



25mm Ground loop installation guide

This installation guide describes the installation of horizontal ground loop systems. Vertical boreholes are not covered as Nu-Heat recommends that this should be carried out by a specialist borehole contractor.

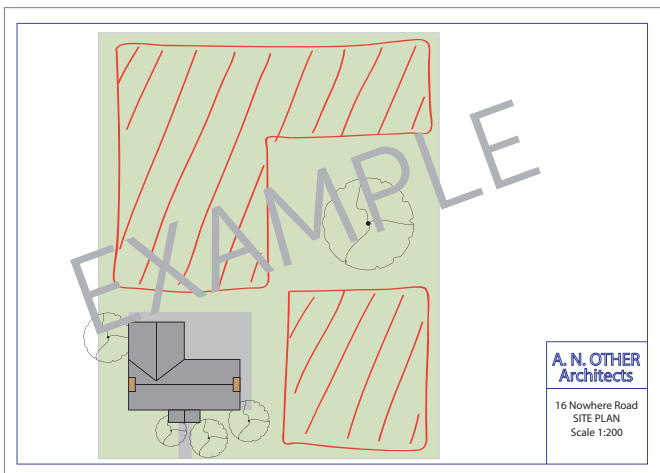
GENERAL GROUND LOOP SCHEME

From the heat pump a pair of flow and return pipes (40 or 50mm diameter) feed out to one or more manifolds. From each manifold an array of 25mm diameter x 100m length pipes are used to collect the energy. These must be at a minimum average centres of 0.75 metres, and all pipes must be at least 1m deep.

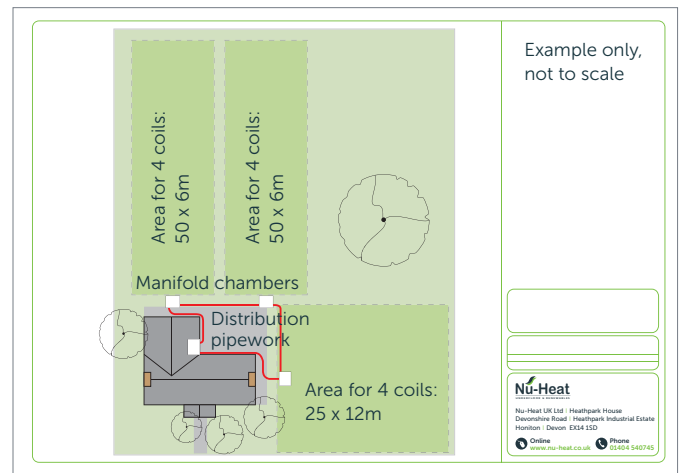
This is all arranged in a 'reverse return' format to ensure that the system is hydraulically balanced.

