City of
Stoke-on-Trent

District Heating Network (DHN)

Web GIS Manual &

Safe Excavation Guidance around DHN Apparatus

Prepared in collaboration with 3D-TD Ltd.

March 2021

DISCLAIMER

Stoke-on-Trent City Council's DHN Web GIS tool is for information purposes only and is intended for general guidance. No guarantee is given on its accuracy and should not be relied upon when excavating near to any Stoke-on-Trent City Council's buried assets.

Stoke-on-Trent City Council's DHN Web GIS tool will not show:-

- Recently installed apparatus
- Apparatus owned by other organisations, e.g. gas distribution operators, local electricity companies, telecoms and other utilities.

NOTICE OF WORKS

Before carrying out any feasibility studies or design works within a 3m vicinity of any of its buried assets you must ensure that you notify Stoke-on-Trent City Council.

Before carrying out any works within a 3m vicinity of any of its buried assets you must ensure that you notify Stoke-on-Trent City Council at least 4 weeks prior to commencement and receive a written consent to proceed.

This can be done by e-mailing DHN@stoke.gov.uk

If works are due to take place on private land you must contact the landowner to make sure works do not infringe on Stoke-on-Trent City Council's easements or wayleaves.

You **shall** ensure that all persons, including direct labour and contractors, working for you on or near any of Stoke-on-Trent City Council's buried assets follow the requirements of the HSE Guidance Notes HSG47 - Avoiding Danger from Underground Services.

This guidance can be downloaded free of charge at www.hse.gov.uk

In line with the above guidance, you will need to verify and establish the actual position of pipes and other apparatus on site before any activities are undertaken.

Further information is available including DWG, SHP and PDF files that can be used to display Stoke-on-Trent City Council's buried assets in your own software portal.

To request further information please e-mail DHN@stoke.gov.uk

HEALTH AND SAFETY WARNING

The Safe Excavation Guidance calls for the use of procedures that can be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

In the preparation of the Safe Excavation Guidance, it has been assumed that the works to be carried out will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

The purpose of the Safe Excavation Guidance document is to define the technical requirements for carrying out civils works in the proximity of the district heating network pre-insulated steel pipes.

When in operation DHN pipes are under stress resulting from thermal expansion and the constrain of the soil barrier that keeps the pipes in place. Therefore, when civil operatives; either expose, or excavate in close proximity to operational DHN pipes there is a significant risk to operatives and local structures when the soil barrier is removed or disturbed around the pipes.

EMERGENCY CONTACT

If a DHN pipe is breached or any apparatus is damaged, the following precautions shall be taken immediately:

1. Evacuate all personnel from the vicinity of the asset.
2. Notify the asset owner using the 24-hour emergency telephone number: 01782 234 234.
3. Ensure no one approaches the asset.
4. Do not try to stop any leaking.
5. Provide assistance as requested by the asset owner, or emergency services to safeguard persons and property.

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Introduction

Stoke-on-Trent City Council is operating a city-wide low carbon district heat network (DHN).

District heating networks are systems distributing heat to domestic and commercial customers generated in a centralised location through pre-insulated pipes as shown in Figure 1. The system installed in Stoke-on-Trent is a third-generation heat networks where the carrier pipes are predominantly pre-insulated steel pipes using water as heat transfer medium.

The network operates with the below typical parameters:-

- Range of Operating Temperature: 85 – 110°C.
- Range of Operating Pressure: 6 – 16 bar.
- Range of Axial Stress in straight pipe sections: 150 – 200MPa.

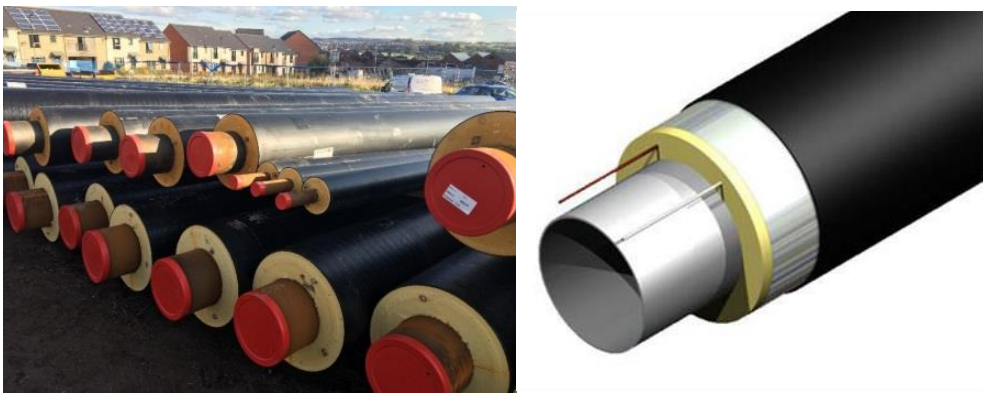


Figure 1 - Typical Pre-Insulated Steel District Heating Pipes.

The DHN Web GIS map provides information on the installed apparatus around the city.

DHN Web GIS Map

How to use WEB GIS Maps

District heating asset records **shall** be obtained and reviewed to establish the location of the pre-insulated pipes and all associated apparatus.

The information on the DHN Web GIS Map is coordinated under OSGB36. This is a tool that can be used to locate, display and print Stoke-on-Trent City Council district heating buried assets.

Prior to the commencement of any construction works the buried assets **shall** be located to verify the Web GIS Map information utilising non-intrusive methods such as pipe locators and various underground utility survey methods. Once located the assets

shall be marked out at regular intervals using asset location markers or other suitable methods.

The DHN Web GIS Map can be accessed by following the link for the DHN Maps on at: https://www.stoke.gov.uk/maps

Key Map Information

The DHN Web GIS Map has a drop-down menu that allows you: -

- To access map features.
- To measure lengths, perimeters and areas between points on the map.
- To reach directly a location with easting and northing co-ordinates.
- To print and produce PDF's of the map on display.

