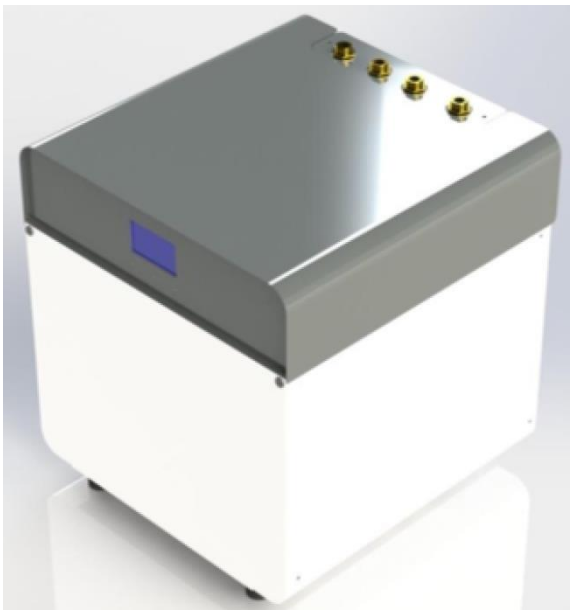
In collaboration with

Ground Source Heat Pump Network

GTC Technical Guidelines

GTC Technical Guidelines and Safety Information for House Builders and Developers



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Section One

Introduction

These guidelines provide you with information on our Networked Ground Source Heat Pump product which consists of drilled ground boreholes, buried pipework and heat pumps. Design, legal, practical and safety aspects are covered including specifying the Developers responsibilities.

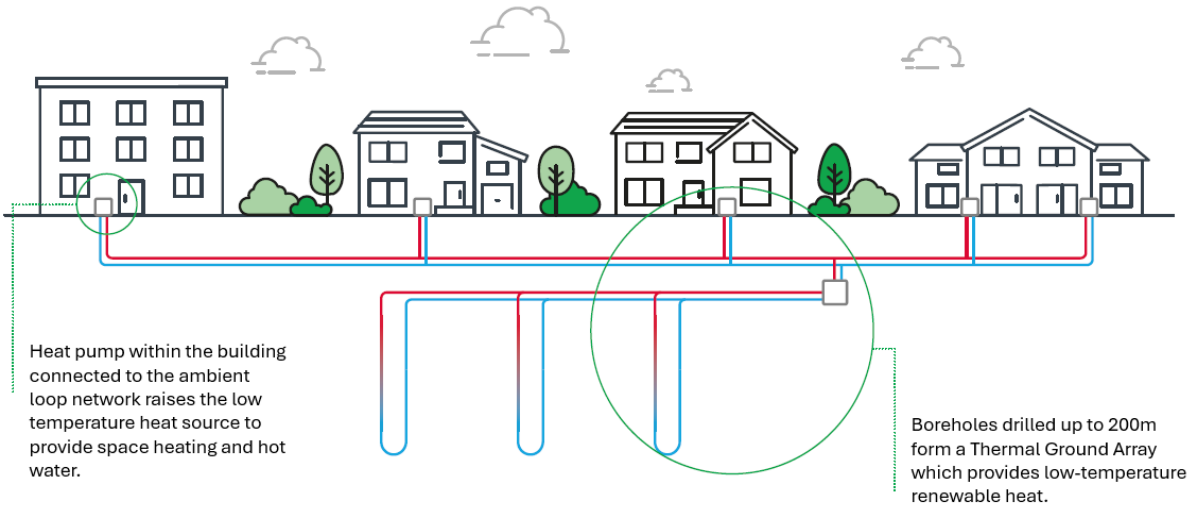
What is the GSHP Network Product?

Vertical closed-loop boreholes connect via uninsulated pipework to heat pumps within dwellings to provide space heating and hot water. The system is highly efficient, zero-carbon ready, and cost-competitive to deliver and to operate.

Each home will be served by a pair of service pipes with isolation valves connected to the ambient heating pipework and connected to an internal ground source heat pump within the dwelling. The boreholes serve as the low-temperature heat source while the GSHP will be powered by electricity from within the home. The GSHP raises the temperature of the heat provided by the ground array to deliver space heating to radiators or underfloor-systems and domestic hot water via a hot water storage cylinder. Groups of dwellings are supplied heat from several connected boreholes. The number of dwellings in a group is typically less than ten. The number of boreholes depends on dwelling sizes, ground conditions, and other site factors.

GTC will install, own and operate the boreholes and pipework up to a house or building entry. GTC will free-issue the heat pump (excluding the hot water cylinder) for developer to install and commission. GTC will adopt the heat pump and pipework within the dwelling that connects heat pump to external pipework.

For more information or assistance, contact us on 01359 758757.



Disclaimer

Although the greatest of care has been taken in the compilation and preparation of this document and offers these guidelines in good faith, GTC can accept no responsibility for any errors, omissions, or alterations or for any consequences arising from the use, or reliance upon the information in this document.

Section Two

Communications

Our opening hours are from 08.00 to 17:00 every weekday. The below is a list of contact details for various parts of the customer journey.

Heat Emergency

To report failure to supply heat or damage to or leakage from a heat pipe, please call **02920 100346 (24-hour contact)**.

Gas Emergency

If you can smell gas or believe a gas pipe has been damaged, please call **0800 111 999** (24 hours).

Electricity Emergency

To report No Supply or Electrical Damage, please call **0800 0326990** (24 hours).

Fibre Emergency

To report damage to a fibre plant or OSCP, please call **02920 028726**.

Water Emergency

To report a loss of supply or a burst or leaking water main, please call **02920 442716**.

Sales

To discuss your utility infrastructure solution needs and obtain a quotation, please contact **01359 240154** or **sales@gtc-uk.co.uk**.

Design

To discuss a utility design or request a variation, please contact **01359 300798** or **network_variations@gtc-uk.co.uk.**

Site Installation

To book in work on your site, please contact **0845 6022498** or **gtcworks@gtc-uk.co.uk**.

Finance Queries

For any queries regarding invoices or billing, please contact **01359 308144** or **credit.control@gtc-uk.co.uk**.

Customer Services

At GTC, we are committed to providing you with excellent customer service and we encourage feedback so that we can ensure we are making our customers happy. If you have any comments or complaints about our service, please contact **01359 302640** or **customerservices@gtc-uk.co.uk**.

Section Three

Safety

Safe Place of Work

GTC requires a safe place of work to be provided for all its staff and contractors. We will seek confirmation that the construction site is a safe place to work.

Upon arrival on site, staff and contractors will report to the Site Manager/Representative to discuss intended works. Prior to undertaking this work, a site-specific risk assessment will be undertaken. If, following this assessment, the works cannot be undertaken in a safe manner, the Site Manager/Representative will be informed. Until a safe working environment is achieved, no activities shall be undertaken.

Site Traffic Rules

All site traffic information should be made available to the team/operative when arriving on site, via a site induction or during the booking in on-site stage.

Equipment and Materials

All materials will be handled, transported, stored and fixed in accordance with the manufacturer's requirements. Any conflict between such requirements, this documentation and the British Standards Institution, shall be referred to GTC in writing for a decision.

The Site Manager/Representative shall ensure their equipment and materials are operated and stored in such a manner that they do not become a hazard within the working area of the GTC team/operative.

Scaffold

Ensure all scaffolding where the team/operatives are to work is removed prior to their arrival on site.

Waste

In most cases, GTC will make use of the waste collection and disposal facilities on site from the Principal Contractor. If this is not possible it should be discussed with your local Project Manager.

Welfare Facilities

In most cases, welfare facilities are to be made available on site from the Principal Contractor.

Utility Protection

Ensure all excavation works onsite are progressed using safe digging techniques. Refer to HSG47 *Avoiding Danger from Underground Services*. GTC utility plans are available via **www.gtc-uk.co.uk/network-locations**..

Competence

Any staff and/or appointed contractor working on behalf of GTC who attend site will have the appropriate training, technical knowledge and experience to discharge the intended works in a safe manner.

Construction Design Management (CDM) Regulations

GTC will act as the 'Designer' and 'Contractor' for the construction and commissioning of networks on new property developments.

The mains pipework, services and GSHPs that will be installed on the development will remain the property of GTC as named in your quotation. GTC will be responsible for the operation and maintenance of the network and GSHPs.

The construction team should leave a marked-up copy of what is live in the site agent's office during the construction phase so that other construction workers have access to live plant information.

Damage

It is imperative that the boreholes, pipework and subterranean manifolds are not damaged following installation, and it is the responsibility of the Developer to ensure that ALL contractors working on site are informed of the location of pipework. The network drawing should always be on site and updated to clearly show the installation progress.

Please note that other utility apparatus may be near our pipework particularly when services cross over other utility mains. The Developer should at the earliest stage establish the location of any non-GTC utility mains and services that may be affected.

Damage to commissioned pipework must be reported immediately to the **emergency contact number 02920 100346** who will arrange for the Emergency Service provider to attend site and undertake any repairs.

Any damage to non-commissioned pipes, no matter how slight, must be reported immediately to GTC.

For further information refer to HSE publication HSG47 *Avoiding Danger from Underground Services* which gives detailed guidance on avoiding damage to underground services, including information on detection and safe digging practices. Free information is available from the **HSE Infoline on 0845 345 0055** or the **HSE website http://www.hse.gov.uk**

Ground Workers Safety

All heat apparatus MUST be treated as live.

- Any injury, damage to plant, however slight, must be notified to the Heat Network Operator and site manager immediately.
- Underground services, particularly electricity and gas can be extremely dangerous.
- Damage to electrical cables can lead to severe burns or even death. Gas leaks can cause fire and explosion.
- Damage can result from excavation or penetration of the ground (e.g. by a road pin).
- Underground services may be commonly found in roads, footpaths and on sites or across open land.
- Make sure you have plans of the underground services in the area and make use of them. This may not always be possible for emergency or unforeseen works.
- Use approved equipment to confirm the position of electricity cables, metal pipes and any other detectable plant within and around the area of proposed excavation.
- Look for signs of service connection cables or pipes, e.g. heat, gas, electricity or water meter boxes, valve covers or a service connection entry into a house or streetlamp.
- Hand dig trial holes (as many as necessary), to confirm the exact position of services near the area of your work. This is particularly important if there are plastic pipes which cannot always be found by electromagnetic location techniques.

All main cables should have a marker tape laid above however this should not be relied upon – this is a useful indication of the presence of a live utility apparatus in the vicinity and therefore you should avoid disturbing the tape.

It is possible that cables or pipes may be embedded in concrete. Electricity cables embedded in concrete **MUST** be isolated before the concrete is broken out – please contact GTC at the earliest opportunity to arrange.

Services are sometimes protected by concrete, polyethylene or earthenware tiles or a marker tape laid above the service - this is a useful indication of the presence of the service; you should avoid disturbing any tile or tape to expose the service if possible.

Do not use existing buried plant as a step to enter or exit any excavation.

Section Four

Definitions

GSHP	The Ground-Source Heat Pump units installed within each consumer property.
DNO / IDNO	District Network Operator / Independent District Network Operator.
ENC	Electricity Network Connections.
Borehole	Vertical borehole drilled to a depth between 150-200m. A closed loop of polyethylene pipe is installed and permanently grouted into place to provide thermal conductivity with the surrounding rock. Boreholes provide the renewable heat source.
Manifold	A chamber usually installed in the footway whereby the borehole pipework, ambient-loop mains and service pipes terminate and can be isolated and commissioned. These will vary by network design.
Borehole Pipework	Underground/buried pipe network for distributing ambient-temperature heat throughout the property development, from the boreholes to the point of use (i.e. heat pumps). This forms the Primary GSHP Network.
Heat Network Operator	Community Ground Source Heating Ltd.
Installation Pipe	The pipework within a consumer's premises between the outlet of the GSHP and the appliances.
Internal Service Riser	A riser heat pipe installed within the structure of a building.
Hot Water Cylinder	A cylinder commonly co-located with the heat pump and supplied by the heat pump. This stores domestic hot water to provide instant availability. Cylinders are excluded from GTC scope, both delivery and ownership.
Mobilisation	The process of setting up the drilling rig and undertaking the initial borehole. This is typically one week duration. De-mobilisation at the end of drilling all boreholes in the current phase of development is also typically 1 week.
Drilling Rig	A tracked vehicle for drilling vertical boreholes typically using pressurised water.

