Tailored Heat Supplies
DESIGN SUPPLY SUPPORT

Underfloor Heating

User Information

This document provides simplified notes coupled with generic advice and guidance on the operation and use of underfloor heating – it is not exhaustive and in all cases users should refer to manufacturers specific guidance on their products interfacing with the underfloor heating system.

Tailored Heat Supplies
DESIGN SUPPLY SUPPORT

General Principles (1)

Underfloor Heating is also described as a floor-warming system.

To this end, it is difficult to describe what you should expect if you have not experienced Underfloor Heating before, but we've attempted to below!

As floor-warming systems operate at lower water temperatures than a conventional radiator system, the concept is that the floor should not feel hot; it should just not feel cold.

This is because the whole available floor area is used to heat the room and is therefore much larger than the small area of a radiator and so can do it with lower temperatures. Generally, the heated floor area of each room should feel this way.

If you have a system with un-heated floors as well as heated floors, you would notice the difference.

Floor-warming systems also deliver heat as what can be described as radiant, that is transmitted through the floor through to you – the best way to describe this is the sun – you feel warmer in the sunshine than in the shade even though the air temperature may be the same!

This means that a room air temperature of say 20degC delivered by underfloor heating would feel the same as 21degC delivered from a radiator system. (Where the heat loss exceeds 50W/m^2)

General Principles (2)

The floor warming system delivers heat as a function of:

- Pipe spacing
- Flow Rates
- Flow Temperature
- Control – being switched on!

Some of these are adjustable and within your control i.e. thermostat and timer settings, possibly water temperature too.

Other items are fixed as part of the design, installation and commissioning process i.e. pipe spacing, flow rates, flow temperature.

To maintain your comfort, we would recommend that you take the time to read and understand this brief explanation of the pertinent points of principle operation. Detailed instructions on how to set or programme each part of your system are available as separate manufacturers instructions.

Tailored Heat Supplies
DESIGN SUPPLY SUPPORT

Room Thermostat:

Room temperature control is a vital and integral part of the control and design of any underfloor heating system.

Each room is generally unique in design and has it's own heat performance characteristic.

Therefore it is important that each principle room has it's own control.

To manage this Room Thermostats are used.

It is important to understand the function they perform:

- **A room thermostat acts as a switch only**
- Thermostats should be set to a temperature which makes the room feel comfortable, typically:
  - Occupied Room (Living) = 20°C
  - Unoccupied Room (Bedroom, Hall) = 18°C
  - Bathrooms = 22°C
- They can only switch the room and system on or off.
- They cannot control how much heat comes into the room from the heating system (the water flow rate and temperature affect heat input).
- Turning a room thermostat to maximum will not make a room heat up faster or even significantly warmer.
- Room temperature adjustments should be made in small increments to allow time for the floor heating to respond.

Typically all our room thermostats work off a 230V supply and measure air temperature only.

However, an external floor or air sensor can be used if required (often in Bathrooms). This sensor can either be placed in the floor to control the floor temperature or on the wall to measure room temperature.

Detailed instructions on how to set or programme each part of your system are available as separate manufacturers instructions.

Time control:

A time clock controls the on/off (setback: high/low) periods for the floor heating system.

This can be provided by using separate time clocks or, if available, by programming functions within the thermostat.

With a **time only system**, we use a time clock and thermostat that does not use setback.
It is recommended **'on' times are typically set for all day**, with 'off' times set during the night.

With a **night setback system**, we use a time clock and thermostat using night setback or Programmable Room thermostat.
It is recommended that due to the potential slow reacting nature of floors, **'on/high' times be typically set for all day, with 'off/low' times set during the night.** Current guidance recommends a setback temperature in the order of 2-3degC less than the design temperature where this can be altered.

The reason for longer 'on' periods is due to the potential slow reacting nature of floors using screed and underfloor heating - a simple analogy would be a water wheel which takes a lot of energy to get going but once it has started to turn it does not take much to keep it running.

Detailed instructions on how to set or programme each part of your system are available as separate manufacturers instructions.

Tailored Heat Supplies
DESIGN SUPPLY SUPPORT

Water Temperature Principles:

Water Temperature is another important element of control for the system as the water temperature directly affects the output of the system.

For example:

1. If the water temperature is 30°C in winter then the rooms will not likely achieve their designed temperature no matter what the thermostat is set to.
2. Conversely, if the water temperature is 60°C in the summer then room may get too warm and too quickly before the thermostat switches it off.

