the floor causes the insulation layer to compress too much the screed could crack due to insufficient support.

Insulation grades of varying strength are available to suit different load requirements. As well as the strength of the insulation, it is critical that it's compressibility (that is by how much the insulation can be compressed and return to its original size after repeated loads being applied) is taken into account.

Generally, the compressibility of standard floor insulation used in underfloor heating installations below floor screeds will easily withstand the floor load imposed upon it.

However in buildings where heavy equipment, traffic, access towers, cherry pickers etc are used, high point loads can cause a problem.

In these situations calculations by a structural engineer are required to determine the force transmitted through the insulation and the strength and type of insulation required for this.

To understand this, the theoretical diagram above details how the load impacts upon the floor.

There are a number of variable factors that affect the load calculation:

- The point load.
- Static or dynamic load.
- The foot print area of the load.
- Depth of screed.
- Type of screed and its ability to disperse the load.
- The ° angle of the load through the floor.
- Depth of insulation.

It should be noted that safety margins in these theoretical calculations of 3-4 times are usually incorporated to reflect unknown data.

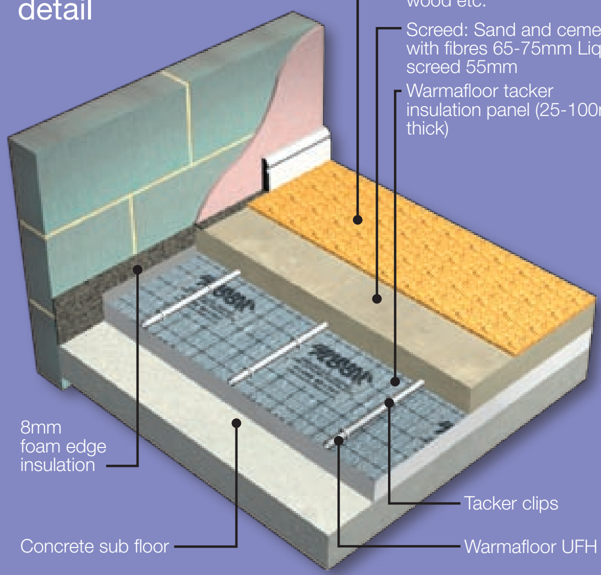
Note - It is important to remember that it is chiefly the ability of the spreading layer to disperse the load that determines any eventual substrate compression and therefore the suitability of the chosen insulation grade.

Remember-screed must be fully cured to full strength before any loads can be applied to it.

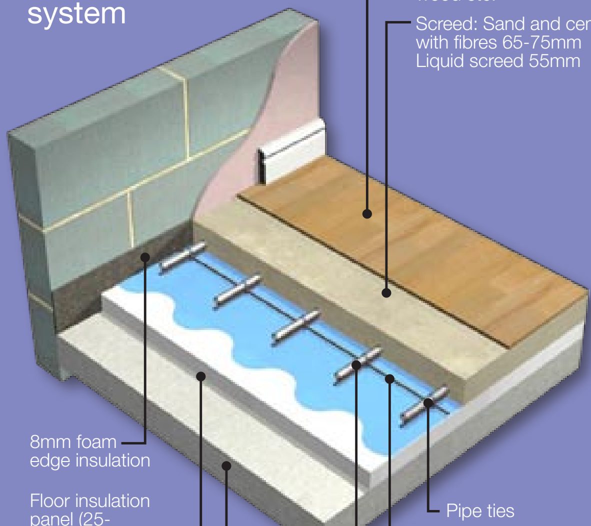
Load and point load calculations are a structural engineering calculation and calculations of load should always be carried out by a qualified structural engineer.

Solid floor screeded systems

Tacker system detail



Wire grid system



Warmafloor systems can be fitted to any type of concrete floor construction which has a screed topping.

The elements of the system; floor insulation, edge insulation, moisture barrier, fixing system and pipework are installed utilising one of the Warmafloor systems as detailed, then covered with the appropriate screed and final floor finish. The system can be selected according to constructional requirements and we will specify what we consider the most appropriate for the project. We will also advise on the most suitable screed depth and type to be used.

Tacker system

The Warmafloor Tacker system is the most widely used system for use in screeded floors due to its versatility and ease of installation.

Warmafloor Tacker floor insulation panels are available in any thickness or insulation material providing solutions to any floor requirement.

The floor insulation panels, whilst generally supplied in expanded polystyrene (EPS) are also available polyurethane (PUR) such as Celotex or in extruded polystyrene (EPS) proving extra strength or greater U values.

Warmafloor Tacker floor insulation panels have a hessian based polyethylene foil, laminated to the face of the panel. The foil has guidelines allowing for correct pipe spacing and fixing and also acts as a moisture barrier.

Acoustic floors to Part E regulations

If the upper floors are being installed to the new sound transmission regulations, a sound deadening foam quilt is required under the underfloor heating insulation; this can be easily incorporated at the design stage.

Wire grid system

The Warmafloor Wire Grid system is a simple to install approach that provides a robust fixing system where Warmafloor Tacker floor insulation panels are not used. The floor is fitted with suitable floor insulation overlaid with a moisture barrier with edge insulation to all walls in preparation for the installation.

An A142 wire grid, which has a 200mm^2 mesh pattern, is laid butt jointed onto the floor insulation.

Warmafloor P.B. pipework is then laid out on the grid in the required configuration and secured with plastic securing

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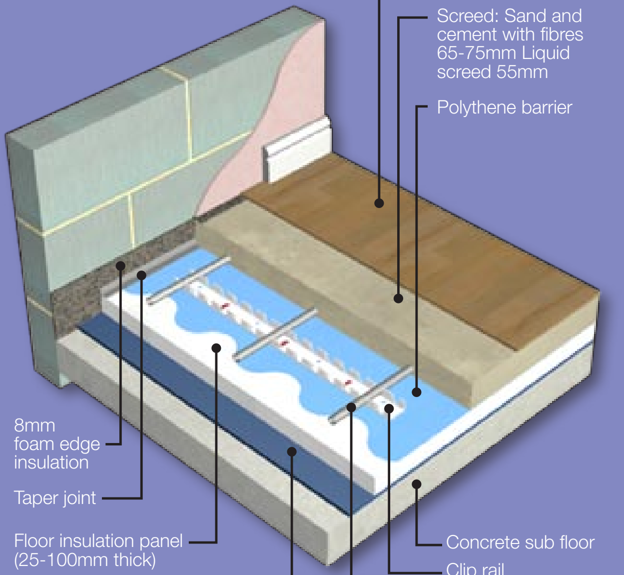
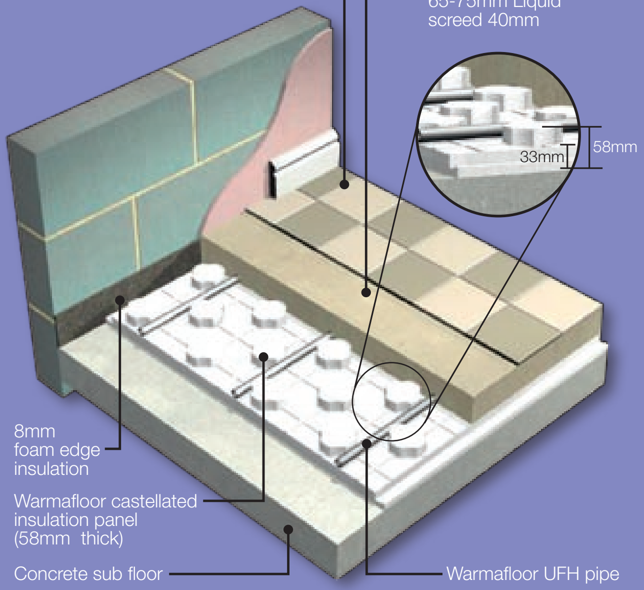
Solid floor screeded systems (continued)

Clip rail system



Castellated panel system



ties. The pipework is circuited back to the manifold. The pipework is then pressure tested before screed laying is carried out before the system is put into use.

