Central Heating
NEW ZEALAND

Installing Hydronic Underfloor Heating

Technical Guide

Version 1.02

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Contents

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Types Underfloor Pipe Installation Methods

There are several different methods for installing underfloor heating pipework, the 4 main methods covered in this guide are;

- Tied To reinforcing mesh.
- Clipped to Insulation.
- Variocomp Module Panel underfloor system
- Installed on a joisted floor with aluminium spreader plates.

For more information on these methods, see our underfloor installation method guide on our website HERE.

Steps for Installing Underfloor Heating

1. Lay primary feed pipes from heat source to manifold location(s).
2. Lay underfloor pipe from manifold to heated areas and back.
3. Install conduit for floor probes.
4. Pressure test with air, inert gas (i.e. nitrogen) or water.
5. Wrap pipe where it is set up for the future installation of the manifold (s) to protect from weather and UV light.
6. Take pictures of the underfloor install & record individual loop lengths (metres).

Steps for Fitting off Manifold and Commissioning System

1. Install underfloor cabinet.
2. Assemble manifold, install and connect pipework.
3. Connected feed pipes to manifold.
4. Fill & flush system and vent air.
5. Run heating system and adjust flow rates, check operation via controls.

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Laying the Primary Pipework (Feed Pipes)

When possible, we recommend the primary pipework is installed in or under the structural slab before the underfloor pipework is laid, this is typically the most direct path from the heat source to the underfloor manifold(s). If there is a domestic hot water cylinder in this system, the feed pipes for this can be run through the slab at the same time. This also reduces the need for air vents and makes flushing of the system during commissioning much easier.

When does the primary pipework get installed?

Feed pipes within the slab should be installed after the perimeter foundations are built, and if it's a raft slab, after the pods have been put down (but before the mesh!). If the underfloor is being installed in a screed floor, with Variocomp, or in a retrofit scenario the feed pipes would be installed after the perimeter walls are built with penetrations made for the pipework.

Steps for Installing Primary Pipework;

1. Have builder mark out walls (as required).
2. Mark the location of the manifold(s), plant, HWC's, and the heat pump.
3. If heat source is outside and requires a slab, mark out the location.
4. Plan feed pipe route from heat source to manifold(s)/HWC (refer to CHNZ equipment layout if shown).
5. Create penetration through (or under) foundation wall if required. If required 150mm (for MT32 pipe) plastic conduit can be used. Where the foundation walls are concrete, or block ensure the builder includes suitable conduits through these for the installation of the feed pipes.
6. Roll out pipe necessary to go from heat source to manifold.
7. Prepare pipework, if not using pre-insulated pipe, apply insulation. If pipework is going through hard fill or underground pipe should be sleeved in waterproof pipe bagging and sealed at each end. If the pipe work is to be run outside the building envelope protect it from mechanical damage and moisture with a rigid conduit (i.e. PVC or un-punched NovaCoil).
8. Prepare pipe route, (through foundation wall, trench through hard fill, cut through rafts or insulation, or penetration through wall).
9. Install feed pipes ensuring they are at a suitable depth in the hardfill or insulation, support these at each end and use a bending spring to allow them to come up straight through the slab.
10. Back fill around pipes if installed in hardfill, if installed in insulation this may be sufficient to hold them in place, if not some spray foam can be used to lock the pipes in.

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Tips for Installing Primary Pipework

Bending Pipe

- Minimum bending radius of MT32 pipe is 160mm by hand, 125mm by spring, 110mm with bending tool.

Protect Pipework

- This will stop the insulation getting waterlogged and prevent heat loss/ increase system performance. Note sleeving pipe is not critical if laid on top of pods

Conduit

- If placing conduit for feed pipes, this will need to be in place before foundation wall is poured.

Mark Manifold Location

- Re-bar can be used to support the feed pipes when rising vertically. This can later be cut off flush with the foundation. If this penetrates the DPM this must be sealed.

Locating Feeds in Future Manifold Location

- For a clean install, pipe can be brought up within the manifold cabinet location.
- Knowing the size of the manifold cabinet used on the project is critical to ensure they are brought up in the correct location.
- Pipe are commonly brought up on the left side of the cabinet for direct connection into the manifold
- Bringing up pipework in the correct location will ensure a tidy manifold cabinet without the need for additional elbows. This is highlighted in the adjacent image where additional elbows/distance is required between the manifold and primary pipework.
- Remember an elbow is equivalent to 2.5m of pipework when calculating the pressure drop of a system, so use these sparingly and where possible use bending tools to create swept bends in the pipe work.

Optimal feed pipe placement in cabinet

Incorrect feed pipe placement in cabinet, note additional elbows.

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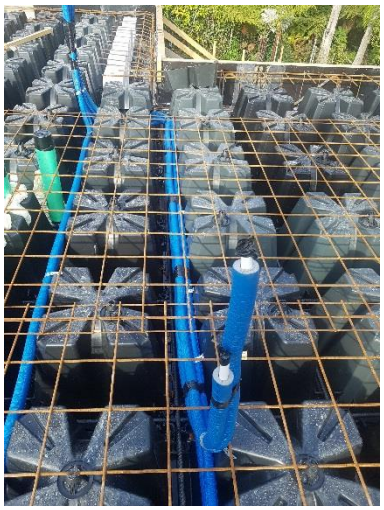
Primary Pipework Installation Images:

Pipe sleeved in waterproof bagging and sealed at both ends.



Pipe between plastic pods

Feeds through rib-raft slab

Feed pipes cut through insulation

Pipe penetration through foundation wall

Trench through hard fill with manifold location marked and rebar installed to support

Feed pipes rising vertically, trenched through hard fill

Multiple feed pipes through slab

Primary pipework in an insulated slab (not pod or raft system) penetrating through foundation wall.

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Installing Underfloor Pipework.

