Comhairle Cathrach
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Dublin City Council

# Dublin District Heating System

# Technical Information Pack for Developers

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*Appendix C - Sample Operating Manual is an example of the unit utilised for Spencer Dock. The manual is given for information purposes only.

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# 1 INTRODUCTION

The Dublin District Heating System (DDHS) is currently being developed by Dublin City Council (DCC). District Heating (DH) is a familiar concept in Europe. It is a system that delivers heat to consumers by using hot water as the transport medium. It is particularly well developed in Denmark where there is high up-take and a large number of centralised heating plants – most of these are Combined Heat & Power (CHP) plants. DH in Denmark is very successful and has a high consumer satisfaction rating. It is proposed to take the best from Danish experience with district heating and apply this to the Irish context in the DDHS.

The DH system in Dublin will be based on the most up-to-date district heating technology available, utilise moderate temperature levels (consumer supply side 80°C, return 40°C), pre-insulated piping systems and energy efficient CHP production units. In this way, greatest efficiencies in the system can be achieved while also providing a high quality source of heat to customers on an individual basis.

Existing planning policy within both the 'North Lotts and Grand Canal Dock Strategic Development Zone' and 'Poolbeg West Strategic Development Zone' requires that all proposed developments be '**District Heating Enabled'**[1]. This report acts as a standardised technical guidance note which DCC can issue to prospective developers within the SDZ on request. It outlines the requirements of a development in order to be considered district heating compatible and gives reference to relevant standards which outline technical details. The main design parameters of the planned district heating system for Dublin are outlined and some information relating to the relative cost of district heating with respect to conventional heating for the benefit of prospective developers is provided.

**Appendix A** of this document outlines technical specifications which can be used as a basis to be compliant with the planning condition to be district heating enabled. The information in this section is based upon the Technical Specification for Spencer Dock. Different developments may have different characteristics which may require slight variation from the information contained within; however these technical specifications will provide a guide to the installation requirements of all developments, including the specific standards to adhere to.

[1] See Section 3

## 1.1 BENEFITS OF DISTRICT HEATING FOR CUSTOMERS

The DH system envisaged by DCC is one where individual consumers can expect a high quality service. As the system operates all year round, unlimited hot domestic water will be available to consumers at all times. Heating specifications will be as good as or superior to conventional heating systems with the added benefits of reduced overall investment costs, competitive user costs and reduced environmental impact. The network will be run as a new utility and individual consumers will only be billed for the heat they use.

There are a range of benefits to consumers associated with a DH system as envisaged by DCC, among these are:

- Primary heat producers i.e. boilers are no longer required at consumer premises. This means:
    - There is no fuel or fuel storage involved or an immersion
    - There is no combustion processes and consequently no local emissions and no requirement for an exhaust gas flue
    - Risks from carbon monoxide are eliminated
    - Noise levels are reduced
    - Requirements for heating system ventilation are eliminated
    - Lower $CO_2$ emissions
- Maintenance requirements are lower and less moving parts
- Reduces labour and maintenance costs compared with individual systems
- Heat and water available on demand 24/7
- There are reduced space requirements on the consumer side, as the heat exchanger can replace:
    - boiler and flue
    - hot water storage tank
    - immersion tank
- Lower cost solutions – a DH network may provide a lower cost method of achieving low carbon targets and improving the 'Green Credentials' for the building/development
- No carbon tax/Public Service Obligation (PSO) levy on DH heating supply
- Improve security of energy supply by reducing dependency on fossil fuel imports
- Increased price security - a DH supplied by waste heat or renewable sources is not affected by oil or gas market price fluctuations
- Offer a more cost effective and affordable source of low carbon heat
- Can be a low carbon approach for dealing with difficult to insulate buildings e.g. solid wall dwellings and historic buildings

# 2 DISTRICT HEATING SYSTEM DESIGN PARAMETERS

A preliminary design for the DDHS was completed by RPS / COWI. Detailed design has only taken place at Spencer Dock and for the crossing of the River Liffey via the Liffey Service Tunnel. DH pipework has been laid in the Spencer Dock Area and within the Liffey Services Tunnel, more recently DH pipes were installed under the new road at Point Depot area. The remainder of the DH System remains to be developed.

The main transmission line from the Dublin Waste to Energy (DWtE) Plant in the Poolbeg area will be designed to carry the entire heat production of 90$MW_{th}$. The network will be established using pre-insulated DH pipes according to the EN 253 specification (District heating pipes - Preinsulated bonded pipe systems for directly buried hot water networks - Pipe assembly of steel service pipe, polyurethane thermal insulation and outer casing of polyethylene).

The DH System envisaged for Dublin will be based on best experience from Denmark. The System will be modern and highly efficient. It will also be designed to give individual customers full control of their heating and value for money.

## 2.1 TEMPERATURE & PRESSURE

The technical principles for the proposed DH system are based upon the general principles for city wide DH systems, and the design is based on the international standard BS EN 13941: "Design and installation of preinsulated bonded pipe systems for district heating".

### 2.1.1 Overview of Design and Operation Parameters

The 'design' temperature of the network has been set as 120°C and the 'design' pressure has been set as 16 bar, with a hydrostatic test pressure of 24 bar; this describes a medium temperature hot water (MTHW) system.

During the initial operation, where only the Docklands and/or Poolbeg area is served, the actual operational pressure will be below 10bar. In order to be energy efficient, the system will initially operate as a low temperature hot water (LTHW) system until which time as an increase in demand requires that the system is operated as a MTHW system.

The general definitions for Medium and Low Temperature Systems are as indicated below:

**Table 1: Definition of Medium and Low Temperature Systems**

| Category | System Design Water Flow Temperature | Operating Static Pressure (bar absolute) |
|---|---|---|
| Low Temperature/ Pressure Hot Water Systems | 40°C to 85°C | 1 to 3 |
| Medium Temperature/ Pressure Hot Water Systems | 100°C to 120°C | >3 |

The overall design principle is to establish an energy efficient medium temperature hot water (MTHW) system. This will initially operate as a LTHW system but is designed to accommodate future expansion and operate as a MTHW system when demand for district heating increases.

The proposed Primary and Secondary temperatures and pressures are within the ranges contained in the above table. The primary system will be designed as a Medium Temperature / Pressure system. The secondary system will be designed as a Low Temperature / Pressure system. As previously mentioned, in order to be energy efficient the system will initially operate as a LTHW system. The initial set temperatures for this early phase will be as follows:

Winter operation:

- Primary side (district heating system)- Flow/Return: 85°C/45°C
- Secondary side (consumer premises)- Flow/Return: 80°C/40°C

Summer operation:

- Primary side(district heating system)- Flow/Return: 70°C/40°C
- Secondary side (consumer premises)- Flow/Return: 65°C/35°C

The wintertime design temperatures differ from conventional boiler design temperatures in two key respects:

**1.** Specific temperatures used and average temperatures within the secondary system are lower than for conventional systems (which typically use temperatures of 82°C supply / 71°C return). Temperature difference is the driver of any heating system; the larger the temperature difference between heat source and heated area, the higher the rate of heat transfer. The smaller this temperature difference, the lower the rate of heat transfer. The difference between the average temperature of the emitters (radiators, coils, under floor heating etc.) and the 'target' temperature for the heated area is therefore greater for a conventional heating system than that is for a district heating configured system.

**2.** The temperature range between flow and return is 40°C compared to 11°C for a conventional Low Temperature Hot Water (LTHW) system. The temperature range is defined by the 'target' inlet and outlet temperature of the water flowing through the emitter. As flow water enters emitters, its temperature will naturally decrease as heat transfer occurs to the water within the emitter and the heated area. Therefore, the surface temperature of the emitter (broadly equivalent to the average temperature of the water within the emitter) is typically around 60°C. New hot water flowing into the emitter at 80°C will add heat to replace heat that has been transferred to the heated area. The rate of heating is varied by adjusting the flow rate. In all situations, the target outlet temperature will remain at 40°C wintertime / 35°C summertime.

Both of the above factors mean that the rate of heat transfer from the proposed district heating configured system (on the secondary side) is lower than it would be for conventional LTHW systems with the same physical dimensions. The district heating system would use lower flow rates within the primary system in order to maintain the required flow and return temperatures back to the plant. The secondary side emitters (radiators, coils etc.) will need to be designed to achieve this. This will normally require larger emitters across the building systems with increased capital cost. However, the benefits include smaller pipe and pump sizes which will reduce the energy required for pumping costs within the building and associated savings. An added benefit will be reduced distribution heat losses due to lower flow temperatures.

The difference in temperature between the district heating configured heating system pipework and its surroundings is also lower than it is for a conventional system. In addition, due to the smaller pipe sizes, the available surface area for heat transfer to occur is also reduced. For similar reasons to those outlined above, these factors result in reduced unwanted heat losses for the medium pressure system.

The lower flow and return temperature rates characteristic of the secondary side heating system which is required with district heating produces an even heating effect with the same levels of comfort as a conventional heating system. The radiators will not be scalding to touch, as they will have an average surface temperature of 60°C. In conjunction with thermostatic controls, they will ensure that building temperatures remain at chosen set points. This has another beneficial effect in that building longevity is increased. Typically a secondary heating system will use reduced flow and return temperatures to the building's heat emitters to ensure that as much energy as possible can be extracted from the primary heating side. As noted previously, this will also ensure that the correct return temperatures i.e. 40°C will be returned to the heat exchanger.

The district heating system is designed to accommodate an increase in system supply temperature to 120°C at a later stage. In this scenario, the winter primary supply side would increase to 120°C but the other temperatures would remain fixed. This will increase the transmission capacity and would also be suitable for older buildings where boiler equipment and radiators were designed conventionally (82°C supply / 71°C return). Where such buildings are to be connected to the district heating system, boiler units would simply be replaced with a heat exchanger.

A network analysis will need to be carried out to identify the exact operational parameters. This will include a check of the supply versus loads and capacity of pipes, temperature and pressure to supply required heat.

## 2.2 SOURCES OF HEAT

The heat production units serving the district heating system could initially consist of:

- A CHP plant located in the Poolbeg area (DWtE Plant), with a design capacity of 90 $MW_{th}$, configured with two streams. This will serve as the base load heating unit for the DDHS.
- Boiler units could be used to serve specific developments until such time as the overall DH system is ready and can reach them, as is the case in Spencer Dock. Some of these boiler units will act as peak load boilers when the development is connected to the network and heat exchangers are installed, while others may not be required in the long term
- There is also potential for temporary containerised local boiler stations with capacities of up to 5MW each, to serve specific developments until such time as the overall district heating system is ready and can reach them. These units will be removed as the DH system develops.

It is likely that a back-up hot water storage tank will be constructed to provide further reserves for the system.

## 2.3 FUTURE EXPANSION

The transmission line and all other installations will be designed to accommodate a possible future increase in operating temperature and pressure levels in the main system. This will enable the main parts of the DH system to be operated as a heat transmission system serving a growing number of consumers.

If required, the temperature level of the main network can be increased from the initial moderate levels (90°C / 10bar) to (120°C / 16bar). This will enable higher heating demands from potential new consumers (e.g. hospitals, older buildings) to be served while also increasing the thermal capacity of the network.

The network will be capable of distributing heat from the principal CHP plant (DWtE Plant) and future additional heat producers (e.g. power stations, industries, local CHP installations etc.) as the number of consumer connections increases.

## 2.4 LOCALISED DESIGN CONSIDERATIONS

The estimated total heat load, and hence design conditions, for the DDHS were established from information provided about:

- Size of developments ($m^2$);
- Development type (residential, commercial, etc.);
- Estimated total annual heat demand (MWh).

The total heat load for each development to be connected to the network should also be individually calculated. This will inform the design requirements of the piping from the main transmission line and associated works. Once the design requirements have been ascertained through network analysis, other considerations should be factored in, including:

- Minimising the route length - minimise the installation period and cost;
- Ease of construction, ground conditions and health and safety issues related to working with large rigid piping in heavily trafficked road areas – minimise installation period, cost and risk of accident;
- Avoiding clashes with existing services and required wayleaves;
- Keeping any traffic disruption to a minimum, particularly due to traffic volumes in the city centre.

The routing of a DH system in areas congested with services can also be challenging for other utilities (i.e. water supply / drainage). Other issues can be due to the rigidity of the pipes themselves, which provide little flexibility to go around existing services or obstacles. Other issues include the width of trench required to accommodate two large trunk mains. Where the DH pipes are being installed in amongst existing services, it may be necessary to divert the services in order to make room for the DH pipes. This can cause challenges as not all services can be easily diverted.

# 3 WORKS REQUIRED

In order to connect to the DDHS, a development will be required to have installed:

- DH pipework within the street, connecting from the main transmission line to each heat exchanger. The sizing of the pipework will depend on the site's location in proximity to the heat sources on the DH Network and the heat load of the development.
- heat exchangers to serve each building, or a group of buildings spaced close together.
- consumer installations, including pipework, valves, apartment units and domestic hot water system, heat meters, radiators, under floor heating etc.