To access the drop-down menu please click on the 3 lines in the top left-hand corner of the screen as shown in Figure 2.

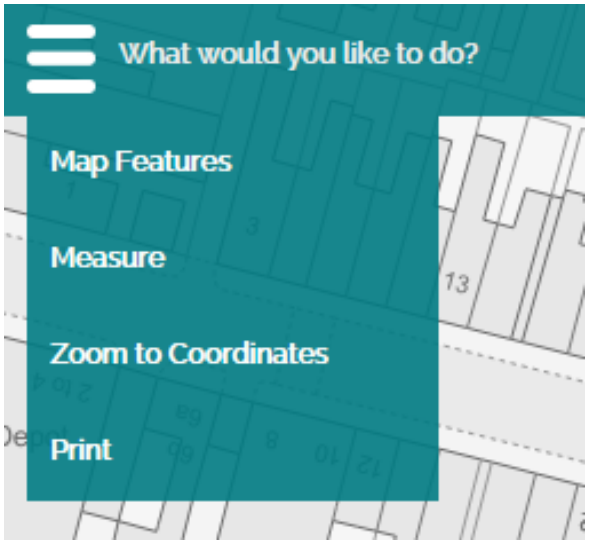


Figure 2 - DHN Web GIS drop down menu.

The "Map Features" function on the top of the drop-down allows you to display and hide various layers with key information for the assets.

The next sections of this document provide further details for each layer.

Duct Apparatus

The layers under this heading as shown in Figure 3, display the location and details of the buried duct apparatus.

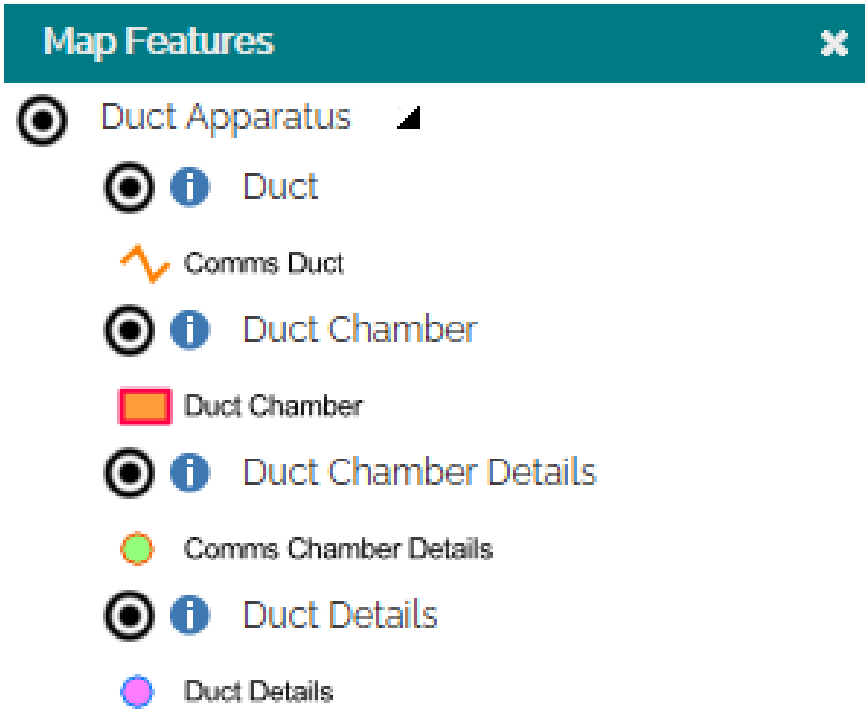


Figure 3 - Layer for Duct Apparatus.

The various layers are as follows:-

- Duct – shows the location of the buried ducts.
- Duct Chamber – shows the locations of the duct chambers.
- Duct Chamber Details – shows details regarding the duct chambers. Further detailed information can be accessed by clicking on the features on the map. A pop-up box will appear with displaying key information as shown in Figure 4. If the pop-up box has a show more option this can be clicked on and a “More Info” box will appear on the left-hand side with all the detailed information displayed as shown in Figure 5. The detailed info includes:-
    - Chamber ID – Unique ID number.
    - Cover Size – Cover Size in millimetres.
    - Depth – Chamber depth in metres.
    - Foundation Material – Material of foundation.
    - Internal Dimensions – Length and width in millimetres.
    - Invert Level – Elevation of invert above Mean Sea Level.
    - Wall Material – Material make up of wall.
- Duct Details – shows duct details regarding the duct. As for the Duct Chamber Details above, more information can be displayed by clicking on the feature as example presented in Figure 6. The detailed info includes:-
    - Duct Size and Configuration – Please refer to Appendix 1 for coding description.
    - TOD Elevation – Elevation at the top of the duct above Mean Sea Level.