Section Five

Roles and Responsibilities

The matrix below identifies the roles and responsibilities for the Developer and GTC:

Ref	Planning and Pre-Construction Documentation	GTC	Developer
Initial Site Information			
P1	Accommodation schedule		x
P2	Development masterplan/Site layout plan		x
P3	Site location details		x
P4	Indicative start date, build-duration and planning status		x
P5	Geological, hydrological & thermal analysis of ground at site location (desktop study).	x	
P6	Identification of any additional checks/processes required for drilling (e.g. Coal Authority, Environment Agency permitting, Unexploded Ordnance checks).	x	
P7	Quotation	x	
P8	Written acceptance		x
P9	Notify of changes in relation to any quote assumptions (e.g. accommodation schedule, building heat demands)		x
P10	Allocated CDM Principal Designer.		x
P11	Outline construction programme		x
P12	Dwelling layout drawings		x
P13	Planning permission submissions		x
P14	Energy strategy		x
P15	Planning conditions pertaining to Boreholes		x
P16	Ground condition report (entire Site, can be provided in phases as required)		x

P17	Site topography drawing (showing existing & final levels)		x
P18	Site noise assessment / requirements (where applicable)		x
P19	Fire strategy (where applicable)		x
P20	Legal easements (e.g. Boreholes on private land) and other necessary legal rights.		x
P21	Construction phasing (sub-projects & mobilisations) plan (identifying required heat-on date).		x
P22	Location of Boreholes on Site masterplan (in liaison with Developer)	x	
P23	Borehole design	x	
P24	Programme for Borehole drilling coordinated with other site civils works (in liaison with Developer)	x	
P25	Route of ambient-loop pipework	x	
P26	Coordination of ambient-loop pipework with existing services / building foundations.		x
P27	Issuing of construction drawings (of ambient-loop network boreholes, mains, services & ancillaries)	x	
P28	Notifying of any changes to accommodation schedule, site layout, dwelling design etc.		x

Ref	Construction	GTC	Developer
CDM			
C1	Allocated CDM Principal Contractor		x
C2	Site welfare facilities		x
C3	Safe access to Borehole locations (for equipment & welfare etc.)		x
C4	Plate load testing – needed for drilling rig (California Bearing Ratings)		x
C5	Safety barriers, exclusion zone around Borehole Sites, traffic management (CDM)		x
C6	Secure Site storage of drilling rig, bowsers/tanks, pipework, and ancillaries & secure, waterproof storage of GSHP units including liability for damage.		x
C7	Off-loading and moving pipes, Borehole probes, grout and materials to on-Site storage		x
C8	Movement of pipes, Borehole probes, grout and from on-Site storage to trench	x	
C9	Off-loading and moving GSHPs to storage		x
Site readiness			
C10	Diversion of existing utilities.		x
C11	Ducts/sleeves for pipework		x
C12	Completion of any soil contamination remediation works		x
C13	Temporary water supply per drilling rig with minimum supply 4ltr/s (*subject to contract)	*	*
Borehole			
C14	Borehole drilling programme	x	
C15	Ground levels within +/- 1m of final level.		x
C16	Setting out Borehole locations		x
C17	Borehole drilling (including provision of drill rig, personnel, method statements, supervision etc.)	x	
C18	Supply (procurement & delivery) of pipes (Boreholes)	x	
C19	Insertion of Borehole pipework & grouting	x	
C20	Thermal response testing	x	
C21	Removal of drilling cuttings (waste) and wastewater		x
C22	Witnessing borehole testing (as left in complete state)		x
C23	Borehole location marker cap (to aid visibility until ambient-loop network constructed and borehole termination fully buried).	x	

C24	Ongoing protection of Borehole against damage (e.g. during non-network civils)		x
Network			
C25	Supply (procurement & delivery) of manifolds, pipework & joints for ambient loop network	x	
C27	Excavation of trenches		x
C28	Provision and maintenance of trench supports		x
C29	Trench perimeter rails / fence		x
C30	Preparation of trench bottoms for heating pipes		x
C31	Access to trench		x
C32	Dewatering of trench		x
C33	Where specified on design, supply and installation of ducting for service and mains pipework (e.g. road crossings)		x
C34	Excavation, supply, and installation of 150mm ID smooth-lined duct into each dwelling (as per specification). For commercial buildings see design specification.		x
C35	Installation of ambient loop network and ancillaries	x	
C36	Installation, testing & commissioning of ambient loop service pipes to plots	x	
C37	Installation of fire-stopping & DPM seal to comply with Building Regulations.		x
C38	Supply 'geothermal' marker tape	x	
C39	Backfill of trenches with suitable backfill material		x
Ground Source Heat Pump			
C40	Confirm required delivery schedule for Ground Source Heat Pumps		x
C41	Provide secure, waterproof storage on Site for GSHPs		x
C42	Train developer M&E contractor once per Year per Site in the installation of dwelling internal pipework (from service pipe isolation valves to GSHPs and installation & commissioning of GSHPs and controls for optimum installation and necessary compliance	x	
C43	Supply of GSHPs	x	
C44	Provision & installation of single-phase electrical supply (within dwelling) for GSHP		x
C45	Mains cold water connection and associated pipework (for filling/flushing secondary heating circuits within dwelling)		x
C46	Provision and installation of domestic hot water cylinder (from approved suppliers list)		x

C47	Installation of GSHPs in line with Design Guide & training as provided		x
C48	Provision and installation of room thermostat/programmer (optionally available via GTC)	Optional	x
C49	Provision and installation of cabling between controller/thermostats and GSHPs		x
C50	Installation and commissioning of dwelling internal pipework (between Network Termination Point and GSHP), including hydraulic flushing, hydraulic pressure test and bleed air		x
C51	All boxing, covering, or hiding of pipework		x
C52	Commission GSHPs to manufacturers' instructions (e.g. flow/return/freeze protection temps)		x
C53	Commission tertiary pipework (dwelling heating circuits & plant inc. anti-corrosion inhibitor (proof of inhibitor levels matching manufacturers guidelines).		x

Notes

Works subcontracted to GTC, or affiliates will be the responsibility of GTC. Works subcontracted to alternative contractors by the Developer will be the responsibility of the Developer.

The Developer shall work with GTC in optimising the heat network route. GTC will be responsible to produce drawings, the Developer shall verify and agree the intended routes. Any costs incurred due to deviation from the agreed routing shall be borne by the Developer.

Section Six

Boreholes

The Developer will carry out all civil and ground works necessary for the borehole drilling to commence (e.g. if land heights are to change, final height at the location of each borehole must be achieved within +/- 1m prior to drilling). Boreholes will be drilled, installed, and commissioned by GTC or its subcontractors.

The Developer is to ensure that all necessary site documents and drawings are made available to GTC at the earliest opportunity after contract award. All changes to site documents and drawings are to be issued to GTC as soon as possible to review and approve against impacts to borehole/network design.

Locating Boreholes

In general, boreholes will be situated within the adoptable footway close to pipework where the site layout permits. Where this is not possible for the situation, boreholes may be situated in private land subject to suitable land rights being obtained to ensure access for maintenance and repair in perpetuity.

The spacing between the GSHP boreholes will be a minimum 10m. We will work with you to identify appropriate locations for the GSHP boreholes. Potential locations in order of preference are as follows:

1. Adoptable verge
2. Adoptable footway
3. Management company-owned soft landscaping.
4. Shared access/gardens where all properties supplied by the boreholes have legal access
5. Adoptable carriageway
6. Private land (not recommended – subject to land rights being secured)

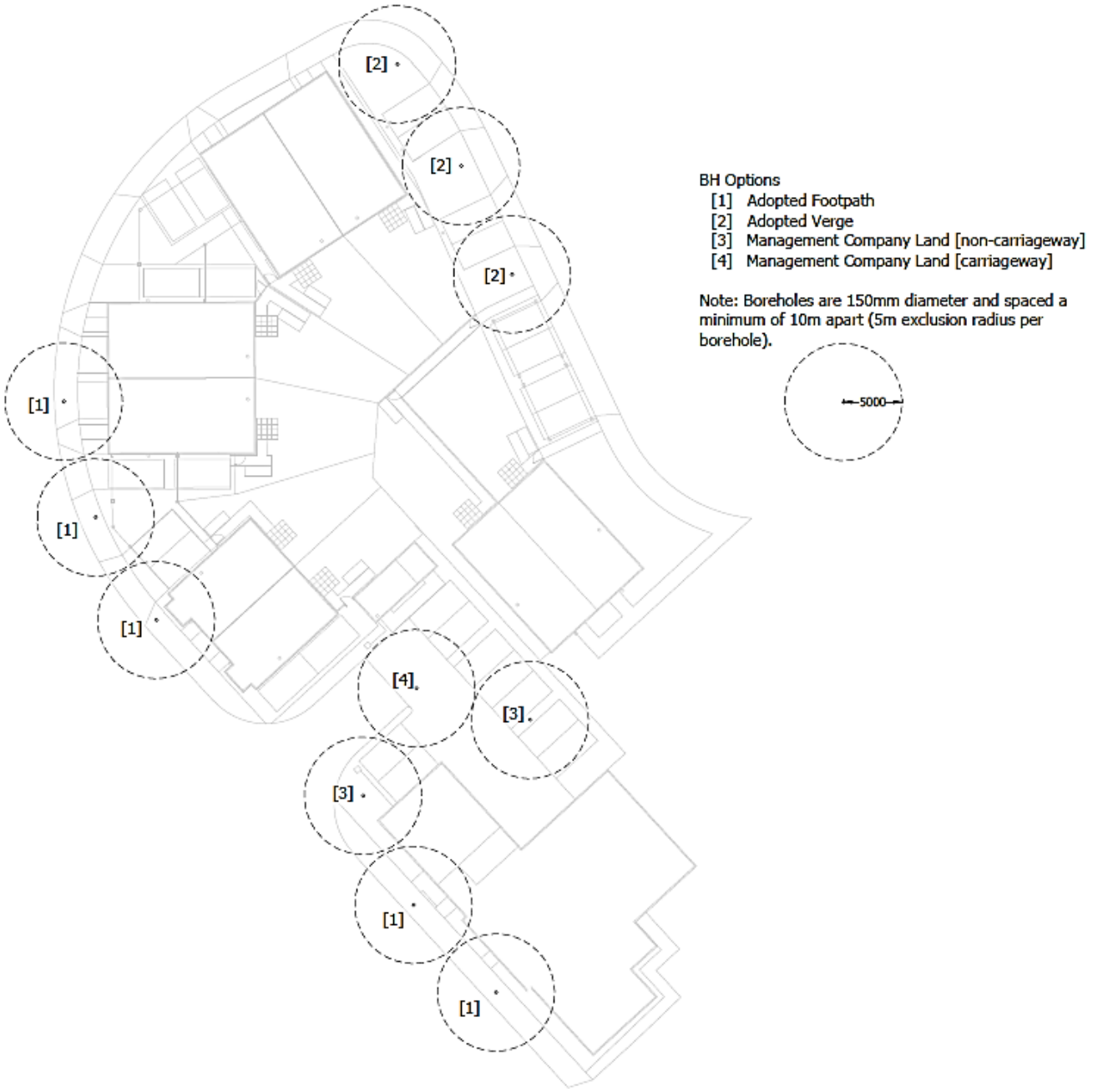


Figure 1:Options for borehole locations & separations.

Legals & Easements

Borehole locations may be subject to a lease as detailed within the quotation. The Developer is required to obtain all relevant planning permission, building regulations compliance and ensure the necessary land rights for GTC.

GTC requires legal rights over all its equipment to secure future ownership and maintenance abilities which are imperative to the continued supply of ambient-temperature heat to the development in perpetuity. Where this equipment is within private land, GTC will need to obtain such rights from the Developer (or landowner where different). To ensure these consents are completed efficiently and at the earliest opportunity, the Developer (or landowner where different) should assist with the following:

- Ensure their legal representative is instructed to act upon acceptance of the project.
- Ensure their legal representative responds to all correspondence received from GTC's legal representative without delay.
- Immediately advise GTC of any changes that may affect the legal title on which GTCs equipment resides.

The timescale of consent acquisitions for a project is importance as they may affect the required commissioning dates if not completed in time. Network and equipment cannot be commissioned until the necessary legal rights have been secured.