The Warmafloor wire grid system is suitable for sand cement or concrete screed coverings but is not suitable for liquid (anhydrate) screed applications.

Clip rail system

The Warmafloor clip rail system comprises plastic pipe locating rails fitted to the floor insulation into which Warmafloor PB Pipework is clipped.

The rails are available for both 16mm and 20mm pipe. Edge insulation and floor insulation overlaid with a plastic moisture barrier is first installed to cover the floor area. The Warmafloor clip rails are then located according to the system design and secured into the floor insulation with fixing pins.

Once the rails are fixed Warmafloor PB pipework is laid out in the required system configuration for the building and connected to the manifold.

Castellated panel system

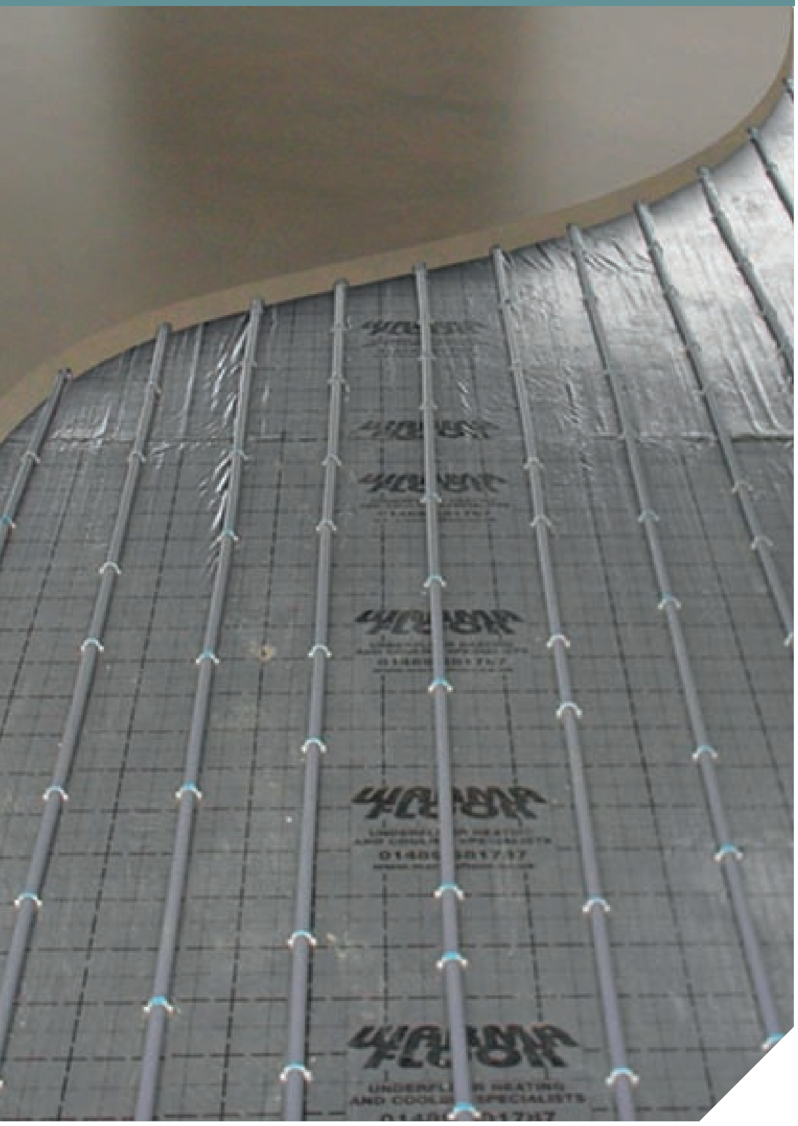
Warmafloor castellated insulation panels are interlocking panels in EPS 100 polystyrene. They incorporate pipe locating castles on the upper face with a plastic finish which acts as a moisture barrier.

Edge insulation is laid around the area to be heated, providing a perimeter heat loss and for expansion. The castellated panels are laid over the floor area, Warmafloor 16mm or 20mm PB pipework is clipped into the panels and the installation is complete.

The castellated panel is better than pocketed systems as the screed can surround the pipe providing a much better output.

Screeds over underfloor heating

Floating screeds



Except for buildings where the concrete slab is left exposed such as a warehouse, all concrete floors are covered with a screed layer which provides a final level finish onto which is installed the floor covering, tiles, carpet, wood etc.

When underfloor heating is installed, perimeter wall insulation and floor insulation panels with a fitted moisture barrier are installed on the floor slab and the underfloor pipework secured to the panels. This is then covered with the final screed layer.

The screed has to be of suitable depth for strength and to provide sufficient cover over the underfloor heating pipework to avoid the screed cracking. When installed over floor insulation the screed is called a floating screed.

There are four main types of screed that are used:

Sand and Cement (with added fibres)

Sand and cement screeds are a mixture of sand and cement generally in a 4 to 1 mixture ratio with water. We recommend the use of added fibres which reduce micro cracking to the screed surface and surface abrasion.

Sand and Cement Enhanced Screeds

Enhanced screeds are sand and cement screeds with added chemicals that improve the properties of the standard screed. The improved properties include faster drying times and/or extra strength. The additives are made by various manufacturers and are sold under their own trade name, e.g. Flexidry. The screeds can be obtained ready mixed or the additives can be site mixed (Warmafloor recommends Flexidry products).

Anhydrite (Calcium Sulphate) Screeds

Anhydrite screeds are a different type of screed from sand and cement. The screed is made from calcium sulphate, sand, water and other chemicals to form a liquid screed. Unlike sand and cement screeds (which are spread, compacted and levelled), the screed is poured onto the floor through a delivery hose and levelled with a dappling bar. Large areas can be covered much quicker with this screed type. It is essential however, that the floor and edge insulation must be fully waterproofed by taping and sealing all joints in the floor and edge insulation. These screeds are sold under manufacturers trade names and delivered to site ready mixed.

