It is important to note that the NZ slab is different from the floor slab construction typically found in the European countries where underfloor heating is prevalent. In New Zealand it is the norm to tie underfloor pipework to the reinforcing mesh within the slab foundation. In Europe this is not permissible, heating pipes there are stapled directly on to an insulation layer on top of the slab then encased in a 65mm screed layer with perimeter insulation wherever the screed meets a wall.

In comparison European floors have much faster response with the floor heating in around half the time taken in our NZ slab. In addition they experience virtually no perimeter heat loss and no heat creep between control zones. This results in far more efficient operation, though with good design and control you can achieve efficient performance from systems piped in the NZ slab.

There is no reason why the European over-screed system can't be done in NZ but regretably as it is not the norm, installing over-screed does tend to attract a premium cost as both architects and builders are unfamiliar with the method.

So, with energy efficiency in mind to get the best out of the standard NZ slab there are some golden rules which anyone considering underfloor heating should apply

1. Slab type and building structure
2. Select the most efficient controllable heat source
3. Understanding the needs of the user and designed to suit
4. Apply good control over multiple zones
5. Pipes laid in a floor should be optimised to perform under the given floor coverings
6. set up and maintain the system to maximise comfort and minimise consumption

Slab Type and structure

Not all New Zealand floor slabs are the same, The standard slab is typically a single pour of around 100mm thickness with a thickened outer edge footing and possibly some thickening for internal supporting walls. When used with underfloor heating the slab should have a minimum 50mm polystyrene layer below the main floor field this will be excluded under the outer footing and any support thickening.
Where underfloor pipes are installed correctly this standard raft foundation slab will perform much better than the alternative a Rib or Pod system though often suppliers of the polystyrene pods will make a great deal about insulating benefits of the extra thickness of polystyrene in a pod they are in fact laid in a pattern which leaves large thickened ribs of concrete making contact to the ground between them, crossing the entire floor area . Despite the fact that the pipes sit above the insulation and heat naturally rises, heat will be drawn in a capillary action through the ribs to the ground below. *It is difficult to accurately compare but you should expect an efficiency loss in the region of 10% with pods over a standard raft.*

Moving up from the slab the structure above ground also plays a part in determining if Underfloor is the most suitable option.

In two story homes often only the ground floor is concrete. Pipes can be installed below timber, but this is not very efficient at all, partly because wooden floors offer up a natural insulation barrier and also because unlike concrete there is no thermal mass storing and dispersing the heat.
Some homes are constructed with the living areas upstairs and bedrooms downstairs in this configuration it is worth asking would we be better installing radiators in the bedrooms as these will offer the benefit of rapid heat output for just the periods necessary and avoid heat rising to an upper story that may already be warm from other sources or from passive solar input through windows

Another issue for consideration is passive solar gain which can be very high in modern homes with large areas of glass orientated to take in the daily sunshine. If your house is in this category then you may experience a situation where by the house is very warm on a sunny winters day , the heating goes into an off status for several hours, only to find that in the late afternoon the sun has gone and the temperature inside drops faster than the floor can regain heat, leaving the occupants cold when they need heat most. using appropriate controls this can be countered, " A *good reason to ensure your design is correct and the installer competent."*

The Heat Source

In order to achieve efficient and effective heating it is important to select the right heat source.

For North island homes built in urban areas two options offer comparable performance Natural Gas and Air to water heat Pumps. In rural areas without piped gas then Air to water takes some beating *, "Note LPG is three times the cost of Natural gas Per KWh so don't be fooled by companies that tell you will save through the absence of line charges"*

On the south island Air to water is an efficient and viable option despite the typically colder climate. The latest generation Heat pumps perform well down to minus 7-10 deg C and beyond but they will be much less efficient making diesel boilers another viable alternative. but remember on balance you get very energy efficient performance from a HP at higher temperatures so consider and take into account daily average temperatures not just how cold it can become at times.

When using Natural Gas there is the bonus a secondary option of using your appliance to heat domestic hot water (DHW) despite what some advocate this is not really viable through a "Heating" dedicated heat pump. *Though there is a way to use the HP to contribute and reduce the need for power at the DHW cylinder. We can advise on this on a system by system basis*

For Heat pump installations a buffer tank is essential for good performance as this will minimise cycling of the HP and soften the impact of lower temperatures on the efficiency of the system our advice would be never fit an air to water HP without a buffer tank in the system, *We can advise in relation to buffer sizing requirements*

We are often asked can wood fired or other (uncontrolled) heat sources can be used the answer is yes but the installation will require certain elements to be safe and to prevent overheating of the underfloor pipework, again we can provide specific information for this on request.

User Requirements and appropriate design

It is very important to ensure that the pipe layout design provides for suitable heat performance for the rooms and areas they serve, it is very easy for a less than competent installer to simply throw in a series of loops, which will lead to inefficient system with inadequate performance.