Central Heating New Zealand will be happy to provide an underfloor layout for a small design fee, this helps to ensure the project has been installed per our design and provides future record of pipe locations should any damage occur or modifications to the house be required. Along with the loop layout, we will provide the length of each loop and the flow rate that has been designed for each loop to deliver the heat required into the space.

When Does the Underfloor Pipework Get Installed?

If Installing on top of mesh or insulation, the pipe work is laid after the mesh has been raised on chairs or the insulation has been installed. It is important to note that Multitubo underfloor pipe is not UV stable so it shouldn't be exposed for long periods of time. Typically, we recommend the pipe is laid 1-2 days before the slab is poured so scheduling with the builder is a must, the pipe should not be left exposed for more than 2 weeks.

If installing Variocomp or spreader plates, the installation will happen later in the build, see below sections, specific to these methods for installation timeframes.

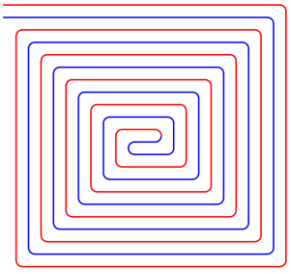
Steps for Installing Underfloor Pipework.

1. Get walls, manifold and fixed joinery positions marked out
2. Check on bathroom and cabinet positions with builder
3. Build temporary manifold placeholder where the manifold cabinet will be installed
4. Attach single pipe to manifold placeholder
5. Lay underfloor loop according to the underfloor layout (if provided)
6. Return to manifold and tie pipework
7. Record length of each loop from metre markings on pipe
8. Mark each loop on pipework at manifold (i.e. Loop 1A, Loop 2…)
9. Take pictures of underfloor pipe installation (LOTS OF PICTURES)
10. Pressure test and leave with pressure gauge attached

Types of underfloor heating loop patterns.

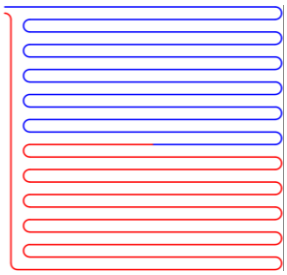
Counter-Flow (recommended by CHNZ)

- Counter flow pattern ensures most bends are only 90° and not as "sharp" (not 180°) which means less pressure drop and less chance of kinking the pipe.
- pattern results in alternating flow and return pipes giving an even spread of heat throughout the floor



Serpentine pattern

- Uneven heat distribution as hottest water is delivered at one end of the room with the coldest at the opposite.
- More 180° bends means increased chance of kinking pipe and higher pressure drop through loop
- Commonly used where there is limited space (i.e. bathrooms)



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Pipe Spacing & Loop Length

The spacing at which the pipe is laid will determine the heat output into the room, tighter spacing (100mm) will result in more heat delivered into the space, while wider spacing (200mm) will result in lower heat output levels. Tighter spacing also means more pipe (& more loops) will be required. Most commonly CHNZ will recommend 150mm spacing as it provides a good balance between heat output, ease of installation and quantity of pipe required, in some areas we will use 100mm spacing where crucial to get more heat into the space, or 200mm spacing in areas with low heat loads.

A good rule of thumb (when using Multitubo 16mm PE-RT or Composite Pipe) is loops should be a maximum of 110m long to ensure the total pressure drop for the underfloor system is not excessive. It is common to see designs from CHNZ where we have pushed this limit as we calculate the pressure drop for each loop based on what has been drawn and the heat required into a space to ensure suitability for the system.

How much pipe should be in a room?

- @100mm spacing's: Multiply room area (m^2) by 10 for the metres required
- @150mm spacing's: Multiply room area (m^2) by 6.65 for the metres required
- @200mm spacing's. Multiply room area in (m^2) by 5 for the metres required
- Remember to add feeds (flow and return) to/from manifold

Minimum Pipe Spacing

In CHNZ underfloor layouts, the pipes are typically shown with a minimum spacing of 50mm between the centres, which amounts to 34mm between the pipes. This spacing is necessary to ensure that there is sufficient space for concrete ingress, and there will be no voids in the slab. Additionally, the flow and return pipes are commonly tied together in Tied together in pairs with 50mm gap between..

On full zone systems, pipes that pass through another zone, through hallways or when exiting the manifold, commonly referred to as "hot tracks," would typically be run with the tight spacing as described above to ensure minimal impact on the other zones. This method ensures that the hot tracks do not affect the temperature of the adjacent zones and maintain a consistent output throughout the system.

We will also commonly run pipes at a tighter spacing through doors to ensure there is minimised risk of damaging the pipe when fixing the bottom plates around the doors.

Underfloor install showing "hot track" of grouped pipe

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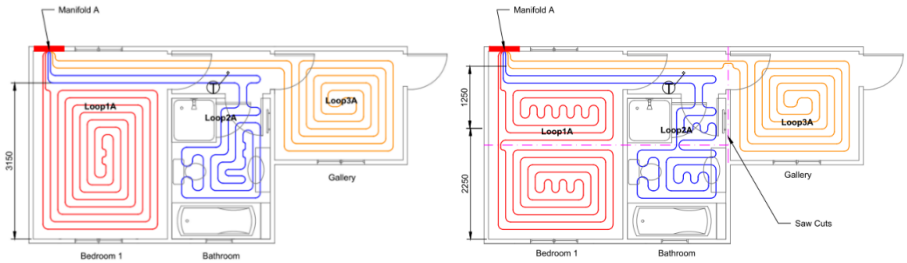
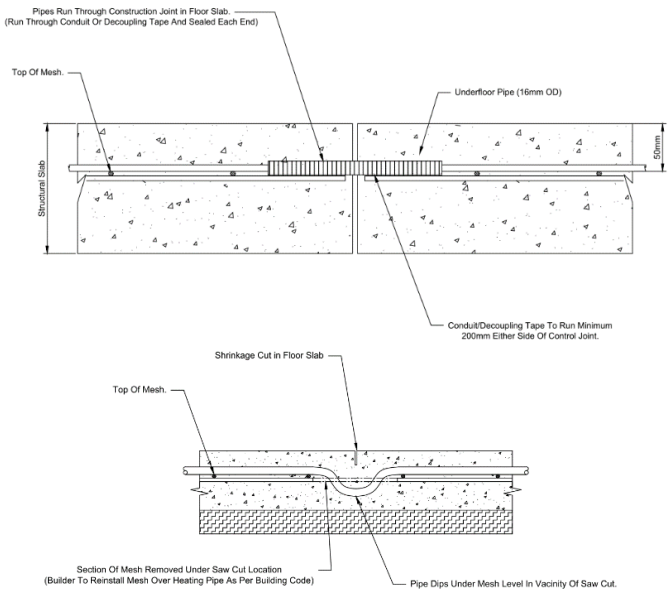
Saw cuts & Construction & Control Joints