Combined with individual room thermostat control, accurately controlled water temperature can improve both comfort levels and efficiency.

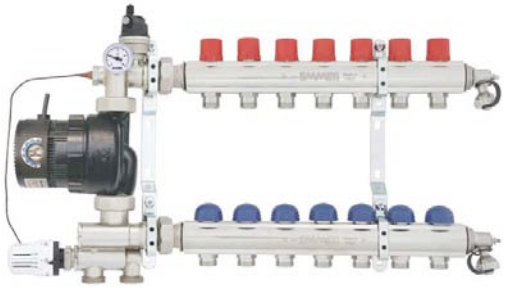
From a control point of view once a thermostat calls for heat with, the heat source i.e. Boiler/Heat Interface Unit/Heat Pump automatically receives a signal to run.

The operating flow temperature of the floor heating system will typically range between 30-55°C.

Note that 60°C is the maximum permissible flow temperature for a floor heating system.

Detailed instructions on how to set or programme each part of your system are available as separate manufacturers instructions.

Water Temperature Control Mixing Manifold:



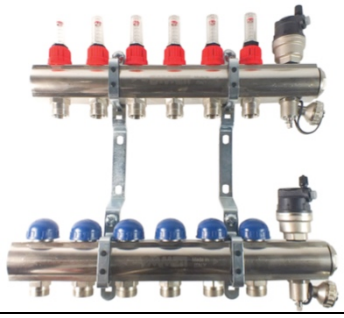
With this system, the end user to suit their needs, according to the time of year and prevailing weather conditions, adjusts the water temperature.

To increase the water temperature, simply turn the dial located on the bottom corner of the mixing kit to the desired temperature.

Once the thermostatic head is satisfied, the water from the Boiler/Heat Interface Unit/Heat Pump is diverted back to the boiler through a by-pass and the Boiler/Heat Interface Unit/Heat Pump own thermostat switches it off.

This method requires a mixing kit per manifold and so will have one pump and water temperature control per manifold.

Water Temperature Control Basic Manifold:



With this type of manifold, there are no local controls for the adjustment of water temperature entering the system.

This means that the Water Temperature control is managed by the Boiler/Heat Interface Unit/Heat Pump controls.

Tailored Heat Supplies
DESIGN SUPPLY SUPPORT

Floor Covering Notes (1):

In all cases, we would recommend you check and follow the installation procedure given by the floor covering manufacturer and installer.

IN ALL CASES MOISTURE, MOVEMENT AND FLOOR SURFACE TEMPERATURE IS A BIG ISSUE TO MONITOR.

PLEASE NOTE THAT THE FLOOR SURFACE TEMPERATURE CAN EXCEED 27 DEG C.

PLEASE SEE THE NEXT SECTION ON FLOOR TEMPERATURE LIMITS FOLLOWING THE FLOOR COVERING NOTES SECTION.

Floor Covering Notes (2):

SCREED MOVEMENT:

- With sand/cement screeds, for areas/rooms in excess of 40m^2, a movement joint should be considered. This should pass approximately 1/3 into the depth of the screed.
- The use of perimeter insulation can provide a means to accommodate expansion of the screed and therefore reduce pressures within the screed, which may exaggerate cracking.
- Using flexible adhesives and/or decoupling (slip) membranes can reduce the pressures of differential expansion of the various flooring products.

SCREED MOISTURE:
INITIAL DRYING HEATING:

- For screeds, to limit the effects of moisture, ensure the screed is as dry as practicable. *BS1264-1* suggests the screed will dry at a rate of **one day per mm** of the first 50mm, followed by an increasing time for each mm above this thickness.
- Heat can be applied to screeds after 21days with sand/cement screed and 7 days with anhydrite based screed.
- For first/initial heating, please follow the procedure as recommended in BS1264,
- We also recommend after initial heating that the system is heated and cooled several times to drive of moisture. (As the screed cools moisture is ‘sucked’ into the dry areas, as the screed is warmed, the top layer is dried out.)

Normally, when laying the floor covering, the common recommendation is that the underfloor heating system is switched off approximately 48 hours before the covering is laid and left for 48 hours after laying before switching the system back on.

After initial heating/first use, continue to the underfloor heating system in line with the control recommendations in this manual.