Depending on the circumstances and timing of the development, the developer may be required to provide a peak-load / reserve boiler to serve the heat load in each building or the development as a whole. Should the development be completed prior to the completion of the DDHS, this boiler will be required to serve the buildings until such a time as the network is ready-for-use. If the development is not scheduled until after the network has been completed, the developer should consult with DCC / the DH operator as to the appropriate requirements of a peak-load / reserve boiler.

Depending on the size of the development, water treatment facility / pressure holding / pumping equipment are to be installed as required.

## 3.1 PIPEWORK

The pipework design for each development will vary depending on their position within the DH Network and the load requirements of the development. There are a number of standards which the pipework, and associated fittings, will be required to comply with and these are detailed in the sample technical specifications in **Appendix A**. Also included in these specifications are details on how the pipes should be preserved (vacuum-sealed or similar approved) in the event that the pipes are not to be used immediately.

In the Spencer Dock development, the main DH line along Spencer Street consists of twin DN400/560 pre-insulated DH pipe. This is the connection from the main transmission line of the DH Network to the development. This is branched off along Mayor Street with twin DN 250/450 pre-insulated DH pipe. The service connections to the buildings consist of twin DN 100/225 pre-insulated DH pipe and these pipes will connect to the heat exchangers when installed.

For the proposed district heating line to run along Spencer Avenue, the detailed design consisted of a DN300/500 pre-insulated DH pipe. Details of these specifications can be found in **Appendix B**.

As previously outlined, the routing of DH pipework in areas congested with services can also be problematic for other utilities (i.e. water supply/drainage). Detailed surveys of existing services in the area to be served by DH pipes should be carried out prior to the detailed design of the DH pipework route.

## 3.2 HEAT EXCHANGERS

Buildings will in general be connected to the network via heat exchangers, typically located in the basement or ground floor of buildings, in order to separate the distribution system from the house installations. They should be located as close as possible to the connection point, to ensure the extent of internal pipework is at a minimum thus reducing heat loss. Where appropriate, a heat exchanger 'sub-station' could serve a number of buildings located closely together.

A heat exchanger has a primary side (DH system) and a secondary side (consumer property) side. Both sides of the heat exchanger are separate and DH water does not cross the heat exchanger. A schematic showing a typical heat exchanger installation in a block of apartments is shown in Figure 1.

In order to bring the temperature on the secondary / consumer side of the heat exchanger to the targeted temperatures (80°C wintertime / 65°C summertime), there must be a temperature difference between the primary side and the secondary / consumer side of the heat exchanger. Therefore, the supply temperature on the primary side of the heat exchanger is set at 85°C wintertime / 70°C summertime. The exit temperature on the primary side of the heat exchanger is 45°C wintertime / 40°C summertime; this means that there is some temperature drop across the heat exchanger as there is within the consumer's heating system (for wintertime and summertime).

During the summertime, space heating requirements will be much lower than in wintertime; the main domestic heating demand in summertime will be for hot water for washing / cleaning. Therefore, during the summertime, the district heating system supply and return temperatures can be reduced. The heat exchangers in the DDHS should be designed according to the following operational parameters:

Winter operation:

- Primary side: Supply/Return – 85°C/45°C. (ΔT: 40°C).
- Secondary side: Supply/Return - 80°C/40°C. (ΔT: 40°C).

Summer operation:

- Primary side: Supply/Return - 70°C/40°C. (ΔT: 30°C).
- Secondary side: Supply/Return - 65°C/35°C. (ΔT: 30°C).

These temperatures were selected as they provide for a more efficient heating system than the traditional system temperatures of 82°C / 71°C through reducing heat losses, pumping costs and pipe size. Upon an increase of the supply temperature to 120°C, the winter primary supply side would increase to 120°C but the other temperatures would remain fixed.

## 3.3 CONSUMER INSTALLATIONS

The DH Consumer Installations is similar to a block heating system, with a Heat Exchanger in the basement of a block or at the entrance to a home instead of an oil/gas boiler. Lower flow rates are required due to the greater difference in Flow and Return Temperatures of the DH system. This results in smaller piping dimensions. There is also a reduced heat temperature loss due to a lower return temperature, compared with the traditional system temperatures of 70/90 degrees. Due to these lower flow rates and reduced return temperatures, radiators will not be burning hot and will deliver a more comfortable even heating effect. Due to this radiators will be required to be bigger than traditional radiators and will be switched on for longer periods during the day to maintain temperatures, rather than switched on and off resulting in temperature fluctuations.

Consumer installations comprise installations (Heat Exchanger / Heat Interface Units) in apartments as well as similar installations in common rooms, which are to be supplied with heating (e.g. staircases, basements etc.). Each consumer's installation will comprise the following equipment:

- Main valves for separating the piping system of the apartment.
- Apartment unit for preparation of hot domestic water. The heat exchanger (heat interface unit) for preparation of hot domestic water is to be designed for operation at supply temperatures down to 65°C, with a return temperature of 35°C.
- Heat meters (see below).
- Radiators and associated piping and valves. The radiators are to be designed for the district heating temperature parameters Supply/Return = 80°C/40°C during peak load during winter.
- Hot domestic water system, consisting of piping from the apartment unit to kitchen, bathrooms etc.
- If the Heat Exchanger (Heat Interface Unit) is to be maintained by facilities management then ideally they should be accessed externally to the consumer's property, in a secure location, for ease of maintenance.

A sample operating manual for an apartment unit has been included in **Appendix C**. These units have been installed in the buildings in Spencer Dock. It shall be noted that the sample operating manual is given for information purposes only.

Figure 1 outlines a sample district heating arrangement within a typical apartment block. A conventional heating arrangement is also shown to provide reference.

## 3.4 HEAT METERS AND METERING

The European Union (Energy Efficiency) Regulations 2014 (SI 426 of 2014) states that heat or hot water 'advanced' meters are required for each individual unit in multi-apartment and multi-purpose buildings with a central heating or cooling source or supplied from a DH network.

Heat meters are to be installed at each individual consumer installation. Heated common rooms managed by a property management company or similar will also be fitted with a heat meter. The specifications of the meters should be based on the European standards EN1434-1 – EN1434-6.

Where appropriate, heat meters will be fitted with equipment for remote reading of consumption, to avoid any inconvenience for consumers in connection with the meter reading, i.e. a smart meter. The location of meters needs to be carefully considered, and positioned at a suitable, secure and accessible private open space, where they can be read remotely and easily maintained.

Where remote recording is not used, the meter reading will be done by 'self-reading' by consumers at regular intervals (e.g. 6 months), with only occasional spot checks carried out by the DH company, or its agents.

In selecting a meter supplier, it is important to ensure that the data is presented by the metering system in a format usable by more than one metering and billing services provider, to avoid being tied in to a particular service provider.

## 3.5 COMMON PIPING BETWEEN HEAT EXCHANGER AND INDIVIDUAL CONSUMERS

Multiple occupancy buildings such as flats or apartments include common areas that need to be heated but which may not be metered. Such areas include foyers and stair wells. The heating system within a multiple occupancy building will also include common system elements including piping, circulation pumps, regulation equipment, and water treatment system. This equipment will be provided and installed by the developer and will remain the property of the owner of the building. There will be heat losses from piping within the building. Therefore, insulation should meet the relevant pipe insulation standards to reduce heat loss to a minimum.

The cost of the heat loss from these sections, where heat loss is not metered, will be covered by a fixed charge corresponding to the calculated yearly heat loss from the entire system and divided among the building occupants. This is similar to how energy is delivered and charged for by other utilities in that all transmission and distribution costs, including any losses up to customer meter points are covered by 'standing costs' within the customer's utility bill.

In larger apartment blocks, a local water treatment system is often applied to protect the installations against corrosion. All circulation water should be treated and losses from the system minimised. As an alternative to a local water treatment system, water for the heating circuit could be supplied (sold) from the DH network to the property management company, thereby reducing the investment. (This could be done directly from the DH system pipework using preinstalled connections or it could be delivered to the site in a tanker and the building system filled from there).

## 3.6 DISTRICT HEATING ENABLED

The following is a summary of the main requirements detailed above for buildings / developments to be 'DH enabled';

- The system must be a centralised water based heating system supplying all heating requirements, including both space and hot water requirements
- The consumer heating system must have a supply temperature requirement no higher than 80 degrees, and must be designed to have a delta-T($\Delta T$) of at least 40 degrees in winter and 30 degrees in summer.
- Heat meters are required at each individual consumer unit (commercial or residential) which can be either read remotely or accessed without entering the consumer's property, and include measurement of the supply and return temperatures to each heat exchanger.
- The design of plant rooms must take account of the requirement for DH supply and return pipe connection manifolds and heat exchangers, and install the appropriately sized flow and

return branch pipeline connections in order to connect to the future DH transmission and distribution network at street level.

- DH pipes must extend from within the private property to the public domain, for easy connection to a DH network and the location of same shall be agreed with DCC/DH Entity prior to any works/installation. Termination of any pipe work inside or outside the building shall include suitable vents, and be located in manholes, all to be in accordance with these guidelines and other relevant guidelines to the satisfaction of DCC/DH Entity.
- Mainline DH pipework are not permitted to pass under buildings, except where such pipes are exclusively for the building in question, where they form part of the secondary/consumer system, and only when suitable isolation valve/manhole in a public area is provided prior to pipe work extending under the building.
- Valves within buildings without basements need to be located in such a manner to facilitate easy access and inspection and to minimise any risk to occupants of the building.

## 3.7 SUMMARY FOR PLANNING SUBMISSION / COMPLIANCE

In respect of applications for developments which include a requirement for being district heating enabled, consulting the previous sections, the following is a checklist:

- Site location plan showing the pipe route and connection point to the wider DH network;
    - DH pipes must extend from within the private property to the public domain, for easy connection to a DH network.
    - There may be a requirement to install further lengths of DH main in the public domain.
- Internal schematic drawing showing locations of DH installations, such as;
    - Plantroom layout indicating future connection to DH scheme.
    - Locations of heat exchange units.
    - Locations of heat meters.
- High level technical specification indicating compliance with this document.
- Expected heat demand for hot water and space heating – residential / commercial, estimated annual heat demand, including expected seasonal base heat load and peak heat demand.
- Expected system maintenance regimes, including maintenance of the heat exchangers and the heat metering system, data collection, and billing of consumers.
- Date of anticipated occupancy.