Development Drawings & Documents

The design, quantity, sizing and locating of boreholes will be subject to calculations for heat demand. It is important that sufficient design information has been provided to enable these calculations. Where data is incomplete, it will be assumed at quotation stage. These assumptions will be stated in the quotation and form part of the offer. Where these assumed values later change due to further details being provided, or changes to the development (layout, property types etc.), a contract variation may be required.

The Developer is to provide GTC with all site layout and the appropriate construction drawings for the full development – per phase, as appropriate. Any changes to the layout or design must be notified to GTC at the earliest opportunity to review impacts to the network design and avoid later delays in construction.

The development accommodation schedule for the full development should be used to generate GTC's quote and subsequently accepted by the Developer. If the development accommodation schedule has not been provided, the Developer shall issue the schedule to GTC as early as possible after quote acceptance. The accommodation schedule should include:

- For domestic properties:
    - Count of plots by type (e.g. 1 bed flat, 2 bed semi, 4 bed detached)
    - Floor area per plot
    - Occupancy (no people) per plot/type
    - Space heating demand (kWh/year) per plot/type
    - Hot water demand (kWh/year) per plot/type
    - Space Heating Emitter type (e.g. radiators, under floor heating)
- For commercial spaces:
    - Notional internal area
    - Use class type (e.g. A1, B1, D1, etc.);

- Where a design has already been undertaken, the space heating and domestic hot water loads in kW and kWh/year

See Section 5 for full list of general information and documentation that the Developer must provide.

Where full information has not been provided, assumed values will be used and detailed in the quotation. Where it is later confirmed that the actual requirements differ from those assumptions a variation quotation will be issued and must be accepted ahead of the design being amended and construction continuing (where already begun).

Construction Programme

The Developer is to provide GTC with a construction programme which shall include the following milestones:

- When borehole sites will be available and ready for drilling.
- Whether multiple mobilisations for drilling will be required (e.g. per phase of development).
- If there is a requirement for early installation of pipework (e.g. areas that require early surfacing/reinstatement)
- Date of when first heat is required.
- Date of when subsequent construction phases require heat.
- Any requirement for temporary heating plant (e.g. sales suites).

Due to the necessary plant and set-up time, it is preferrable to drill boreholes in as few mobilisations as possible. A specific number of mobilisations will have been assumed and stated in your quotation. Should you require additional mobilisations (to fit with your build programme for e.g. site civils), please request this from us. There will be a charge for additional mobilisations.

Ground Contamination Survey

The Developer is to provide GTC with the ground contamination survey of the development. The survey will need to cover the areas including:

- Boreholes.
- The full buried ambient-loop pipework route.

Any required remediations because of the ground contamination survey will be the responsibility of the Developer and must be undertaken prior to any GTC works.

Existing Utility Services Drawings

The Developer is to provide GTC with utility drawings validated by onsite CAT Scans depicting below and above ground utilities including, but not limited to:

- Electrical power network (inc. overhead cables)
- Below ground drainage
- Natural gas network
- Mains cold water
- Communications
- Underground tunnels
- Underground structures
- Unexploded bombs
- Mine workings

Development Phasing

The Developer is to provide GTC with the development phasing programme, detailing the intent to construct the number of units for each year until completion.

GTC shall design the network infrastructure for the requirements of the entire development, phases or specific areas as appropriate.

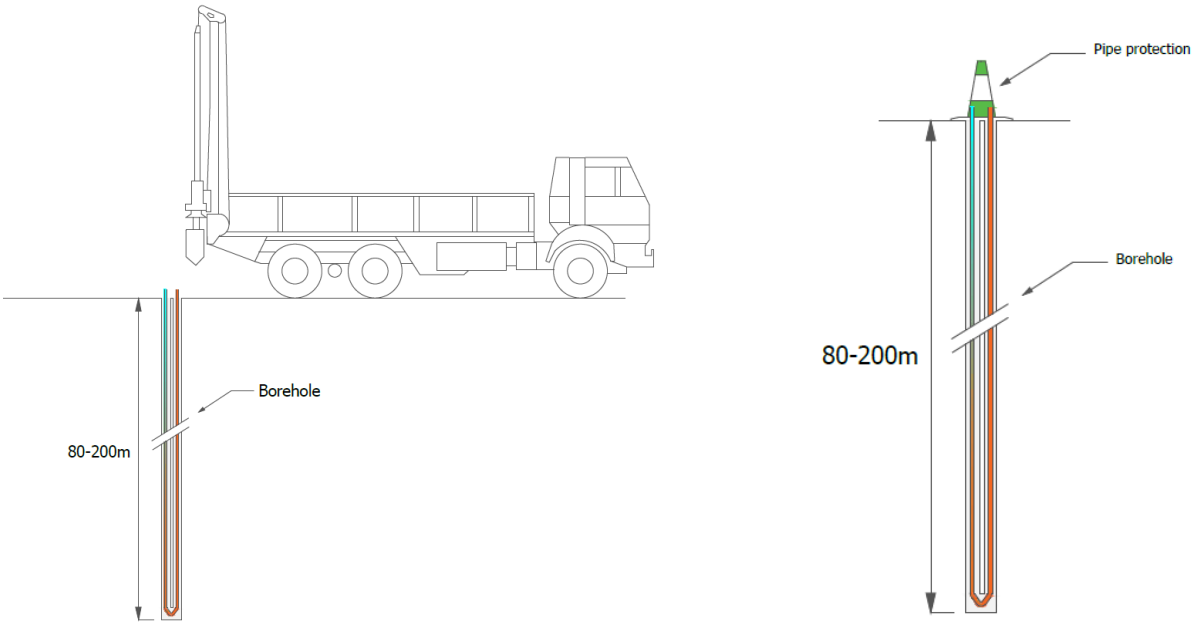
The Developer shall reference the current issue of the Technical Guidelines (which will supersede all previous revisions) for all phases.

During pre-construction, GTC shall liaise with the Developer to establish the borehole drilling programme such that it can be accommodated by the wider site civils programme (e.g. achieving final land heights where significant change is planned). At borehole locations, all land heights must be within +/- 1m of their finish level prior to drilling taking place. Boreholes are sized for the heat loads intended and cannot be moved or extended once installed. Therefore, the design and energy demand of each area of the site must not change per mobilisation. Significant cost, chargeable to the Developer, may be incurred where post-construction changes (such as where additional or replacement boreholes are required due to change in layout or damage post-construction).

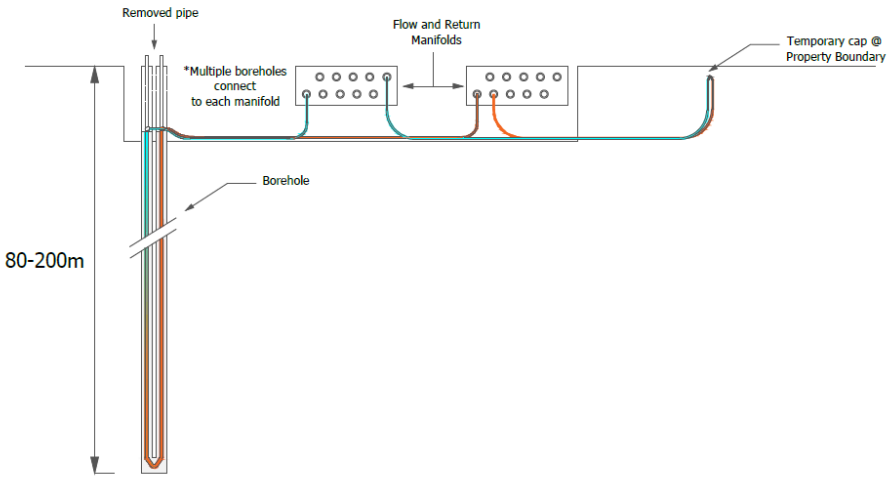
Construction Order

In general, it is preferable for boreholes to be drilled, installed and left ‘capped’ prior to other construction work taking place – in particular prior to curbs and building foundations being installed. This is to ensure that no damage occurs to e.g. curb edges from the drilling plant and to ensure that we can drill safely and without inconveniencing other activities on site. We will of course work with any Developer to establish a drilling and construction programme that suits their needs. As a guide, the following order is preferred:

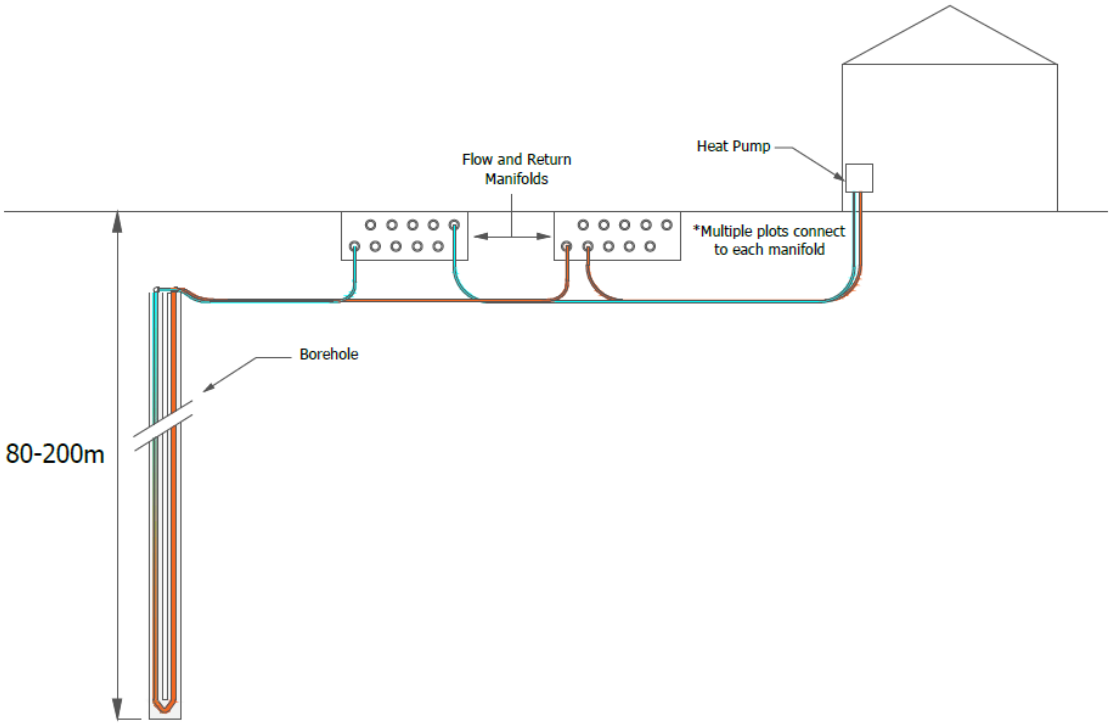
1. **Civils works to establish near-final ground levels (within c 1m of finished level).**
2. **Boreholes drilled, installed and capped.**

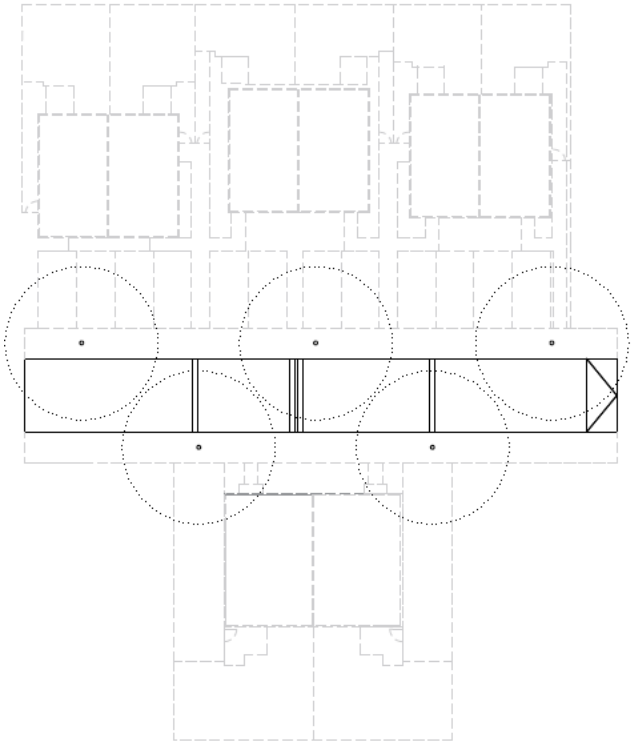


3. **Key roads (to sub-base level) – inc. installation of any ducts for road crossings.**
4. **Curbs installed.**
5. **GSHP Manifolds and pipe network installed, tested & commissioned (inc. boreholes).**