Pipe spacing can vary depending on the floor area of the room, ceiling height, the room's orientation, number of external walls and area of glazing. Also the room Type (bedroom, Living etc,) Some attention should also be paid to the proposed floor coverings most designs allow for potential carpet, but overlay timber laminates etc, can require design adjustments. The design should try to understand the family too, does anyone work from home, has a family member got special needs etc, all have a bearing on design.

Control is also an important consideration. Though we know many less knowledgeable installers do so, we would never recommend any underfloor system have just one control point, , it is extremely inefficient, so much so that in Europe multiple control is a requirement of the building code.

The above said care needs to be taken at the design stage to ensure that the controls being specified are appropriate for the end user. Heating installers will have reasonable understanding of thermostats and time clocks, but they are not the ones who will be using them. Often the home owner will find a digital control hard to use, make sure the end user is getting controls they are comfortable using.

It is not uncommon to find home owners who have fantastic control systems which can potentially give significant energy savings, left permanently in a locked on mode because the user can't get their heads around setting them.

Heat IQ provide floor loop sizing and control zone recommendations in our off plan design service

Control Zoning

In general the more control zones the better

If each bedroom has its own control then a guest bedroom or a siblings room can be isolated or controlled down when not in use. In any case individuals within a family will tend to have very different heat preferences in bedrooms.
Open plan living areas will usually form the homes primary living area so one control over multiple areas within the open plan is fine, but if say this is a large L shape then a control on either end may be beneficial, especially if one end catches the sun or if there is a fire at one end.
Bathrooms often require heat when other areas don't so again separate control. This is particularly the case with en suites where we not want heat in the bedroom but still want warm tiles in a morning.
Hallways are awkward as they often have pipes passing through them to other zones so they will always get some heat however if a significant dedicated floor loop is installed then a separate control is sensible. Media rooms and dining rooms also tend to be used at given times so should also be controlled.
Remember the relatively small on cost of multiple controls will pay back in a very short time through significant energy savings.

Our off plan designs include Zoning recommendations

Getting the floor pipework right

Correctly laid pipes in the slab are crucial to having even heat output they may be hidden in concrete but it is extremely important to ensure they are laid properly. We strongly advise that anyone installing or having underfloor heating installed keeps a photographic record of the pipes as laid before they are encased to serve as reference in case of unexpected issues .
Note also before the insulation and mesh are laid flow and return pipework from the heat source to a manifold and or buffer tank will need to be run fully insulated and sleaved, below the slab.

Because of the particular issues around the laying pipes in the mesh in a New Zealand floor slab the following should be the norm in all installations

1/ No floor pipes should be closer than 500mm from the outer edges of the foundation slab. This will minimise perimeter heat loss

2/ All internal walls should be marked on the polystyrene, wherever possible pipes should not pass below wall lines. However in reality it will sometimes be required to pass below walls, when this is the case the installer and the builder should retain a drawing with crossing points clearly marked. To avoid later puncturing with frame fixings etc,

3/ Pipe loops within rooms should be kept 350mm from wall centre lines this will minimise zone to zone heat creep.

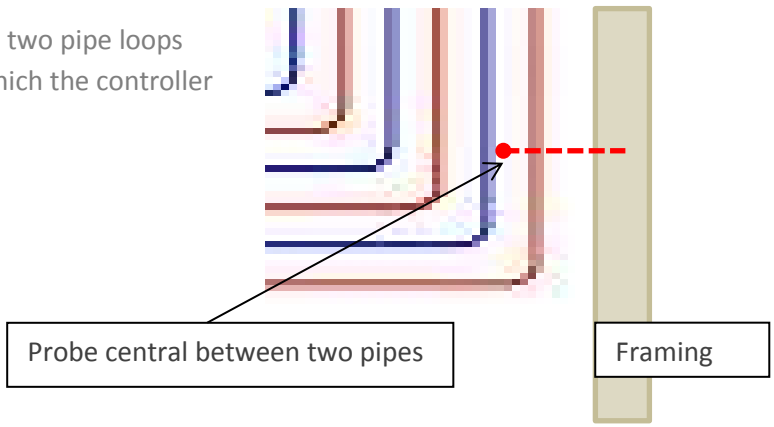
4/ whenever possible pipes should be laid in a counter flow configuration This gives the most even distribution of heat rather than a serpentine which will start hot and run cooler as it crosses the floor

5/ Do not lay pipes below kitchen units, in walk in pantries, built in store cupboards or into wardrobes (other than walk in robes) the installer should also identify and keep well away from fridge and freezer locations.

6/ In the NZ Slab spacing between pipes should be as per the system design and may vary room by room from 100mm apart but in any case should never exceed 200 mm as a rule of thumb.

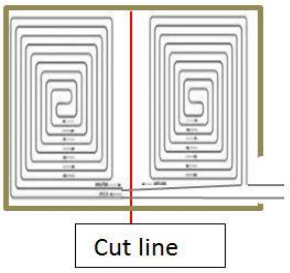
7/ Floor probes are wired sensors used with underfloor controls. Installed into the floor with the pipe system they allow a controller to be used either to work of ambient temperature in the room or of static desired temperature at the floor. We strongly recommend the use of floor probes on every control in a bathroom or any room with potential for high passive solar gain

The probes should sit between the first two pipe loops below the point adjacent to the wall which the controller is to be fitted to.