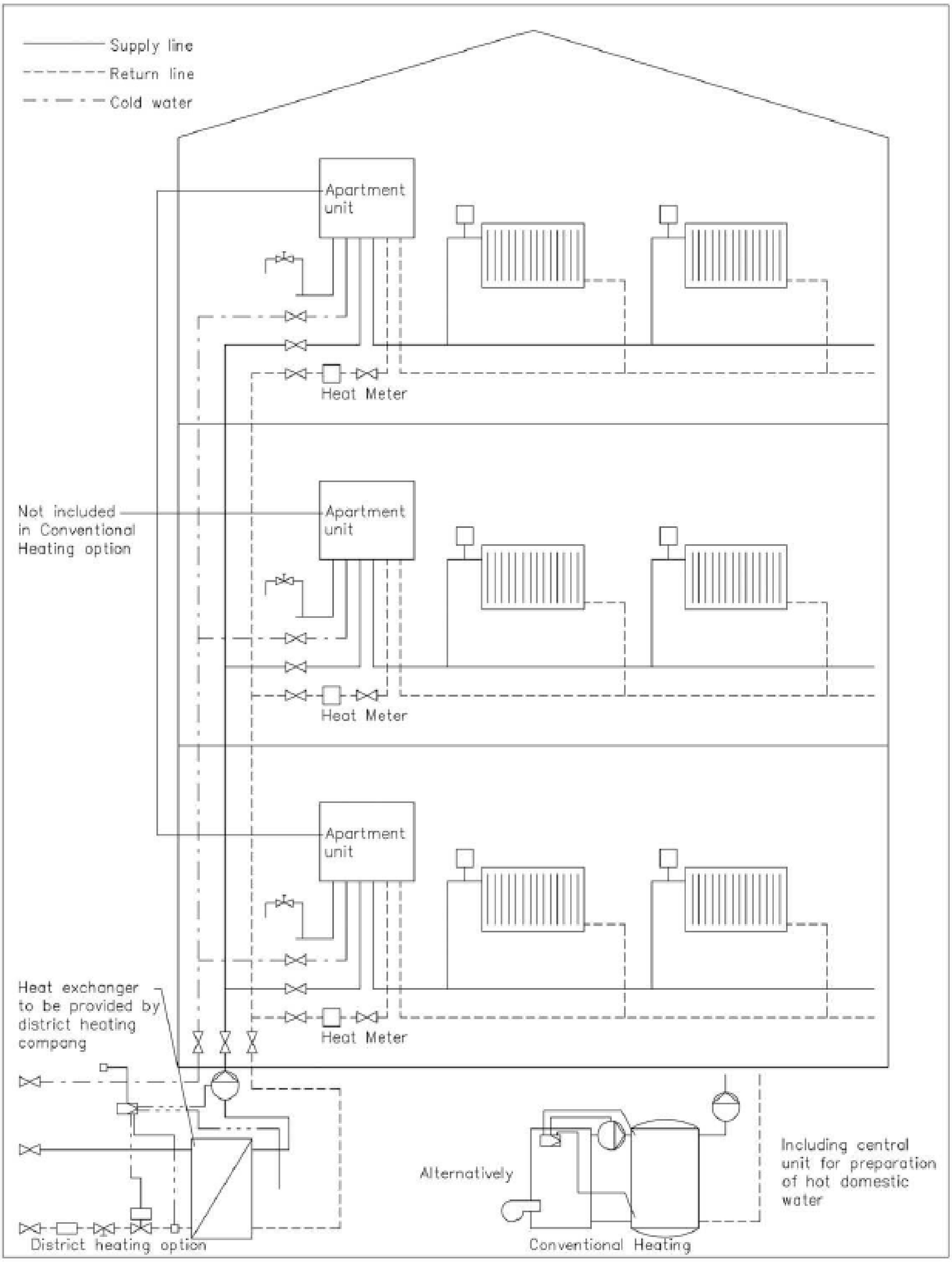



**Figure 1: Schematic showing DH Arrangement & Conventional Heating Arrangement in a Typical Apartment Block**

# 4 DEVELOPER INVESTMENT COSTS

Previous experience from the UK and Scandinavian countries shows that DH investment costs will be lower than for conventional heating systems. The main area in which cost savings can be made is with heating plant. With DH, there is no requirement to install boilers or flue stacks at individual premises. Boiler equipment represents a large fraction of heating system capital costs. Instead of a boiler, heated premises are supplied with heat via heat exchangers. A large heat exchanger will typically serve large buildings or groups of buildings, while individual premises will also typically be isolated with smaller heat exchanger units.

The DDHS is being progressed by DCC. It is envisaged that when the network is completed, it will be handed over to a DCC/DH operator to maintain and further develop. The DCC/DH operator will specify the requirements of the DH pipework and heat exchangers for each development based on the requirements of the network. The pipework specifications from the main transmission main up to the heat exchanger will be provided by the DCC/DH Operator to the developer. The approach to the procurement and installation of this DH branch main will be discussed and agreed with the DCC/DH Operator in line with DH network requirements and the development's needs. The heat exchangers and consumer installations will also typically be specified by the DCC/DH Operator.

Figure 2 and Figure 3 outline the expected technical and commercial models for the Dublin DH Network.

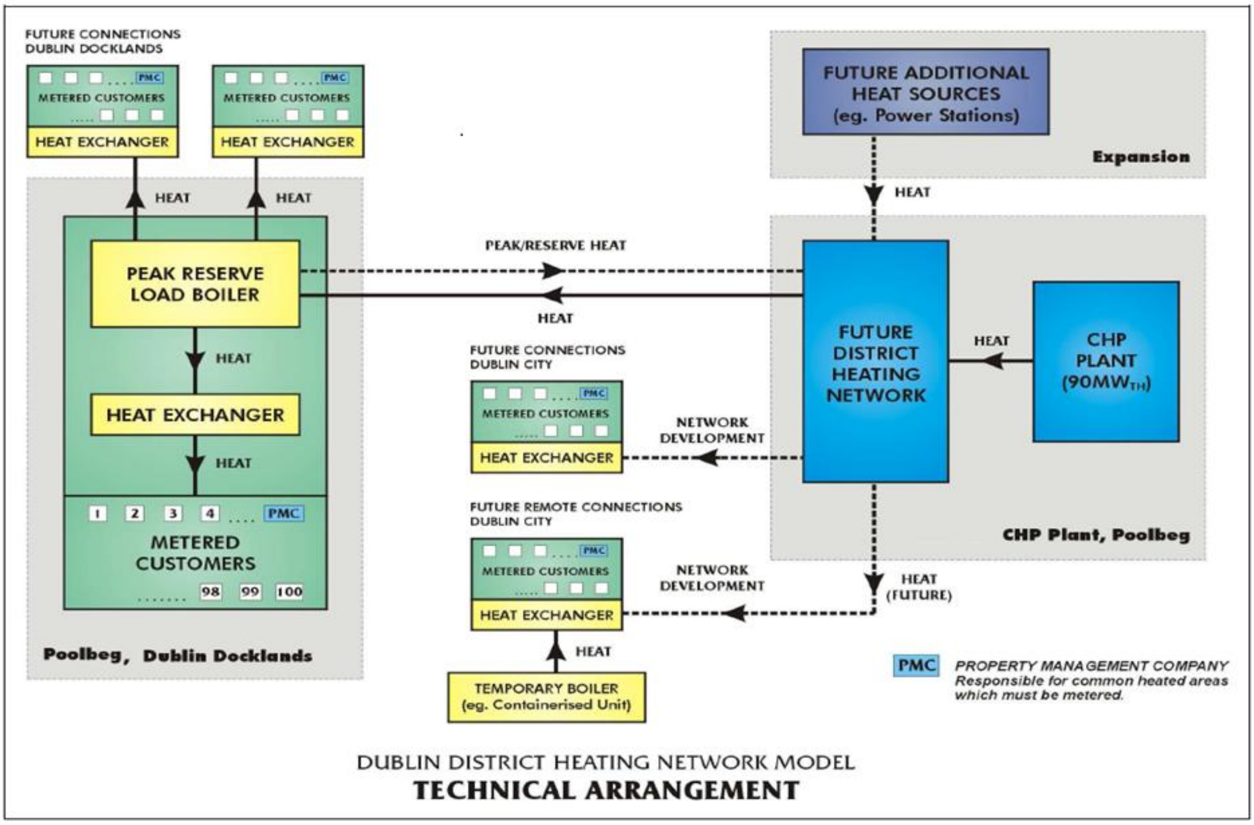



**Figure 2: Dublin DH Network Technical Arrangement Model**

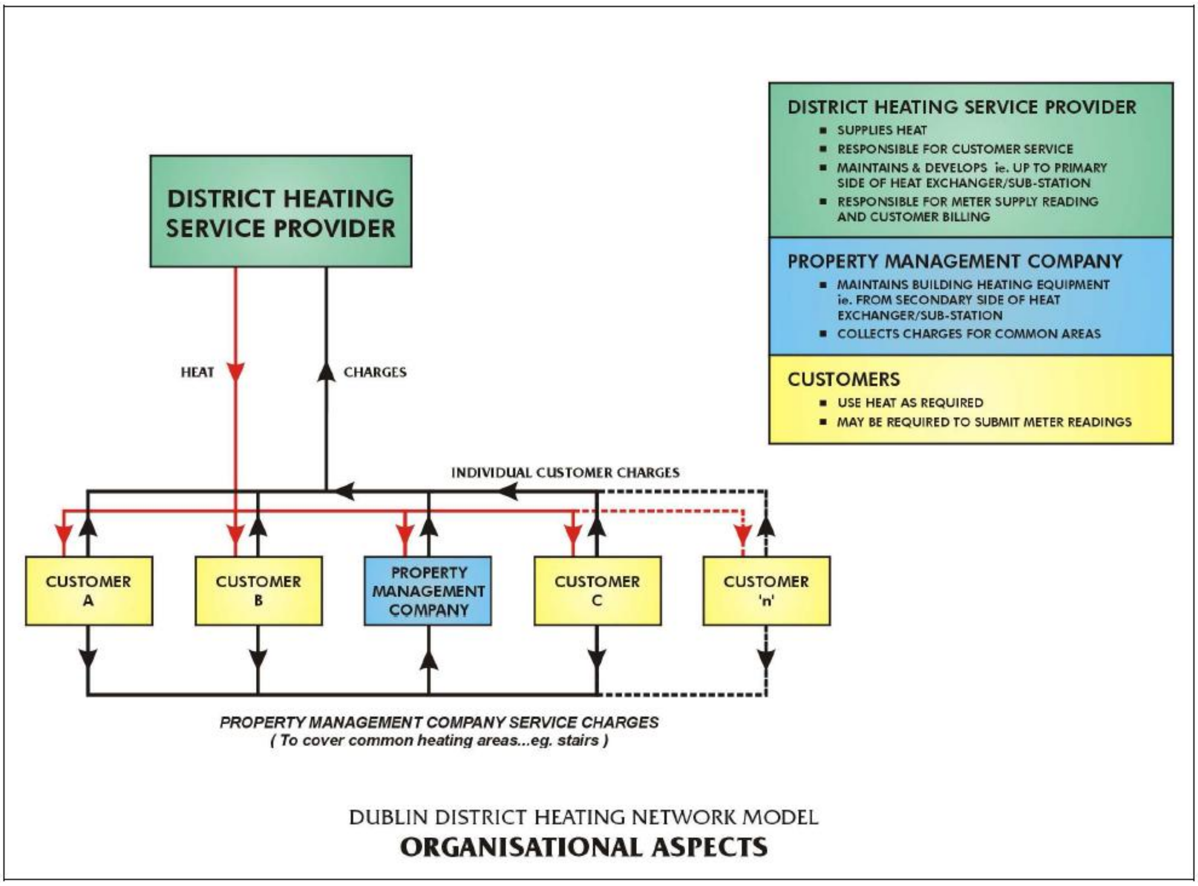



**Figure 3: Dublin DH Network Organisation Aspects**

Although larger radiator sizes will be required with district heating supply and return temperatures of 80°C and 40°C respectively (conventional heating typically uses 82°C and 71°C), pipework dimensions will be reduced to account for lower volumetric flow rates (by as much as 70%) and pump sizes will also be smaller. The net result is that capital costs for radiators and pipework, pumps and valves etc. will be approximately the same as or only marginally more expensive than conventional heating arrangements.

Connection costs to the district heating system will be comparable with other utilities but of course will be site specific. Typical connection costs for district heating and gas are in the region of €4,500*. A comparison of heating system costs for a typical 3,000m$^2$ office building with a heating load of 235kW has been made in Table 2 to illustrate the likely cost saving which is offered by district heating.

**Table 2: Typical connection costs for district heating and gas (estimate costs from 2005)**

| Item | Gas Heating | District Heating | Saving |
|---|---|---|---|
| Boiler, pumps and boiler panel | 62,795 | N/A | |
| District Heating Consumer Installation | N/A | 25,772 | 37,023 |
| Gas Connection | 4,500* | 4,500 | 0 |
| DH Connection | N/A | 4,500* | (4,500) |
| Radiators | 211,462 | 218,672 | (7,210) |
| Heating Pipework | 8,660 | 6,495 | 2,165 |
| Hot & Cold Water Pipework | 19,347 | 14,943 | 4,404 |
| Civil costs and Misc. Costs | 118,571 | 118,571 | 0*** |
| **Total Costs** | **425,335** | **393,453** | **31,882** |
| **Total Saving for District Heating** | | | **31,882** |

* Based on typical 25m connections. Similar costs involved.
**Cost of gas connection included for district heating system as customers may want or need this for cooking purposes.
*** In fact civil costs will be lower for district heating due to reduced installation requirements of heat exchanger as opposed to boiler units and the lack of requirement of a flue stack.

# 5 CONCLUSION

There is a planning condition for developments within the ‘North Lotts and Grand Canal Dock SDZ’ and ‘Poolbeg West SDZ’ to be ‘District Heating Enabled’. This Technical Note has been prepared to provide potential developers within the SDZ’s of details of the relevant technical specifications and associated requirements in order to comply with this planning condition. This package can be issued to prospective developers within the SDZ’s on request.

A brief overview of DH has been provided, along with the preliminary design specifications for the DDHS. The expected works requirement for developments has also been outlined, although it is noted that each development will be unique in their requirements. The developer will be required to liaise with DCC/DH Operator to design and install the pipework, heat exchangers and consumer installations, as well as all other supporting equipment, to ensure that the development can be DH compatible and that it is viable with other parts of the Network.

# APPENDIX A - SAMPLE TECHNICAL PACK

# SAMPLE TECHNICAL PACK

This is an example technical specification pack with technical specifications and requirements which is to be made available to prospective developers in order that they comply with the planning condition to be district heating compatible. Certain aspects of the specifications may vary dependant on the buildings to be connected and their locations. Example technical drawings have been included in Appendix B. These drawings relate to the Spencer Dock development on which this example technical pack has been based.

## Table of Contents

# 1 GENERAL INFORMATION

The works described in this document comprise installation of:

- a DH branch line connecting different blocks
- a crossing of a junction
- main pipeline connection
- as well as supply pipelines to tie individual buildings that will be terminated inside the respective buildings.