Adjust the underfloor layout to account for saw cuts and control joints. When designing an underfloor layout, we try to minimise (and group) crossing over saw cuts. This will mitigate potential for damaging the pipe when the concrete is being cut, and if pipe is damaged, all damage will be localised to a small area where the concrete can be broken up and pipe repaired.



How saw cuts can affect an underfloor layout



Pipe sleeved across control joint

Pipe dipped below section of mesh

Pipe dipped below section of mesh

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Installing Floor Probes

Floor probes enable control of the floor temperature in an underfloor heating system. This is important as the mass of the floor is large and slow to react to the occupant requirements. Floor coverings and thickness of the slab or screed exacerbate this lag. In New Zealand this is especially critical as we don't have consistently cold weather, in a lot of regions we will have cold, frosty mornings with sunny, warm afternoons meaning that if we are not monitoring the temperature of the slab, the lag between system requiring heat, and the system outputting heat can lead to poor performance of the underfloor system. This problem is also exacerbated by the fact that high heat loss homes with large amounts of glazing are common. This is different to what the weather and typical homes are like in Europe and North America where they can often successfully use only air sensing thermostats.

Central Heating New Zealand's approach to underfloor control is that if we are heating the floor we need to control via a combination of the air and the floor while maintaining the floor at a minimum slab temperature. We are trying to avoid temperature lag and overshoot to produce the best comfort.

Floor probe Locations

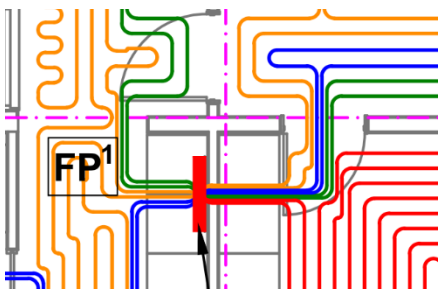
Commonly, floor probes would be installed to terminate above ground within a wall directly below the room thermostat, this method requires a blanking plate is installed at low level to ensure the floor probe is accessible for replacement or else damage to the Gib may be required for access. While this installation method is suitable, another common method for floor probe installation which we recommend and commonly detail on our underfloor drawings, is installing multiple conduits in the slab and terminating the conduit within the underfloor manifold. Terminating within the manifold means that less care needs to be taken to get the probe in the correct location (within a wall) as the manifold is a known location where all of the underfloor pipes are already terminating. By installing multiple probes, during commissioning/fault finding, an alternative probe location can be used. From the manifold, a suitable screened twisted pair cable can be used to run the floor probe back to the thermostat.

On our underfloor layout drawings, we will detail our thermostat & floor probe locations with the following symbols, you may also note that a table detailing the conduit length has been included for ease of installation.

FP Recommended Location Of Floor Probe. Run Conduit From Manifold Or Nearest Wall & Terminate Centrally Between 2 Pipes At This Location. Refer To The CHNZ Underfloor Installation Manual For Additional Details.

T CHNZ Thermostat

Floor Probe Lengths		
FP^1	Floor Probe To Manifold A	2 Metres
FP^2	Floor Probe To Manifold B	8 Metres



Installing of floor probes conduit

The floor probes that are supplied with our controls come with a sensor length of around 3m metres and a diameter of 5mm at the sensor tip. During the underfloor installation we recommend a conduit is installed to enable the probe to be installed/replaced at a later date. If the probe was installed directly into the concrete floor, should the probe fail or give a false reading, replacement would not be possible. The same Multitubo 16mm underfloor pipe which is to be used for the underfloor install is suitable to use as this conduit.

The conduit should be attached within the slab or screed before the concrete is laid and should be situated evenly at the same level (i.e. above the mesh) between two of the underfloor pipes. If possible, the conduit should, ideally run in the same direction as the underfloor pipes. The end of the conduit that is in the slab should be sealed with tape to prevent concrete ingress.

Extending Floor Probes

Floor probes can be extended with the use screened twisted pair cable and should avoid long runs parallel to mains cable to avoid electrical interference and false probe readings.

What if a floor probe/conduit has not been installed during the underfloor installation?

Whilst floor probes have been installed by grinding a slot into the surface of the concrete slab, this really is not a great solution as it is difficult to replace if the sensor fails. Also, there is the risk of grinding through an underfloor pipe that is close to the surface. In most scenarios we would advise against cutting or grinding a chase in concrete floors to fit a floor probe, but if no conduit has been installed this method can be used to improve system control.

Floor Probe installed on mesh

Floor probe installed in insulation. Note, the location shown is not ideal. The probe should terminate at the same level, run parallel to the underfloor pipe.