Tailored Heat Supplies
DESIGN SUPPLY SUPPORT

Floor Covering Notes (3):

Detailed are some basic guidelines to assist when choosing your final coverings:

Vinyl:

When using this floor covering, please ensure that suitable glue is used when laying and fixing this in position.

Tile or Stone:

This floor covering is the most compatible with underfloor heating as it transmits the heat very well.

- For areas in excess of 40m^2, a movement joint should be considered. This should pass through the stone and approximately 1/3 into the depth of the screed.
- When tiling, use a good quality tile adhesive as this is normally flexible and can take a small amount of movement by the screed.
- Decoupling membranes can also assist in reducing the impact of cracking due to differential product expansion
- Stone can be laid at any thickness. The only issue this raises is that the thicker the stone, the larger the thermal mass and slower the reaction time to warm up and cool down the floor.
- When laying the stone use a continuous adhesive bed to ensure continuity between the screed and the stone.

Hardwood:

This floor covering is also compatible with underfloor heating although some consideration may be required with the heating design:

1. Movement is a big factor with hardwood.
2. Engineered boards using plywood as their base with a thick hardwood veneer offer a more stable solution.
3. Manufacturers recommend that a narrow board with low moisture content is used.
4. Do not lay hardwood that is thicker than 22mm, 18mm is typical.
5. Do not lay felt underlay underneath the flooring as this is a very good insulator.

When installing the hardwood, there are many different methods – consult your supplier for their recommended method.

Floor Covering Notes (4):

Detailed are some basic guidelines to assist when choosing your final coverings:

Carpets:

When considering carpets, the underfloor heating standard BS(EN)1264 recommends that the combined TOG rating of the Carpet and Underlay does not exceed 1.5 TOGs.

A study available from BEAMA Underfloor (the Underfloor Heating Manufacturers association) has shown that there appears to be a difference between the manufacturers stated TOG rating and the effective TOG rating – this is due to the different test methods used to establish the TOG rating. It has been suggested that this difference is in the order of 1.0 TOG.

To summarise, matching the limit stated by BS(EN)1264:

Effective rating	Manufacturers rating
1.5 TOG	2.5 TOG

Some general guidelines that may help are:

- Do not use felt or foam underlay
- Use an underfloor friendly underlay.
- Do not use pure wool carpets as their structure traps air and insulates, use an 80/20 blended one.
- Do not use a felt or foam backed carpet – use a woven backed one.
- Go for a dense pile carpet as this is less likely to trap air.
- The thinner the carpet the better it performs with underfloor heating.

Tailored Heat Supplies
DESIGN SUPPLY SUPPORT

Floor Temperature Limits (1):

The underfloor heating surface temperature limits in accordance with BS(EN)1264 are:

- 29degC in a normally occupied space
- 35degC in peripheral areas
- 33degC in bathrooms/en-suites

A further limit of 27degC is sometimes applied by floor covering manufacturers for products such as vinyl, other glued floor coverings and wooden floors.

The floor surface temperature may exceed a 27degC limit, if applied. This can be caused by:

- Sunshine through windows, patio doors and conservatories.
- Congested pipework in transition areas such as those leaving the manifold.
- Peripheral zones at areas of increased heat loss such as patio doors and glazed areas.
- Reaction time of the system by thermal mass, thermostat type, thermostat accuracy and operating temperature of system.
- Reduced heat requirement in an area with localised hot spots with the heating still switched on such as kitchen hobs or bathrooms.

This is not new and exclusively related to underfloor heating. Vinyl, other glued floor coverings and wooden floors have been used in housing and commercial applications for decades.
With modern construction, the impact of this is reducing, as heat load requirements are becoming less.

Whilst attempts can/should be made to mitigate this as much as possible, this may not be entirely unavoidable and we would recommend an impact assessment is carried out when considering products where limits are stated.

Items to consider as part of the impact of this are:

- Identification of potential hot spots
- Floor surface temperature range due to heating in normal operation
- Floor surface temperature range in heating hot spots
- Floor surface temperature range due to solar gains
- Confirmation/justification of this limit from manufacturer
- Impact of temperature range on Adhesion
- Impact of temperature range on Product deterioration
- Impact of temperature range on Product movement

Floor Temperature Limits (2):

For Example, for a typical, well insulated, property. The table below show indicative floor temperature performance.