The Developer's Designer shall confirm in writing to DCC all District Heating designs and site changes relating to this document.

The pipeline networks are to be planned and designed according to the specifications of the pipe supplier.

The pipelines must not be placed over or under other longitudinal pipelines or cables. Likewise, minimum distance requirements of other utilities must be observed.

The system will be constructed using pre-insulated steel pipes, extra insulation, equipped with signal wires for leakage control. The pre-insulated valves are equipped with drain valve / bleeding valves. These may be on one side of the shut-off valve or on both sides.

The Developer is to arrange for all necessary permissions and approvals for the performance of the works, as well as be responsible for all negotiations with the Land owners, utilities, and local road authority:

- Road opening licence
- Traffic Permit
- Taking In Charge
- Traffic Management Plan
- Chapter 8 - Temporary Traffic Measures and Signs for Roadwork's
- Guidance for the Control and Management of Traffic at Road Works

Waste materials shall be removed to an appropriately authorised / licensed facility for disposal or recovery.

## 1.1 GENERAL DISTRICT HEATING DESIGN DATA

The supply pipes as well as the return pipes are to be designed for:

| | | |
|---|---|---|
| $T_{min}$ | = | 10°C |
| $T_{max}$ | = | 120°C |
| Working Pressure | = | 16 bar |

## 1.2 BRIEF DISTRICT HEATING INSTALLATION PROCESS

The working process described is valid for all works pertaining to placement of the DH pipes.

- Site setup and enabling works including any site investigation works required to facilitate the works
- The pipes are to be laid out in order to be joined together.
- Check that pipes are clean before joining.
- Welding of pipes.
- X-ray control and leak test.
- Welding repairs if necessary inclusive of control.
- Connection of alarm wires and installation of (SCADA) alarm control panel as per Section 3.5 on page 37.
- Joint works inclusive of foaming / insulation at welded joint and leak test.
- Surveys of the pipeline for preparation of location for each pipe by number, as-built drawings, see section 3.6.2 on page 38 (including location of all joints, level of pipe at each joint and location of all fittings etc.).
- The supervisor approves the pipe trench before covering.
- 200mm of sand covering pipes to be laid out and compressed.
- Twin Ø110 mm diameter ducts are to be laid out where specified.
- Warning net is to be laid out on top of sand covering as per Figure 4 on page 28.
- Existing services over the pipes to be restored.
- Construction of valve chambers.
- The filing of the ground inclusive of reinstatement of working areas.
- Compacting control.
- Reinstatement of ground surfaces.
- Cleaning of the pipes.
- Adding of water.
- Final pressure test.
- Removal of water.
- Vacuum sealing of pipe system.

## 1.3 SAMPLE EXTENT OF WORKS

The extent of the works comprises that which is highlighted on drawings DG0020 B01 showing the extent of the DH network to be installed (Spencer Dock example site).

The contract works are to be terminated with shut-off valves placed inside a plant room and with welded end cover and end fittings at each termination point as shown in drawing number DG0022 B01.

At the termination of the main pipelines where extensions of the pipeline networks are planned, welded end cover and end caps must be installed. End fitting details for each termination point are specified in drawing numbers DG0022 B01.

## 1.4 SERVICES

Prior to commencement of the works the Designer will identify any known services and agree with the relevant utility owner how they are to be diverted or managed during the works. All known services shall be documented in the Preliminary Safety and Health Plan and the Contractor will assure themselves as to the presence of underground and overhead services within the site.

Services diversion design is the responsibility of the Designer, and the works Developer's Designer is responsible for any diversion works, service location, protection and avoidance. The Developer's Designer will be responsible for liaison with utilities companies required to facilitate the works. Their Contractor is responsible for contacting the utilities providers in order to identify their cables/pipes before digging.

Damage to the existing cables/pipes is the responsibility of the Contractor. Any damage must be reported to the relevant authorities.

The re-laying of existing cables/pipes in connection with the district heating works must be agreed between the Developer's Designer and the cable/pipe owner.

Where utility branches are not known, the Developer's Designer shall make every effort to ascertain where they are located and design their levels accordingly. Where connections are encountered, they must be documented accordingly with their positions marked on an existing services drawing.

## 1.5 HEALTH AND SAFETY

Designers and Works Contractors must ensure safe conditions and work practices in compliance with the Safety, Health and Welfare at Work Acts 2005, and the Safety, Health and Welfare at Works (Construction) Regulations 2013, and any amendments thereof.

Construction works shall be inspected by a competent person in compliance with Health and Safety Authority (HSA) recommendations including any relevant updates and completion of the HSA's Approved Form (AF3).

## 1.6 ROAD WORKS CONTROL / TRAFFIC MANAGEMENT

Any Contractor working within Dublin City Council's jurisdiction shall comply with "Directions for the Control & Management of Roadworks in Dublin City – June 2010" and its revisions, which is available for download on www.dublincity.ie, click on Main Menu / Roads and Traffic / Roadworks Control Unit / Roadworks Control Directive, or

http://www.dublincity.ie/main-menu-services-roads-and-traffic/roadworks-control-unit

**Roadworks Control Unit,**
Environment & Transportation Department,
Block 2, Floor 6,
Civic Offices,
Wood Quay,
Dublin 8
**Telephone:** (01) 222 2246
**Email:** roadworks.control@dublincity.ie

The Department of Transport, Tourism and Sport's (DTTAS) 'Chapter 8 - Temporary Traffic Measures and Signs for Roadwork's' shall also be complied with.

DCC's Roadwork's Control Unit is responsible for the control and management of roadworks in the City with a view to minimising their impact on traffic flow and maintaining public safety.

Every road in the City has been assigned a Traffic Impact Number from 1 to 5, according to its importance as a strategic traffic route. Impact 1 and 2 include lightly trafficked routes while numbers 3, 4 and 5 are the heavily trafficked routes.

All roadwork's in the Dublin City area are regulated by the Roadwork's Control Unit by

- The issue of Directions/Permits/Consents in relation to all proposed roadwork's
- Putting conditions on all Directions/Permits/Consents
- Carrying out inspections and issuing Violation Notices if required

Notification must be submitted to the Roadwork's Control Unit in relation to all proposed roadworks in the Dublin City Council area.

In addition to a Roadwork's Control Licence, anyone requiring to excavate the public road (carriageway / footway and / or associated grass verge, must also apply for a Road Opening Licence from Road Maintenance Services.)

All notification and other requirements regarding the control and management of roadwork's in Dublin City are set out in the Roadworks Control Directive.

All applications are made using the Roadworks Control Online Extranet System and are submitted by the relevant utility (e.g. E.S.B., Bord Gais) or main contractor and not by sub contractors or individuals.

A team of Roadworks Control Inspectors is constantly engaged in the inspection of roadworks, to enforce general directions such as

- Roadworks identification signs
- Signposting, barrier control and illumination
- Conduct of roadworks so as to minimise traffic disruption and danger to pedestrians and traffic

Site conditions will be managed by the Developer and Works Contractor and it will be their responsibility to ensure safe working conditions and practices at all times.

### 1.6.1 HGV Management Strategy

The Dublin City Council Heavy Goods Vehicle (HGV) Management Strategy was introduced on the 19th February 2007. The HGV Strategy provides for a ban on 5+ axle vehicles during the hours of 07.00-19.00 seven days a week from a designated cordon area (which includes most roads and streets within the work area) and provides a limited permit scheme for 5+ axle vehicles that need to load/unload within the city centre area. Further information is available on www.dublincity.ie.

## 1.7 ROAD AUTHORITY / ROAD MAINTENANCE DIVISION

Road Maintenance Services is the local Road Authority for the jurisdiction of Dublin City Council and is responsible to maintaining to the Public Right of Way for all public roads and footways, and anyone requiring to excavate the public road, carriageway, footway and / or associated grass verge, must also apply for a Road Opening Licence from Road Maintenance Services. They can be contacted through www.dublincity.ie, click on Main Menu / Roads and Traffic / Road Maintenance and Street Repair, or

http://www.dublincity.ie/main-menu-services-roads-and-traffic/road-maintenance-and-street-repair

**Road Maintenance Services**
Block 2, Floor 4
Civic Offices
Wood Quay
Dublin 8
**Tel**: (01) 222 2255
**Email**: roadmaintenance@dublincity.ie

**Emergency road maintenance, e.g. sudden road collapse.**
Call (01) 679 6186 (24 hours a day)

Excavation of trenches, backfill, asphalt, reinstatement and taking in charge shall comply with the following;

- The 'Purple Book' officially known as 'Guidelines for Managing Opening in Public Roads (September 2015)' and updates, published by the Department of Transport, Tourism and Sport (DTTAS).
- DCC Road Maintenance Specification document 'Construction Standards for Road and Street Works in Dublin City Council May 2015', which is available on request from DCC's Road Maintenance Division.
- DCC's 'Directions for the Control & Management of Roadworks in Dublin City (June 2010)' and updates available for download on www.dublincity.ie.

# 2 DISTRICT HEATING SPECIFICATIONS

## 2.1 GENERAL

Design data:

- PN 16 bar
- Supply temperature 120°C
- Extra insulation (Logstor Series 2 or pipes equivalent to these)
- Expansion of the pipe system must be absorbed by natural expansion / alternatively by use of Start-up compensators / E-muffs.

All works have to be carried out by competent personnel, as outlined in this specification, being fully familiar with the works in question.

In order to avoid too high stresses in the steel pipes, the DH network is designed with the use of start-up compensators. This means that start up compensators must be built in where long straight lengths of pipes occur. Start-up compensators are to be placed, adjusted and welded according to the pipe supplier’s instructions.

The flow pipe is placed to the right of the return pipe, when looking in the heat flow direction with the heating supply behind.

In tandem with the DH pipelines, 2 pc. Ø110 mm PE pipes are to be laid. The location of these pipes is to be agreed in writing with DCC, prior to submission of the commencement notice.

## 2.2 PIPES AND FITTINGS

The pipe system should be pre-insulated bonded pipes with diffusion barriers according to the standards

- EN253, "District heating pipes. Preinsulated bonded pipe systems for directly buried hot water networks. Pipe assembly of steel service pipe, polyurethane thermal insulation and outer casing of polyethylene"
- EN488, "Preinsulated bonded pipe systems for directly buried hot water networks - Steel valve assembly for steel service pipes, polyurethane thermal insulation and outer casing of polyethylene
- EN489, "Preinsulated bonded pipe systems for directly buried hot water networks - Joint assembly for steel service pipes, polyurethane thermal insulation and outer casing of polyethylene".

### 2.2.1 Steel Pipes and Fittings

- P235GH steel according to EN 10217-2 or St 37 according to DIN 1626.
- Manufacturer's certificate 3.1B according to EN10204.
- Preparation of ends according to ISO 6761.

### 2.2.2 Insulation

Polyurethane foam according to the requirements of EN253.

### 2.2.3 Casing Pipes

Polyethylene PEH according to the requirements of EN253, EN448 and EN489.

### 2.2.4 Joints for Foaming

All joints must be welding sleeves. Holes for inserting foam into joints must be welded closed upon completion of filling with foam.

### 2.2.5 E-Muffs

In order to reduce the tension in the DH pipes once in operation, E-muffs are installed. E-muffs are compensators which function only once. When the system is heated the pipes on either side of the E-muff are allowed expand, thus reducing the tension in the pipes when the system is operated at working temperature.

### 2.2.6 Pre-insulated fittings

Pre-insulated fittings must be X-ray examined 100%. The examination must comprise all welds carried out by the pipe laying / welding contractor. All joints of steel pipes must as a minimum be of quality level B according to ISO 5817.

### 2.2.7 Alarm System

All pipes are to be delivered with leak test alarm wires cast in the insulation. The alarm system must be completed with alarm taps and fault-locators that can transfer the signals to the SCADA monitoring system points. The monitoring point is to be located in a suitable location. In time the fault-locators are to be connected to the SCADA monitoring system through laid-out signal cables. The pipe supplier has to deliver a description of the alarm system, sub-components and method of operation in connection.

Key drawings with location of alarm components are to be provided by the pipe supplier. After testing, documentation should be provided in the form of as-built drawings with all relevant information on future operation of the alarm system. Pipe supplier shall deliver all necessary parts for a complete alarm system.

The pipe supplier will co-operate with the Contractor in testing the alarm system and putting it into operation.

### 2.2.8 Pipe supplier certification and quality control

In connection with pipes and pipe components, the pipe supplier must deliver the following certification for:

- Steel pipes
- Bends
- T-pieces
- Reductions
- Start-up compensators (if applicable)
- Valves
- Diffusion barriers
- End caps
- Any other parts needed in the pipe system offered, e.g. foam pads for absorbing expansions (if applicable)
- Complete alarm system including signal cables

Test results from manufacturer's quality control for delivered:

- Steel pipes
- PEH casing pipes
- Polyurethane foam.