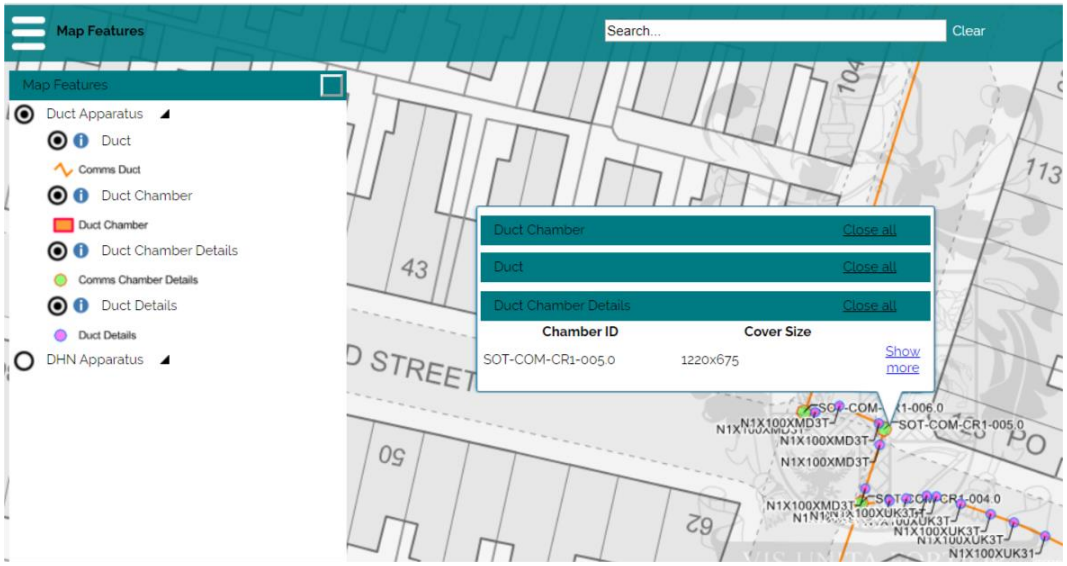


Figure 4 - Duct Chamber Details Layer, "Key Information".

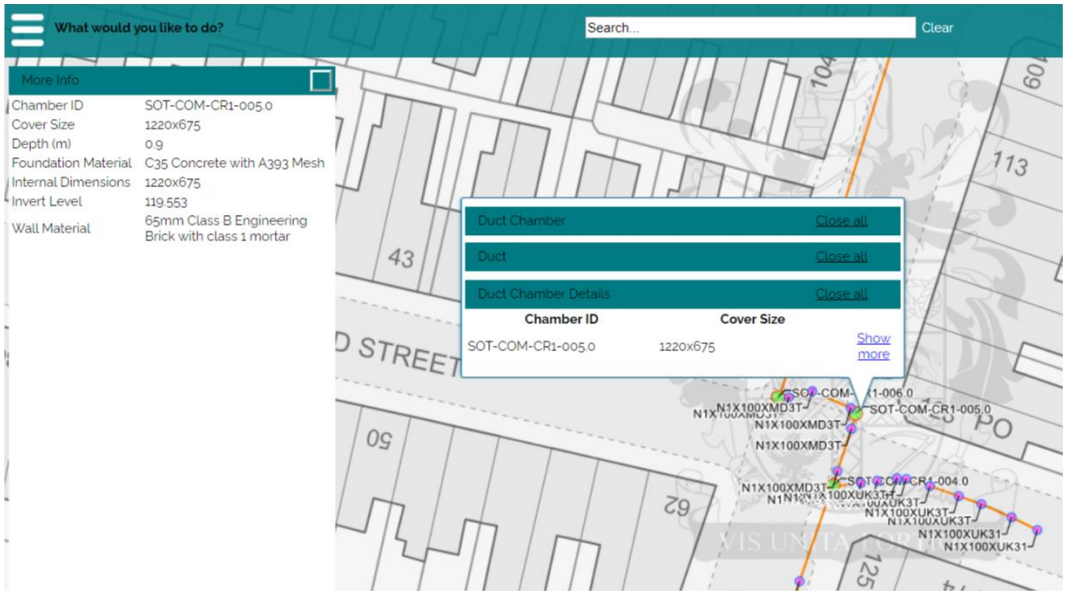


Figure 5 - Duct Chamber Details Layer, "More Info".

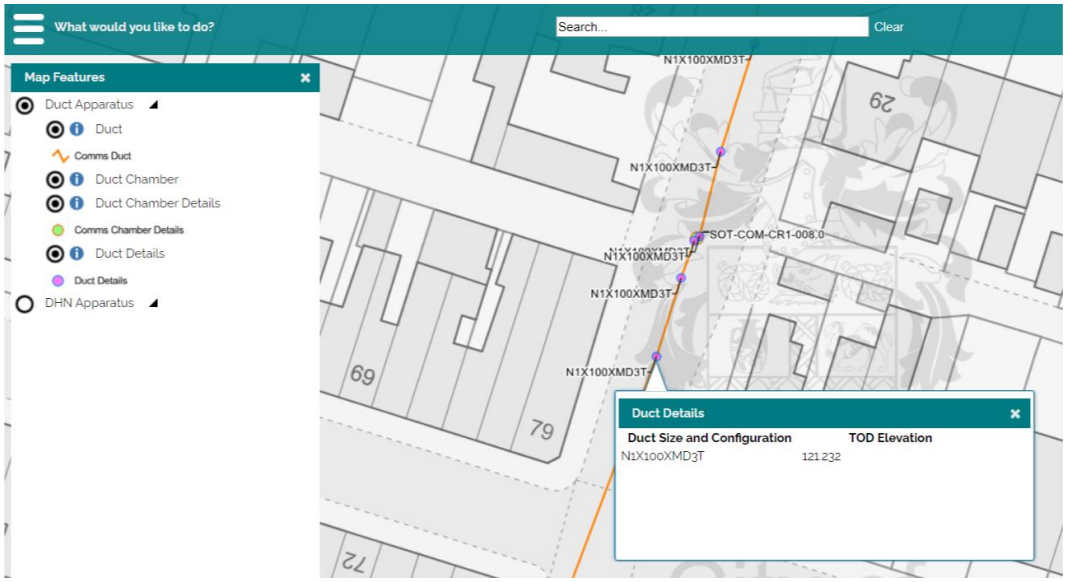


Figure 6 - Duct Details Layer.

DHN Apparatus

The layers under this heading as shown on Figure 7, display the location and details regarding the buried district heating apparatus.