PLANNING THE GROUND ARRAY

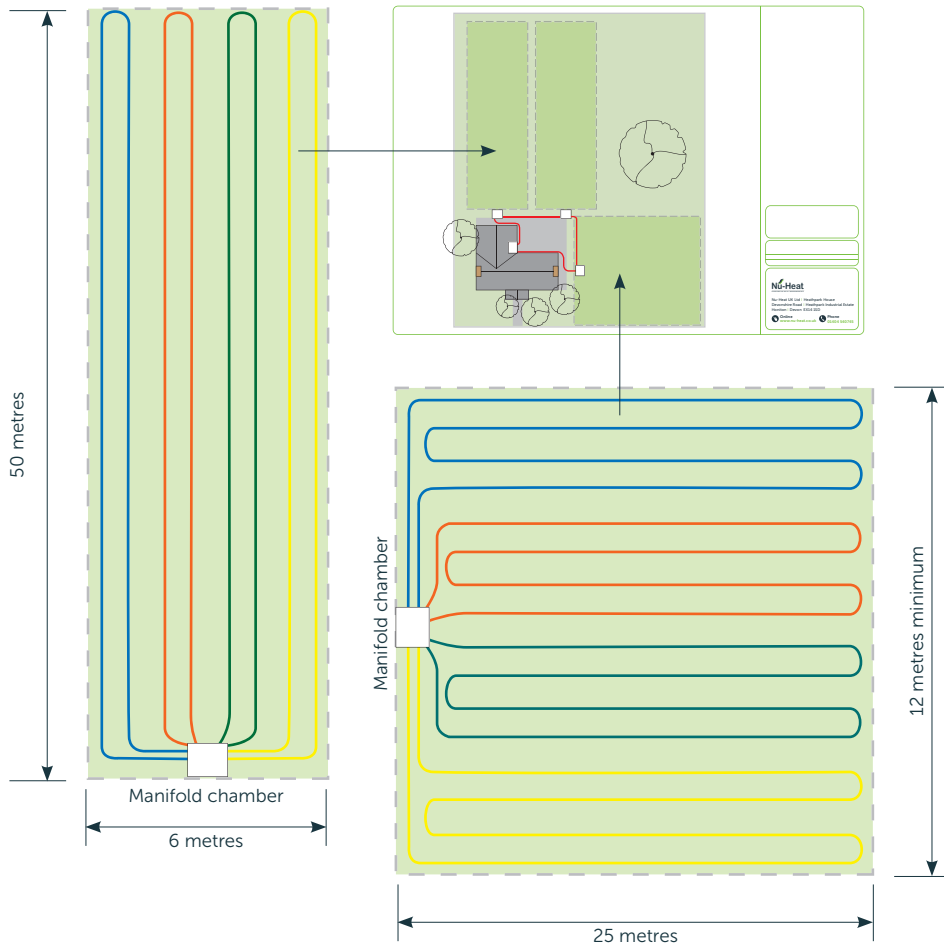
Ground plan



The *Design Checklist* will ask for a scaled drawing/dimensioned sketch of the plot indicating the area intended for the ground loops. Any obstacles must be indicated, including buildings, trees, services, and areas of tarmac, which must be avoided.

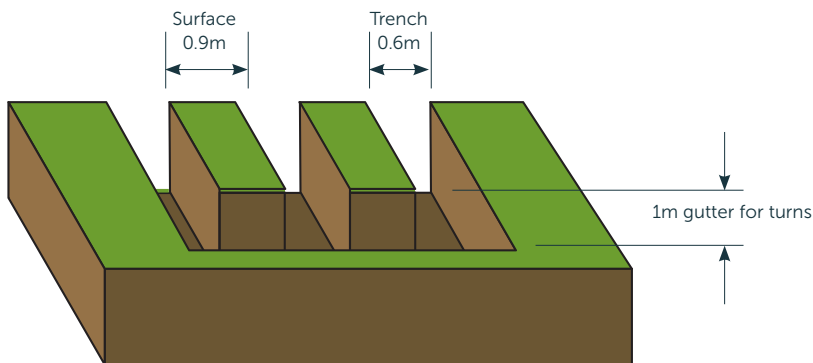


From this information your Nu-Heat designer will produce a CAD layout showing the agreed position of the heat pump, the route of the flow and return pipework, the manifold(s) and the area that each manifold will feed. This will be sent in the *Handover Pack*.



The full pipe array is not shown as this can only be finally determined on site. The plan will detail the number of pipes in each area, and the dimensions of the area. The pipe layout will then follow the general formats shown above/below.

- The pipe runs along the longest length
- Must be at min. 0.75m average centres



If any manifolds are to be installed in different locations from those indicated on the plan, the quantity of distribution pipework required may change. In these circumstances, please contact Nu-Heat for advice.

GROUND LOOP INSTALLATION

This is most conveniently done whilst general excavation and groundworks for the property are being carried out and is best handled by the groundworks contractor.