In addition to the standard marking, each pipe and each component must be supplied with a serial number. Where pipes are cut to size on site, the pipe serial number is to be transferred to all parts of pipe to be used and a cutting list must be made. This list should record where the individual parts of the cut pipes are used.

### 2.2.9 Design and Documentation

The supplier must produce calculations and analysis documenting that the pipe system offered fulfil all requirements according to EN 13941, "Design and installation of pre-insulated bonded pipe systems for district heating". This involves specific technical specifications of expansion arrangements, changes of direction, branches and other sensitive elements.

The pipe supplier must carry out analysis for the entire network. Furthermore, the pipe supplier shall review the design and propose the necessary adjustments needed to fulfil the requirements of the specific pipe system to be installed.

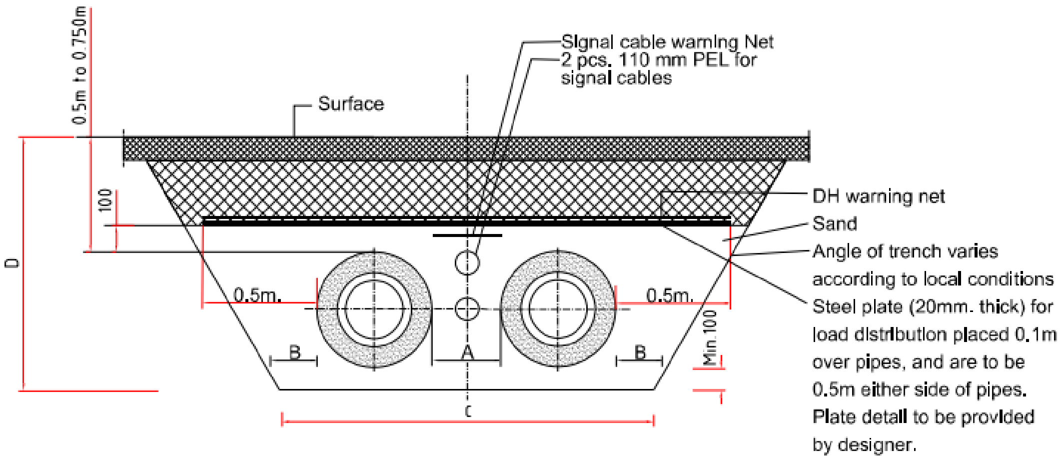
## 2.3 SAND AND GRAVEL MATERIALS

Materials for building-in around the district heating pipes must be good, uniform materials and not be frost susceptible. The Designer must approve the materials, documentation, and compaction prior to asphalting works.

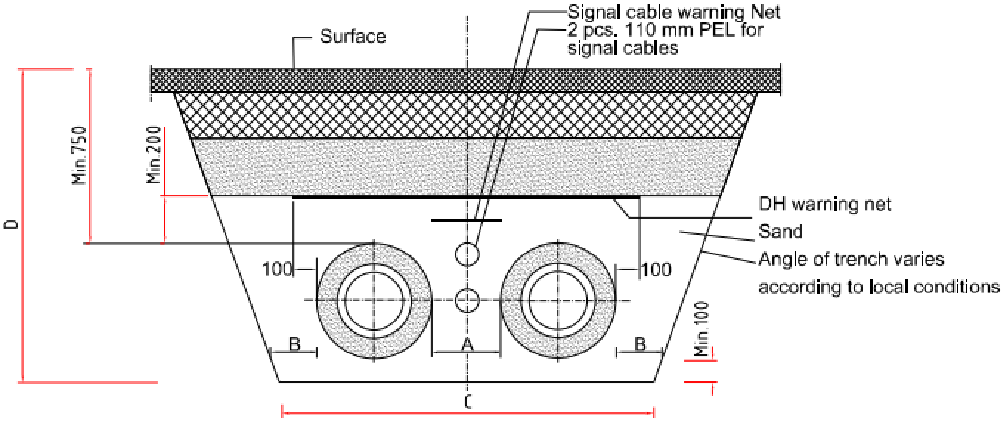
### 2.3.1 Sand

For filling around and above the DH pipes (bedding materials), a minimum 200mm cover of sand material with the following specification below is to be used.

- Sand is to be free of clay 0 – 8 mm
- Less than 10% is to be < 0.125 mm
- Less than 50% is to be < 0.5 mm
- Number of dissimilarity > 2.5




CROSS SECTION
SOIL COVER <0.750m.




CROSS SECTION
SOIL COVER >0.750m.

**Issued 23.02.2010 by RPS**
**Revised by DCC August 2016**
**Not to Scale**

| Nom Dia mm | Pipe Dia mm | Ø Jacket pipe mm | A mm | B mm | C mm | D mm |
|---|---|---|---|---|---|---|
| 50 | 60.3 | 140 | 200 | 200 | 880 | 840 |
| 65 | 76.1 | 160 | 200 | 200 | 920 | 860 |
| 80 | 88.9 | 180 | 200 | 200 | 960 | 880 |
| 100 | 114.3 | 225 | 200 | 200 | 1050 | 925 |
| 125 | 1319.7 | 250 | 300 | 200 | 1200 | 950 |
| 150 | 168.3 | 280 | 300 | 200 | 1260 | 980 |
| 200 | 219.1 | 355 | 300 | 200 | 1410 | 1055 |
| 250 | 273.0 | 450 | 300 | 200 | 1600 | 1150 |
| 300 | 323.0 | 500 | 300 | 200 | 1700 | 1200 |
| 350 | 355.6 | 520 | 300 | 200 | 1740 | 1220 |
| 400 | 406.4 | 560 | 300 | 200 | 1820 | 1260 |
| 450 | 457.0 | 630 | 300 | 200 | 1960 | 1330 |
| 500 | 508.0 | 710 | 300 | 200 | 2120 | 1410 |
| 600 | 609.6 | 800 | 400 | 300 | 2600 | min 1500 |

**Figure 4: Example of District Heating pipes under a carriageway**

### 2.3.2 Filling

In connection with filling around the pipes, it is necessary to see that the compaction is optimum around the pipes, possibly by hand tamping, which is to be used only where necessary.

Filling may, at maximum, be of 200 mm thick layers and compacted before the next layer is backfilled into the trench.

DH warning net to be laid 200 mm above each pipe. The net must be Netlon (Expo-net Denmark) type 12A in purple - or similar, and must be supplied with the superscription "Take care district heating underneath". The net must be 200 mm wider than the pipes.

In connection with the filling a warning tape is to be laid 200mm above the signal cable duct.

## 2.4 IN-SITU CONCRETE

All concrete must have a minimum compressive strength (equal to or greater than) of 35N/mm$^2$. Where reinforcement is required this must have a yield strength of 460N/mm$^2$ or greater.

The concrete Contractor has to document the concrete strength from the ready-mix plant. All delivery notes have to be delivered to the Designer and are to be supplied with information on where and with what purpose the concrete is used.

## 2.5 VALVE CHAMBERS

The chambers will be established by taking the foundation to solid ground. The foundations are concrete formworks or are to be built in concrete blocks.

The chambers are terminated to a level with a cover of cast iron to BS EN 124. Frames shall be designed to prevent covers falling into chamber. The chambers should be constructed according to drawing no. DG0024 B01.

The foundations and chambers shall be designed in accordance with DCC's 'Directions for the Control & Management of Roadworks in Dublin City (June 2010)' and updates available for download on www.dublincity.ie

The Developer’s Designer shall note that chambers must be cast in-situ for carriageways and shall note the following material specifications;

- Blocks shall comply with CL. S10 of IS. 20 Part 1:1987 or Cl. 30N/20mm;
- In-situ concrete. Mortar shall comply to IS406;
- Engineering bricks to Cl.B to I.S.91:1983 set in 1:3 (Cement and mortar).

# 3 DISTRICT HEATING TESTING SPECIFICATIONS

## 3.1 WELDS AND JOINT WORKS

The fitters that shall carry out the joint works and insulation must have a certificate from the pipe supplier. Electric welding is to be used. All welding must be conducted in dry weather conditions.

Before commencing the works, the Pipe Contractor has to present a list of the welders to be used, including code used by each welder for marking the welds. For each welder the following tests are to be included:

1. Pipe welding certification carried out on 273 x 5mm pipe (electric welding). Welder must be certified to competently carry out a quality level B weld as per ISO 5817, and their certification must be valid.

2. Judgement by use of X-ray of the welding test from an impartial welding institution. As a minimum, quality level B welds according to ISO 5817 must be achieved.

3. All joints of the steel pipes are to be carried out as welded joints with minimum quality level B weld according to ISO 5817.

4. 100% X-ray controls of the welds are required.

5. If a defect weld is found, it has to be repaired and a new x-ray control to be made.

The certificates of all welders are to be approved by the Designer before the works are commenced, just as the welding procedure has to be approved by the Designer. Copy of valid welder qualification certificates showing code welding standard BS EN ISO 9606-1, to be included in the Safety File for hand-over.

All welds must be marked on the casing pipes with weld number and welder number. This can be done using permanent marker on the casing beside the welds.

All joints carried out on the casing pipe must be marked with number and date.

The Contractor is responsible for keeping the pipe book (journal) for all welds, starting position and flow and return, the number of the weld, the number of the welder as well as date of the weld.

The Contractor is responsible for keeping a journal for all joints, containing the number of the joint and date. Joints, necessitated by damage to the PE casing pipe, are also to be entered into the journal. This journal can be implemented in the pipe book.

As an integrated part of the pipe book, the Pipe Contractor must prepare detailed dimensioned sketches for each branch pipe.

Copy of the pipe books for pipe works and joint works and branch sketches are to be delivered to the Designer before the inspection of the pipelines for covering.

## 3.2 NON DESTRUCTIVE TESTING (NDT)

NDT of welding shall be covered by an independent inspection company accredited by the National Authorities or by another Certifying Company approved by the National Authorities.

All NDT personnel shall be qualified and certified in accordance with EN ISO 9712 (Formally EN 473). Copy of valid NDT Record of PCN certification, to be included in the Safety File for hand-over.

The extent of NDT shall meet the requirements of EN 13480-5 and as stated below:

- All welds shall be 100% visually examined.
- All guarantee welds, which shall not be pressure tested, shall be examined by radiography as well as ultrasound.
- All welds in piping system shall be 100% radiographic examined.
- Socket welds and branch connection welds, which cannot be radiographic examined, shall be examined by magnetic particle or liquid penetration methods to the extent stated for butt welds.

### 3.2.1 X-Ray Control

All welding joints of steel pipes must as a minimum be of character B according to ISO 5817.

The Employer can have tests taken at his own cost at any time. If the Employer finds any error the Contractor must pay for additional control, up to 5 controls per error found can be demanded. The Employer's welding tests do not relieve the Contractor neither from performing necessary tests nor from documenting that these have been carried out.

Repair and re-testing due to deficiencies are to be made when necessary and at the Contractor's expense.

Other forms of welding error rectification apart from re-grinding of defect welding must only occur with the agreement of the welding inspector.

A welder being repeatedly responsible for defective weldings may be required to be dismissed by the Employer until he has been re-approved in accordance with EN ISO 9606-1 (Formally EN 287-1).

## 3.3 E-MUFF WORKS

The E-muff is compressed to degree calculated using the exact length of pipe from a bend to the first E-muff. The E-muff is compressed by the use of a tool consisting of a threaded bar, a hydraulic tool or similar. When compressed correctly the E-muff is fixed with tack welds. When fixed the muff is welded in as a small piece of pipe.

When the DH system is to be put into operation the tack welds are removed, giving the adjoining pipes the possibility to expand until the E-muff is fully compressed. When fully compressed the E-muff is fixed by the use of a full weld around it.

If this DH system is not to be in operation for several years a temporary shrink joint is to be mounted over the E-muff. Shrink joints are a type of joint where the joint and casing pipe are not melted together as is the case for the welded joints used elsewhere in this project. Using a shrink joint makes it possible to remove the joint without damaging the casing pipe once the system is to be put into operation. When the system is to be put into operation the shrink joint is to be replaced by a welded long type joint.

## 3.4 TESTING

### 3.4.1 Required Proof Test (clause 9.3 of EN 13480-5)

The pipe system shall be tested in accordance with EN 13480-5 with a test pressure of 24 bar.

### 3.4.2 Joint

The joints are to be leak tested with air of an internal-pressure of 0.2 bar.

The Designer must be given reasonable notice of all the leakage tests. The Contractor shall prepare method statements for the works and will record the details of the leakage tests. The approval and sign off of method statements and leakage tests will be a responsibility of the Designer; Method statements will be issued to DCC/DH Entity for comment prior to commencement of testing operations.

### 3.4.3 General Requirements for Proof Test

The Contractor shall submit all testing procedures and schedules for approval to the Developers' Designer, and for comment by DCC.