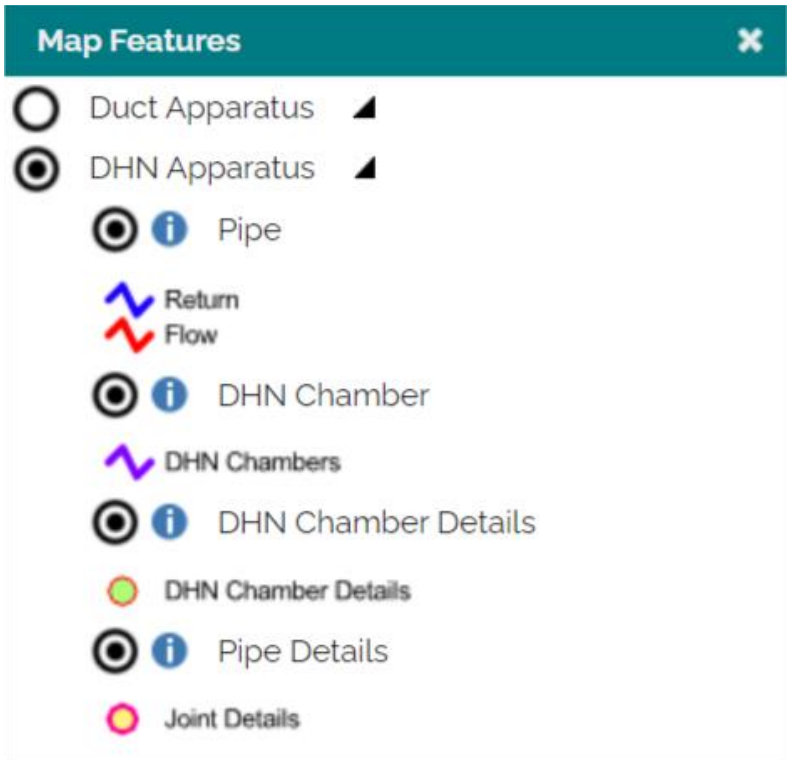


Figure 7 - Layer for DHN Apparatus.

The various layers are as follows:-

- Pipe – shows location of the buried pipes.
- Valve Chamber – shows the location of the valve chambers.
- Valve Vent and Drain Chamber – shows the location of the valve, vent and drain chambers.
- DHN Chamber Details – shows details regarding the DHN chambers. Further detailed information can be accessed by clicking on the features on the map. A pop-up box will appear with displaying key information as shown in Figure 4. If the pop-up box has a show more option this can be clicked on and a “More Info” box will appear on the left-hand side with all the detailed information displayed as shown in Figure 9. The detailed info includes:-
    - Chamber ID – Unique ID number.
    - Cover Size – Cover Size in millimetres.
    - Depth – Chamber depth in metres.
    - Foundation Material – Material make up of foundation.
    - Function – Apparatus inside the chamber.
    - Internal Dimensions – Length and width in millimetres.
    - Invert Level – Elevation of invert above Mean Sea Level.
    - Wall Material – Material make up of wall.
- Pipe Details - As for the DHN Chamber Details above, more information can be displayed by clicking on the feature. The detailed info includes:-
    - Joint Number – Unique ID number.
    - DY Outer Casing – Diameter of pipe in millimetres.
    - Mean_Z – Elevation at the top of the pipe at Mean Sea Level.

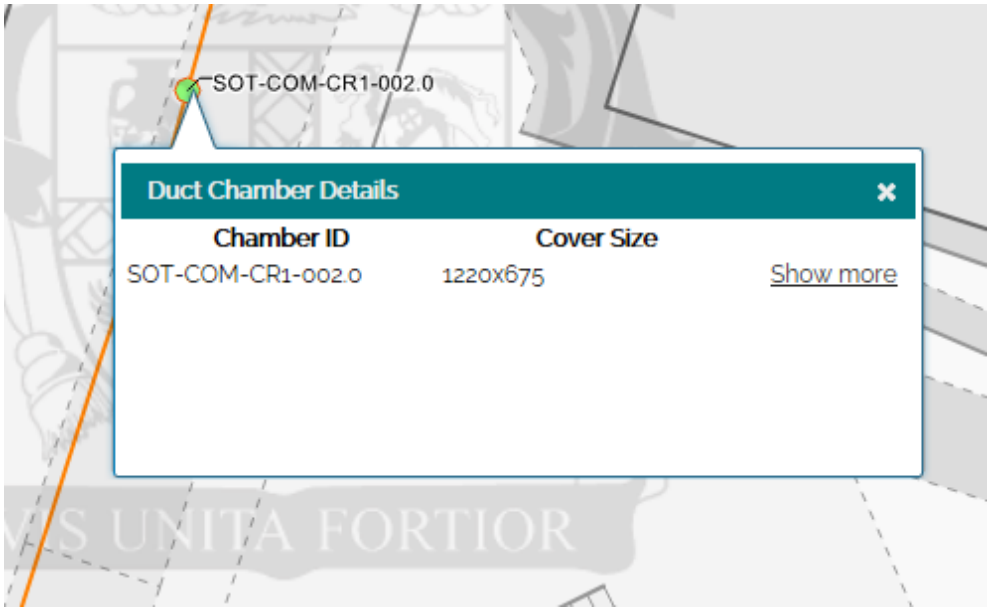


Figure 8 - Features pop up box.

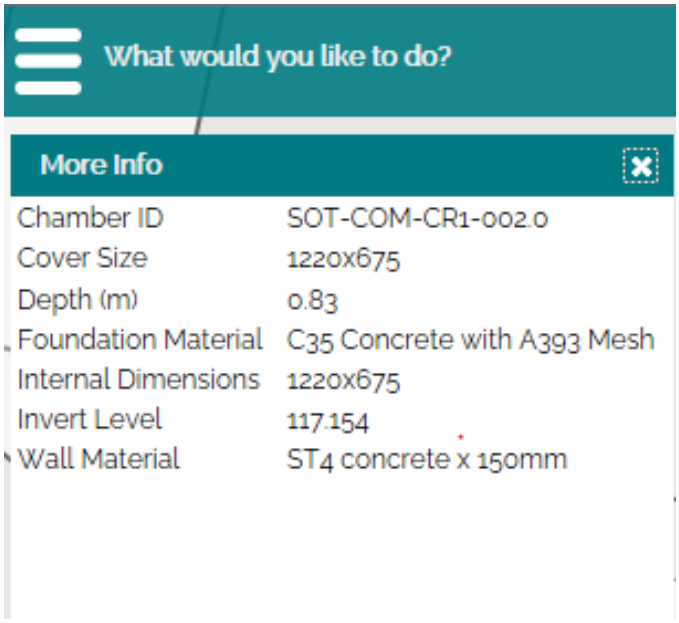


Figure 9 - More info box.