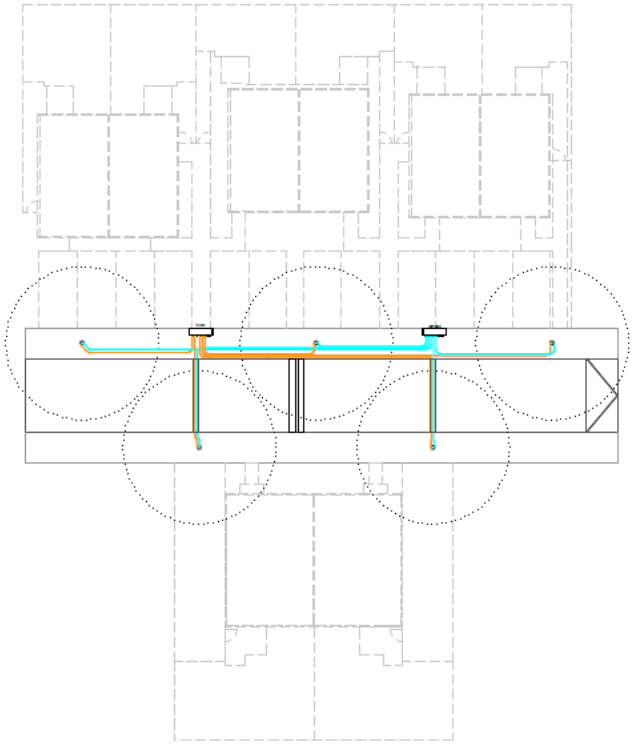


6. **GSHP Services to plots installed, tested & commissioned.**
7. **Dwelling near completion (substantially complete & live electric supply to GSHP)**
8. **GSHP installed and commissioned within dwelling – heating available for e.g. drying-out plaster.**

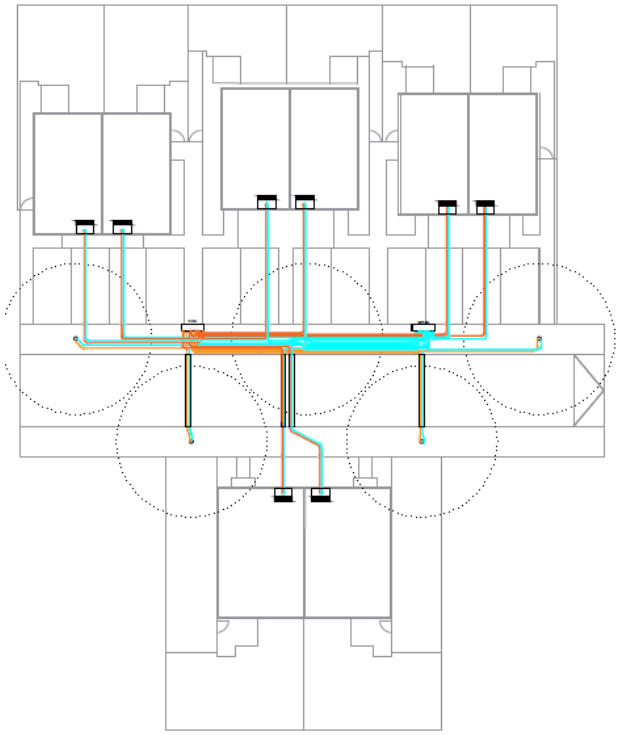




Civil works to circa 1m finished levels [1], Boreholes drilled, filled, and capped [2], and key roads, inc. ducted road crossings, to sub-base level [3].



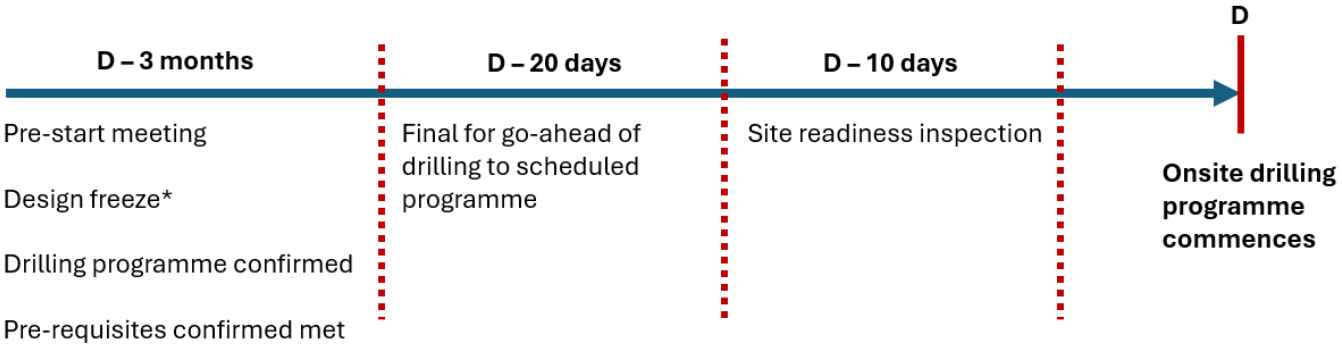
Curbs installed [4], Borehole to manifold pipe network installed and commissioned [5].



Manifold to property pipe network installed [6]. As property is nearing completion [7], GSHP installed and commissioned [8].

Drilling Programme

GTC or its subcontractors will undertake drilling in accordance with an agreed programme of works once all pre-requisites have been confirmed as met. Drilling will take place on a 'per mobilisation' basis whereby the area of site being drilled has been confirmed as the final site layout/housing schedule for that area (as heating needs and drilling locations must be fixed). On this basis, the following activities will precede the commencement of drilling:



** Per drilling mobilisation (i.e. area of site covered under this mobilisation)*

Figure 2: Example of typical rig used for drilling

Borehole – Construction & Left State

The borehole will be drilled, a preformed PE ground array pipe inserted, and the hole backfilled with a specialist conductive grout which ensures that the ground array performs thermally as intended to supply heat to the connected premises.

Two PE pipes will be left with ends sealed at the top of the borehole. These will be later connected to the ambient loop network.

To help ensure that no damage occurs to the installed borehole pipework (e.g. by later civils works), a green cone (see below) will be securely fastened to the top of the borehole. It is the responsibility of the Developer to ensure that no damage occurs to the borehole and any remedial work required due to post-installation damage will be charged to the Developer.

Figure 3: Example of cone secured to borehole top to assist in preventing damage (e.g. by later civils works)

Borehole Drilling Prerequisites

Prior to borehole drilling taking commencing, the following must be in place:

1. **Welfare facilities that are in-line with HSE Guidance:**
    - Drying room.
    - Drinking water.
    - Means of heating food.
    - Rest space.
2. **Construction pre-requisites:**
    - Water supply for drilling purposes.
    - Approved temporary works calculation (including plate load test results).
    - Onsite operative competencies (approved by Developer), e.g. SHEA
    - All operatives completed site induction.
    - Approved RAMS sign-off.
    - Traffic management plan.
3. **Site details:**
    - Working hours.
    - Identified restricted areas.
    - Emergency arrangements.
4. **Site operations:**
    - Access to permit to work systems.
    - Access to site for the unloading of a three axle 40-ton low loader.
    - Waste provision for solids and liquids.
    - Storage set down area.
    - Secure storage area.
    - Mud cleaning and equipment set down location relative to the Borehole location (within 20 metres).
    - Boreholes marked out two weeks ahead of drilling start date.
    - Safe access to marked Boreholes.

Section Seven

Buried Pipework

The network, comprising of flow and return pipework, will route underground throughout the development as shown on GTC's network layout drawing. Pipework is uninsulated and will typically be of 40mm nominal diameter. Any deviations to the routing of pipework must be agreed in advance with GTC before construction. It is the responsibility of the Developer to ensure all contractors working on site are informed of the location of the buried pipes and services.

A pre-start site meeting will be arranged at the start of your development. At any stage of construction, you can contact GTC for advice and guidance. It is desirable that the Developer agrees a programme of construction which will enable GTC to co-ordinate main laying activities, within our set timescales.

The Developer is responsible for all excavations, duct laying and backfill work on site, unless otherwise specified within the quotation.

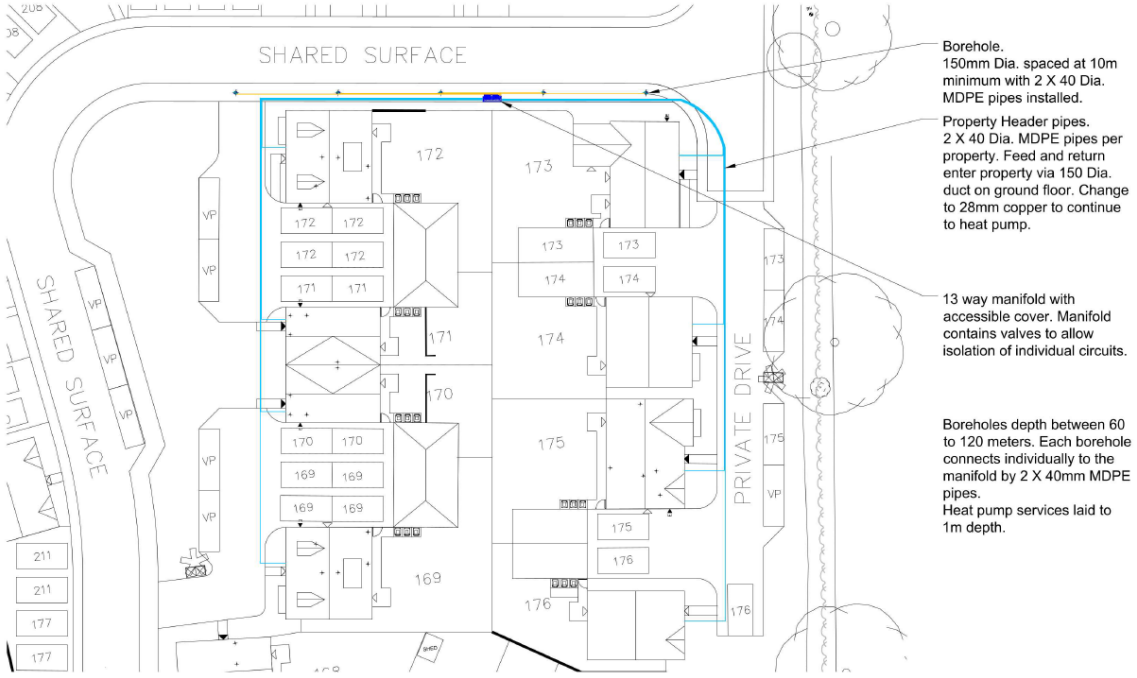


Figure 4: Example typical network layout

Trench

For GTC to be able to install pipework, boreholes and ancillary equipment, the Developer must ensure that the trench meets the following requirements:

- Ensure kerb braces have been installed prior to scheduling work with GTC. In exceptional circumstances, where this is not practical or reasonable and with the express written permission at Director level, GTC may accept a site-specific indemnity letter signed by the Developer accepting a “line and level” approach. In such circumstances the Developer will indemnify GTC against all costs relating to future relocation (due to locating error or changes to site layout) of all utility pipes, ducts, and cables and/or repairs to damaged pipes and ducts.
- Carry out all necessary excavation and backfilling work for the installation of pipework and associated equipment.
- Maintain an obstacle free route to allow installation work to be carried out in one visit wherever possible.
- Structural reinforcement of the trench as necessary to allow for safe operation of pipe laying.
- Removal of all sharp objects which will potentially damage the pipework.
- Removal of any water pooling/flooding.
- Provision of valve chambers and covers.
- All safety barriers.
- Ducting, supplied by the Developer, can only be used for perpendicular road crossings; and to route the service pipe to a dwelling building entry location.
- Ensure that you have read, understood, and signed ‘CDM Construction Plan Parts C and D GU-DPR-FM-1014’.
- Ensure groundworkers are trained, competent and registered to lay ducting and/or services in accordance with the design drawing.
- Maintain a register of trained and competent groundworkers.
- Lay ducting for mains in accordance with the design drawing.
- Lay ‘geothermal pipe’ marker tape, supplied by GTC, 300mm above mains pipework or ducting prior to backfilling the trench.
- Lay ‘geothermal pipe’ marker tape, supplied by GTC, 75mm above service pipework or ducting for services before backfilling the trench.
- All mains and services should be minimum 250mm away from other utility services.
- Trenches should be a minimum of 450mm wide (wider as necessary subject to trench layout and required utilities).
- Pipework should be run at a depth to allow minimum cover levels as shown below.
- Any ground heat exchanger pipe passing within 600mm of a drainage pipe, private drainage system (septic tank, package treatment plant or cesspit) or water pipe the ground heat exchanger pipe shall be insulated with non-compressive 19mm closed cell insulation.
- Any ground heat exchanger pipe passing within 600mm of a wall or structure should be insulated with non-compressive insulation suitable for operation at all temperatures and conditions experienced by the ground heat exchanger system.