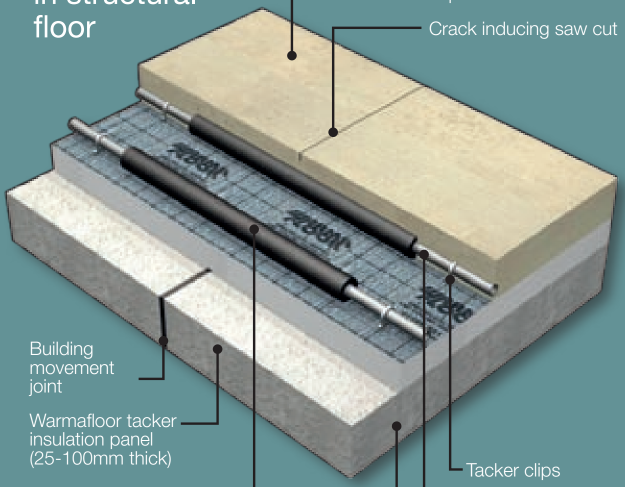
Whilst a large area of this screed can be installed quickly it has the disadvantage of a long drying time and it cannot be laid in wet areas or laid to falls.

(continued)

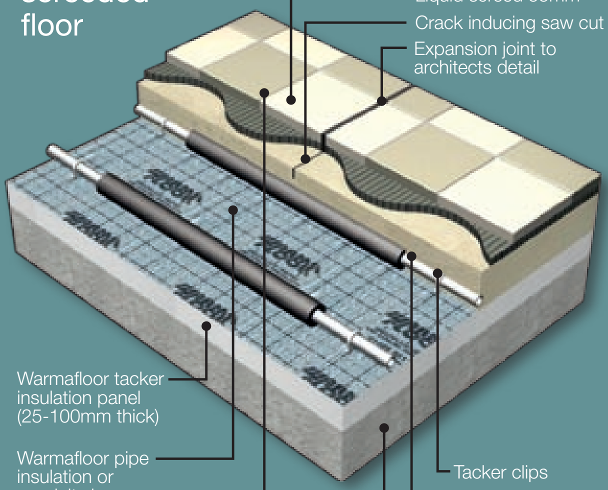
Remember - No concrete floor will be flat and level on a building site, so it is best do a level floor survey to ensure enough depth above the floor slab is available for the underfloor heating and screed. When specifying screed depths, ensure the minimum specified depth allows for some intolerance in the floor slab.

Screeds over underfloor heating (continued)

Movement joint in structural floor



Expansion joint - screeded floor



Liquid Cementatious Screeds

This type of screed is similar to an Anhydrite screed but uses cement instead of calcium sulphate, it is generally much stronger and can be rapid drying, although available it is not as common in use.

Expansion Joints-Crack Inducers

All screeds expand and contract to some degree so allowance has to be made for this. The perimeter insulation fitted with underfloor heating allows for some of this, however large areas will need to have expansion joints or crack inducer cuts in the screed itself to allow movement and avoid screed cracking. Expansion joints will also be required to mirror any expansion joints in the floor slab. These should be as recommended by the screeder or architect.

Day Joints

Day joints are positions where the screed has been finished on one day and will be carried on the next day. In these positions, to avoid cracking, the joint needs to be reinforced with mesh to bond the screed together. Alternatively an expansion joint could be fitted in this position.

Floor tiles, marble floors, stone floors

Where the screed is to be finished with a rigid tile, marble or stone topping the expansion provisions are very important as screed movement can crack the floor finish. The flooring should be designed by the floor installer detailing expansion provision in the floor tiles themselves. This can then be mirrored with a separate bedding layer with expansion joints or in the screed below.

Alternatively, a de-bonded bedding layer for the floor finishes can be installed above the screed.

Screed level and surface flatness

All screeds have to be installed to a British Standard of level and flatness.

Flatness - the variation in gap under a straightedge placed anywhere on the surface to be not more than the following:

A - 10 mm under a 2 metre straightedge SR3
B - 5 mm under a 2 metre straightedge SR2*
C - 3 mm under a 2 metre straightedge SR1

*In general use

Permitted level deviation from floor datum +/– 15mm.

Reinforcing Mesh

In sand cement type screeds the use of D49 mesh or chicken wire or an SBR slurry consisting of polymer, cement and water can be used to reinforce the screed to avoid cracking. In areas where a number of underfloor circuits can come together such as some manifold locations, or where the screed is below the recommended thickness, the screed should be reinforced by the installation of D49 mesh, at mid point in the screed, over the underfloor pipework.

Screed Treatment for finishes

If an adhesive or other finish is to be applied to the screed, it may not be able to be applied directly; a sealer may be required first. Always check with adhesive/finish manufacturer.

Protection

Screeds are not a wearing floor finish and should always be protected until floor covering is fitted.

Screed over underfloor heating (floating screeds)

Screed types		Sand and cement with added fibres	Enhanced sand and cement with added fibres	Enhanced sand and cement with added fibres	Anhydrate (calcium sulphate)	Flowing cementitious
Trade Names		Site or plant mix	- Flexidry - Tarmac Truscreed - K-Screed	- Flexidry etc.	- Tarmac Truflow - RMC Supaflo - Lafarge Gyvlon	- Ecoscreed
Installation rate m² per day		100-250	100-250	100-250	500-1000	600
Screed strength		18Nmm²	25Nmm²	30Nmm²	30Nmm²	30Nmm²
Recommended minimum screed thickness over insulation*	Domestic*	65mm	65mm*	65mm	55mm	55mm
	Commercial*	75mm	75mm*	75mm	55mm	55mm
Minimum cover over pipework		40	40	40	30	25
Light foot traffic		24-48 hours	12 hours	12 hours	24-48 hours	4 hours
Site traffic		5 days	5 days	5 days	5 days	2 days
Suitable for wet areas		Yes	Yes	Yes	No	Yes
Approx screed drying times @20°c ambient		-	1mm per day up to 40mm the 0.5mm per day	-	1mm per day up to 40mm the 0.5mm per day	-
55mm thick		-	-	-	70 days	70 days
60mm thick		80 days	18 days	7 days	80 days	80 days
65mm thick		90 days	20 days	7 days	90 days	90 days
75mm thick		110 days	22 days	7 days	110 days	110 days

Notes:

Drying times - Exact drying times for screed to completely dry are dependant upon temperature, humidity and air movement in building.

*Cover over pipes - Screed depths stated above allow sufficient cover over underfloor pipework allowing for some level of intolerance in floor slab.

Floor coverings - Before application of floor coverings, moisture content of screed must be checked.

Lower screed thickness - Some enhanced sand cement screeds can be installed at a depth less than shown in the table, when used with reinforcement - however in all cases this must be checked and confirmed by the screed manufacturer (e.g. Mapei Topchem + screed).

Useful contacts

Screed Moisture Testing of modern screeds must be done using a **Carbide Bomb Tester** not an electrical resistance type. These can be obtained from:

Flexidry Shop
0845 555 5656
www.flexidry.shop.com

Flexidry Screed is recommended by Warmafloor which is available in variable drying times in 7,14 or 21 days and also is more resistance to cracking and surface abrasion.