Chamber ID Tags

Chamber IDs displayed on the DHN Web GIS Map will correspond to the ID Tags displayed on the chamber lids located in the highway as shown in Figure 10.

Figure 10 - Example of identifying tag attached on the chamber lids.

Additional Mechanical and Civil As-Built Information

Additional Mechanical and Civil As-Built Information that is not displayed on the DHN Web GIS Map is available in CSV format on request. To request this information please e-mail DHN@stoke.gov.uk

Importing Information into CAD or GIS

If you would like to import information displayed on the DHN Web GIS Map into your own systems then this is available in CAD, CSV and FDB formats on request. To request this information please e-mail DHN@stoke.gov.uk

General Considerations prior Construction

When undertaking earth works in the proximity of operating district heating pipes, the Contractor **shall** ensure that all procedures and operations, including all civil and mechanical works **shall** be delivered in compliance with; Construction Design and Management Regulations 2015 and all applicable legislations, including but not limited to the Health and Safety at Work etc Act 1974, New Roads and Street Works Act 1991 and HSG 47.

Pre-Construction Design and planning stage

During the pre-construction design and planning stage, if it is anticipated the new excavation will cross or run parallel with the DHN pipe network the designer/planner **shall** inform and liaise with Stoke-on-Trent City Council for proposed design approval at DHN@stoke.gov.uk

Trench Design and Spatial Requirements

As a minimum the contractor **shall** consider the following details when developing a trench design suitable for the intended operation and fulfils the requirement of the district heating pipes:-

- Accuracy of As-Built DH Network Data.
- Exclusion zones for parallel excavation with district heating pipes.
- Maximum exposable lengths of district heating pipes.

Safe Digging Practices around DHN Pipes

Direct and consequential damage to district heating pipes can be dangerous both to operatives and to the general public due to the high temperature of the heat transfer medium and potential high axial stresses in longer straight pipe sections. It is crucial to always consult the asset owner prior to the commencement of any excavation work within the 1m zone of influence of the pipes, indicated on Figure 11 and follow the safe digging practices set out therein.

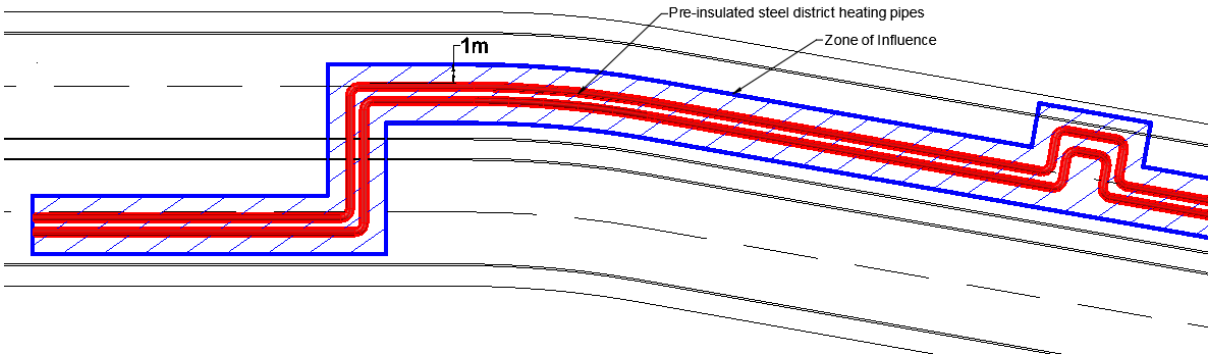


Figure 11 - Example of Zone of Influence Around the District Heating Pipes

If it is anticipated that the pipes will be exposed during the planed works, the asset owner shall be advised in advance and the asset owner will arrange a representative to attend site to inspect the pipes upon exposure.

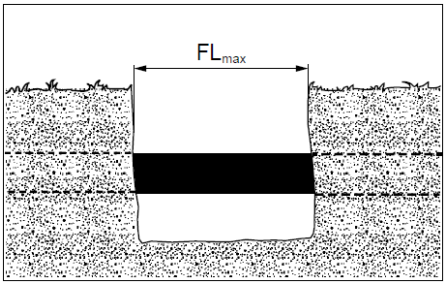
Excavation Exposing Surrounding Bedding Material and DHN Pipes

Maximum Exposable Pipe Length

When excavation routes intersect with DHN pipes in operation or the pipes are exposed for any reason, the contractor **shall** ensure that the trench width and the exposed pipe lengths do not exceed the maximum allowable length. The exact length is dependent on the axial stress level at a particular location of pipe section. The values provided in Table 1, are for guidance only and therefore it is essential to consult with the asset owner prior to any earth works take place in the proximity of the DHN pipes at DHN@stoke.gov.uk.

Table 1 - Typical maximum exposable district heating pipe lengths.

Steel pipe O.D.mm	FLMax with 190MPa maximum Axial Stress (m)	FLMax with 210MPa or higher maximum Axial Stress (m)
26.9	0.7	0.5
33.7	0.9	0.7
42.4	1.2	0.8
48.3	1.4	1.0
60.3	1.7	1.2
76.1	2.2	1.5
88.9	2.6	1.8
114.3	3.3	2.3
139.7	4.1	2.8
168.3	4.9	3.4
219.1	6.5	4.4
273.0	8.1	5.5
323.9	9.6	6.5
355.6	10.5	7.1
406.4	12.0	8.1
457.0	13.6	9.1
508.0	15.1	10.2
610.0	18.1	12.2



Excavation above the pipes

All trench excavations take place directly above the district heating pipes where the excavation length exceeds the maximum exposable length, detailed in Table 1. A minimum of 500mm exclusion zone **shall** be maintained between the top of the district heating pipes and the bottom of the excavated trench.