Where PE pipework is laid below **soft ground or footways**, pipework shall have a minimum depth of cover (to the top of the pipe outer casing) of **600mm**.

Where PE pipework is laid below **roads/carriageways**, pipework shall have a minimum depth of cover (to the top of the pipe outer casing) of **800mm**. Trenches must allow for a gradual incline on the approach to a road crossing.

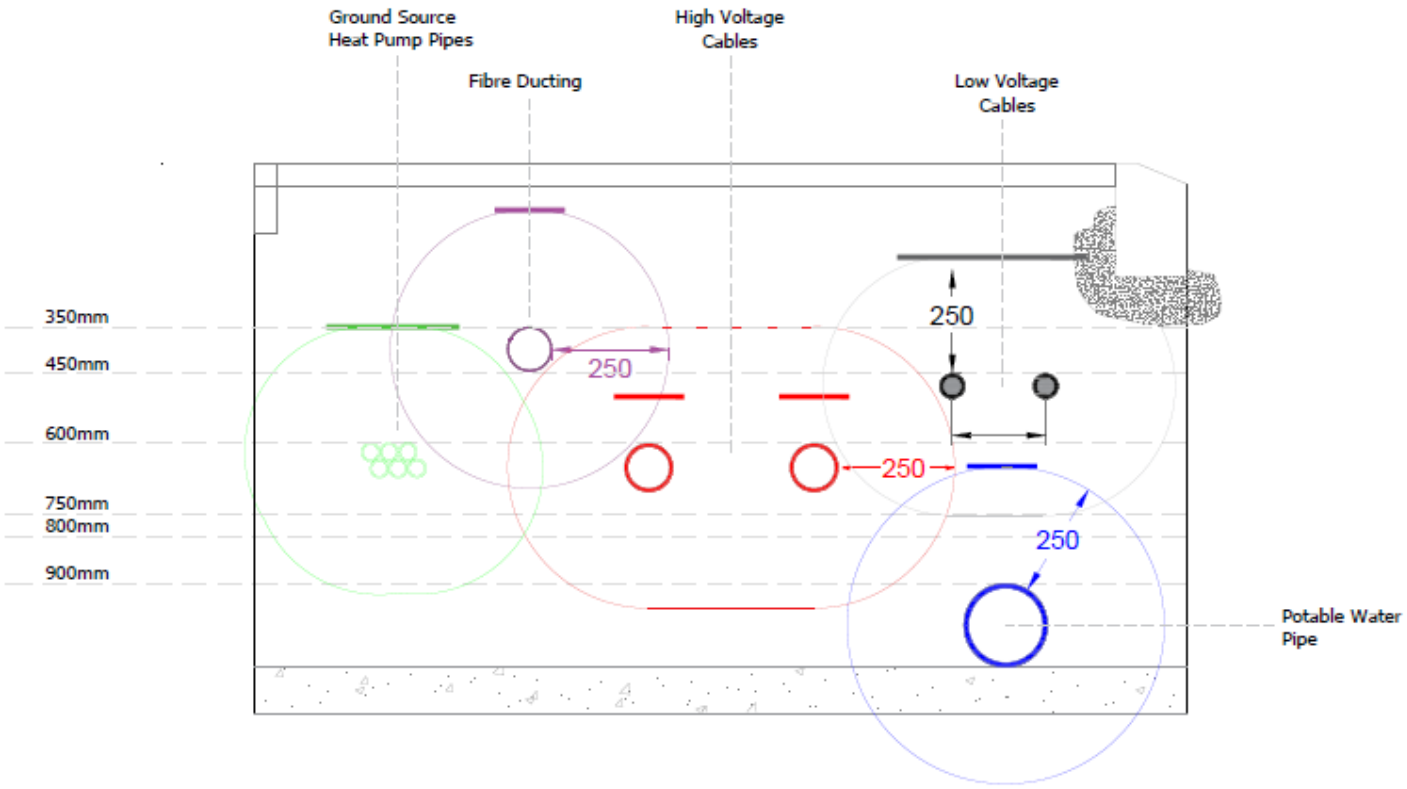


Figure 5: Multi-utility trench layout

Manifolds

Subterranean manifolds that connect pipes to and from the boreholes as well as service pipes to dwellings will be supplied and installed by GTC as per the network design. These manifolds are designed to assist in accommodating provision of other utilities in the same footpath as far as possible and appear like ordinary street chambers as used for conventional utilities. The manifolds include a self-contained water-tight below-ground lid, above which a conventional chamber lid with appropriate load rating is installed. The manifold is designed to sit within a conventional solid-ring chamber system manufactured by Cubis Systems to accommodate structural loading where necessary.

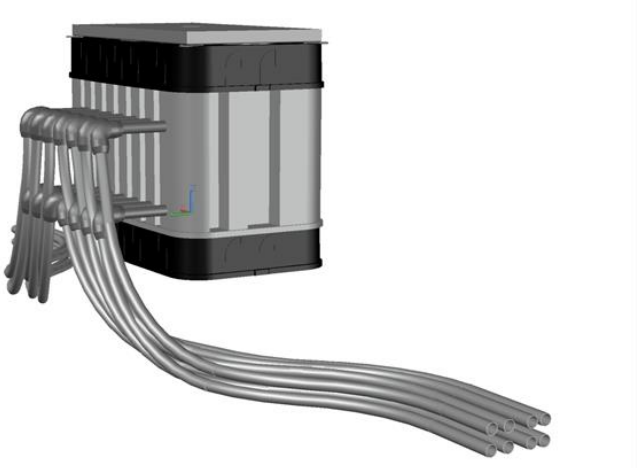


Figure 6: Model of the below-ground manifold

Adjacent Utilities

Pipework will be laid alongside other buried utilities required for the development. It is GTC's preference for all pipework to be laid below public soft dig areas such as grass verges. If none is available or the land is private, pipework shall be laid below public footways wherever possible. Only in unavoidable circumstances shall pipework be laid below vehicle carriageways and must by prior arrangement with GTC.

The Developer shall follow the guidance depicted in GTC's multi-utility trench drawings for minimum distances between adjacent services. Where GTC are not the asset owner, the Developer shall request similar documents from the asset owner for verification by GTC.

Traffic Loads

Pipework laid underneath roads must comply with loading classifications SWL 30 (=300kN total load) or SWL 60 in accordance with DIN 1072. With appropriate surface structure according to the guidelines for the standardisation of the surface structure of traffic areas (RStO) the pipes can be driven over with SWL 60. The Developer shall inform GTC if there is potential for vehicles with a SWL greater than 60 to drive over where pipework is located.

The trench shall have no less than 5 metres of transition to the point at which the additional depth of cover is required. If there are a significant number of road crossings in a short space (e.g. front facing properties on the opposite side of the road to the mains pipe) then the pipework in the footway shall have a depth of cover appropriate for a road crossing (800mm from the top surface to the top of the pipework outer casing). In this instance, half of the trench for the pipework shall be a full pipe size lower to allow for tee connections.

Fig.4 shows the depth of cover to the top of pipework for vehicular loads. All road crossings shall be ducted as detailed in the section below.

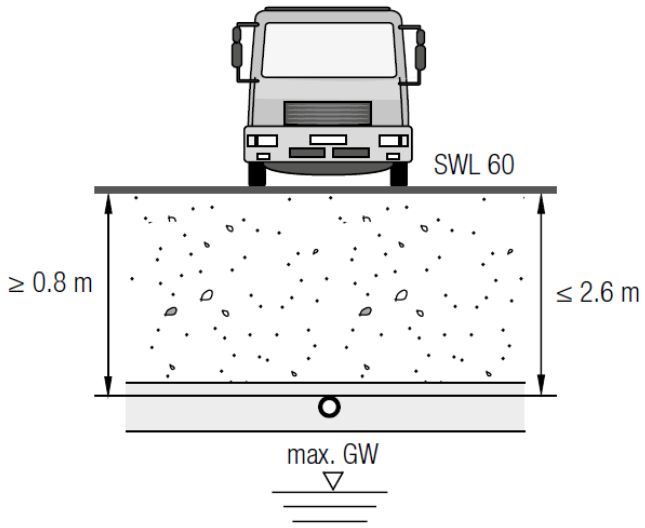


Figure 7 – Trench depth for vehicular loads

Ducting

Pipework will be laid in an open trench excavated by the Developer. Rigid ducting shall be used for perpendicular road crossings. The Developer is responsible for the supply and installations of ducting. A suitable standard for plastic ducting is BS 4962.

Internally corrugated ducting must not be used for road crossings – internal bore must be smooth wall. Usually, pipework will not exceed 40mm nominal diameter and therefore ducts with an internal diameter of 100mm are required. In exceptional circumstances where this differs, details will be shown on design drawings issued by GTC.

Bottom of Trench & Backfill

The width at the bottom of the trench is subject to the external diameter of the pipe(s); if additional working space is required e.g. to make joint connections; or if it is part of a multi-utility trench but is typically 450mm.

Trench bases should be compact and must be partially backfilled with sand (grain size 0/4). The thickness of the trench base (i.e. from the underside of the pipe to the bottom of the trench) should be a minimum of 100mm.

Backfilling above the installed pipework must only take place once GTC have confirmed that pipework is installed and commissioned. Backfill should be compacted by hand and of the same grade sand as underneath. The minimum depth of fill above the pipe is 100mm.

Handling the Pipes for Installation

All pipework deliveries are to be accepted and moved to an appropriate storage facility by the Developer. GTC will be responsible for moving all pipework from the Developer' storage facility to a position close to the trench for installation. All pipework uncoiling is to be undertaken under by GTC for safety reasons. Pipework shall be laid into the trench by GTC.

Materials Delivery & Storage

In preparation of GTC commencing work on-site, there is a requirement for the Developer to responsibly store pipe and fittings on site.

- Pipe and associated equipment will be delivered directly to site and must be visually inspected on delivery and any damage to be marked, set aside and immediately reported to GTC.
- Any loss or damage occurring after delivery will be chargeable to the Developer.
- Under no circumstance are pipe coils to be untied without the supervision of a suitably trained GTC operative.

Unloading

Before unloading, thoroughly inspect all material for shipping damage. Pay close attention to the inside radius of the coil – where damage may occur in the form of a rip or tear in the outer jacket.

Pipe coils are to be transported horizontally, lying completely flat on a load area, and must be secured to prevent slipping. The area must be cleared prior to loading.

Note: PE pipe coils are packaged with protective end covers and coiled, then fastened with nylon straps.

When lifting coils, lifting straps must be placed around the entire coil. When using a forklift, contact points must be protected (for example, fork tines may be padded, or inserted in a section of polyethylene pipe longer than tines, and so on); the lifting must be performed on the entire coil. Forks must not be inserted between coils in a stack, or between pipes in the coil.

Forklifts should be used in accordance with '*BK-HAS-MS-0142 Use of Forklift Truck*'.

Always lift coils from the transport vehicle using wide straps around the coil. To avoid damage, do not drop from truck bed or from similar elevation, or drag the coils over coarse or sharp surfaces. For short distances, manually roll the coil.

Handling

Prior to installation, some coils will require handling and loading on to a horizontal, or vertical, de-coiler. Depending on the weight of the coil, this operation can be completed by a team onsite utilising lifting straps and in accordance with GTC document '*PO-HSE-MS-0171 Manual Handling*'.