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Installation Methods:

Tying to Mesh

This installation method is the most common method for installing underfloor pipe in New Zealand. As there is likely to be saw cuts, a process where the slab is cut to control/prevent cracks, care must be taken to avoid damage to the pipe. While minimizing crossings where possible, where the pipe does cross under a saw cut, the pipe should be grouped, and a section of the mesh removed. The pipe can then be laid lower in the slab in this location and the mesh reinstated once the pipe is laid. A recommended alternative to saw cutting is the use of crack inducers (such as a Crackmate or CANZAC crack inducer) as this will reduce the risk of damage to the pipes.

Where the pipe cannot be tied to the structural mesh or clipped to the insulation layer, a light gauge sacrificial mesh can be installed (typically by the builder) below and before the structural mesh. The sacrificial mesh and underfloor pipe would be installed prior to the structural mesh. Care must be taken by the builder when fitting the structural mesh to prevent damage to the pipe and ensure the structural mesh does not rest on or pinch the pipe.

The easiest and quickest method to fix the pipe to the mesh is with the use of rebar tie wire and a tie wire gun available from CHNZ or other local suppliers.

Considerations for tying to mesh:

Please discuss the below recommendations with the builder, architect, and/or structural engineer prior to the underfloor installation.

- We recommend the structural mesh be a minimum of 50mm from the top of the slab to ensure the pipe is at a sufficient depth (34mm cover above top of 16mm pipe) to minimize the risk of damage from saw cuts/other slab fixings and ensure the pipe will not be seen on the surface due to high points in the structural mesh.
- Where possible to mitigate damage to the underfloor pipe, we recommend minimal saw cuts or the use of crack inducers.
- The slab will need to be designed to meet the current building code requirements depending on the specific region. This may mean additional insulation or edge insulation is required.
- Underfloor pipe should have no/minimal crossing under walls, any wall fixings would increase the risk of damaging pipe. Any crossing under walls should be confirmed suitable.
- If sections of mesh are to be removed then reinstated, the requirements of this detail should be confirmed suitable.

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Clipping to insulation

In situations where it is not possible to tie the pipe to the mesh, for example a polished concrete floors where numerous saw cuts are required, if there is a layer of insulation at the bottom of the slab a common solution is clipping the underfloor pipe directly to this. This method provides ample clearance from the saw cuts to the pipe and is therefore at low risk of being damaged.

Clipping to insulation is also used for the European screed floor method where the underfloor heating pipe work is installed in a thin screed, thermally broken from the structural slab. A 30-50mm layer of high-density insulation is fitted over the structural slab and a thin layer (10mm) of insulation is fitted around the perimeter of the screed. The screed is typically 50-80mm thick depending on the supplier/installer and provides a lower thermal mass underfloor heating system.

Clipping to the insulation uses plastic pipe clips to fix the pipe to the insulation, the clips supplied by CHNZ feature two long barbs providing a secure fix into the insulation, commonly Multitubo composite pipe is used however PE-RT pipe is also suitable for this application. A high density (XPS) insulation is recommended as this allows the pipe clips to have a greater hold down strength.

Considerations for clipping to insulation.

Please discuss the below recommendations with the builder, architect, and/or structural engineer prior to installation.

- We recommend the concrete cover above insulation is no greater than 100mm as the greater the concrete depth over the pipes, the greater the system losses & thermal lag, and the system may require a higher temperature water injected into the slab. These changes would reduce the efficiency of the underfloor system.
- High density XPS insulation is preferred as the pipe clips are less likely to pull out. To ensure sufficient clip penetration, we recommend at least 50mm insulation (30mm minimum) is used. (insulation TBC to meet required slab R-values)
- Clipping to insulation is not suitable for raft type slabs where steel in ribs is above the level of the insulation layer.

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Installing Variocomp

Variocomp is a system by Variotherm in Austria. It is a quick-reaction, light-weight underfloor system that can be used in both new and existing houses. It can be installed on a concrete or wooden floor either directly or on a thin layer of insulation (XPS). The pipes used in the Variocomp system are smaller in diameter than what is used in either the Kiwi In-slab or the European Screed method. These pipes are installed in a reinforced gypsum board panel, which is installed over the structural floor or insulation. After the pipe is installed in the panels a screed is used to fill the panel voids and provide a finished level for levelling compounds or floor coverings to be applied.

Depending on the finished floor covering, a calcium sulphate self-levelling compound (5-10mm thick, supplied by others) may need to be applied over the Variocomp system to allow the floor coverings to be installed. It is wise to allow for this in the original budget as decisions on floor coverings often change. The Variocomp system will require architectural detailing and additional builders work for integration into the home.

Considerations for Variocomp

Please discuss the below recommendations with the builder, architect, and/or structural engineer prior to installation.

- The Variocomp underfloor system will add at least 20mm to the structural height build up. On new floors this may require a set down to ensure an even finished floor level across the entire project, in retrofit applications, this may mean doors/skirting will need to be modified.
- A suitable, clean, level substrate is required for the system to be installed over.
- The building should be enclosed with wall lining and window joinery installed prior to installation of the Variocomp system.
- We recommend no other trades complete work in the area until the Variocomp system installation is complete.
- A floor levelling compound up to 10mm thick laid by the flooring contractor may be required with soft floor finishes.
- The architect/builder will need to clearly understand the requirements of the Variocomp installation.
- The Variocomp system has specific requirements around maximum loadings and minimum compressive strength of the substrate insulation. Special consideration should be given to heavy objects such as pianos, aquariums, bathtubs, and pool tables.
- Please carefully review the Variocomp installation guide to ensure you are fully aware of all installation steps and considerations.