Continued

8/ Expansion cuts the heating installer should ensure that pipework avoids any expansion cut line see picture. and where it does have to cross it passes beneath the mesh. cut mesh and drop pipes low to avoid the cut re place / re tie the mesh above. It is a nigtmare trying to repair pipework damaged after the slab has been laid



Important notes relating to the builder

It is also essential to have the building contractor increase the amount of Support chairs used to suport the mesh. This will ensure minimum rolling (High and low points) which are the result of the concrete placers walking over the mesh as they lay concrete. If they stand at one side of a chair the pipes are pushed down whitle at the other sde of the chair they will rise.

In the ideal there should be abetween 25 an 35mm of cover over the pipes to the finnished floor. The builder should be made aware of this requirement before he boxes up the foundation so he can set the mesh hieght . Note also floor thickness requirements should be verified with your local autority, we know that different councils require differing thicknesses when UFH is installed.

Pipework brought up to the manifold should be a series of pairs, ideally held in a simple locating jig but in any case however they rise from the floor they should be clearly marked up as pairs and notes kept to identify which pair is which zone and which loop within that control zone. Your notes must also note the length of pipe in each loop.

Keep the notes taken safe, it will be many months before the manifold is fitted your pipe marking must be permanent and notes clear and easy to refer to. Commissioning can be a nightmare if nothing is marked or recorded.

Pipes not filled with water will try to float in wet concrete
All the Pipes in the floor should be water filled and ideally pressurised to around 20 PSI before the concrete is poured. Keeping them under pressure with a gauge fitted throughout the build will ensure any damage during concrete placement or, later from accidental drilling is immediately evident and traceable

System commissioning and user set up

To fill and vent the heating system follow the instructions supplied with the heating appliance and relevant manifold. Essentially the system will need to be completely free of air before the system can be set up.
There will be various requirements relating to commissioning the relevant heat source but assuming this is done, set the system to call for heat on all the zone controls.

Referring to your installation notes, each loop off the manifold can now have its flow rate set. This is not a precise art but simply opening everything fully will leave an imbalance in the system which will impact upon overall efficiency. Start by setting the flow of any loop over 80m in length to around 2.2 L per minute Loops between 50 and 80m to 1.7 L per minute and shorter loops between 1 and 1.5 L per minute.
The manifold may have an injection or blending type pump station so the method of setting it up will differ slightly, also if the heat source is an Air to water Heat pump the manifold may not have a blending station at all, in this case the HP maintains a given temperature as required for the floor in the buffer tank (typically @ 5 Degrees warmer than the floor requirement). Depending on the design parameters used and floor area covered, manifold delivery temperature into the floor should be set to between 32 to 40deg C. Under no circumstances should floor pipes ever be run at temperatures in excess of 50 degrees C as this will place excessive expansion pressure on the pipework which could lead to pipes imploding into their own waterway which can't be rectified.

Setting up control

In the vast majority of installs the heat source once set requires no interaction from the end user. The zone controls however do, there are many different controls with an array of features but for guidance we follow a typical control type here.

Underfloor works best when maintaining heat it is not designed to have to heat up fully and cool down daily so the key is timing and setback. For the periods when heat is required the floor area should be set to the (comfort) output requirement when not required the control should take the temperature back to a (setback) temperature of 2 to a max, of 4 degrees back from the comfort setting

For example the primary living area (using a Heat iq HIQ112 or 417 control)

8 AM to 10 AM comfort (say 22) - 10 AM to 3.30 PM setback (at say 18) - 3.30 to 10PM Comfort (22) - 10PM to 4 AM Setback (at say 118) - 4 PM to 8 AM setback (at 19)

Or for the master bedroom

6 AM to 8.30 AM (comfort at 19) – 8.30AM to 4Pm setback (at 16) - 4pm to 6 pm Setback (at 17) – 7pm to 10PM (comfort (at 19) - 10 pm to 6 am Setback (at 16)

The above are based on ambient air readings at the controller when passive solar gain is an issue or in bathrooms where warmth under foot is required whatever the temperature then using floor probes switches control to the current floor temperature the same principles of setback will apply but the given temperatures required will be different "to suit" **Note:** where a Heat pump is the Heat source we recommend no more than 2 degrees of setback, - Heat pumps are more efficient maintaining a single temperature.

Most controllers also provide an option to permanently lock in comfort mode or off mode so once established the time control settings will rarely need to be changed.

Heat IQ are heating specialists with a wide range of quality Underfloor heating equipment in stock. We do not install heating but we are happy to provide off site guidance, we maintain a list of experienced contractors who have Network IQ accreditation.
Look out for the Network IQ logo when selecting a competent installer.