Storage – General Guidance

The onsite storage facility shall be a secure compound, with careful consideration given to the following:

- Security of all materials and equipment from theft, vandalism, accidental damage, or contamination. Precautions should be taken to prevent debris and water from entering pipe and fittings (pipe end caps on coils, intended to prevent ingress of contamination, should be kept in place during storage).
- Safety of the site workers, public, especially children and blind persons.
- The movement of traffic and construction equipment.
- All pipe store locations should be on a suitably firm hard standing, level ground, free from ground water, mud, and other damaging material with adequate access for construction vehicles and/or lifting equipment.
- All pipework must be securely stored. Badly stacked pallets, coils or bundles may slip or collapse, causing injury to personnel and/or damage to the pipe.
- Pipe and fittings are not to be stored on the ground, suitable pallets or wooden battens should be the interface between the ground and material.
- Pipes and fittings should be stored away from exhaust outlets and other high temperature heat sources and where contact is possible with aggressive chemicals such as lubricating or hydraulic oils, chemical solvents, diesel, or gas oils, etc.
- No other materials should be stored or placed on top of the PE pipe or fittings as this may damage or affect the dimensional stability of the pipe and fittings.
- Pipes must be kept sealed at cut ends to prevent foreign material entering the pipes and damage to the pipe from UV radiation.
- Care should be taken to prevent damage to, and distortion of, pipe ends and fittings.
- Stock should be stored in such a manner as to ensure adequate stock rotation on a “first-in, first-out” basis.
- All pipes are to be inspected for any storage and transportation damage before being placed in a trench. Any damaged pipework found in storage will not be used and is the Developer’s responsibility to return damaged items to the supplier or remove from site.

Storage – Individual Pipe Lengths

Pipe lengths stored individually should be stacked on clear level ground in a pyramid not more than one metre high, with the bottom layer fully restrained by wedges.

Sticks in bundled packs should be stored with the restraining battens in place.

The bottom layer of pipes should be laid on timber battens at one-metre centres. Where possible PE pipework will be supplied in a coil but in some circumstances, it may be supplied in straight lengths.

Straight pipe lengths shall not be stacked more than 1m from ground.

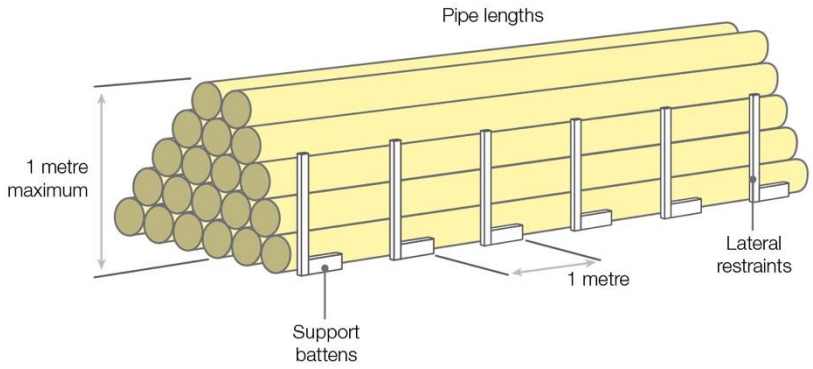


Figure 8 – Storage of straight pipe lengths (loose)

Storage – Coiled Pipe

Coiled pipe should be stored flat and on firm level ground which has suitable protection for the bottom coil. Where space is limited, and coils are to be stacked, the height of stacked coils should be such that the stack is stable, and the uppermost coil can be safely handled. The maximum height of coils stored horizontally shall be 2 metres.

Wooden battens placed below the bottom coil and used as spacers between each layer will facilitate easy access for slinging. When the need for transportation is required, it should only be carried out by trained operatives. Batches of coils delivered on pallets must remain secured to the pallet and only be broken at the time of use. All pipe coils are to be stored horizontally as shown in Fig.8 below.

Prior to installation, some coils will require handling and loading on to a horizontal, or vertical, de-coiler. This work shall be undertaken by a competent GTC team onsite utilising appropriate lifting equipment and in accordance GTC procedures.

WARNING: Under no circumstances shall a person not competently trained cut the bands on coiled pipe.

Fittings

Where electrofusion and mechanical fittings are to be stored on site, they should be under cover in dry conditions, preferably on racking in a lockable container. They should be kept in their boxes/packaging until ready for use. Fabricated fittings may be stored outdoors if they are protected against damage and prolonged direct sunlight.

Manifold Chambers

Where identified by GTC, the Developer shall undertake the trench (note the dimensions will differ from the pipework requirements and as indicated on GTC drawings), base and wall levelling, and chamber cover. The chamber must not be backfilled as future access to valves will need to be made. Backfill material should not be able to enter the chamber after works have been completed. Any backfill material which has entered the chamber must be cleared by the Developer. Chambers are designed to be waterproof however and standing water in the trench prior to installation will need to be removed. Pumping of water from trenches is the responsibility of the Developer. The Developer shall allow for all necessary drainage to allow all water ingress to route to the below ground water source.

Bundles

Where pipe lengths are to be removed from a bundle, it should be from a single bundle with no unbroken bundles underneath; stakes should be securely fixed to retain the bundle shape whist stock is drawn from the bundle.

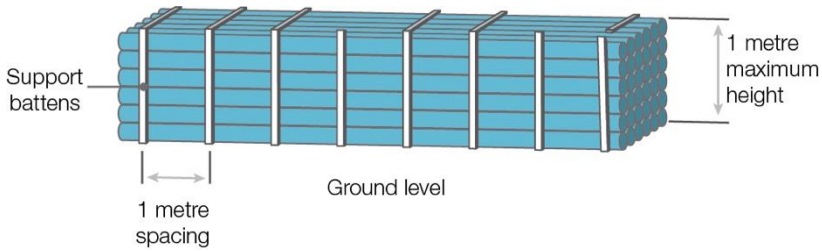


Figure 9 – Broken bundles of pipes

Ground Workers

Ensure ground workers have enough knowledge about safe working practices on site and that work is carried out safely.

- Ground workers must be aware of the large amount of stored energy in coils of pipe. Coils of pipe should be carefully restrained and unwound following the guidance in section Materials Delivery & Storage.
- Where connections are to be made to an existing heat main, the GTC Project Manager shall advise the Developer/groundworker of the type of connection to be undertaken and the dimensions of the excavation necessary to facilitate the connection.

Section Eight

Plot Connection

General

The Developer is required to undertake all excavation works on-site to enable the service pipe or service ducting to be laid, allowing the connection to the main and the service termination at the building to be completed. The service pipe should be laid in a straight line along a route as shown on the agreed design, any deviations must be agreed with GTC, prior to laying the service pipe or service duct. The route should be perpendicular to the property and take the shortest route practicable. Services will be laid, in trenches or inserted into ducts provided by the Developer. The Developer shall install a pre-formed 150mm internal diameter bend pipe at the time of foundation/slab construction in accordance with GTC requirements.

The Developer shall supply and install all above ground pipework and insulation. This pipework connects to the isolation valves (adjacent to the dwelling entry PE pipework) to the GSHP.

Sleeving/Ducting & Excavation

A service pipe will connect mains pipework to a dwelling. The Developer is responsible for the trenching to each dwelling for the installation of each service pipe.

GTC shall supply and install the below ground service pipe as described in this section. The service pipe shall be kept as short as possible.

The service pipe shall be located such that replacement can be made if required or at the end of the pipe lifespan. The service pipe shall not be located under any buildings or structures which will prevent this access.

If the installed service pipe or ducting has insufficient cover, or no marker tape has been laid above the pipe or ducting, or the duct ends have not been sealed, then the ambient loop mains service will not be connected/commissioned, and the Developer will be notified.

The Developer is responsible for all building Structural and Civils design associated with pipework entry to the dwellings.

Plot Pipework

The Developer shall supply and install all sleeve/ducting to route pipework through the building wall line, including all fire stopping and the prevention of gas ingress to meet the necessary Building Regulations. The seal between the sleeve and pre-formed bend shall be by the Developer, the specification of which shall be submitted to GTC for approval.

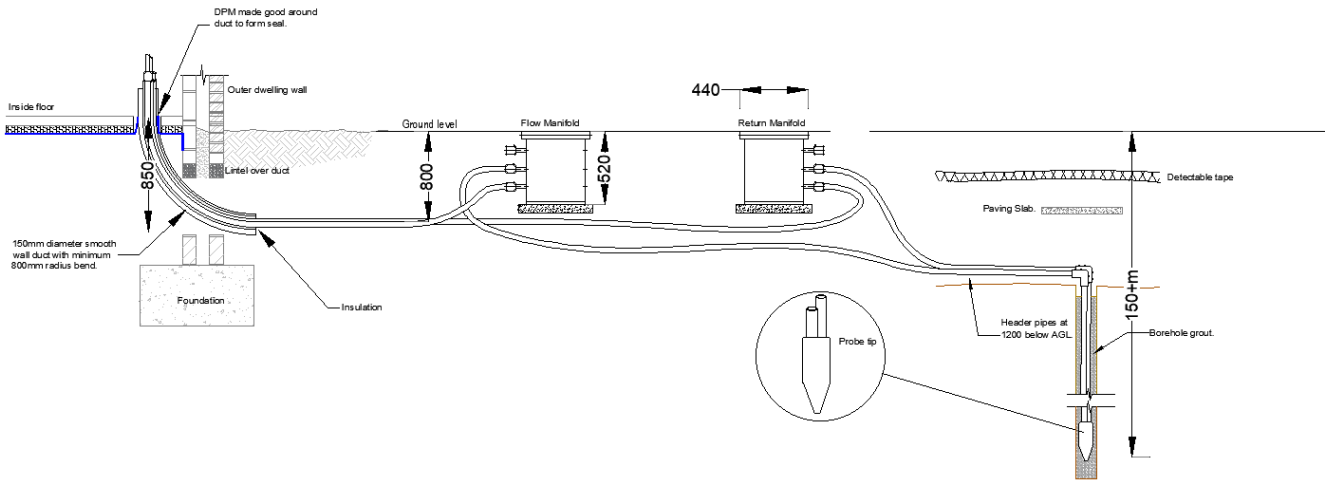


Figure 10: Typical network cross-section - borehole to plot service.

Following the termination of each service, the Developer must install a 5-way valve arrangement within the dwelling to facilitate commissioning:

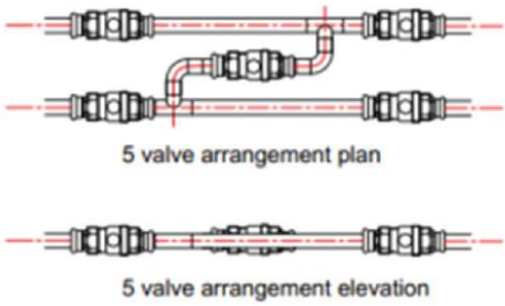


Figure 11: 5-way valve arrangement required within each dwelling

For large multi-occupancy buildings, a single building entry may be specified together with internal pipework serving each dwelling within the building. In these cases, specific construction details will be provided as part of the approved construction drawings and will show where the GTC responsibility for construction ends (usually at the valve after the building entry) and where the Developer takes responsibility for installation (usually from that valve up to the GSHP in the dwelling).

The GSHP and all network pipework (inc. within the building) will be owned, operated, and maintained by GTC's sister company Metropolitan.

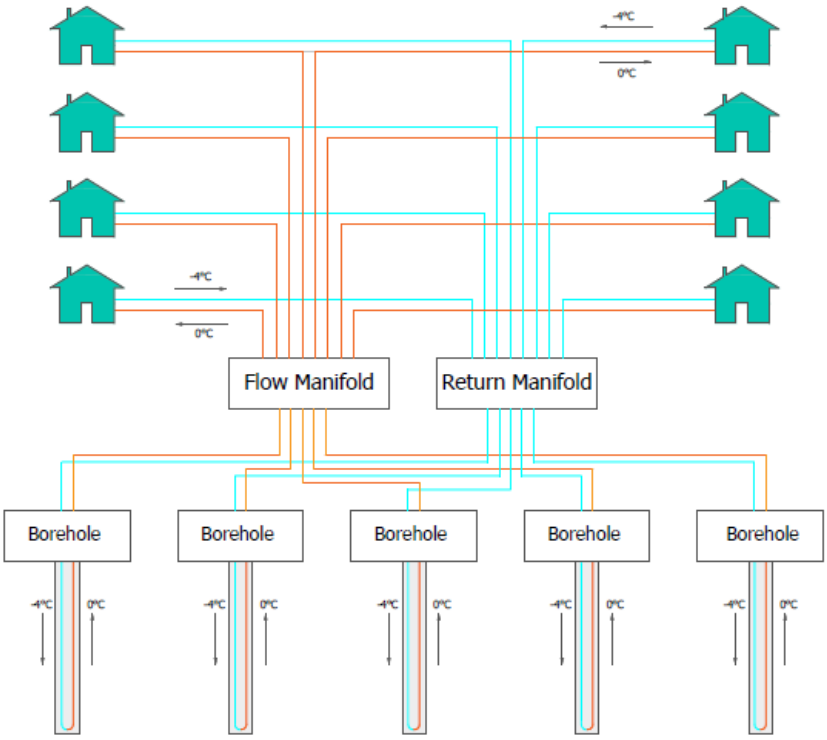


Figure 12: Connectivity schematic

Insulation

Internal pipework must be insulated to prevent the formation of condensation on the pipe surface which may lead to water damage of the building fabric. Continuous insulation is required on all above ground ambient temperature pipework. This is to ensure that a complete vapour barrier is provided.