Steps for installing Variocomp

1. Lay plastic membrane
2. apply self-adhesive edge insulation
3. Place Variocomp panels, (note joinery where blank panels should be installed)
4. Lay Variocomp pipe in panel according to layout
5. Apply screed compound and spreaders
6. Lay additional screed if required (may be needed for soft floor coverings)

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Please refer to our Variocomp Specification HERE along with the detailed Variocomp installation guide HERE for more information on the Variocomp underfloor system

Varocomp Underfloor Drawings

When Variocomp is the underfloor installation method, there are some additional details which will be shown on the layout that are specific to the Variocomp product. These are the Origin of first panel, movement joints & clamp track spacing.

Origin of the first Panel

As the Varicomp panels essentially make up a 100mm x 100mm grid, it's important to know the corner where the underfloor layout designer has chosen as the starting point in a room. Often the best place for a Datum is the opposite corner of the room from the doorway where the pipes enter the room.

= Origin Of First Panel

Movement Joint

Where Variocomp is installed in large areas a movement joint may be necessary. They are usually made with the Variocomp Edge Insulation tape. A movement joint will be required where:

- To separate large areas, the maximum section size is 80m2.
- To break up long rooms, the maximum edge length is 12m
- The Variocomp pipe transitions through a door

= Recommended Movement Joints With Edge Strip Insulation

Clamp Track Spacing

Variocomp pipe run in areas where no panels have been installed are typically run in a plastic clamp track that has a 40mm pipe spacing. As these area will have no blank or active panel installed and would otherwise require being filled with the Variocomp screed, its recommended to keep Variocomp hot tracks to a minimum and where possible install cut sections of blank panel to fill voids reducing the need for screed. A small strip of blank panel down either side of a clamp track section will also help to provide a flat surface to use when levelling out the screed

When in the Build is Variocomp Installed?

Variocomp should be installed after the walls have been erected, windows installed, and the building is weather tight. It is common for Variocomp to be installed after kitchen/bathroom joinery has been installed however ideally it should be installed before as the floor level will be raised by 20-30mm.



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Installing spreader plates

The spreader plate system suits new build or extensive renovation projects with joisted floors. An aluminium spreader plate is fitted between the joists allowing for pipe to be pressed into the spreader plate, the heat from the pipe is transferred into the spreader plate which transfers the heat to the floor surface heating the space above. The spreader plate system should ideally be used in areas that do not require a high output and is most effective with boiler powered systems. An example of an ideal application for spreader plate underfloor heating is upper floor bedrooms, the output from this system is likely to be suitable for this application however any living or bathroom areas where the system is installed will likely require supplementary heating at times.

Considerations for spreader plate installing

- Spreader plates will require the joists spacing to be at 400mm centres.
- Insulation (supplied by others) must be fitted to ensure spreader plates are pressed against the underside of the floor covering.
- For the safety & protection of the installer, to ensure they cannot fall through the joists, upper floor areas may require a false floor within the joists.

Spreader plates

Spreader plates piped from below with false floor added for installer safety

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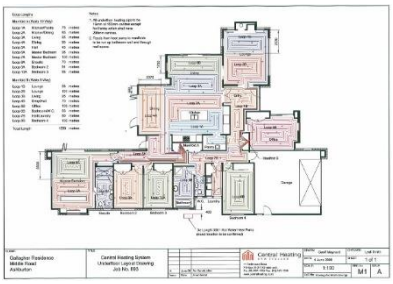
Tips for Installing Underfloor Pipework

Laminate CHNZ Underfloor Layout

- When laying underfloor pipework, it helps to follow a plan
- As this can get damaged while installing, we recommend it is protected
- Loop lengths can be recorded next to the manifold table or on the back of the laminated sheet



Get Walls Marked Out

- Get the builder to mark where the walls, saw cuts, and control joints are going to be and confirm on the day of laying that the plan hasn't been changed
- Generally, don't lay pipes under walls– go in and out of rooms through doorway (there are exceptions)
- Take lots of pictures so you know where the pipe is after the concrete is laid
-

Manifold Position

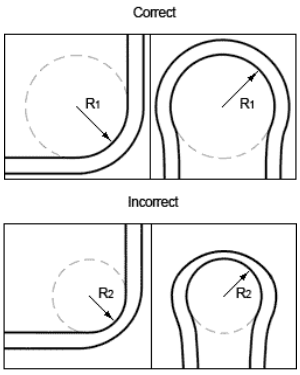
- First build manifold placeholder in correct position.
- Use re-bar and or mesh (or other) to construct temporary manifold.
- Remember concrete is to be poured around it.

Use Pipe De-coiler

- Ideally one installer feeds the pipe, and another will fix it to the mesh/ clips to the insulation.

Bending Pipe Around Corners

- Be careful not to kink the pipe on tight corners & be aware of laying PE-RT pipe in extreme heat as the pipe can become more mailable and more prone to deforming.
- A "keyhole" pattern should be used for 180° bends to avoid this.
- Multitubo PE-RT Inverse & MT16 Composite has a minimum bending radius (by hand) of 5 x 16mm (pipe diameter) or a radius of 80mm



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Start pipe loop

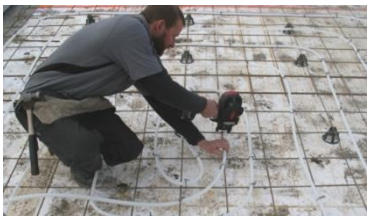
- Leave plenty of pipe at the beginning and end of loop
- Attach pipe to temporary manifold (in position for that loop) and lay underfloor loop.
- Flow pipes should be @50mm centres to align with ports on manifolds (flow and return can be tied together.
- Make sure pipe is pushed down – without kinking – so that it comes out of the floor under the manifold as far as possible
- Once the loop is laid If there is enough pipe remaining on the coil for the next loop, loop the pipe and lay the next loop without cutting the pipe, this will reduce the amount of connections required for the pressure test.