Should a leak develop in a weld during testing, the defect shall be removed by chipping, grinding, flame gouging, or arc air gouging, and the area shall be rewelded. All repair welds shall be preheated and postheated as originally required, and the basic principles of the same welding procedure as initially used shall be employed as far as applicable.

After repair, the weld shall be re-examined. The progressive inspection requirements apply as they do for defects discovered during inspection.

The affected piping shall be retested when repairs have been finalized and approved.

### 3.4.4 Preparation for proof test

Pressure, temperature and time recorders shall be used for all hydrostatic tests. The pressure shall be shown in bar and the temperature in °C.

Pressure gauges and recorders used to indicate and record test pressure shall be dead weight tested for accuracy according to a procedure, dependent of type of equipment. Pressure gauges and recorders shall have been calibrated within the previous 30 days.

Minimum of one gauge shall be positioned at the highest point and one recorder to be positioned at the lowest point. Accuracy of pressure gauge shall be at least 1% at full scale and 1% for the recorder. The test pressure shall be within the range of 25% and 66% of the scale of the gauge dial.

If there is a deviation of more than 2% between gauge and recorder during test, the test shall be stopped and the equipment recalibrated.

Piping joints and welds shall not be insulated or physically covered until satisfactory completion of testing in accordance with this specification, except for painting of prefabricated welds.

All piping shall be adequately supported before the pressure test. Spring or other variable type supports shall be blocked to prevent movement.

Unless otherwise noted, all valves are to be through body tested. First block valve for pressure instruments shall be included in the test.

Where the test pressure to be applied to the piping is greater than the maximum allowable test pressure for valves, the valves shall be blinded off on the side to be tested, or removed and replaced by dummy spools.

A list shall be prepared of sensitive equipment that shall be removed, blocked off or isolated during testing, such as relief valves, inline instruments, turbines, pumps, compressors and vessels. This list shall be a part of the test procedure prepared by the Contractor.

### 3.4.5 Hydrostatic Pressure Test (clause 9.3.2 of EN 13480-5)

For hydrostatic testing the test fluid shall in general be fresh water.

The pH-value of the water shall be between 6.5 and 7.5.

Testing with water shall not take place with system temperatures 4°C or less or where the ambient temperature during test falls by 5°C or more, nor during rain or fog unless under suitable cover. Testing may however be performed under a lower temperature with a proper frost preventative added to the test water.

The following are excluded from pressure tests:

- All small bore instrument control piping downstream of the first piping block valve.
- Open drains and vents to atmosphere.

The water pressure test is to be conducted after completion of the x-rays and jointing works on the completed pipes, by filling the system with water that can be supplied from the public potable water supply.

The water must not be added until all the pipes are covered, leaving the pipe ends uncovered. All pipe ends are to be mounted with a weld-on end. The weld on ends should be fitted with valves for venting the pipes and pipe stubs with valves and connection fittings for hoses and a manometer depending on the high and low points of the system.

The adding of water will take place via the aeration-connecting piece of the main valves. The main valves must all be closed upon filling the system with water to allow for pressurisation of the pipes to occur. All venting valves should be manned and open. When water is coming out with no air, the valves should be closed. Pressure is now added until the manometer shows the required internal pressure of 24bar (1.5 x future working pressure) for the whole section.

The overpressure is maintained for a minimum of 1 hour, and the plant will be approved if no defects are found during this period. Maximum allowable pressure drop is 0.1 bar over 1 hour. The Designer and DCC/DH Entity must be advised in advance of the pressure test. The carrying through and documentation of the adding of water, the aeration, and the pressure test are undertaken by the Contractor. The Designer checks and approves the pressure test, while DCC/DH Entity staff will witness it. Upon approval of the test the water is to be removed from the pipe system. Pressure should first be taken off the system slowly by gently opening one of the small valves on the weld on ends. When the pressure has reduced to a safe level, the water should then be drained from low point(s) in the system. The weld on ends may need to be removed for this. If this is the case, when all the water is removed, new weld on ends should be mounted and any remaining stubs/valves should be cut off and the holes closed by welding on plate or plug.

Care should be taken to remove all water from piping to be operated below 0°C. This includes relief valves, control valves, and any other component that have been tested in a shop. Where required, blowing by dry air to remove any trapped water shall be performed.

Where permanent or temporary strainers have remained in place for the hydrostatic pressure test, they shall be removed following the test and thoroughly cleaned before reinstalling.

### 3.4.6 Cleaning of piping

Special precautions shall be taken during erection to prevent foreign matter from entering the piping system. Protective covers shall not be removed until just prior to final assembly.

Scale, dirt, welding electrodes, slag, and other foreign matter shall be removed from the piping after erection. It is desirable that this also be done as erection progresses.

Procedures for cleaning shall be developed prior to start. Items of equipment, which would be sensitive to damage during cleaning shall be removed, blocked off or isolated. A list of the items in question shall be prepared and be part of the flushing procedure.

### 3.4.7 Flushing

Flushing shall take place after pressure and leak testing unless otherwise accepted by the Employers Representative. After flushing and testing all lines shall be completely drained unless otherwise dictated by the Employer.

Water for flushing will have to be taken from the public water supply if possible, or from tank lorries. The use of water from the public mains will require permission from Irish Water and their agents in Dublin City Council's jurisdiction (Water Services).

Measures shall be employed to prevent the introduction of foreign matter into pumps, instruments, and other equipment. Temporary strainers shall be used during the flushing operation, unless spools or valves can be dropped out and suitable deflectors provided to prevent refuse from entering the instruments and equipment.

All valves shall be flushed fully open.

Temporary supports shall be installed where deemed necessary.

Any piping that cannot be adequately cleaned by flushing shall be dismantled for cleaning.

After flushing the piping systems shall be completely drained and protected against corrosion, unless otherwise agreed with the Employer.

Low velocity water flushing may be used with approval by the Employer. Water velocity shall be minimum 1.5 m/s. Flushing shall continue until water is clear, but for not less than 10 minutes

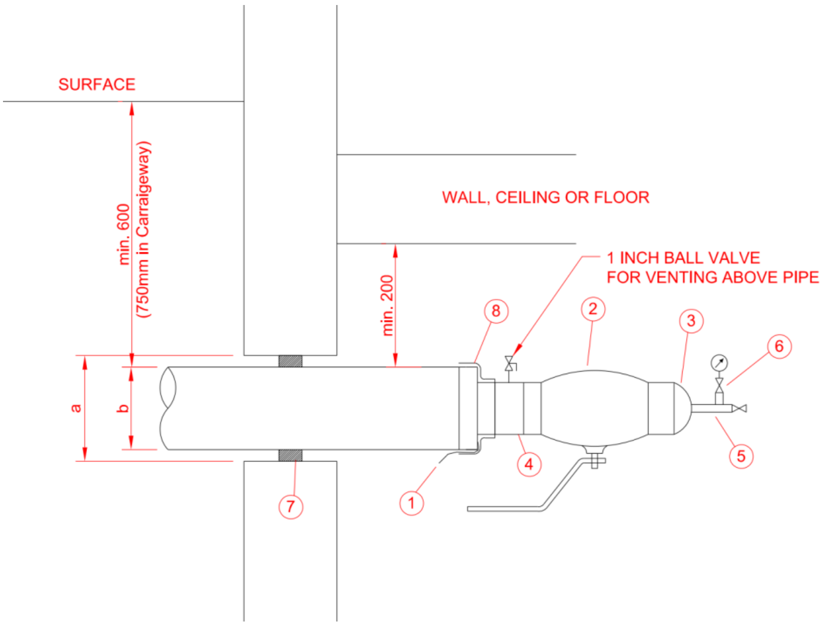
After flushing of the pipeline is completed the used water will be disposed of to the foul sewer network under permit from Irish Water or shall be transported offsite for disposal at an appropriately authorised facility.

### 3.4.8 Vacuum Sealing / Dew Test

The DH pipe system now should be vacuum-sealed. Vacuum sealing is performed to remove all moisture from the system in order to avoid corrosion in the pipes before they are put into operation. The philosophy is: If there is no oxygen or humidity in the pipes, the pipes will not corrode. Any moisture left from the pressure test will boil and get sucked out of the system when the vacuum is applied.

Vacuum sealing should be conducted with an approved vacuum system with a nominal capacity of at least 30$m^3$/hr and an end pressure of 0.1mbar working at a pressure of 5 to 8 mbar.

Referring to Figure 5 (Extract from drawing DG0020 B01), the vacuum system is to be established at the end point of a pre-determined branch. Numbers in half brackets in the following refers to point numbers in Figure 5 and the drawing previously mentioned, with reference to ‘Branch Termination When Finished in Buildings’.




1 WIRE FOR LEAK DETECTION SYSTEM OUT UNDER END CAP. ARE CONNECTED TO ALARM BOX ON WALL.

2 BALL VALVE WITH STAINLESS STEEL BALI

3 PIPE END TO BE WELDED ON END OF VALVE

4 PAINTED WITH ANTI CORROSIVE PAINT

5 1 ¼ INCH PIPE SUPPLIED WITH BALL VALVE TO BE USED WHEN DEAERATING PIPES AND ESTABLISHING VACUUM.

6 ½ INCH PIPE WITH BALL VALVE AND PRESSURE GAUGE

7 LINK SEAL, TYPE AS GIVEN IN DIAGRAM

8 END CAP

9 END FITTING ACCORDING TO DATA SHEET 2.7.6.1 FROM LOGSTOR

Extract from RPS Drawing DG0022 REV: B01

**Figure 5: Branch Termination when Finished inside Buildings**

In the weld on end of the pre-determined branch a pipe with a ball valve 5) is to be mounted (either by welding or simply by use of a screwed connection). At the pipe is a branch with another ball valve 6) with a manometer attached. Dimension of the end of 5) is to be of dimension suitable for the pump to be attached. When creating the drawing, a pipe of size 1 1/4 inch was considered to be suitable. This dimension may have to change once the make and type of vacuum pump is chosen.

When the pressure test is complete all water must be pumped out of the ends of the pipes and at the branch points. These must then be sealed as specified earlier. It is required that Developer then carries out a 'Dew Test' on the pipe work to ensure that moisture has been removed from the system. The test has to reach a minimum temperature of -20°C. Once this has been reached and witnessed by DCC/DH Entity representative the Vacuum sealing can commence.

The vacuum pump is then attached at the pre-determined location. Depending on the make and type of pump, it may be necessary to have the pump running for several days until the specified level of vacuum (5 to 8 mbar) has been reached. Once the specified vacuum has been reached the main valve 2) and the two service valves 5) and 6) are all closed, and the pump can be removed. DCC/DH Entity representative to witness the manometer for a minimum period of 12 hours to ensure that the Vacuum has held.

One week after the pump has been stopped, the pressure is controlled by first opening the main valve 2) and then the service valve leading to the manometer 6), while keeping 5) closed. If the pressure is as when the pump was stopped it is considered to be ok. If vacuum is lost, the fault is to be located and repairs made.

Pressure is to be controlled once every week for a month. When pressure has not changed for 4 consecutive weeks the system is considered to be satisfactory. All readings (date, time and reading of manometer as well as start and end time for running of the pump) are to be documented and this documentation is to be handed over together with all other documentation for the pipe network and the vacuum pump itself. DCC representative is to witness readings, when they taking place on site.

It should be noted that once the 'Vacuum test' has been successfully carried out and if the development(s) is not able to be connected to the DDHS immediately, due to DH network not being operational at this location, DCC/DH Entity request that Contractor / Building Owner installs a pressure gauge to the end of each DH pipe (flow and return) so that the Vacuum can be monitored on a 6 month bases by a DCC/DH Entity representative. This is to ensure that no water vapour is present in the pipes until the DHHS is operational, thus preventing corrosion over the period between now and operation of the system.  It is recommended that Contractor will monitor this for the first month, and then DCC are to assume responsibility for the monitoring. The readings shall be done monthly for the first six months and then every six months until the system is operational.

Provided the gauge doesn't move, a sign off sheet agreed with Designer / Building Owner will be certified after each inspection. If the gauge does move, the vacuum will have to be re-established as per the attached procedure with the vacuum monitored weekly for a further month to make sure the vacuum is maintained.

DCC/DH Entity will agree a schedule of access with Designer / Building Owner for DCC/DH Entity representative to access the building at a time convenient to them.

## 3.5 ALARM SYSTEM

The pipes and pipe components are delivered with 2 leak test alarm wires. The Contractor is responsible for the mounting of the alarm system and of fault-localiser boxes. Location of the boxes is to be agreed with the Designer.

Pipe supplier provides the overall drawings with approximate placement of alarm components.

The Contractor shall install all installations for cables, signal and electricity cables to test boxes and fault-locators. The test boxes and the fault-locators are to be placed near the property line.

The Contractor shall in co-operation with the pipe supplier test the alarm system and put it into operation.