Parallel Excavation

Excavations parallel to district heating pipes must be carried out in such way that they do not cause lateral buckling of the pipes. This is achieved by providing an adequate lateral guide for the DH pipes.

Parallel excavations alongside DH pipes must be fully shored if the distance between the pipes and the shoring is less than 0.6m. Cavities between the soil and the shoring is not permissible, all cavities must be filled and compacted. The minimum distance between the edge of the trench and the pre-insulated district heating pipes **shall** be a minimum of 0.4m.

District Heating pipes are typically installed with 150mm of hard compacted sand to a CBR of 15% around the pipes, if excavations are to be carried out which exposes the

sand surround, temporary works designs need to take into consideration that the sand does not fall away from the pipe and expose more than the maximum allowable guidance. If this does happen the asset owner **shall** be advised immediately.

Backfill and Reinstatement

Where the district heating pipes are exposed during excavation the Contractor **shall** backfill and reinstate in accordance with the DHN backfill shown in 0 and Stoke-on-Trent City Council Highways Specification.

The Contractor **shall** ensure that prior to backfill a backfill schedule is completed and any new installation is surveyed to OSGB36 and information provided to The asset owner. The DH pipe **shall** be inspected by and accepted by the asset owner, with photographic records provided.

Contractor **shall** reinstate a warning tape a minimum of 300mm above the crown of each pipeline to help protect the pipes against future damage. Warning tapes **shall** be of polythene and not less than 150mm wide and 0.1mm thick or marker netting 500mm wide for pipes with casings over 300mm. They **shall** bear a continuously repeated legend, as appropriate (e.g. CAUTION HEATING MAINS or similar) in block letters not less than 30mm high as shown in Figure 12.

Figure 12 - Typical Warning Tape and Typical Warning Mesh.

During backfilling operations, where temporary works are required, the temporary works design **shall**, where applicable, detail the level of backfill required to remove props and sheet supports, to ensure suitable support is maintained on the DH pipe.

The Contractor **shall** ensure that materials used **shall** comply with Local Authority - Highways Specification and New Roads and Street Works Act, in particular; Specification for the Reinstatements of Openings in Highways, Appendix A1, Class A to D.

After the completion of the work, the level of cover over the asset **shall** be the same as that prior to work commencing, unless otherwise agreed by the asset owner as a change in the soil cover depth may affect the mechanical properties of the district heating pipes.

DHN Pipe Sand Surrounds and Compacting Method

Figure 13 provides typical reinstatement over DHN pipes.

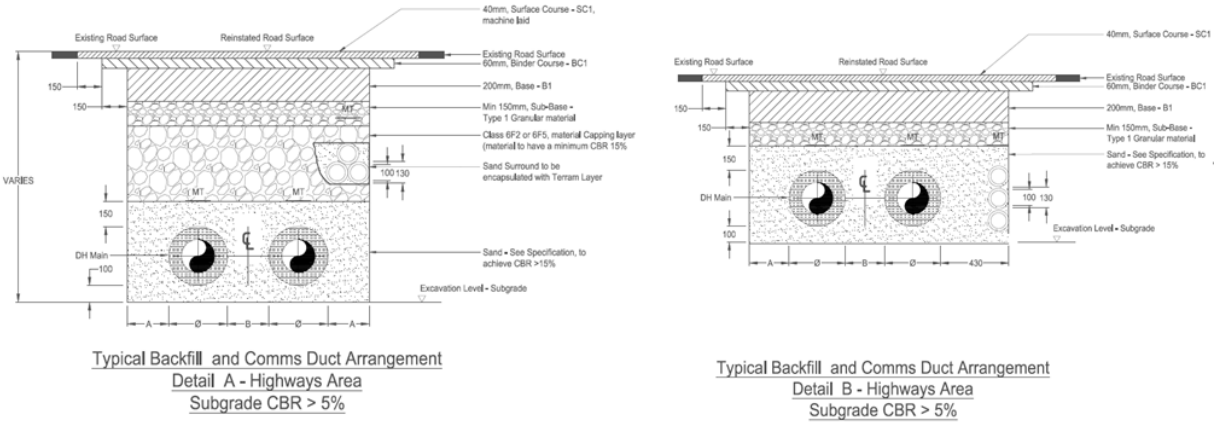


Figure 13 - Typical Trench Details for Pre-Insulated District Heating Pipes.

The Contractor **shall** test to ensure that the sand bed **shall** be composed of material containing less than 5% of particles smaller than 0.1mm and contain no elements with a diameter larger than 20mm.

In water-bearing land, the Contractor **shall** ensure that the laying bed **shall** be composed of material with an aggregate grading between 5 and 20mm.

The Contractor **shall** confirm its compacting procedures with the asset owner prior to each backfill process and adjust its methods appropriately to account for Temporary Works design, and impact of removing sheet piles during compaction.

As a minimum the sand compaction process around the District Heating pipes **shall** be completed using a mechanical trench compactor with a compacting plate no greater than 200mm between the pipes, and in the following stages:-

- Initial sand compaction up to the base of the pipes.
- Phased compaction with a minimum of 100mm intervals up to 150mm above the crown of the pipe.

Following the removal or adjustment of sheet piles, the Contractor **shall** recompact sand and **shall** test.

The Contractor **shall** undertake and record CBR tests following compaction of the sub-base, and **shall** achieve a minimum CBR of 15%.

Foam Concrete

Where the Contractor seeks to use Foam Concrete, prior written acceptance **shall** be obtained from the asset owner at DHN@stoke.gov.uk who will provide a full specification for the foam concrete as well as the test procedure to be carried out once cured.