Groundworks contractor:

- Excavate the trenches.
- Construct the manifold chamber(s).
- Lay the ground collector tube and connect to the manifold.
- Fill and pressure test the collector with water.
- Back-fill the trenches.
- Excavate trenches for flow and return pipework
- Lay, fill and pressure test flow and return pipework back to an agreed position.
- Back-fill flow and return trenches.
- Leave the system full and under pressure.

The above scope should be signed off by the site manager as being installed in accordance with these instructions, fully pressure tested and water tight.

Heat pump commissioning engineer:

- Flush through and add antifreeze.

SEQUENCE OF INSTALLATION

- 1 Mark out all manifold positions and pipe arrays
- 2 Excavate the area for the manifold chamber(s)
- 3 Install the manifold chamber(s) and position the ground loop manifolds inside
- 4 Excavate trenches for the flow and return pipework between all manifolds, and back to the heat pump
- 5 Install the flow and return pipework into the trenches between the manifolds and back to the heat pump
- 6 Excavate the trenches for the 25mm coils
- 7 Start with the coil and manifold furthest away, connect the 25mm coils to the relevant manifold and install in the trenches.
- 8 Pressure test as per method over the page.
- 9 Leave the system fully pressurised ready for the heating engineer to connect to the copper pipework next to the heat pump

IMPORTANT NOTES

- Position manifolds as shown – if they are too close then the pipe arrays will cross over
- Each coil must connect back directly to the manifold, and must not be extended or cut for any reason to maintain even pressure drop
- All 25mm pipe supplied must be installed to achieve the level of heat extraction needed
- Excavate all trenches for the 25mm pipe at the same time, if this is not possible due to land constrictions with trench spoil then excavate as many as possible and carry out pressure test for that portion of the system.
- Trenches for the 25mm pipe should be at least 0.6m wide to accommodate a tube run down each side
- Trenches for 25mm pipe should be 0.9m apart, and at least 1m deep.

EQUIPMENT & PARTS NEEDED

- Materials for constructing manifold chambers – the number of manifold chambers required will be stated on the quote.
- 13mm Armaflex insulation
- Pressure test pump

HEALTH & SAFETY

When digging and working in trenches, current Health & Safety requirements for safe working must be followed.

All trenches deeper than 1.2m must have unstable trench walls supported.

Guidance on safe excavation techniques can be found in:

- BS 6031 – Code of Practice for Earthworks (general trenchworks).
- Report No. 97 – Trenching Practice (specific advice).
- Report Um 1049: 1990 (review of current practices).



1 Marking out all manifold positions and pipe arrays

Before excavating any trenches all pipe runs and manifold positions should be marked out using spray line marker. This ensures that all loops fit into the area allocated and the pipes run back to the manifold easily.

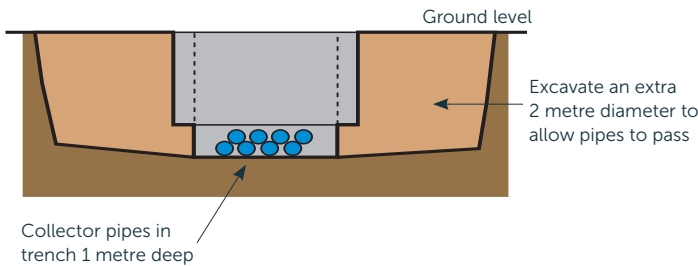
The plot CAD layout indicates the number of manifolds and coils to be installed. The approximate position of the manifold(s) will have been discussed during the design process and the correct amount of pipework to run between the heat pump and the manifolds will have been supplied. If the distance needs to be extended, please contact Nu-Heat for advice.