All external pipework should be clad to provide mechanical protection, vapour and weatherproof barriers with Polyisobutylene sheeting (PIB). Armaflex Evo Insulation or equivalent is suggested.

Pipework Specification

The Developer is to supply, install, test and commission all above ground pipework and insulation from the dwelling entry isolation valves (isolation valves supplied by GTC), up to and including the GSHP connections.

In single domestic properties, any internal pipework between the service pipe valve and the GSHP shall be in 28mm copper unless specified otherwise by the GTC approved design.

The Developer shall pressure test pipework to '*BESA TR/6 Site Pressure Testing of Pipework*'; and flush the pipework between the valve entry position and the GSHP to BSRIA document '*BG29/2021 Pre-Commission*

Cleaning of Pipework Systems) and submit the following documents to GTC, identifying the applicable plot number on the document:

- Certification of pressure test
- Certification of flushing

Above ground pipework should not be filled with water/glycol until the connecting below ground service pipework is commissioned and ready to supply ambient temperature water to the above ground service pipe.

If the above ground service pipe is flushed and commissioned more than 48 hours in advance of the connecting below ground service pipe the Developer shall be responsible for maintaining the integrity of the pipework and all corrosion prevention means e.g. filling with nitrogen gas or pre-commission cleaning agent such as Hydrosphere (or equivalent). Any pipework filled with a temporary anti-corrosive agent shall be clearly labelled on the pipework. The Developer is responsible for the removal and disposal of any anti-corrosion agent in the service pipework.

Before opening to the ambient loop system, any service pipe which has had an anti-corrosion agent shall undergo water quality sampling by a UKAS accredited laboratory. The water quality shall follow the guidelines depicted in the current '*BSRIA BG29 Pre-Commission Cleaning of Pipework Systems*'. If the sample does not meet the guidelines stated, the Developer shall treat and dose the pipework accordingly, and undergo further testing until the water quality meets the guidelines.

All valves and components must be accessible post construction (i.e. not buried in solid floors, or behind drylining). If valves are to be concealed, they must be accessible in the event of an emergency e.g. triangle key or similar.

GTC shall supply and install isolation valves above ground, which is where GTC's pipework supply and installation scope of supply ends. The Developer is responsible for all above ground copper pipework to the GSHP, including testing and chemical cleaning. For the isolation valves, the Developer shall also supply and install a removable insulation jacket to the thermal conductivity noted in section Pipework Insulation below.

The Developer shall supply and install all Earth bonding required for the copper pipework.

The Developer shall be responsible for all concealment of the void, pipework and isolation valves. Isolation valves must be accessible in an emergency e.g. located in an easily openable cupboard/box.

Pipework in the dwelling to the GSHP shall be as short as possible, accessible and not permanently concealed (i.e. not routed in a building cavity, cast into screed, etc.).

Fire Stopping

The Developer shall be responsible for complying with Building Regulations and undertake all fire stopping requirements associated with the service pipe to dwellings.

Where a service pipe is enclosed within a duct or an enclosure, the duct or enclosure must comply with the building regulations and shall be at least half hour fire resistant and comply with the relevant Building Regulations; suitable removable access/inspection panels shall be made available.

The pipework insulation specification shall not be compromised through fire compartments. The Developer shall procure an appropriate fire stopping insulation which includes the minimum thermal conductivity requirements stated in section Pipework Insulation.

Commissioning

Commissioning of the ambient temperature network is required prior to any heat pumps being connected to the system and is only possible once all property side connections are completed up to the isolation (5-valve) arrangement. Not all plots need be ready for commissioning at the same time. Our networks are designed such that the ambient loop network can be commissioned, then, separately individual service connections can be brought into commission. To keep our costs competitive a minimum call-off of 5 plots is usually required.

Section Nine

Ground Source Heat Pump (GSHP)

General

The Ground Source Heat Pump shall be supplied (free issued) by GTC for installation by the Developer. The Developer shall store the GSHP on site (in accordance with the storage requirements below) until required for their installation. While GTC will undertake commissioning of the boreholes, network and service pipes to buildings, it is the responsibility of the developer to install (1) internal pipework between service pipe and the heat pump and (2) the heat pump itself. The developer will commission the internal pipework and heat pump following guidance and training provided by GTC.

It is the Developer's responsibility to identify and consult with GTC to ensure that adequate provision is made for siting and installing the GSHP. Kensa Shoebox Heat Pumps can be installed with a non-vented system set-up (subject to Building Regulations). The Developer should provide property layout plans showing the proposed GSHP positions prior to the final design of the heat services. Once the design is approved, any variations required shall be submitted to GTC for approval.

The GSHP installations shall be sited so that:

- It is in the same room as the below ground pipework entry void.
- Fixed to a wall internally, the wall shall be an external wall, as close as possible to the below ground service pipework and connecting sub-main.
- Ideally at the front of the property.
- Above ground service pipework shall be kept to a minimum.
- In a room where connected services (mains water, power, drainage and fibre) are readily available – e.g. a utility room is ideal, but a kitchen is also acceptable.
- The optimum location in the dwelling is in a utility room where connected services are available (mains water, power and drainage).
- Alternatively, if a utility room is not available or is located at the rear of the property, the Kitchen is an alternative location where connected services are available.
- The GSHP can be installed, adjusted, serviced, and exchanged.
- The GSHP is easily accessible for inspection and meter reading.
- All functions of the installation can be easily operated.
- Does not create an obstruction hazard along access and egress routes.

A GSHP installation shall not be sited:

- Where it might be outside the operating range of the GSHP as specified by the manufacturer.
- Where it might be exposed to accidental damage.
- Where it might cause an obstruction.
- Where it might be affected by a damp or a corrosive atmosphere.
- Where it will constitute a danger to any person.
- At such a low level that there is a significant risk of it being submerged in the event of flooding.

GSHP Site Storage

The Developer is to provide a suitable facility and space for the storage of GSHPs on site. The onsite storage facility shall be a secure compound, with careful consideration given to the following:

- Security of all materials and equipment from theft, vandalism, accidental damage, or contamination.
- Safety of the site workers, public, especially children and blind persons.
- The movement of traffic and construction equipment.
- All GSHP store locations should be on a suitably firm hard standing, level ground, free from ground water, mud, weatherproofed and other damaging material with adequate access for construction vehicles and/or lifting equipment.
- Badly stacked pallets may slip or collapse, causing injury to personnel and/or damage to the pipe.
- GSHPs are not to be stored directly on the ground, suitable pallets or wooden battens should be the interface between the ground and the equipment.
- GSHPs must be fully covered to prevent foreign material entering or damaging the GSHPs.
- Stock should be stored in such a manner as to ensure adequate stock rotation on a “first-in, first-out” basis.
- All GSHPs are to be inspected for any storage and transportation damage before being installed in a dwelling. Any damage identified to a GSHP must not be used and reported immediately to GTC who will advise of subsequent action. The Developer will be responsible for all damages identified by GTC and the Developers GSHP commissioning engineer at GSHP commissioning.

It is the Developer’s responsibility to identify and consult with GTC to ensure that adequate provision is made for siting and installing the GSHP. The Developer should provide plans of all dwelling types showing the intended GSHP position. Once the design is approved, any variations required shall be submitted to GTC for approval.

Kensa GSHP Dimensions

The details below show a typical dimensions of the Kensa Shoebox GSHP. An additional 50mm shall be allowed around each side of the GSHP to allow for front cover removal access therefore the overall width space required for the GSHP is 710mm. There are two principle heat pump sizes available for our networks: Kensa Shoebox 3 and Kensa Shoebox NX 6 which will be selected based on property size and design.

GTC shall advise of the full GSHP specification at the detailed design stage, following the Developer’s acceptance of GTC’s quote however standard specifications follow:

Shoebox Heat Pumps

Features and Benefits

- Quiet operation
- Low running costs
- Low carbon emissions
- Ease of installation inside a dwelling
- Available in 3kW and 6kW
- Single phase
- UK manufactured
- Access to industry grants

Product Description

The Kensa Shoebox range of heat pumps are designed to provide space heating and domestic hot water (optional extra) for well insulated buildings with multiple accommodation. By using a communal ground array this avoids the high heat losses associated with running high temperature pipe throughout buildings improving the overall efficiency of the system.

The Shoebox heat pump is designed specifically to operate with low noise levels enabling easy installation in places such as an apartment's kitchen.

The unit has been specifically designed to provide a renewable alternative for heating multiple apartment blocks.

The Shoebox heat pump is available in two sizes; a 3kW version and 6kW version. Both units come complete with the ground side water pump internal to the unit reducing the complexity of installation.

Kensa Shoebox heat pumps use low grade renewable energy from a communal borehole field and each individual apartment's heat pump concentrates this to a higher temperature to provide heat into the apartment's heating system.

As a UK manufacturer, Kensa offers a high quality product which is supported by leading industry technical support to ensure the application engineering is performed to the highest standard.

Warning - when a heat pump solely is used for heating domestic hot water, it may not get the water hot enough to kill the dangerous Legionella that can breed in hot water cylinders. Alternative arrangements may therefore be required to ensure the cylinder is pasteurised regularly. The installer/ end user should check if this pasteurisation is required by local regulations, bearing in mind that there are often different rules for installations in rented or commercial properties.

Shoebox NX Heat Pump

Features and Benefits

- **5.8 kW output**
- **Quiet operation**
- **Low running costs**
- **High SCOP**
- **A+++ ERP**
- **Simple installation**
- **UK manufactured**
- **Integral vibration dampening**
- **Low power consumption**
- **Single phase**
- **Small footprint**
- **Perfect for Networked Heat Pumps**

Product Description

The Kensa Shoebox NX heat pumps are designed to provide space heating and domestic hot water for newbuild and retrofit applications.

The Shoebox NX heat pump is designed specifically to operate with low noise levels.

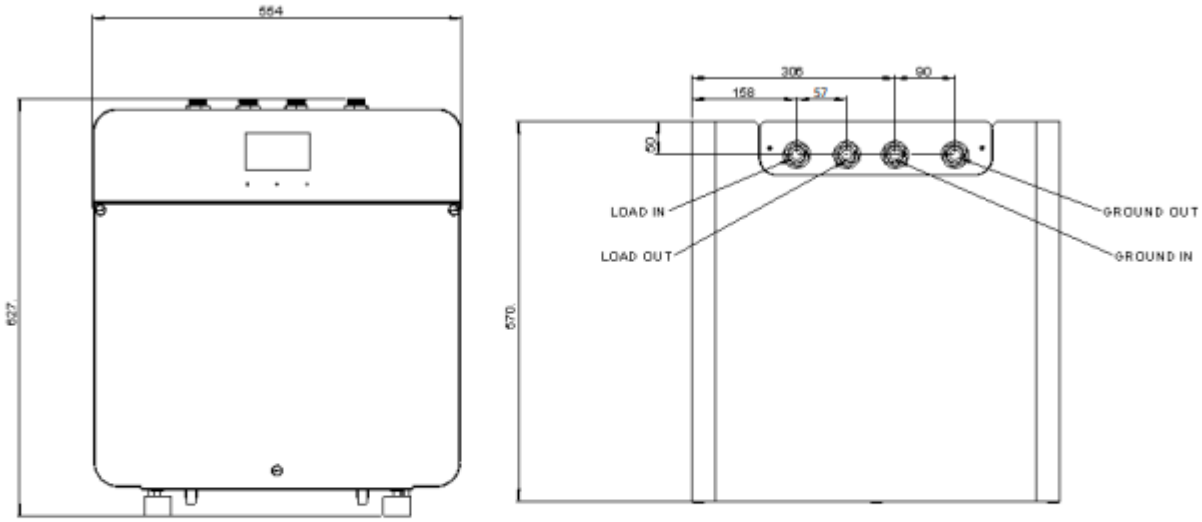
The Shoebox NX heat pump comes complete with a ground-side water pump internal to the unit, reducing the complexity of the installation. The Shoebox NX has low sound emissions compared to other heat pumps on the market, allowing for flexibility in installation location.