Expansion Cushions

At location where the DHN pipe are subject to expansion, expansion cushions made of white polyethylene foam pads are used. Those are typically found around bends (elbows) to absorb movements resulting from thermal expansion and contraction as shown on Figure 14.

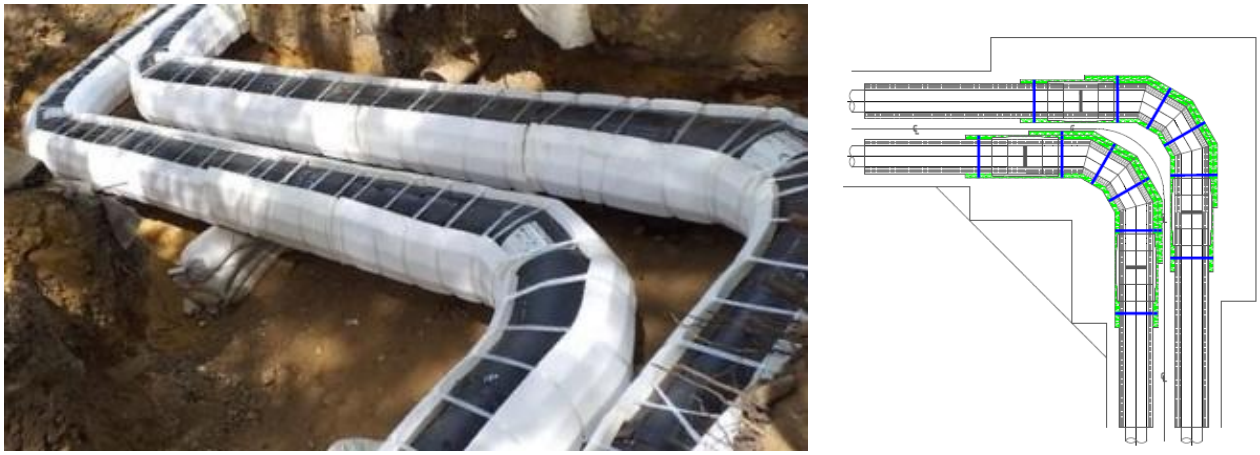


Figure 14 - Typical Expansion Cushion Arrangement.

If the pads are removed or damaged during excavation these **shall** be reinstated to their original state in accordance with the as-built information which is available from the asset owner. Replaced foam pads **shall** be fixed to the pre-insulated pipes using cloth duct tape or similar on all segments of bend and on every 750mm on the straight sections to keep them in correct position during backfill. Expansion cushions shall be acquired from a supplier, authorised by the asset owner. The list of authorised suppliers can be obtained at DHN@stoke.gov.uk.

References

- BS EN 13941:2019 Design and installation of pre-insulated bonded pipe systems for district heating.
- Logstor Design Manual.
- AGFW Rules and Standards: FW 401.

Appendix 1 – Assets Coding

The assets and assets configuration are named using a sequence of up to 5 codes as follows:

1st Code – Utility/Service Type.

2nd Code – Internal Diameter per asset (mm).

3rd Code – Material Type.

4th Code – Horizontal Configuration (How many wide) or number of ducts.

5th Code – Vertical Configuration (How many deep) or "T" for triangular configuration.

Refer to Table 2 to determine the key for the first 3 codes.

1st Code			2nd Code			3rd Code	
Code	**Utility/Service Type**		**Code**	**Dimension**		**Code**	**Material Type**
A1	ELEC – Street Lighting		XØX	Asset outside diameter or width		OL	LEAD
A2	ELEC -Traffic Lights and sensors					OC	COPPER
A3	ELEC - LV					OA	ALUMINIUM
A4	ELEC – 11kV Cables					OS	STEEL
A5	ELEC – 33kV Cables					CI	CAST IRON
A6	ELEC – 132kV Cables					DI	DUCTILE IRON
B1	GAS - LP					CN	CLAY NEW
B2	GAS – MP					CS	CLAY SALT GLAZ
B3	GAS - IP					PV	UPVC
B4	GAS - HP					TW	TWIN WALL
C1	Mains Water					MD	MDPE
C2	Storm Drainage					CO	CONC
C3	Foul Drainage					FG	FIBER GLASS
C4	Combined Drainage					FO	FIBER OPTICS
D1	BT					MC	MASS CONC
E1	CATV					AB	Abandoned
F1	Virgin Media					IR	Iron
G1	Energis					UK	Other/UKNOWN
J1	Colt						
K1	Mercury						

1st Code			2nd Code			3rd Code	
Code	**Utility/Service Type**		**Code**	**Dimension**		**Code**	**Material Type**
L1	World Telecom						
M1	Cable & Wireless						
N1	Comms other						
P1	DH or DC						
Q1	STEAM MAIN						
Q2	CONDENSATE						
R1	Dis-Used						
U1	Other/ UNKNOWN						

For further understanding about the 4th and 5th Code, see the various Configuration Examples provided at the end of this appendix.

Figure 15 and Figure 16 provide examples for a comm apparatus.

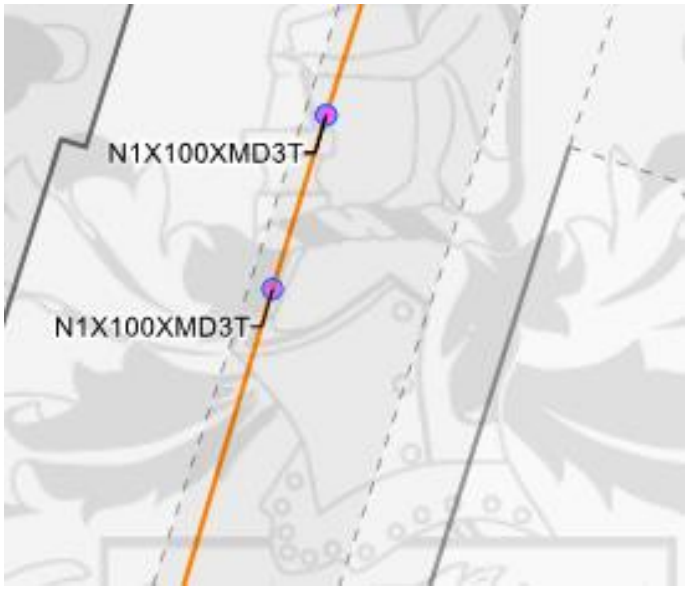


Figure 15 - Coding Example1.