2 Excavate an area for the manifold chambers

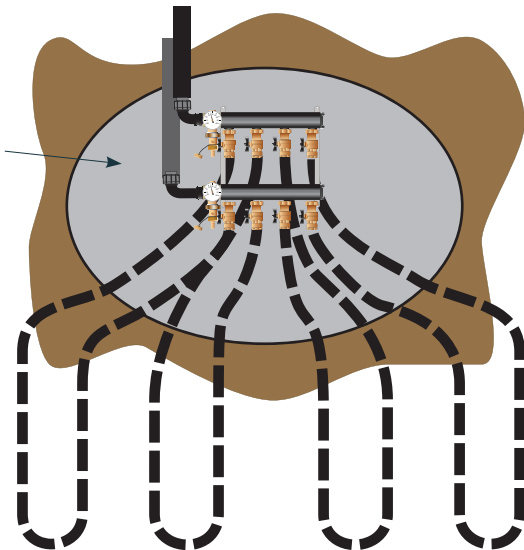
The area for the manifold chambers should be excavated with an additional 2 metre area around the chamber to allow pipes to pass through. The chamber must be buried deep enough for the ground loop pipes to leave the chamber at a depth of 1m. The flow and return pipes may need to go deeper at the manifold chamber to keep all pipes below 1m depth.



Cross section



Floor-mounted example



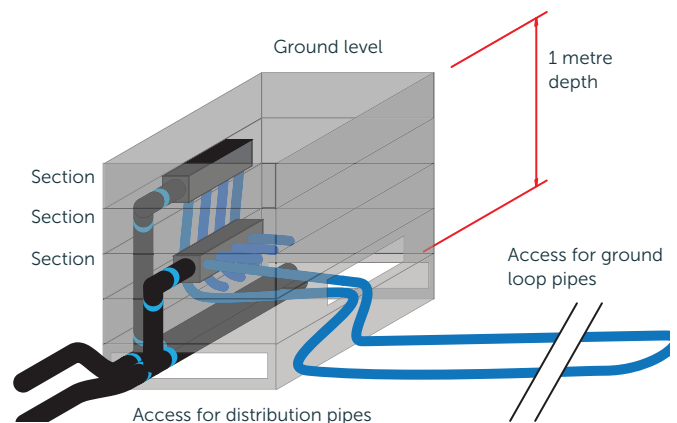
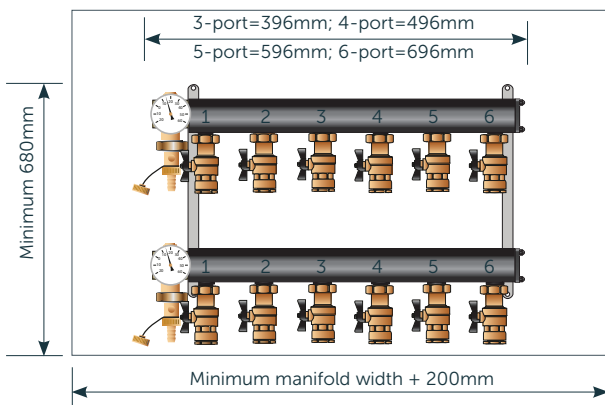
3 Install the manifold chamber and manifolds

Chambers should ideally be pre-fabricated and constructed from concrete or plastic, however manifold chambers can also be constructed using brick or block.

When the manifold chamber has been constructed the manifold should be fixed into a position that allows access to all connections. Slots should be cut/built in to allow pipes to pass as illustrated.

Note: Do not install air vent. Temperature gauges are optional.

Minimum bend radius of 25mm pipe = 455mm
 Lowest rail must be higher than 500mm from chamber floor



4 & 5. Installing the flow & return pipework into the trenches between manifolds, and back to the heat pump

Flow and return pipe work will be supplied in either 40 or 50mm diameter, but will generally be the same throughout. The diameter will depend on the length required, to stay within the available pump head. This length should not be exceeded.

Trenching must be excavated from a position near the heat pump to the first manifold, and also between any subsequent manifolds. Note that multiple manifold systems must follow the reverse return principle, and therefore up to three pipes must be accommodated between manifolds. The final return to the heat pump may however follow an alternative route to the flow.

Flow and return pipework must be 0.6m apart to prevent heat transfer between the two. Any pipes closer than 0.6m apart must be insulated using water-resistant insulation.