Don't leave rust marks

- Using ordinary tie wire on the manifold ends may leave permanent rust marks if exposed to the weather
- Use non-rusting wire or zip ties or protect pipes if rusting is likely

Fix pipe

- Fix to mesh at positions needed to hold pipe down flat and give the right spacing – usually every 400mm
- More fixings are required if going around a tight corner



Avoiding potential punctures

- Knock down any wire ties sticking out near the pipe.

Common Pipe fixing methods

- MAX wire tie gun (cannot be used in wet weather)
- Zip ties (cable ties)
- Tacker gun with pipe clips (staples)
- Hand operated clip gun

Whilst laying pipe

- Avoid kinking pipe as this will restrict or prevent flow
- Be careful not to melt the pipe when using high power lights or any other heat source during and after the installation– it has happened
- Follow the pipe plan and stay 200mm away from wall and fixed joinery positions unless otherwise arranged
- Record how long each loop is when laid by noting the length marking on the pipe

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Put in conduit for floor probes

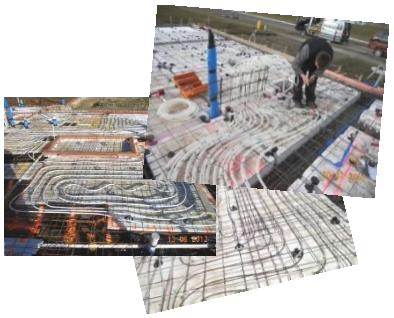
- A conduit allows replacement of faulty floor probes during the life of the system
- An offcut of pipe is commonly used, this can be supported with rebar where rising vertically as shown in pictures.
- The probe conduit should be pass under the loops and then rise up to the level of the pipes where it is to terminate, parallel, equally spaced between two pipes to reduce the risk of probe getting false or bad temperature readings.
- The end should be sealed (tape or similar) to prevent concrete ingress.
- If supplied, refer to CHNZ underfloor layout for optimal floor probe location.
- There are two common methods for installation of a floor probe conduit.
    1. Bring floor probe up within wall directly below thermostat. This is the most common method for floor probe installation and the sensor can run directly to thermostat(s). This can make it difficult to replace the sensor if required and may necessitate a blanking plate or cutting a hole in the GIB.
    2. Bring conduit back to manifold and run wiring from manifold to thermostat(s). This method allows ease of replacing the sensor should it fail & multiple conduits can be run to allow for ideal probe placement.

Probe/wiring added at pre-wire stage

Poor probe placement

Take lots of pictures

- Before the concrete is poured take lots of photos of all the rooms.



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Pressure Testing Underfloor Pipework

Once an underfloor system has been laid, as it will soon be embedded in concrete and inaccessible should any damage have occurred during installation it is important to pressure test so that any damage can be repaired, or loops replaced. We recommend an underfloor system is tested to 6bar and monitored for 30min to ensure pressure does not drop.

The underfloor pipe can (and should) be left under pressure test for the duration of the project's construction, the builder (or installer) can periodically check the pressure gauge to ensure pressure has held and no damage has occurred. If the underfloor pipe is damaged, i.e. a nail through a base plate punctures a pipe, commonly the pressure released can be heard to identify the damaged location so that the pipe can be repaired. After repairs the system should be re-pressure tested to confirm fix was suitable.

Pressure tests should be recorded, you can find our pressure test report on our website

What to test pressure test with?

Several different mediums can be used for completing the pressure test on the underfloor system, the most common being;

- **Oil free compressed air (Recommended By CHNZ)**
  - Requires electrical connection & compressor onsite
  - Makes an audible "wooooosh" when pipe is punctured alerting to the damaged caused.
  - Fluctuations in pressure to be expected with change in temperature
- **Inert gas (nitrogen or similar).**
  - Does not require electricity.
  - Will make a noise similar to compressed air
- **Water – NOT RECOMENDED**
  - Increased risk of freezing and damaging pipe.
  - Pressure can commonly fluctuate 1-2 bar with temperature throughout the day.
  - Will not make noise when punctured but could cause wet spot in slab showing sign of damage.

Steps for pressure testing;

1. Flow test each loop by blowing air down to ensure no blockages
2. Connect all loops in series using either elbows, or straight connectors
3. Connect gauge, tee fitting and end cap.
4. Connect isolation valve to free outlet of the tee and ensure it is set open
5. Connect a compressor (or other) & charge to 6bar. **Closely watch the pressure gauge!**
6. When up to pressure close the isolating valve and fit plug.
7. Wait 30 min to ensure pressure has not dropped.
8. If pressure has dropped, check for leaks, repair pipe if necessary and repeat the above steps until pressure test has passed.
9. Leave on pressure test for duration of construction.
10. Wrap manifold in black DPM plastic (or similar) to protect from weather and UV light.

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Tips for Pressure Testing

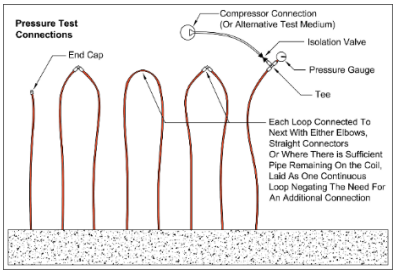
Test Pressure

- We recommend the system is tested to 6bar, this is 3x the typical operational pressure and 2x the pressure relief valve rating.
- Its important that the initial pressure holds without fluctuation for at least 30 minutes
- System should remain on pressure test throughout construction until the manifolds are fitted.

Equipment

- CHNZ supplies a test kit (product code TESTKIT) which contains the required fittings necessary for pressure testing
- You may need an additional connector depending on what is being used to pressurise the system.
- Standard Multitubo crimp fittings can be used if required.
- Compressor, Inert gas bottle, or Garden tap & Hose

Before Pressure Testing



- Ensure each loop has no kinks or blockages by blowing compressed air through it. This eliminates the possibility of a crushed pipe at the installation stage.
- complete this test with less than 1 bar pressure on the gauge
- Record that each loop has flow tested on your test sheet.