Flexidry
0845 555 5656
www.flexidry.com

For technical assistance on screeds contact:

CSC Screeding
0845 500 4055
www.cscscreeding.co.uk

Tarmac
0800 121 8218
www.tarmac.co.uk

Ecoscreed
01372 842 102
www.websiteaddress.com

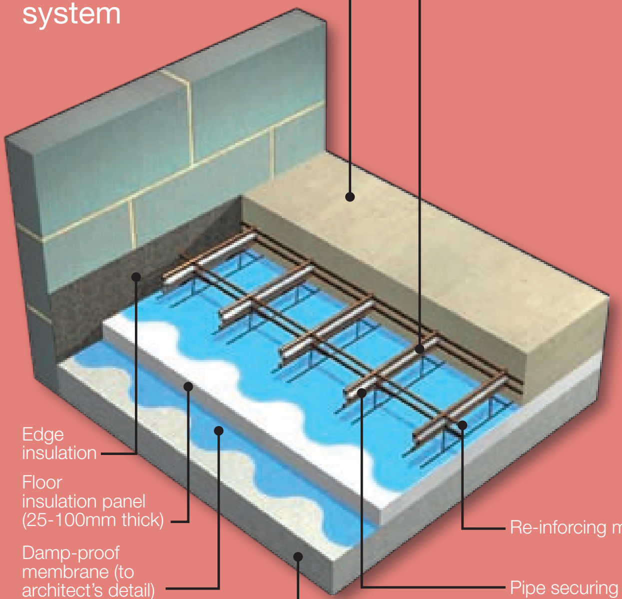
Lafarge Gyvlon
01925 428 780
www.gyvlon.net

Cemex
01932 568 833
www.cemax.co.uk

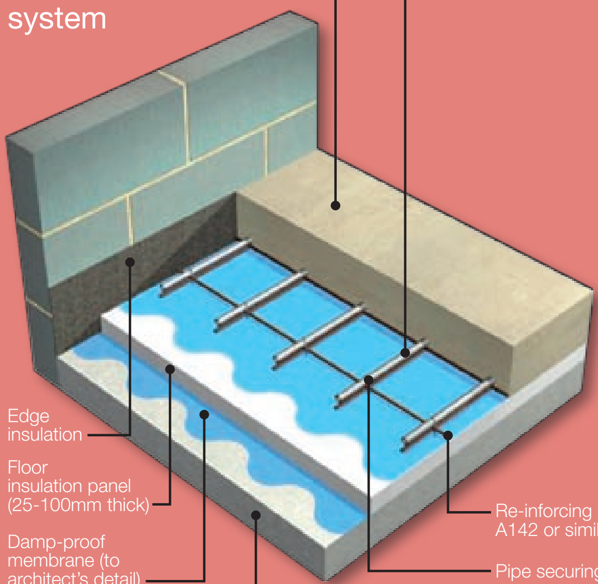
Note: always contact the screed manufacturer for specific requirements.

Structural slab floor systems

Structural floor with reinforcing mesh system



Concrete slab floor wire mesh system



Warmafloor systems can be incorporated within load bearing structural floors in a variety of applications.

There are generally two types of structural floor construction; those that consist of a simple concrete slab construction, and those which incorporate a re-enforcing wire mesh grid at mid level in the floor.

Structural floor system

The floor construction generally comprises a compacted and level hardcore bed of sand, blinded flat, onto which is laid insulation panels of the required density and thickness. This is then overlaid with a vapour barrier, and edge insulation is installed to the perimeter of the building.

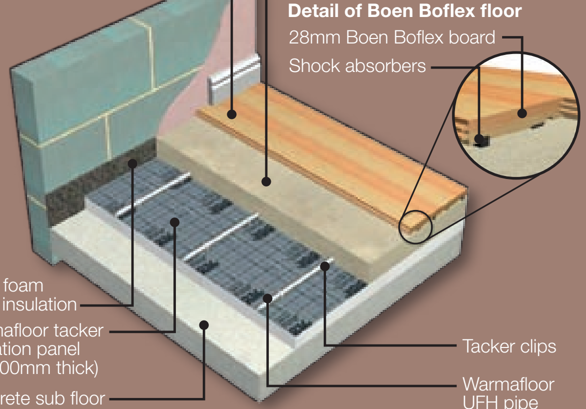
Wire mesh is then installed on the floor insulation – in the case of simple concrete slab floors – or in the case of structural floors, at the required level in the slab.

Warmafloor PB pipework is secured to the mesh with pipe ties in the required configuration and spacing, concrete is then laid to the correct depth and strength, dependent upon the design criteria of the slab.

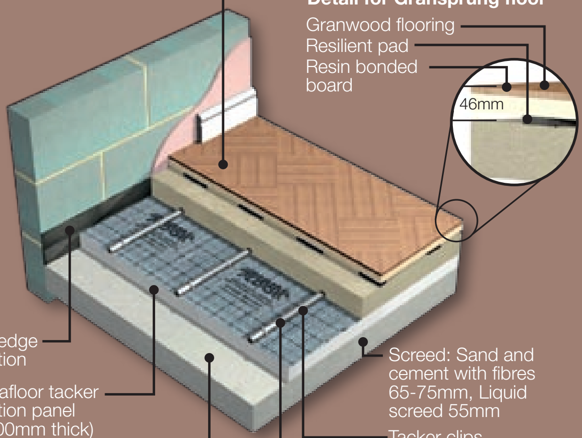
Wooden floors

Sports halls, assembly halls and dance studios etc.

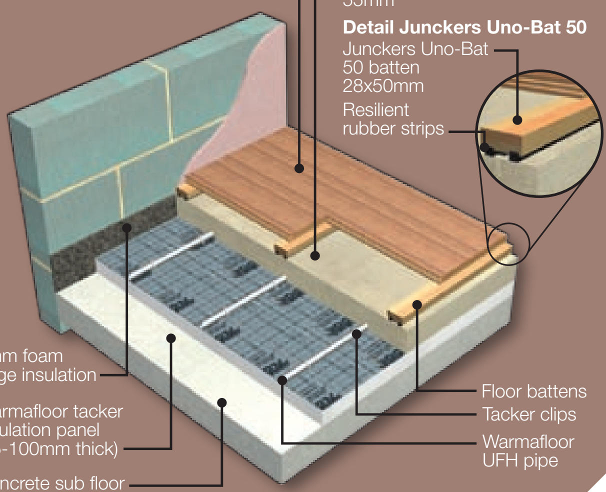
Boflex floor on heated screed



Gransprung flooring system



Junckers Uno-Bat 50 in heated screed



Underfloor Heating can be installed with most types of wooden floors quite effectively. Care must be taken in the design of the system and the flooring materials used to ensure a trouble free system.

Floor types

There are a wide variety of wooden floors available for varying purposes from sports to dance; they also have a wide range of different floor finishes. They either fit directly onto the floor screed or will be mounted on floor battens of various types. In our opinion wooden floor systems operate best when fitted over a heated screed, as the screed acts as an energy store during off periods, retaining some heat; whereas a completely wooden system looses all its heat as the system is lightweight and needs more time to heat up from cold.

Heat Output

The Heat Output from a wooden floor system is limited by the wooden floor itself. As timber is an insulant, it restricts the available heat that can penetrate through it. The maximum output through the floor is between 70 and 75 watts per sq.mtr. of floor, whereas concrete/screeded floors can provide 100 watts per sq.mtr.