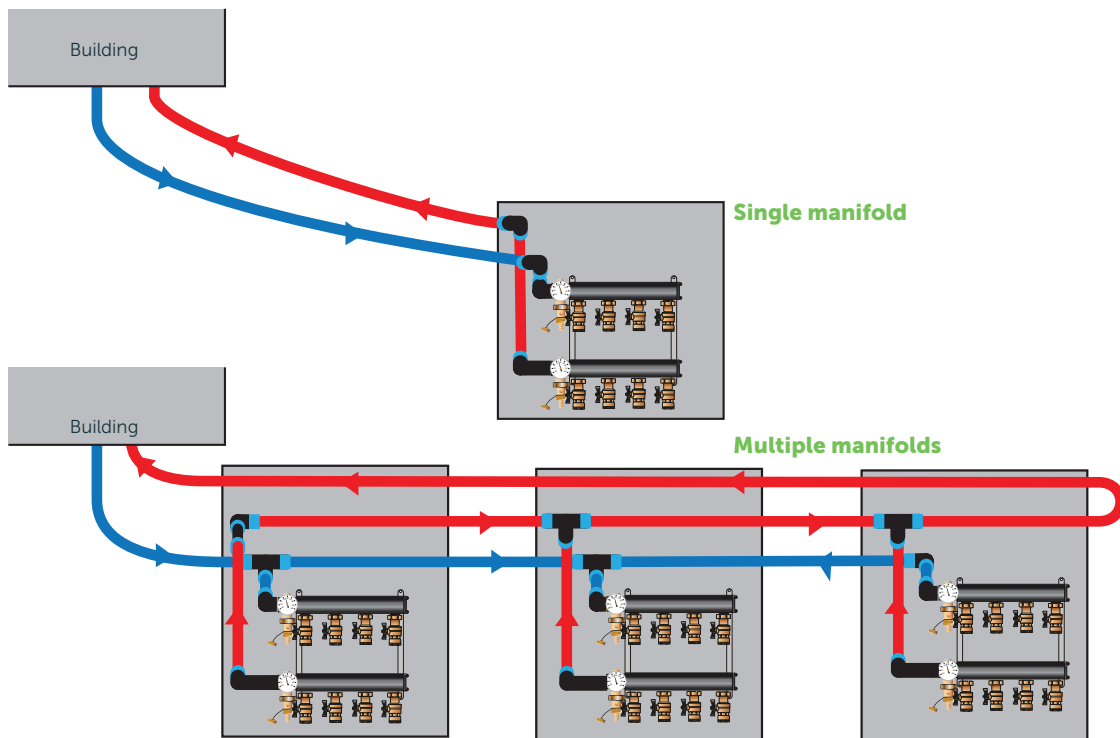
Insulation must be installed for a minimum of 3 metres from any building foundations in order to stop the ground from freezing and potentially causing damage.

Various methods for taking the pipe into a building are shown below.