Failing the Pressure Test

- If the pipe is damaged the 30 min pressure test will fail
- A puncture or damage to the pipe will result in a reduction in pressure during the initial test. This damage will need to be located and repaired to allow the pressure test to be passed
- See our pipe repair guide HERE (and below).

Passing the Pressure Test

- The pressure test can be considered “passed” when the pressure has held at 6bar, unchanged for 30 minutes or more.

Checks

- Regular checks by installer or builder should be made, any reduction in pressure of more than 0.5 bar should be noted and investigated.

Hazard Board

- After pressure testing is complete leave the gauge attached so any pipe puncture will be indicated by a loss of pressure test
- As this is potential for danger on the building site this should be noted on the site hazard board.
- All floor standing heaters (such as a diesel blower heater) should not be used as it increases risk of damage to pipe due to excessive localised heat

Protect Pipework and Pressure Gauge

- Shrink wrap to protect from UV and corrosion.

Fixing damaged pipe

While taking all steps to mitigate damage, accidents happen, and pipe(s) may need to be repaired and there are a few methods for how this can be done as outlined below. In addition to the methods below, for Multitubo composite pipe, standard press fittings can be used.

In addition to saw cuts and nails which would be the most common cause for damaged pipe in the slab, underfloor pipework can also be damaged in other ways. There have been cases of BBQs, diesel heaters and halogen lights melting pipe embedded in the slab. Supports for precast walls have also punctured pipe requiring repairs. It is important that the builder and other trades understand that there is pipe in the slab and understand what practices should and should not be used on projects with underfloor heating.

The best form of repair will always be ensuring the pipe does not get damaged in the first place. Taking steps to mitigate potential cause for damage while laying underfloor could prevent costly mistakes in the future, i.e. ensuring there are no high points in the mesh, flattening mesh ties, and grouping across or dipping below saw cuts (or having crack inducer used instead).

Steps for Fixing Damaged Pipe

1. If slab has already been poured, damaged pipe will need to be exposed by digging out the concrete around the pipe, care should be taken to ensure other pipes are not damaged while this is done.
2. Cut out damaged section of pipe
3. Insert new section of pipe (if required) and use crimped or compression connectors
4. When connection is finished pressure test again if possible
5. Then wrap in protective tape (Denso or similar) before filling in floor

Method for Fixing Multitubo PE-RT pipe.

Option 1:

- 1x UFJR – *Telescopic Joint Repair Connector*
- 2x CONMTPERT - *PE-RT Pipe Connectors (or CONMT1634 for composite pipe).*
- This would then be wrapped in Denso tape, pressure tested, and the slab re-filled:
- As the connector is extendable, a larger section of pipe can be repaired, and additional pipe is not needed to make the connection.

Option 2:

- 1x CONMTPERTDN - *PE-RT Pipe Joiner.*
- 2x CONMTPERT - *PE-RT Pipe Connector (or CONMT1634 for composite pipe).*
- This would then be wrapped in Denso tape, pressure tested, and the slab re-filled.
- May require two sets of connection to join the pipework once the damaged pipe has been removed. Insert new section of pipe if required if damage is greater than 28mm

Please Note: For composite pipe, if preferable Multitubo press fittings are also suitable for pipe repairs within the slab. The composite pipe should be reamed and the sight windows on the press fittings should be used to ensure the correct insertion depth has been achieved. This fitting should also be wrapped in Denso tape and pressure tested as per the above options.

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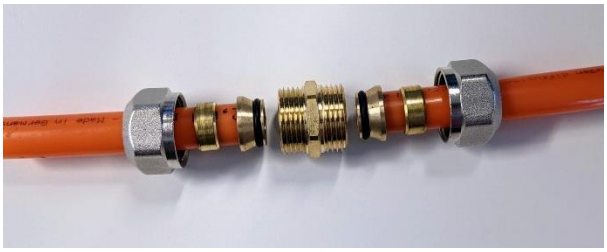
Pictures of Underfloor Pipe Repair

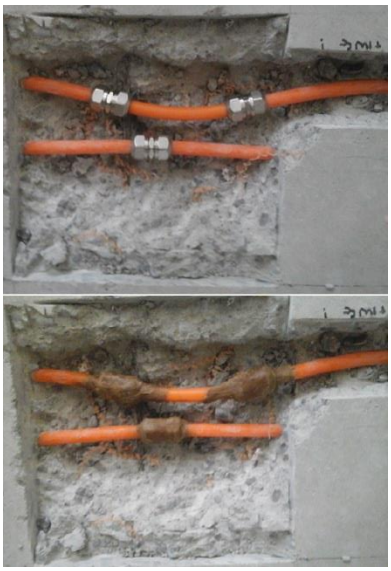
Pipe repair using telescopic connector (option 1 above)



Option 2 Pipe repair assembly
(CONMTPERT – CONMTPERTDN - CONMTPERT

Pipe cut as mesh had high spot along saw cut, this highlights why we minimise & group crossing over saw cuts

Large section of pipe cut and repaired



Option 2 pipe repair where large section of pipe needed to be removed, requiring 2x repairs for single pipe. Subsequently wrapped in denso tape.

Multiple pipes cut requiring repair when cutting the slab

Pipe melted by a diesel heater (for drying) which required repair

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Installing the manifold

After the underfloor pipe has been laid and the walls built with the building weather tight the manifold cabinet and manifold can be installed.

When Should the Manifold be Installed?

The manifold & cabinet is best installed before walls are lined and painted.