This however is not a problem in a modern building where heat output required is generally in the range of 30 to 65 watts per square metre.

The most suitable wooden floors are those with the lowest resistance to heat transfer, so floors which rely on a thick foam underlay below the floor to provide sufficient spring are normally unsuitable.

Output required 50watts/sq.mtr	22mm wooden floor on batten resistance (°C)	22mm wooden floor on foam resistance (°C)
Floor surface temp	25.8	25.8
Temperature loss through board	-9	-9
Temperature loss through foam	0	-15
Screed surface temp	33.5	49.8
Mean water flow temperature	40.5	55.8

Temperatures will vary for different sq.mtr. outputs

If the underfloor system is in a building with various floor finishes- some screeded, vinyl, some carpet or timber- and the underfloor heating is running at the same mean temperature for all floor types, the output from the wooden floor will be less at the same mean temperature and pipe spacing, which may be insufficient to heat that room. In this case, the pipe spacing needs to be reduced

(continued)

Useful contacts

Junckers (Uno-Bat 50)
01376 534 700
www.junckers.co.uk

Reflex Sports Floors (Boflex)
0800 345 7085
www.reflexsports.co.uk

Granswood (Gransprung)
01773 606 060
www.granwood.co.uk

and the underfloor heating mean flow temperature will have to be increased locally in the wood floor area to take into account of this reduction. This may mean that a separate manifold, at a different mean flow temperature will have to be used.

Air gaps between heated screed and timber floors

It is often stated that in battened floors an air gap between a heated screed and a timber floor will reduce output.

However this is not the case. We have installed systems in this method for a number of years. Having a complete heated screed floor below the timber floor results in a much larger heated floor surface being available. This radiates to the underside of the timber floor providing a uniform heat over the surface area instead of more localized heat that occurs with diffusion plates, so the output is the same -if not greater- and the floor surface temperature variations are much less, which is better for the timber floor itself.

An additional benefit is that the timber floor installation is much faster and there is no interface between the underfloor system and the floor above.

Chipboard and Plywood Floors

Using underfloor heating with chipboard or plywood floors generally presents no problems, providing the thickness of the flooring is kept to reasonable limits.

Hardwood Floors

Careful specification is required in each instance to ensure lifelong structural stability and performance of hardwood floors. Wood, being a hygroscopic material, is very susceptible to movement when exposed to different humidity levels. Timber absorbs moisture from the atmosphere when humidity is high (normally during the summer months), causing expansion; whilst in the winter months when the heating system is in operation and humidity is low, the timber will shrink. This expansion and contraction is most noticeable across the width of a piece of wood and in some cases, particularly with boarded floors. The compound effect may add up to several inches of movement across a room width. Therefore, if traditionally machined tongued and grooved boards are installed in such an environment, be prepared to accept large amounts of movement in the floor.

Laminate Hardwood Floors

To overcome the problems associated with hardwood plank floors, a number of flooring companies now produce laminate hardwood floors. These consist of layers of plywood with hardwood veneers or plastic finishes bonded to the surface. This construction method offers a stable solution which avoids most shrinkage and gaping problems associated with timber.

Suitability

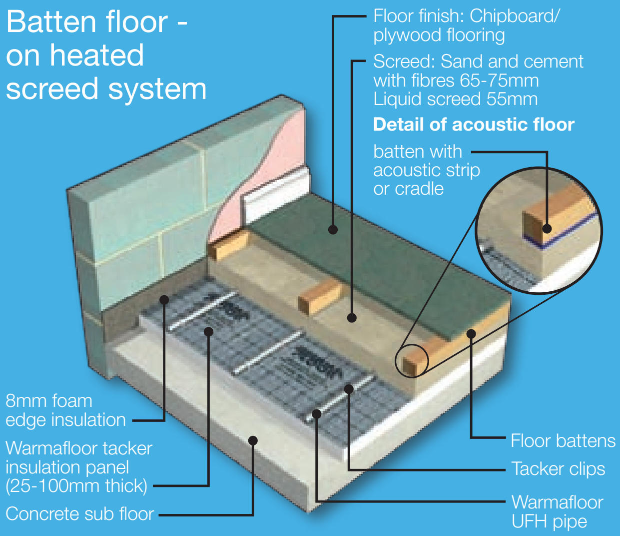
To determine the suitability of any flooring for use over underfloor heating, the following information from the client/ architect is required:

- Flooring manufacturer.
- Manufacturer’s floor type.
- Floor section with dimensions.
- Floor resistance
- Manufacturers installation sheet with particular reference to fitting over underfloor heating

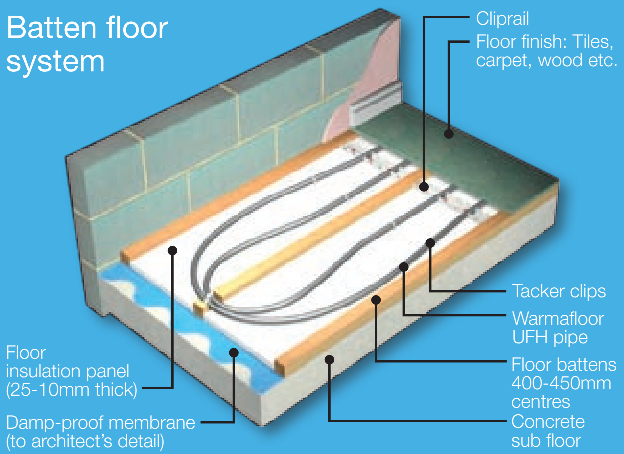
Warmafloor has fitted underfloor heating in conjunction with numerous types of timber floors including the following manufacturers:- Junckers, Reflex Sports, Boflex sports floors, Gransprung, Harlequin, Forerunner and Pulastic.

Batten/sprung floor systems

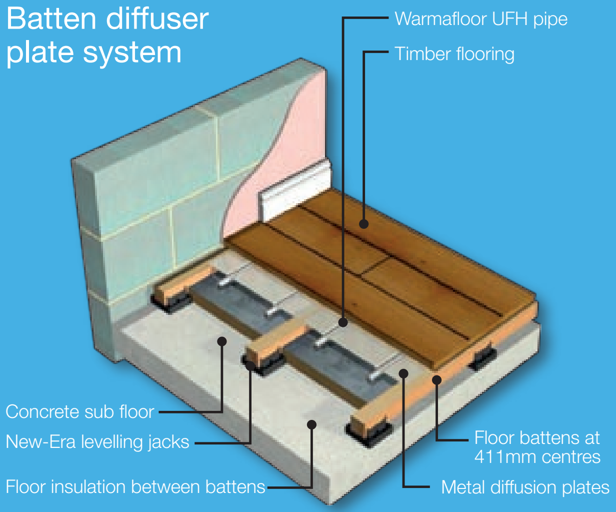
Batten floor - on heated screed system



Batten floor system



Batten diffuser plate system



Warmafloor has a number of systems to suit different applications of batten and sprung floors.

These can be split into four system categories for use over:

- Heated screeds
- Concrete or timber floors
- Engineered timber floors
- Concrete floors with adjustable height battens.