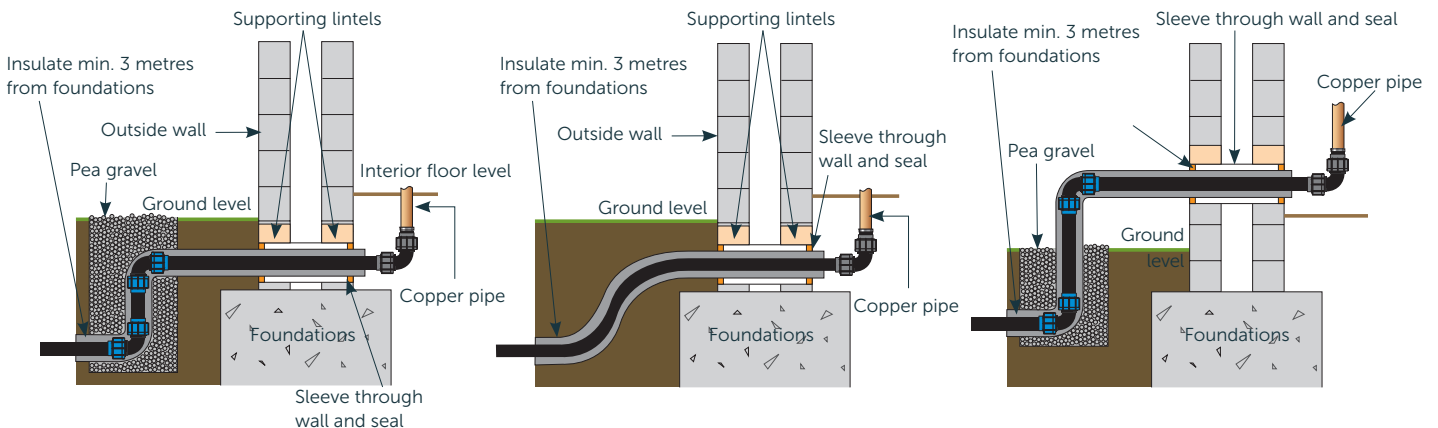
Note: Inserts are supplied for the 40/50mm pipe.

Compression fittings must not be buried – they must be left accessible.

If space is at a premium and not all trenches can be excavated at once, try to install and pressure test as many ground loops as possible before back-filling.



There are several different methods for installing the pipework into the main house:

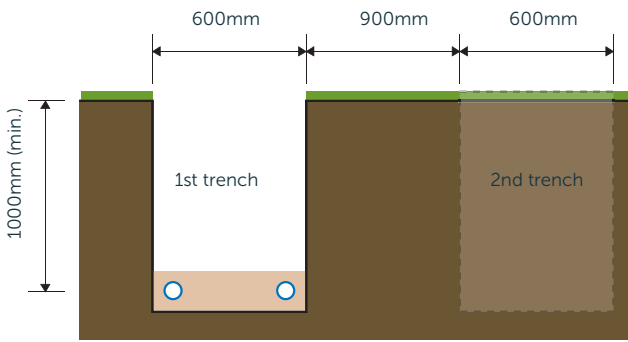


Option 1
Installation below ground level

Option 2
Installation below ground level (without joints)

Option 3
Installation above ground level

6 & 7 Excavating the trench for the first 25mm coil, and installing



With all manifolds in position and the distribution pipework installed, the trenches for the collector coils should now be excavated.

Trenches should be excavated using a minimum 600mm bucket to a depth of 1m, allowing the coil to be installed along each side of the trench.

If the fill material has too many sharp stones, a bed of sand can be optionally laid to add an extra layer of protection for the pipes against sharps. Note that in this case the trench needs to be deeper in order to keep the pipes 1000mm from the surface.

Starting with the manifold furthest from the heat pump:

- 1** The coil should be unwound outside of the trench, leaving the coil lying on the ground. When uncoiling the pipe aim to be back at the manifold with the end of the coil.
- 2** The coil can now be pulled into each side of the trench starting from the manifold end and continuing until all the coil has been installed in the trench. The entire 100m of the coil must be installed to allow the heat pump to operate correctly.
- 3** Connect to the manifold. Loosen the isolating valve compression assembly but do not dismantle. Insert pipe to stop end and tighten lock ring.

Note: Inserts are not needed for 25mm pipe.

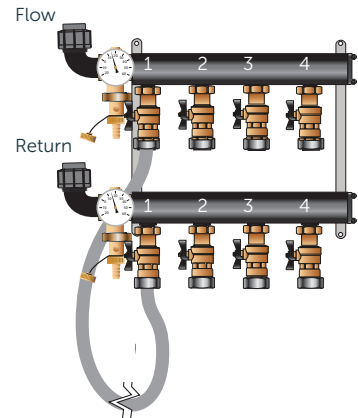


Connect the flow end of the pipe to the manifold and then uncoil the entire length of pipe outside of the trench.