The name N1X100XMD3T should be broken and read as follows:-

N1 = Comms other
X100X = 100mm inside diameter
MD = MDPE
3 = 3 (number of ducts)
T = Triangular Configuration

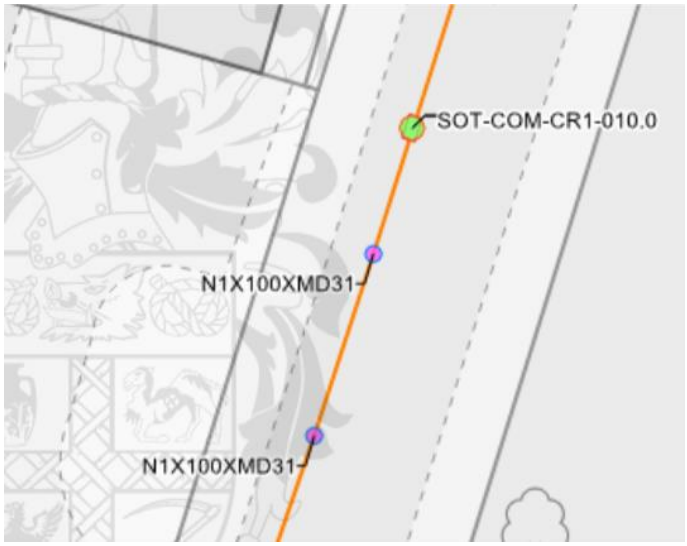


Figure 16 - Coding Example 2.

The name N1X100XMD31 should be broken and read as follows:-

N1 = Comms other
X100X = 100mm diameter or wide each
MD = MDPE
3 = Horizontal configuration.
1 = Vertical Configuration

Table 2 - Coding Keys.

1st Code			2nd Code			3rd Code	
Code	**Utility/Service Type**		**Code**	**Dimension**		**Code**	**Material Type**
A1	ELEC – Street Lighting		XØX	Asset outside diameter or width		OL	LEAD
A2	ELEC -Traffic Lights and sensors					OC	COPPER
A3	ELEC - LV					OA	ALUMINIUM
A4	ELEC – 11kV Cables					OS	STEEL
A5	ELEC – 33kV Cables					CI	CAST IRON
A6	ELEC – 132kV Cables					DI	DUCTILE IRON
B1	GAS - LP					CN	CLAY NEW
B2	GAS – MP					CS	CLAY SALT GLAZ
B3	GAS - IP					PV	UPVC
B4	GAS - HP					TW	TWIN WALL
C1	Mains Water					MD	MDPE
C2	Storm Drainage					CO	CONC
C3	Foul Drainage					FG	FIBER GLASS

1st Code			2nd Code			3rd Code	
Code	**Utility/Service Type**		**Code**	**Dimension**		**Code**	**Material Type**
C4	Combined Drainage					FO	FIBER OPTICS
D1	BT					MC	MASS CONC
E1	CATV					AB	Abandoned
F1	Virgin Media					IR	Iron
G1	Energis					UK	Other/UKNOWN
J1	Colt						
K1	Mercury						
L1	World Telecom						
M1	Cable & Wireless						
N1	Comms other						
P1	DH or DC						
Q1	STEAM MAIN						
Q2	CONDENSATE						
R1	Dis-Used						
U1	Other/ UNKNOWN						

Configuration Example 1 - N1X100XMD11:

The name N1X100XMD11 should be broken and read as follows:-:

N1 = Comms other
X100X = 100mm diameter or wide each
MD = MDPE
1 = Horizontal configuration.
1 = Vertical Configuration
Comms Duct 1 wide, 1 deep.
Recorded survey point position is indicated by the blue arrow.

Configuration Example 2 - N1X100XMD23:

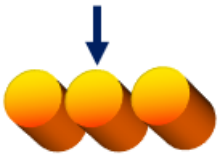
The name N1X100XMD23 should be broken and read as follows:-

N1 = Comms other
X100X = 100mm diameter or wide each
MD = MDPE
2 = Horizontal configuration.
3 = Vertical Configuration
Comms Duct 2 wide and 3 deep.
Recorded survey point position is indicated by the arrow.

Configuration Example 3 - N1X100XMD31:

The name N1X100XMD31 should be broken and read as follows:-

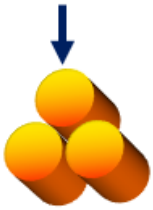
N1 = Comms other
X100X = 100mm diameter or wide each
MD = MDPE
3 = Horizontal configuration.
1 = Vertical Configuration
Comms Ducts 3 wide and 1 deep.
Recorded survey point position is indicated by the blue arrow.



Configuration Example 4 - N1X100XMD3T:

The name N1X100XMD3T should be broken and read as follows:-:

N1 = Comms other
X100X = 100mm diameter or wide each
MD = MDPE
3 = 3 (number of ducts).
T = Triangular Configuration
Comms Ducts staked as a triangle.
Recorded survey point position is indicated by the arrow.



Configuration Example 5 - N1X100XMD42

The name N1X100XMD42 should be broken and read as follows:-

N1 = Comms other
X100X = 100mm diameter or wide each
MD = MDPE
4 = Horizontal configuration.
2 = Vertical Configuration
Duct configuration with different number of ducts at different levels, 4 wide 2 deep. Recorded survey point position is indicated by the arrow.