Batten floor over heated screeds

Batten floors can be installed over floors that have a Warmafloor heating system already embedded in the screed. The screed provides a level surface so that a battened floor system can be installed on top of the heated screed without further builder's work being required. This system is widely used in sports and assembly halls and can be used with batten depths up to 50 mm. The screed provides a uniform heat to the timber floor avoiding peaks of temperature that can occur with other methods fitted between battens.

Batten floor over concrete

In this application suitable floor insulation is laid between the floor battens and the underfloor pipework is installed using a clip rail fixing, or secured into the insulation using Tacker pipe clips.

Batten diffuser plate system over concrete

In the case of sports halls and similar applications, battened floors are sometimes installed where adjustable height floor battens are used providing a variable floor void between 50mm-400mm. In these situations a diffuser plate system is required. Floor insulation should be installed between battens by the flooring contractor and Warmafloor metal diffuser plates with pipe grooves are installed. After installation of the plates, pipework is slotted in to the grooves in the plates and circuited back to the manifold. Flooring is then installed over the completed system.

Where this system is used on ground floors the thermal value of the insulation used must meet the requirements of Part L2 building regulations.

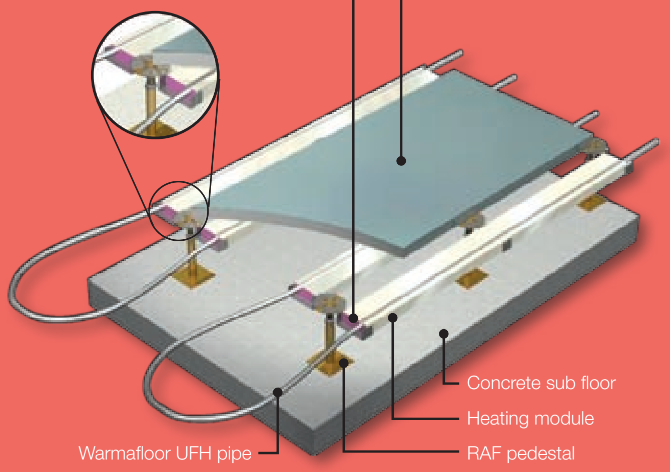
Acoustic floors to Part E regulations

If the upper floors are being installed to the new sound transmission regulations, the battens should be fitted with acoustic foam strips or cradles, often with acoustic mineral wool.

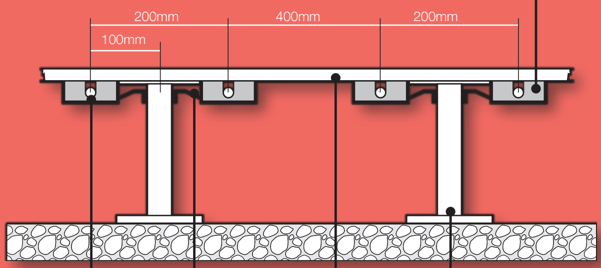
Raised Access Flooring (RAF) systems

Raised Access Flooring system

Detail for raised access



Section through floor



The Warmafloor Raised Access Flooring (RAF) system provides warm water underfloor heating/cooling into standard raised access floor.

The system can be used with many Kingspan and Propaflor RAF systems.

The RAF floor pedestals are installed and the special Warmafloor RAF brackets are attached to the pedestals. Warmafloor 35mm thick, 1.2m long heating modules are then quickly and simply clipped into the brackets. Once these are all fitted, continuous lengths of Warmafloor 16mm 5 layer underfloor heating pipework is inserted into the Warmafloor Raised Access Floor modules connecting to underfloor manifolds as necessary. Floor panels are then laid as normal.

Heating

The Warmafloor RAF system can provide radiant heating between 50-80Wm² at a flow temperature of 45 - 60°C

Cooling

Using a flow temperature of 13°C the system can provide upto 25Wm² from the floor surface. If used in conjunction with Plenum Ventilation and standard grilled floor panels, this can be increased to 35- 40 wm²

The Warmafloor Raised Access Flooring System makes it possible to install heating/cooling within raised floors, providing a way for large open plan offices to be heated evenly and comfortably. Areas can be zoned and independently controlled should there be multiple offices and should layouts change the heating modules can be repositioned as required providing a very flexible system.

System Benefits

- A very cost effective solution compared with other alternatives.
- Fast efficient installation
- Heating modules provide good access to floor void
- Can be retro-fitted to suitable floors
- System future proof, as can be dismounted and repositioned.

There are various types of pedestals for RAF systems. The name and type of the pedestal should be stated so. The correct RAF bracket can be supplied for installation.

Using natural ventilation systems

Natural ventilation systems such as the Monodraught, Passivent and Windavent systems are often used in conjunction with underfloor heating. When they are, it is important that they do not conflict with each other. Detailed below is a typical Monodraught control strategy, other manufacturers may vary.

The dampers to the system are controlled by a central control panel, which has spring/summer/autumn/winter setting. Spring/summer/autumn/winter operation is fully automatic. Spring operation starts 1st March; summer 1st May; autumn 1st September; winter 1st November.

Summer setting

In summertime (daytime) the ventilation dampers will start to open at a room temperature of 16°C and if the room temperature rises, the dampers will open 20% for every 1°C increase in temperature until they are fully open at 21°C. At night time (midnight) the dampers will open fully to purge the room of stale air and then return to temperature control at 6 o'clock the next morning.

Winter settings

Winter operation is as above but with a set point of 22°C before the dampers start to open. (At 27°C, they will be fully open.)

To prevent the room from over-cooling, the dampers will not open at night.

Spring and autumn settings

The same as the Winter Setting but with a set point of 19°C, with fully open set at 24°C.

Manual override

If extra ventilation is needed before dampers are fully open, press the small button marked 'open' on the temperature sensor. The open LED will illuminate and the dampers will be fully open for 20 minutes. If the 'open' button is pressed a second time, the system will revert to automatic control. The 'close' button operates in a similar way but it will close the dampers for 20 minutes.

Minimum Temperature setting

Please note that if the room temperature is below 15°C, then the override push button will not open the dampers until the room temperature rises above 15°C. Night time cooling (in the summer period) is also inhibited below 15°C.

CO_2 Operation

If the CO_2 level rises above 1500ppm, the damper will open to 40% for 15 minutes and then close for 30 minutes and it will repeat this operation until the CO_2 level falls below 1400ppm. If the CO_2 level falls below 1400ppm during the 15 minute opening period then the dampers will revert to temperature control until the CO_2 level reaches 1500ppm. If the internal temperature calls for the dampers to be open more than 40% during this cycle then the dampers will open to the temperature settings until the room temperature calls for less than 40% opening.

Heating system interlock

A signal from the BMS could be used to operate an interlock to inhibit the controls when the heating is on.

Fire alarm interlock

A signal from the fire alarm system could be used to close the dampers if the alarm is activated.

Useful contacts

Moondraught
01494 897 700
www.moondraught.com

Passivent
0161 962 7113
www.passivent.com

A1 Ridge Flue Limited
0870 160 2280
www.a1flues.co.uk

Underfloor manifolds and actuators

Standard modular manifolds

Warmafloor standard modular manifolds are used where the water supply temperature to the manifold is provided at the correct temperature and flow rate for the underfloor system.