Pull the pipe into the trench running along each side. Connect the return end of the coil to the return manifold. Do not cut the pipe to fit.

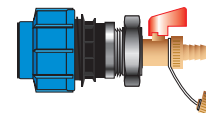
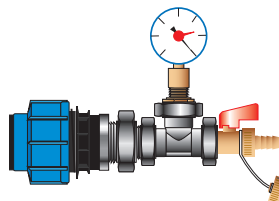
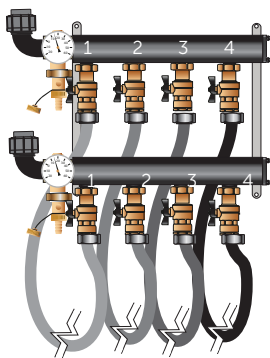
Manifold



Because the manifold is reverse returned, connect pipe from flow port 1 to return port 1, etc.

8 Fill and pressure test the flow & return pipework, and 25mm coils

When the flow and return pipe work, and the 25mm coils have all been connected they must be pressure tested.



- a** Close all flow and return valves on all manifolds except one loop on one manifold.
- b** Fit Nu-Heat fill and flush valves to flow and return pipework.

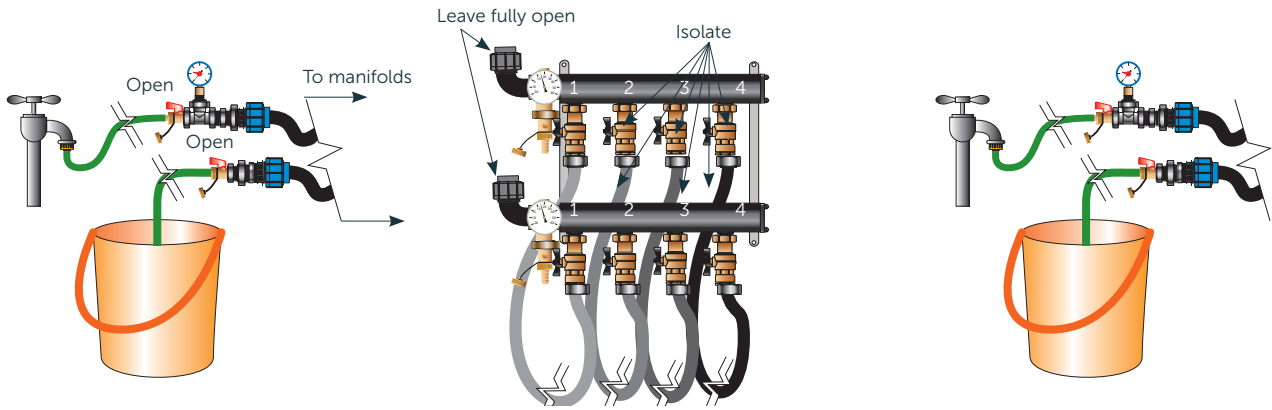
Filling set with pressure gauge

Fittings to connect from 40/50mm flow & return pipe to a pressure gauge and hose fitting.