Kensa heat pumps use low-grade renewable energy. Each heat pump concentrates this energy into a high-temperature output to provide heating and hot water to the dwelling.

All Shoebox NX heat pumps come with integrated non-return valves as standard.

As a UK manufacturer, Kensa offers a high-quality product that is supported by industry-leading technical support to ensure the application engineering is performed to the highest standard.

Performance data—rated heating output at B0/W55 BS EN14511	
Power consumption (kW)	1.78
Coefficient of performance* (COP)	2.98
Heating water (secondary) based on 47°C in, 55°C out	
Design flow rate (l/min)	9.72
Pressure drop at design flow rate (kPa)	3.33
Electrical Values @B0/W55	
Rated voltage (V)	220-240V/ 50 Hz
Power supply current rating (A)	16
Rated current max (A)	11.6
Typical running current @ B0/ W55 (A)	8.8
Starting current (A) ****	12.2
Power Factor '@0/55C	0.89



* The COP figure quoted excludes the water pump electrical input and is calculated according to EN14511.
** In-built immersion heaters will increase running costs and CO_2 emissions as they use direct electricity, because of this Kensa heat pumps do not include them.
*** By increasing the flow temperature from the heat pump, the efficiency of the unit will drop and the COP decreases.
**** The starting currents are per phase. For full details on how the starting currents are calculated please contact Kensa.

Note: Design flowrates and pressure drops are based on a ground temperature of 0 and –3°C and a load temperature of 30°C and 35°C or 47°C and 55°C

GSHP Electrical Supply

The Developer is to provide and install a single 230V fused fixed spur from a dedicated MCB on the dwelling consumer unit to the Heat Pump in each dwelling.

The MCB must be sized based on the heat pump model as follows:

C16 (16A) for a Shoebox 3

C25 (25A) for a Shoebox 6

C16 (16A) for the NX5

GSHP Commissioning

The Developer is to undertake all commissioning requirements for the GSHPs. The Developer shall ensure commissioning is carried out in accordance with the manufacturer's recommendations and to a method statement to be agreed with GTC.

GTC will provide training once per year, per site for the Developer's appropriate contractor to understand the commissioning procedure. Additional training may be available for a charge.

Prior to GSHP commissioning, space heating and domestic hot water systems should be installed, tested, chemically cleaned and dosed and ready to receive heat from the GSHP. Space heating and domestic hot water valve set points should be factory set and verified on site by measurement. Documentation of all PI-TRV (Pressure Independent Radiator Valve) setpoints shall be issued to GTC for their records.

The Developer is required to confirm to GTC the GSHP serial number installed at each plot number / dwelling postal address on each GSHP commissioning certificate.

Any issues that arise during GSHP commissioning shall be immediately reported to GTC, even if is resolvable by the commissioning engineer. GTC shall advise of the course of action to be followed. The issue(s) shall be recorded as part of the commissioning certification and the course of action taken.

The Developer shall inform GTC of the commissioning programme for each dwelling, allowing GTC access for witnessing the commissioning of each GSHP.

Dwelling Space Heating and Domestic Hot Water

It is imperative that the Developer's appointed designer and contractor undertaking dwelling space heating and domestic hot water design, installation and commissioning follow the requirements of this document. Any deviations must be reported to GTC at the earliest opportunity to review the operational implications. If the deviation(s) have a commercial impact, this will subsequently be the responsibility of the Developer.

The Developer is responsible for completing a heat loss calculation in line with the Heat Loss section of the CIBSE Domestic Heating Design Guide.

The heating distribution system shall be designed for a flow temperature from the heat pump of 45°C unless otherwise agreed in the contract agreement. The system shall also be designed and operate with a return temperature to the heat pump of less than or equal to 5°C below the heat pump flow temperature.

The Developer is responsible for all space heating requirements in the dwelling including the calculation and specification of emitters. The developer should note that systems operating at lower flow temperatures require oversizing compared to those used for 70°C flow. Without this oversizing the system will not achieve in room target temperatures.

The heating system shall be designed with minimum 25% open zones (without TRV or zone valves) when the smallest zone is in circuit. If it is not possible to achieve this then a buffer tank should be installed to prevent the Heat Pump from short cycling when radiators or zones shut down. This solution adds expense and space requirement for equipment and may reduce the operating efficiency of the heat pump.

For buildings with a domestic hot water requirement a hot water storage cylinder should be supplied. The tank volume shall be sized in accordance with MCS Guidance. The tank coil size shall either be approved by GTC for use with the appropriate heat pump or have at least 0.3m2 surface area / kW, where surface area is calculated as length x pipe diameter ignoring any fins or corrugation on coil surface, if this is not followed then the performance of hot water production will be reduced.

Kensa Heat Pumps are supplied with a three port divertor valve, it is imperative that this diverter valve is directly controlled by the heat pump as per installation manual.

All dwelling domestic water flow rates should be in accordance with Building Regulations and should follow the latest guidance depicted by the NHBC. Any deviation from NHBC's guidance in this area should be reported to Kensa at the earliest opportunity to assess the impact on system sizing.

It will be the Developers responsibility to flush and clean the tertiary (in dwelling) space heating system and any cooling system prior to the tertiary systems being opened to the heat pump.

BSRIA Pre-Commissioning Cleaning of Pipework Systems Amended 6th edition (BG29/2021 is recommended to be followed to collect any debris prior to commissioning.

The developer will install inhibitor to the heating and hot water closed system, the inhibitor must satisfy Kensa product warranty requirements. The developer will provide a test certificate making clear the inhibitor levels within each property meet the manufacturers requirements.

The design of all space heating and domestic hot water systems shall be submitted to GTC for comment.

Underfloor heating design considerations

In addition to the above, the following also applies for systems using underfloor heating. To ensure a minimum of 25% open zone it is recommended with underfloor heating to use a manifold with actuators only to the bedroom zones. This provides more than the 25% minimum requirement and allows the properties floor to maintain a more uniform temperature ensuring comfort. Correct pump specification is of high importance to ensure design flow rates can be achieved throughout the underfloor heating distribution pipework. Manifold pumps and thermostatic blending valves are should not be fitted as the Heat Pump will control the system's temperature.

If open zone control is not possible, a buffer tank should be installed to prevent the Heat Pump from short cycling when zones shut down. This solution adds expense and space requirement for equipment and may reduce the operating efficiency of the heat pump.

Return temperatures should be set to a maximum of 40°C to optimize the system's efficiency. This setting will provide a flow temperature of 45°C aligning with a 5°C or lower delta T requirement.

The underfloor heating design table provided in the underfloor manufacturers proposal shall be followed when commissioning the system to ensure each zone has the correct flow rates.

The design of all space heating and domestic hot water systems shall be submitted to GTC for comment.

System Temperatures

System flow and return temperatures for dwelling space heating and domestic hot water are to follow the requirements shown in Table 4 below**. Any deviations from these temperatures could have significant impacts on the efficient operation of the GSHP and it is therefore imperative these temperatures are designed, implemented, and verified**:

Table 1 – GSHP Space Heating and Domestic Hot Water temperatures

Type	GSHP Flow / Outlet Temperature (°C)	GSHP Return / Inlet Temperature (°C)
Space Heating (Radiators)	45	40
Space Heating (Underfloor Heating)	45	40
Domestic Hot Water	65	60

Space Heating Room Thermostat

GTC recommend the Passiv Smart Thermostat to provide greater running efficiency and smoother installer and user experiences. Contact us for details.

Domestic Hot Water

All dwelling domestic water flow rates shall be in accordance with Building Regulations and should follow the latest guidance depicted by the NHBC. Any deviation from NHBC's guidance should be reported to GTC at the earliest opportunity to assess the impact on plant sizing.

It will be the Developers responsibility to flush and chemically treat/chlorinate and clean the tertiary (in dwelling) space heating system and submit to GTC water sampling certificates from a UKAS accredited laboratory prior to the tertiary systems being opened to the GSHP.

Section Ten

Multi Occupancy Buildings

Multi-occupancy Buildings should follow the principals of dwellings where possible. The main difference will be the building entry requirements and distribution pipework to flats in the form of riser and lateral pipework.

Early consultation (at the design stage at the latest) with GTC should take place for GTC/GTC to evaluate designs associated with the ambient loop infrastructure. GTC's Ambient loop Heating guidance documentation should be requested and issued to M&E design consultants in advance of design production.

Typically for 2/3 storey buildings, individual ambient temperature services will serve each dwelling. For larger buildings a single building entry will be used, and separate riser and lateral pipework will serve each dwelling with the GSHP also located in each dwelling. Different options are available to suit the Developer, please contact us to discuss your case.

Risk Assessment

A bespoke risk assessment is required for all flatted property installations. The Developer must provide the following information to the GTC Designer relating to the building/block.

- Special occupancy type (e.g. elderly, disabled etc) expected in the building.
- How is 24/7 access guaranteed.
- The type of building construction.
- Detailed floor plans and building layouts.
- Proposed GSHP locations.
- Isolation of service pipe to each dwelling.
- Other utility and service routes.

The Developer or the principal designer acting on behalf of the client will be required to sign the GTC Risk Assessments as deemed appropriate.

for minimum requirements.

Fire Stopping

The Developer shall be responsible for complying with Building Regulations and undertake all fire stopping requirements associated with the district heating pipework and routes.

Fire stopping and protection from fire must be constructed and in place prior to the commissioning of any riser/lateral pipework within multi-occupancy buildings, written confirmation is required from the Developer confirming fire stopping and ventilation is not compromised.

Risers and laterals shall be fire stopped between fire compartments in accordance with Building Regulations.

Where a riser or lateral is enclosed within a duct or an enclosure, the duct or enclosure must comply with the building regulations and shall be at least half hour fire resistant and comply with Building Legulations; suitable removable access/inspection panels shall be made available.

As previously mentioned, all internal ambient temperature pipework must have a continuous covering of suitable insulation to prevent condensation. The Developer must ensure that this is met, while not compromising fire safety within the building.

Internal Pipework

Ambient temperature pipework shall be in an accessible riser, dedicated only for heating pipework. Under no circumstances shall heating pipework be located in the same riser as mains cold water or LV/HV cabling.

To allow for movement a sleeve is required through any boxing/plasterboard for each lateral pipe passing through from the riser to the meter positions. The sleeve shall be filled with either fire retardant non-setting mastic or alternatively a fire-retardant silicone sealant to allow for movement of the lateral pipe installed. It is not acceptable for any plasterboard to be in direct contact with the lateral pipe resulting in restraining the lateral and preventing movement.

Risers and laterals shall be sleeved where they pass through any floor or wall.

Lateral pipework can route at high level, fixed to the soffit and should be as far as practicable from all other services.

Service connections to each dwelling or landlord use shall be complete with a lockable isolation valve on both flow and return outside of the premise boundary, so that a flat can be easily isolated in an emergency without entering the flat.

GTC shall require access to heat risers and laterals 24/7 post commissioning.

Section Eleven

Commercial Areas

All commercial use areas on a development which are connected to the ambient temperature network must follow the guidance depicted within this document, particularly with regards to the design of secondary systems.

GTC will design a solution to meet the specific needs of the Developers commercial buildings.

Early Design

Details of the commercial area should be provided to GTC at the earliest opportunity during the design stage, ideally the heat load required to supply from the district heating if it has been designed. If this is unavailable, the Net Internal Area and the space use type should be provided, with any details of untypical requirements, for GTC to approximate the required load from the district heating.

Subject to the heating needs and wider site conditions, commercial loads can be served by our ambient network solution. All construction details and requirements will be set out as part of your bespoke design.

Contact us with your requirements for further details.

Notes

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