The manifolds are manufactured in brass in a modular bayonet fit format. The manifold has a unique rapid fit assembly method providing high flexibility in achieving the correct number of outlets required. Additional circuits can be easily added and maintenance is simplified as components can be replaced individualy. The manifolds are available with standard manual circuit control valves or these can be replaced with 24volt or 240volt electric actuators for automatic circuit control via a room thermostat or sensor.

Warmafloor standard modular manifolds are manufactured complete with all necessary guages, valves, airvents and isolation valves with pipe connectors available to suit 16mm or 20mm pipework.

The fitted pressure guage and flow and return thermometer makes checking the system operating parameters and fault finding very simple as readings can be easily taken at any time.

Manifold dimensions

Circuits	2	3	4	5	6	7	8	9	10	11	12
Manifold width (mm)	290	340	390	440	490	540	590	640	690	740	790

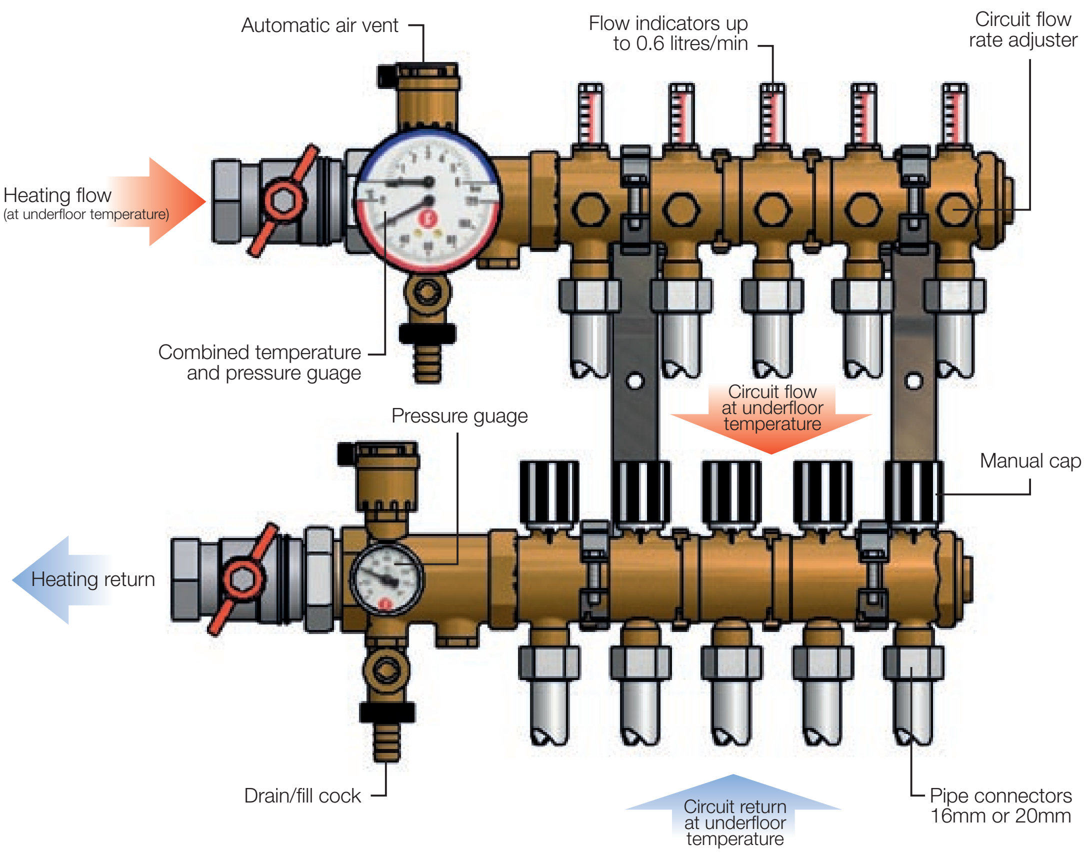
Manifold Height 370mm - **Depth** 125mm
Fitting clearance - manifold width 100mm, height 250mm, depth 175mm
Manifolds should be fixed at a height of 300mm from finished floor to bottom of manifold. Access is required to front of the manifold for maintenance purposes.

Electric actuator 24v or 240v

These are available for automatic circuit control via a room thermostat or sensor

Voltage	240v	24v
Power consumption	2.5 watts	3.0 watts
Running current (max)	30 ma	150 ma
Maximum current	0.15 amp	0.25 amp
Time to fully open	4 minutes	3 minutes

Power ON	Circuit open
Power OFF	Circuit shut



Pump mixing manifolds

Warmafloor pump mixing manifolds are for use were the LPHW supply to the manifold is at a higher temperature than required for the underfloor system.

The pump mixing manifold thermostat is set to the required underfloor water flow temperature and the injector valve mixes the hot water from the heating system to the desired underfloor flow temperature.

Pump manifolds are used where the heating system is a combination of radiators and underfloor heating, whether it is a new installation or where an underfloor heating installation is added to an existing radiator system.