### 3.5.1 Cable Works

The Contractor will assemble signal cables from the fault-locators. Cables for the alarm system, test boxes and fault-localiser boxes will be part of the pipe delivery.

Additionally, in connection with the DH pipelines, 2 pc. Ø110 mm Hydrodare or equivalent PE pipes are to be laid. These are to be left empty for future use.

### 3.5.2 Alarm System Testing

As the DH pipes and alarm cables are installed, the alarm cables must be tested to ensure their capacity over long runs. The test documentation will be prepared and delivered to the Designer.

Testing should be made in co-operation with the pipe supplier. All faults recognised during the testing have to be resolved before taking over of the work. DCC/DH Entity to witness the successful operation of the alarm system prior to handing over.

## 3.6 SAFETY FILE HANDING-OVER DOCUMENTATION

An overall handling-over procedure must be held at the termination of the civil and pipe works.

'Handing Over' of the pipeline to DCC/DH Entity will happen upon satisfactory completion of the pipelines, and upon receipt of a satisfactory Safety File.

In connection with the quality assurance, the Contractor is to deliver the following services for the approval of the Developer's Designer:

### 3.6.1 Pipe book (Journal)

The Contractor has to keep a pipe book (journal) showing where each pipe number is installed.

The format of the pipe book has to be approved by the Designer before the works commence. The pipe book (journal) shall include but will not be limited to the following data;

- Pipe & fitting certificates (from the pipe mill, material details, composition, date manufactured etc.);
- Pipe & fitting numbers (unique pipe Ids: these may be project specific or added at the mill);
- Weld numbers linked to each pipe number (i.e. what pipe was welded to what pipe);
- Welding procedures used;
- Welder details including name, contact details and qualification documentation;
- Welding NDT results (X-ray, Gamma ray (if used) and MPI / UT testing);
- Details for PU insulation and PEH casing pipe;
- Details for the trace wires;
- Depth of cover;
- Inspector's certification;
- Any field bends including degrees.

### 3.6.2 Recording of Pipeline

Before covering the pipes, the Contractor shall take care that the system is surveyed. The survey must be carried out after backfilling between the pipes, so that these will not be moved after the details are confirmed.

The survey should be carried out in a way so that all the determinative components (bends, valves, reductions, etc.) including welds; can be determined by an x, y, z - co-ordinate for the line. At least every 3rd weld in straight stretches must be surveyed. As reference, a point number has to be stated for each set of co-ordinates. For future retrieval of the pipeline, fixed ground objects (corner of a building, caps, and iron mast, kerbs, cone, etc.) are to be recorded.

The as-built drawings and the co-ordinate list should be delivered to the Designer, which will go through these for corrections if any. After carrying out these corrections, a master film, 1 print of the as-built drawings, 1 copy of the co-ordinate list as well as 1 diskette/CD-ROM in ASCII-format with the information is to be delivered to the Designer. Furthermore, the drawings should be delivered on diskette / CD-ROM in a format compatible with the requirements outlined in this specification.

The as-built drawings and the co-ordinate list have to be presented before the Contractor can forward a request for initiating the handing over procedure.

Material Certificates, maintenance requirements, supplier details etc. should be included in the Safety File. Calculations and analysis for the entire pipe system, technical specifications describing expansion arrangements, changes of direction, branches and other sensitive elements will also be documented by the Contractor in the safety file.

The documentation of recording at termination of the works must comprise:

1. As-built drawings in 2-D (minimum scale 1:500 with details in 1:100 or 1:200). On the as-built drawings, the system line (centre line) must be stated, and the components recorded have to be dimensioned in a chainage, and the levels of the system (top level of pipe) must be stated, too. Weld numbers for every weld should be included on a separate AutoCAD layer. All CAD files shall be compatible with MicroStation (Version 8.1) and shall be issued in a compatible format (DGN, DXF, DWG). The Contractor shall provide PDFs of all CAD files issued to DCC.

2. The Contractor is responsible for taking care that all branch pipes are recorded and marked on the as-built drawings. It is especially of importance that the recording is carried out where the branch pipes cross the property lines. On the system line, the services should be recorded in the same chainage, and the normal measure from the object to the system line must be stated.

3. A printed co-ordinate list stating point number and x, y, z – co-ordinate for each point recorded. The numbers of the welds recorded appear from the co-ordinate list. The co-ordinate list and the as-built drawings are to be delivered as one piece of documentation and should be cross-referenced.

4. All survey data including CCTV survey and asset survey data should be compatible with the DCC's GIS package and should be geo-referenced. The Developer's Designer should provide DCC/DH Entity with geographic data in both Irish Transverse Mercator (ITM) and in Irish Grid (IG) in compliance with Topographic Survey Specification for Urban Projects. All reports should be submitted in hard copy, PDF and Microsoft Word format.

5. Data to be transferred, whether strictly required under the directive or not, should comply with the INSPIRE Directive requirements as to metadata and specifications.

### 3.6.3 Recording of Alarm System

Survey and notation should also comprise cabinets and cables for the alarm system, including cables for electric supply of alarm boxes. The documentation of recording at termination of the works must comprise:

- Alarm system components
- SCADA Monitoring points
- Method of operation
- Drawings showing location of alarm components

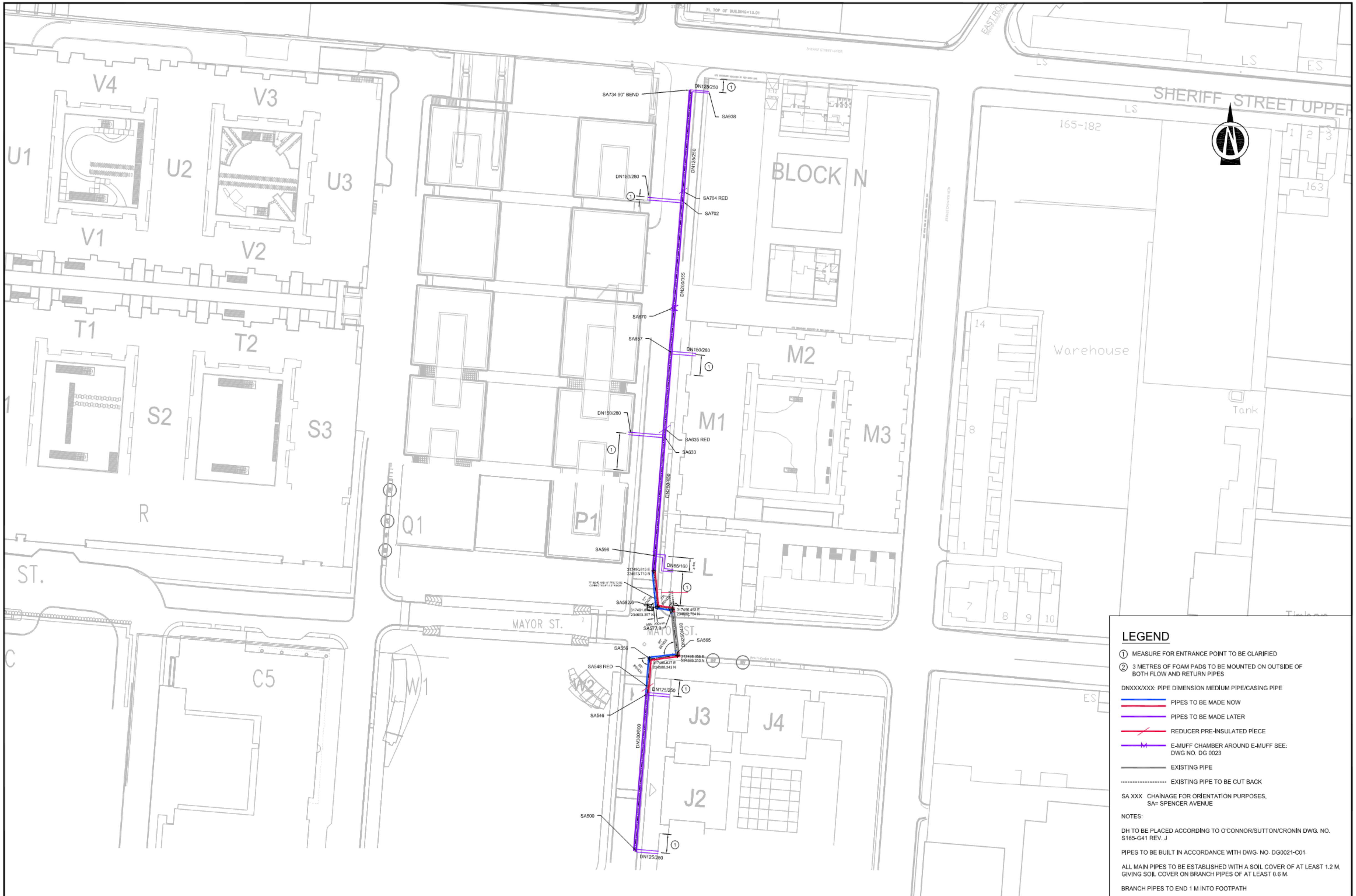
## 3.7 SAFETY FILE HANDOVER SUMMARY

The Developer's Designer will prepare as-built drawings including information necessary for DCC/DH Entity for the future operation of the DH network. All as-builts shall be prepared and delivered in compliance with the requirements outlined in this technical specification.

The following information is the minimum information to be included in the hand-over of the Safety File from the Developer's Designer to DCC/DH Entity;

- Certifications
  - Fittings
  - Welders
  - Inspection certificates
  - NDT Inspector's certificates
- Test results
  - X-rays
  - Pressures results
  - Vacuum results
- Pipe Book
- Records GIS
  - Service crossings
- Alarm system components

# APPENDIX B - SAMPLE DRAWINGS




## LEGEND

1. MEASURE FOR ENTRANCE POINT TO BE CLARIFIED
2. 3 METRES OF FOAM PADS TO BE MOUNTED ON OUTSIDE OF BOTH FLOW AND RETURN PIPES

DNXXX/XXX: PIPE DIMENSION MEDIUM PIPE/CASING PIPE

- PIPES TO BE MADE NOW
- PIPES TO BE MADE LATER
- REDUCER PRE-INSULATED PIECE
- E-MUFF CHAMBER AROUND E-MUFF SEE: DWG NO. DG 0023
- EXISTING PIPE
- EXISTING PIPE TO BE CUT BACK

SA XXX CHAINAGE FOR ORIENTATION PURPOSES, SA= SPENCER AVENUE

NOTES:

DH TO BE PLACED ACCORDING TO O'CONNOR/SUTTON/CRONIN DWG. NO. S165-G41 REV. J

PIPES TO BE BUILT IN ACCORDANCE WITH DWG. NO. DG0021-C01.

ALL MAIN PIPES TO BE ESTABLISHED WITH A SOIL COVER OF AT LEAST 1.2 M, GIVING SOIL COVER ON BRANCH PIPES OF AT LEAST 0.6 M.

BRANCH PIPES TO END 1 M INTO FOOTPATH

Client:

Dublin City Council
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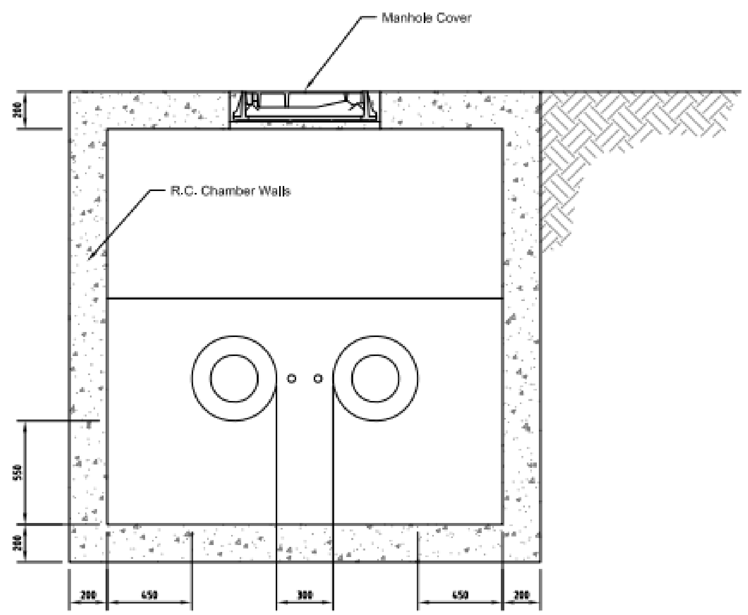
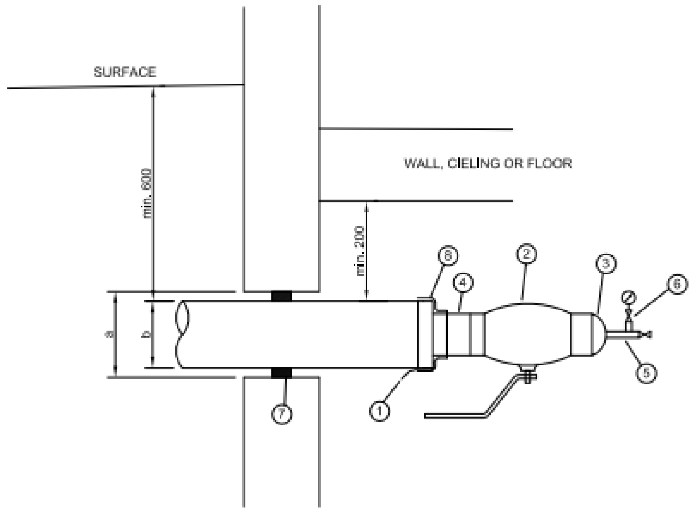
|---|---|---|---|---|---|
| C01 | 04/12/08 | TMP KBAL | Revised for Construction | OG | PWE |
| B01 | 25/06/08 | TMP KBAL | Issue for Tender | OG | PWE |
| A01 | 24/06/08 | TMP KBAL | Issue for Approval | OG | PWE |