Please note that the better insulated the property, the lower the heating requirements and floor surface temperature becomes.

Please note that using your heating controls correctly will reduce the impact of floor surface temperature – for example, if you leave your room thermostat and water temperature at maximum all day, then the floor will potentially heat up higher than designed.

	General Heating	Peripheral Heating	Peripheral Solar	Manifold
Room	**Normal Operating Floor Temperature Range**			
Living	23-26°C	23-30°C	≈>27°C	
Kitchen	23-26°C	23-30°C	≈>27°C	
Bedroom	22-25°C	23-28°C	≈>27°C	
Hall	22-25°C	23-28°C	≈>27°C	≤33°C
Bathroom	25-33°C	25-33°C	NA	
	Indicative Maximum Floor Temperature Range			
Living	23-30°C	23-33°C	>27°C	
Kitchen	23-30°C	23-33°C	>27°C	
Bedroom	23-30°C	23-33°C	>27°C	
Hall	23-30°C	23-33°C	>27°C	≤33°C
Bathroom	25-33°C	25-33°C	NA	
Season	**Indicative Frequency of Exceeding 27degC**			
Spring	Low	Low	Med	Low
Summer	Low	Low	Med	Low
Autumn	Low	Low	Med	Low
Winter	Low	Low	Med	Med

General Heating: This is the bulk of the area in a room heated by the floor heating system

Peripheral Heating: This is a zone up to 1m from the external wall where the pipework density can be increased to offset higher heat losses in the area – check your underfloor heating layout to ascertain the full extent of this.

Peripheral Solar: This is the area of floor impacted by solar gain, for example larged glazed areas.

Manifold: This is the area of congested pipework around the manifold which is the focal point for all the floor heating pipework. The location of the manifold is indicated on your underfloor heating layout and congested pipework runs will be easily identifiable around it.

Tailored Heat Supplies
DESIGN SUPPLY SUPPORT

Maintenance:

The underfloor heating system should not require maintenance as such.

All pumps provided are self-regulating and require no maintenance.

However, it is suggested that you:

1. Periodically (annually) check that any compression fittings are tight (i.e. the 27mm silver nut between manifold and plastic underfloor heating pipe.) Be careful doing this on the return manifold as you will need to grip the flow meter with a adjustable wrench to stop it from moving.

2. Periodically check the pressure of the system to ensure that there is water present. We would normally expect to see a pressure in the region between 1 – 2.0 bar.

3. Periodically (annually) check the water quality in the heating system – this may require flushing out the heating system, replacing heating water and additives.

4. Periodically (annually) check the operation of all components.

5. Periodically (annually) check the flow rate settings for each underfloor heating pipework loop on the manifold.

If you are ever unsure that the system is maintaining pressure, simply isolate the manifold by turning the two red handles on the isolation valves, noting the pressure and leaving for approximately one hour. When you return the pressure may have dropped, as long as it has not dropped to zero, then the underfloor heating system pipework is holding pressure.

Troubleshooting:

Detailed over are some common problems that may arise in the operation of the system:

The pressure shown is too low!

- Most systems will lose pressure over time.
- You can top up the pressure from the mains supply to the boiler. This should improve the pressure of the whole system.
- If you think there is an issue with the manifold, isolate the manifold by turning the two red handles on the isolation valves, noting the pressure and leaving for approximately one hour. When you return the pressure may have dropped, as long as it has not dropped to zero, then the system is holding pressure.

My rooms are not heating up!

Is the system switched on to occupied mode?
- Check time clock settings.

Is the thermostat switched on and calling for heat?
- You can check the thermostat by turning the temperature dial; you should hear it click off as you turn it down or on if you turn it up.

Is the actuator rising up?
- You can see a black tab if they are fully on and operational, no raised tab if they are down.

Is the correct thermostat connected to the correct actuator?
- By turning the thermostat on and off you should see the correct actuator tab rising and falling – it takes several minutes for a tab to rise and then to fall.

Is there a hot water flow to the manifold and is it being passed through the manifold?
- Check the temperature gauge on the manifold.
- Do both manifolds feel warm or hot?
- Are both isolation handles open (pointing in line with the pipes)?

Is the pump running?
- You can usually feel a slight vibration on the pump when it is running (If you change the speed of the pump, you can feel the speed change).

For testing electrical wiring & components we would recommend that suitably qualified engineer is contacted.