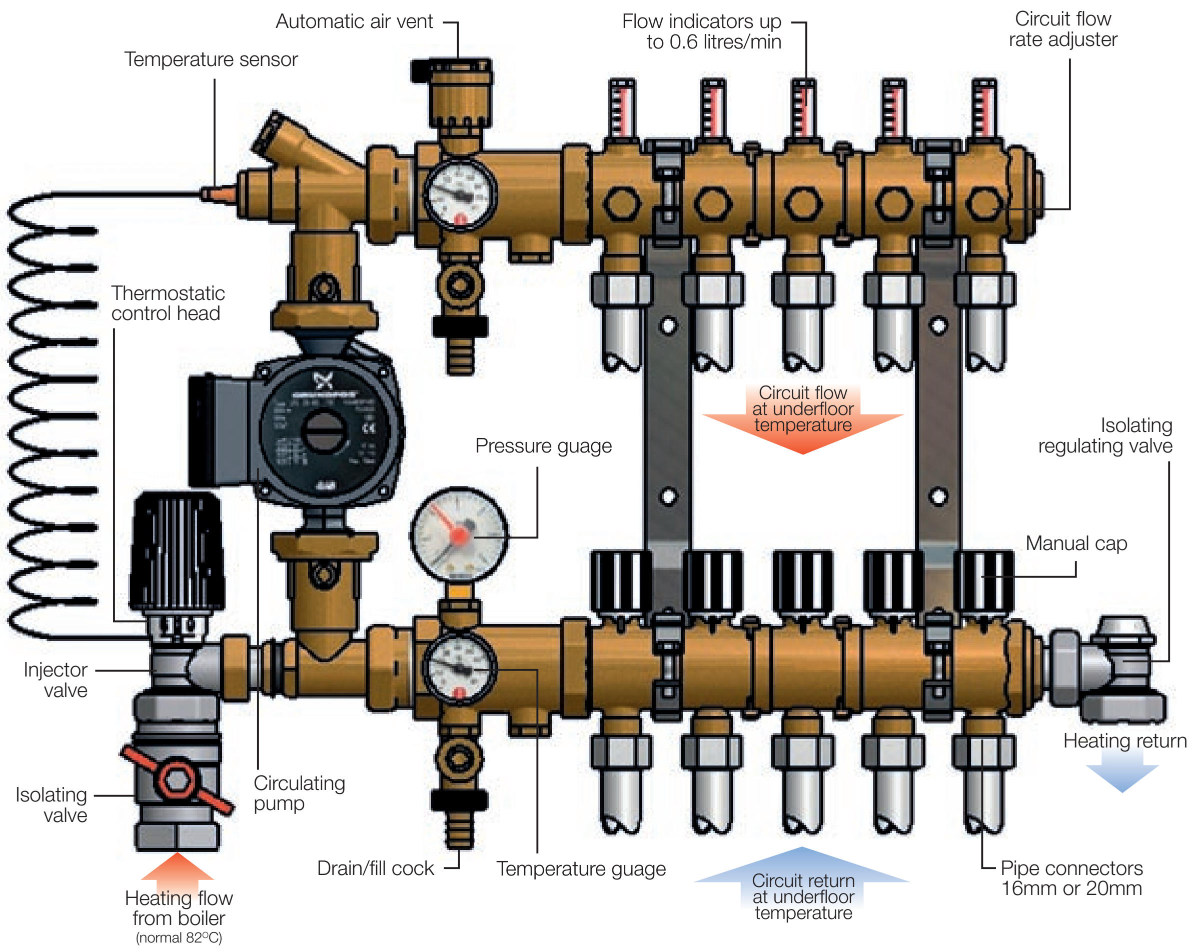
The size of the injector valve used on the mixing manifold is selected dependant upon the system output required as detailed. When the manifold serves multiple circuits it is installed with an electric wiring centre to which room thermostats/sensors, electrical actuators and the pump is connected. The manifolds are manufactured in brass in a modular bayonet fit format. The manifold has a unique rapid fit assembly method providing high flexibility in achieving the correct number of outlets required. Additional circuits can be easily added and maintenance is simplified as components can be replaced individualy. The manifolds are available with standard manual circuit control valves or these can be replaced with 24volt or 240 volt electric actuators for automatic circuit control.

Manifold dimensions											
Circuits	2	3	4	5	6	7	8	9	10	11	12
Manifold width (mm)	420	470	520	570	620	670	720	770	820	870	920

Manifold Height 395mm - **Depth** 165mm
Fitting clearance - manifold width 100mm, height 250mm, depth 215mm
Manifolds should be fixed at a height of 300mm from finished floor to bottom of manifold. Access is required to front of the manifold for maintenance purposes.

Thermostatic control head settings		
Screeded floor	Position	Temperature °C
	1	23
	2	34
	3	45
	4	56
Timber floors	Position	Temperature °C
	5	67

Valve size	Heat output
1/2"	3kw
3/4"	7kw
1"	15kw



Thermostats

Warmafloor controls - thermostats and sensors

Fitting - a thermostat will fit directly on to the wall surface or on to a standard wallbox.

Standard thermostat		Tamperproof thermostat	
230v	24v	230v	24v
WF-SS-S-230	WF-SS-S-24	WF-SS-T-230	WF-SS-T-24
Size - 85(w) x 85(h) x 31(d)		Size - 85(w) x 85(h) x 31(d)	
Colour: white		Colour: white	
Electronic room thermostat for reliable accurate temperature regulation		Tamperproof electronic room thermostat for reliable accurate temperature regulation	
Features: - Operating range can be limited by adjustable locking pins behind cover - Can be used with remote sensor - Demand indication by LED on face		Features: - Operating range can be limited by adjustable locking pins behind cover - Can be used with remote sensor - Demand indication by LED on face	

Wiring centres

240/24v

Wiring centres can be provided to interface between the room thermostats and the manifold circuit actuators. The wiring centres will also operate the manifold circulation pump (if fitted). The wiring centres have a volt free contact for remote boiler demand or BMS interface/signal.

- Supply to all wiring centres is 240 volt.
- 24 volt wiring centres have an inbuilt transformer.

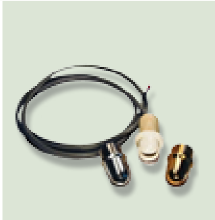
Remote sensors

Remote sensors are generally for use in wet areas (showers, bathrooms etc) or sports halls etc where standard surface mounted thermostats are not suitable.

They can be used with either standard or tamperproof room thermostats.

Sensors are wired to either the standard or tamperproof room thermostats above.

Averaging -4 sensors can be wired in series to provide an average temperature reading for large areas.



Nipple sensor	Remote sensor	Thimble sensor
WF-SS-NS-W	WF-SS-RS-W	WF-SS-WP
Sensor is mounted on white backplate for flush fitting into standard electrical wall box (also available to special order in brushed steel - ref. WF-SS-NS-SS)	Sensor is mounted in white enclosure for wall mounting	White plastic sensor has no back plate and is designed for insulation in the end of 20mm conduit (also available to special order in brushed steel - ref. WF-SSTS-BS)

Testimonials and projects

Tel: 01489 581787 www.warmafloor.co.uk

“ We would like to take this opportunity to thank each and everyone of you for the efforts that you made during the project.

Mark Waller, Halsion Limited - Project: Lymington Hospital

“ The installation was completed quicker than envisaged, and a good example of collaborative working practice.

Gary Price, Project Manager, Carillon Plc.

“ We write to thank everyone involved in the above project for the professional and efficient manner in which you undertook the task and completed in the face of all the difficulties thrown in your path.

Coleman & James (Services) Limited - Project: Canterbury Christ Church University College Bookshop

“ The cooperative from Warmafloor had an excellent manner and attitude. If more individuals were similar, it would make site management more pleasurable.

Dave Shelbourn, Project Manager, Kier Building Services

A selection of Warmafloors school projects

Project	Location	Square Metre
Glasgow College	Glasgow	3,850
SEBD School	Edinburgh	2,500
Joseph Priestly School	Leeds	1,340
Salford Academy	Manchester	1,780
Hadley Learning Centre	Telford	20,000
Castle Rock School	Leicester	5,400
CNS High School	Norwich	2,750
Gordano School	Bristol	2,300
St. Josephs School	Newport, Wales	7,900
Queen Elizabeth School	Carmarthen	2,800
Ben Johnson School	London	2,100
John Hunt School	Basingstoke	10,000
Dutchy College	Cornwall	1,100
Les Nicholles	Guernsey	10,100
Bognor Secondary School	Bognor	10,800
East Manchester Academy	Manchester	3,300

UNDERFLOOR HEATING & COOLING

Underfloor heating in schools

A Warmafloor technical guide

This guide has been produced to give an understanding of systems and strategies involved in the successful design and installation of an underfloor heating system within a school, college, university or educational building.

Warmafloor GB Limited offer a CPD Certified seminar on underfloor heating and cooling - The Way Forward.

The seminar lasts approximately two hours and counts towards mandatory training for design engineers.

Course speaker: Michael Lamb (CIBSE) who has 20 years experience within the underfloor heating industry.

For further technical information and the latest company news, visit our website at:
www.warmafloor.co.uk

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constructionline