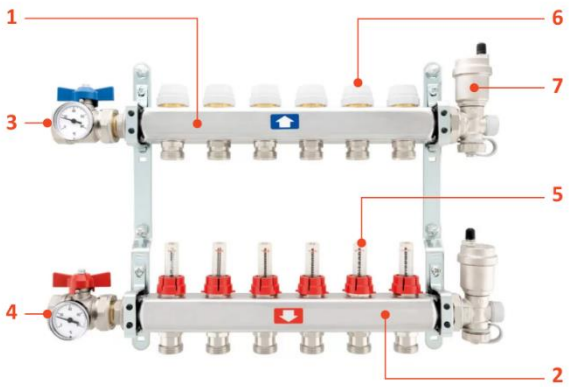
Steps for Installing Manifold & Cabinet

1. Installing the cabinet (if used)
2. Installing manifold
3. Cut, Ream and connect underfloor pipes
4. Connect feed pipes
5. Protecting cabinet and pipes

Manifold Components

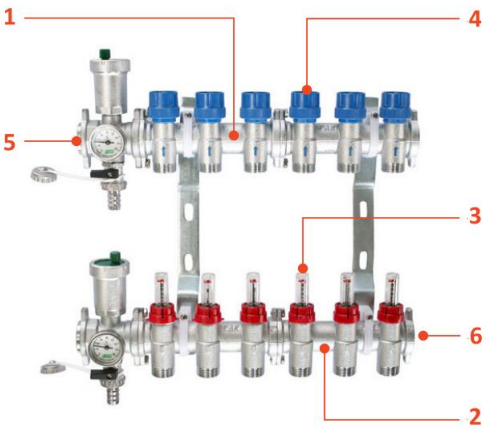
iTAP

1. Manifold Return Branch
2. Manifold Flow Branch
3. Isolation ball valve with thermometer (return)
4. Isolation ball valve with thermometer (flow)
5. Flow meter & regulation valve
6. Control valve with M30x1.5 thread (for electric actuator if required)
7. AAV end set with ¾" drain valve
8. Optional Mixing unit available (not pictured) for high temp systems



FAR

1. Manifold Return Branch
2. Manifold Flow Branch
3. Flow meter & regulation valve
4. Control valve with M30x1.5 thread (for electric actuator if required)
5. AAV end set with 1" flow/return connection & ¾" drain valve
6. 1" threaded connection for FAR blanking plug, or FAR bypass valve or additional manifold ports
7. Optional mixing unit available (not pictured) for high temp systems



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Tips for Installing Manifold & Cabinet

Install Manifold Cabinet (if used)

- Can be installed either recessed or wall mounted
- Mount higher for easier piping/access
- Can be custom made by builder and even hidden behind false panel.

iTAP Manifold

- Stainless Steel construction
- MAX 14 loops
- See iTAP Manifold Installation guide on our website.

FAR Manifold

- Nickel plated brass construction
- Modular manifold can be extended easily.
- High flowrate manifold means manifold can have 20+ ports
- See FAR Manifold Installation guide on our website.

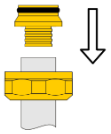
Connecting Pipes to The Manifold

- Connector for MT16 PE-RT Pipe (CONMTPERT)
- Connector for MT16 Composite pipe (CONMT1634
- Label Loops for Future reference
- Connection Feed Pipes to The Manifold Ensure to Thread Seal Feed Pipe Connection

Composite Connector *PE-RT Connector*

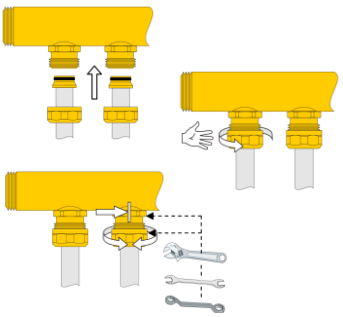
Installing Fitting

- Cut and **ream** pipe
- Push sleeve nut over tube
- Also push over olive if using PE-RT and nozzle
- Insert euro-cone end fitting



Tightening pipe connectors

- Insert pipe into screw connection
- Tighten by hand
- Secure the outlet screw connection using an open-end wrench (24mm) and tighten the clamping ring nut using an open-end wrench 30 mm (Force approx. 25-30 Nm or 18 lb ft).



Protect cabinet

- This will ensure cabinet is not damaged

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Filling the system & Commissioning

Once the manifold (and heat source/additional equipment) has been installed, it is time to fill the system. This can be done one of two ways, using a garden hose and systematically opening and closing each loop. Alternatively, a high-powered flushing cart can be used and, in some instances, may be required.

Steps for filling the system (using a standard Garden Hose)

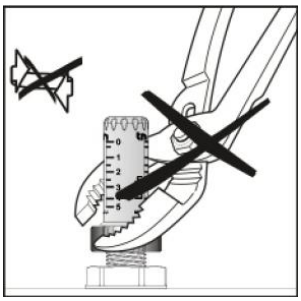
1. Shut down all loops except 1 (or 2 if sufficient pressure is available)
2. Connect inlet hose to flow fill point
3. Connect outlet hose to return drain point
4. Run hose until all the air is expelled from the loop
5. Isolate loop, then open and fill next loop

Flushing Cart

- Conserve water
- No mess on construction site
- Easier dosing of inhibitor
- Capable of flushing systems a standard garden hose could not
- Considerably faster than hose - less time on site
- Minimises air entrapment in system

Flow Rate

- Typical flowrate through a loop should be in the range of 1 to 3 Litres per minute.
- Shorter loops will have higher flow rates due to less hydraulic resistance. You may need to reduce the flowrate by adjusting the flow meter.
- CHNZ will provide design flow rates with our Underfloor Layouts
- Can need to be adjusted over time to suit customer's comfort levels.
- As adjusting the flow rates to a loop will affect the flow seen through the rest of the loops, multiple passes across the manifold from left to right may be required to achieve the desired flow rates.



Testing a multi-zone system

- Switch off all thermostats
- Turn on all thermostats one at a time and check there is flow in the correct loops
- Actuators take 2 ½ minutes to open

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