Draining set

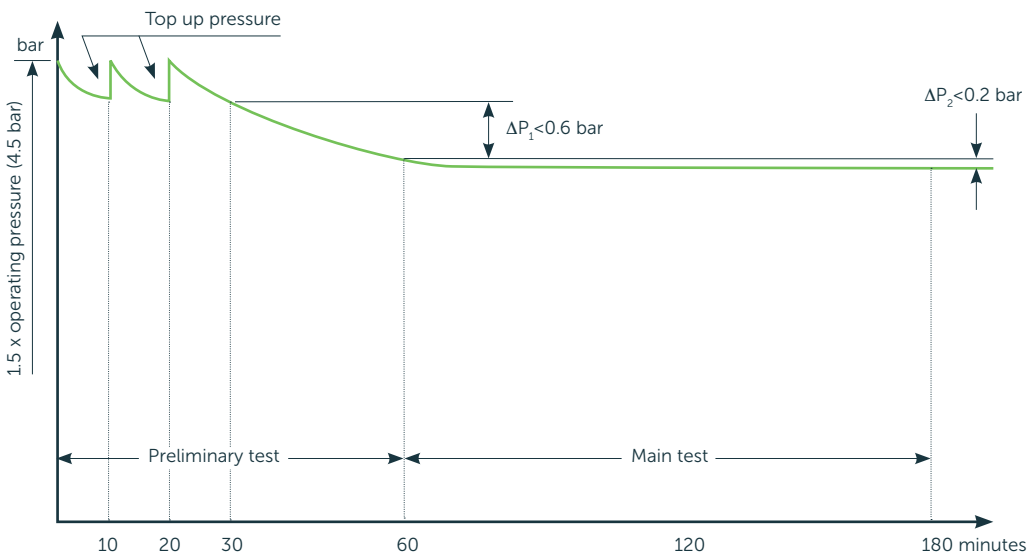
Fittings to connect from 40/50mm flow & return pipe to a hose fitting.

8 Fill and pressure test the flow & return pipework, and 25mm coils continued...



- c** Connect a hose between a tap and the filling valve and also connect a hose to the flush valve and run it to waste or a bucket.
Open the tap and allow water to run for at least 15 minutes after the bubbles disappear.
- d** Repeat step 3 for all other 25mm loops by closing one flushed loop and opening another until all have been flushed and no air is present.
- e** Close the flush valve and allow the pressure to build before closing the fill valve.
Remove hoses and hose adaptors from the fill valve.
- f** Fit a pressure test set and check for any initial leaks. If necessary, repair leaks, re-test and proceed.

Leakage testing – DIN 1988-2



- g** Before the main pressure test is undertaken a preliminary test at 4.5 bar should be maintained for 30 minutes, being topped-up twice at 10-minute intervals (see graph above).
After 30 minutes, record the pressure in the table overleaf. Leave without adding further pressure for the next 30 minutes then record the pressures again. The difference in measurements should be no greater than 0.6 bar.
- h** For the results to be meaningful, the main test must be started immediately after the preliminary test. The test is conducted over two hours at the end of which the pressure must not have fallen by more than 0.2 bar.
After successfully testing, reduce the pressure to 1 bar.

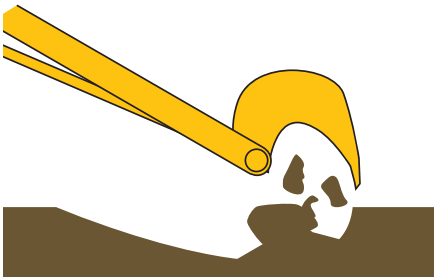
Record the test data

Please record all test data in the table below for the Commissioning Engineer to inspect.

Proof of the successful execution of the pressure test and its accurate documentation is a warranty requirement!

Preliminary test		bar/psi	Main test		bar/psi
A	Operating pressure x 1.5 (e.g. 4.5 bar)	<input type="text"/>	A	Beginning	<input type="text"/>
B	After 10 minutes (restore to pressure A)	<input type="text"/>	B	End	<input type="text"/>
C	After 20 minutes (restore to pressure A)	<input type="text"/>	C	Test pressure	<input type="text"/>
D	Pressure after 30 minutes.	<input type="text"/>	D	Pressure after 120 minutes	<input type="text"/>
E	Pressure after 60 minutes: admissible pressure drop <0.6 bar	<input type="text"/>	E	Is pressure drop <0.2 bar? Yes/No	<input type="text" value="Yes/No"/>

Note: Anti-freeze is not added until the commissioning stage.

**9 Back fill the trenches**

Leaving the pipework under pressure the trenches can now be back-filled. Where sharp stones are present in fill material, protect the pipe with a layer of sand to prevent damage.

Make a note of the pressure in the loops before and after back-filling to ensure the system has suffered no damage.