Project: Dublin District Heating Project

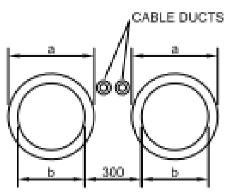
Title: SPENCER AVENUE DISTRICT HEATING SYSTEM LAYOUT

| | | | |
|---|---|---|---|
| Drawn by: | TMP | RPS Job No: mde0128 | |
| Checked by: | KBAL | COWI Job No: 59318 | |
| Approved by: | PWE | File No: mde0128DG0020C01 | |
| RPS approved: | OG | Drg. No: DG0020 | Rev: C01 |
| Scale: | 1:500 @ A1 | | |
| Date: | 24/06/08 | | |




BRANCH TERMINATION WHEN FINISHED INSIDE BUILDING



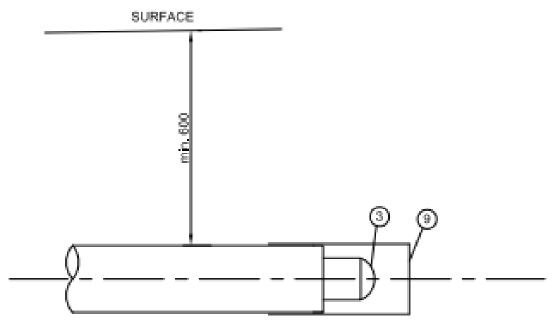

HOLES FOR LEADING IN BRANCH

*Note:*

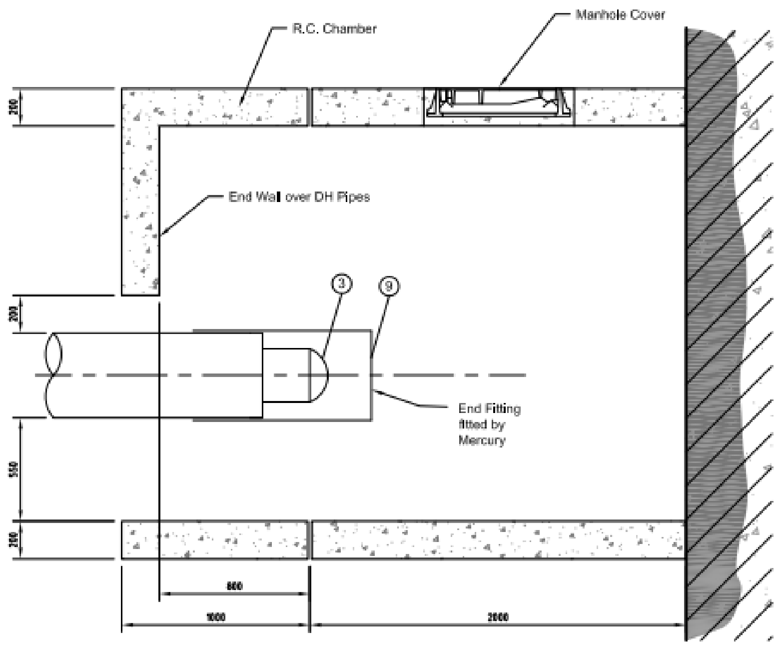
*DH pipes to finish 700/800mm inside culvert to allow welding and fitting of muff at later date. Access for welder should be provided in the form of iron rungs or suitable alternative inside culvert.*

1. WIRE FOR LEAK DETECTION SYSTEM OUT UNDER END CAP. ARE CONNECTED TO ALARM BOX ON WALL.
2. BALL VALVE WITH STAINLESS STEEL BALL
3. PIPE END TO BE WELDED ON END OF VALVE
4. PAINTED WITH ANTI CORROSIVE PAINT
5. 1 ¼ INCH PIPE SUPPLIED WITH BALL VALVE TO BE USED WHEN DEAERATING PIPES AND ESTABLISHING VACUUM.
6. ½ INCH PIPE WITH BALL VALVE AND PRESSURE GAUGE
7. LINK SEAL, TYPE AS GIVEN IN DIAGRAM
8. END CAP
9. END FITTING ACCORDING TO DATA SHEET 2.7.6.1 FROM LOGSTOR

| | a Diameter wall mm | b Outer diameter pipe mm | Type link seal |
|---|---|---|---|
| Cable ducts | 73-80 | 40 | LS 275 |
| DN 65 | 245-255 | 160 | LS 300 |
| DN 80 | 250-260 | 180 | LS 360 |
| DN 100 | 300-310 | 225 | LS 410 |
| DN 125 | 320-330 | 250 | LS 410 |
| DN 150 | 350-360 | 280 | LS 425 |
| DN 200 | 415-426 | 355 | LS 425 |
| DN 250 | 480-490 | 400 | LS 400 |




BRANCH TERMINATION WHEN FINISHED OUTSIDE BUILDING WITHOUT MH




BRANCH TERMINATION WHEN FINISHED OUTSIDE BUILDING WITH MH

## NOTES

Poss. No. 5 and 6 only to be mounted at one branch point of each phase of the project.

Client:

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|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| B01 | 25/06/08 | TMP/KBAL | Issue for Tender | OG | PWE |
| A01 | 24/06/08 | TMP/KBAL | Issue for Approval | OG | PWE |

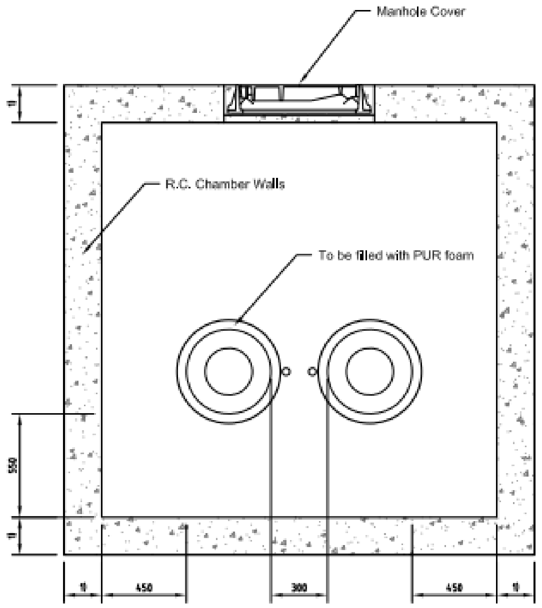
Project:

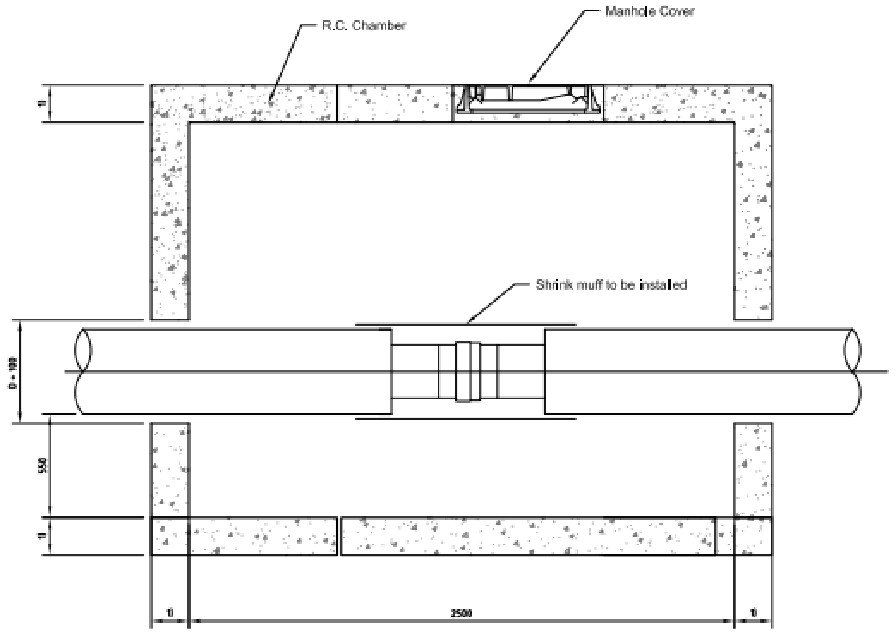
Dublin District Heating Project

Title:

SPENCER AVENUE BRANCH TERMINATIONS

| | | | |
|---|---|---|---|
| Drawn by: | TMP | RPS Job No: mde0128 | |
| Checked by: | KBAL | COWI Job No: 59318 | |
| Approved by: | PWE | File No: mde0128DG0022B01 | |
| RPS approved: | OG | Drg. No: DG0022 | Rev: B01 |
| Scale: 1:20 @ A1 | | | |
| Date: 18/06/08 | | | |




## NOTES

1) Dimensions of concrete to be specified according to all future loads

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|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| B01 | 25/06/08 | TMP / KBAL | Issue for Tender | OG | PWE |
| A01 | 24/06/08 | TMP / KBAL | Issue for Approval | OG | PWE |

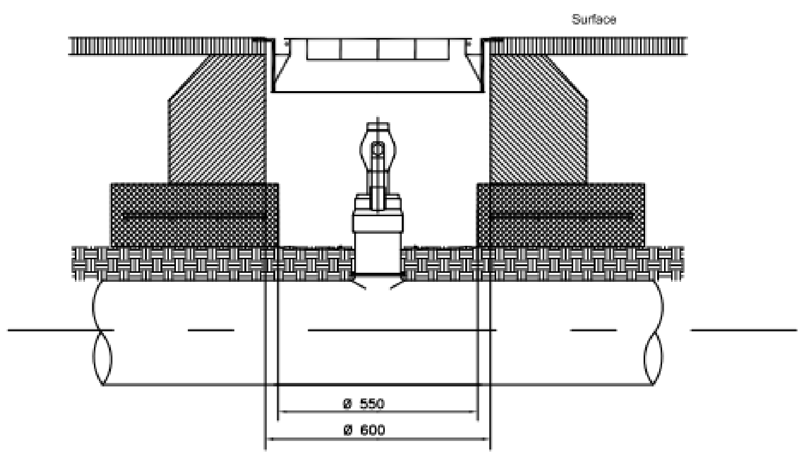
Project:

Dublin District
Heating Project

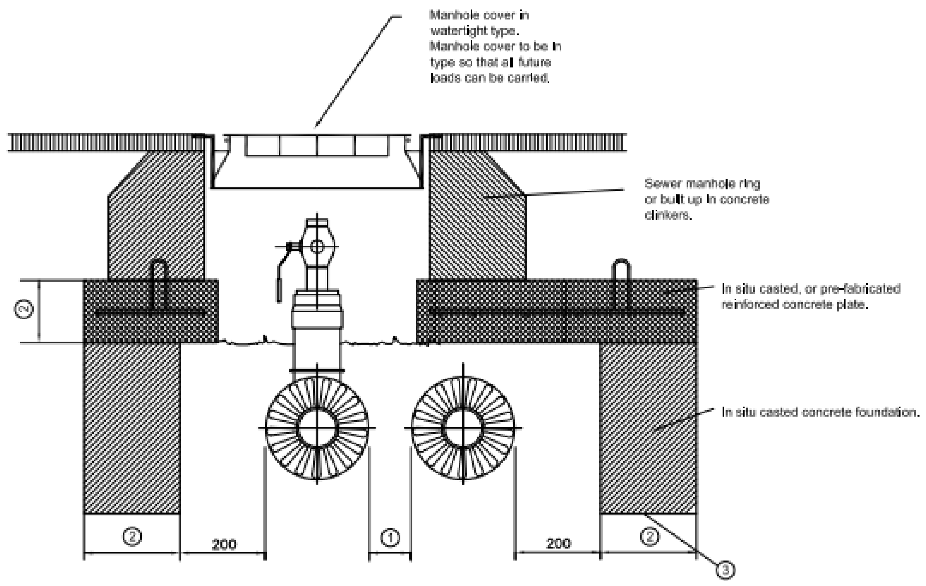
Title:

MANN HOLE
AT E-MUFFS

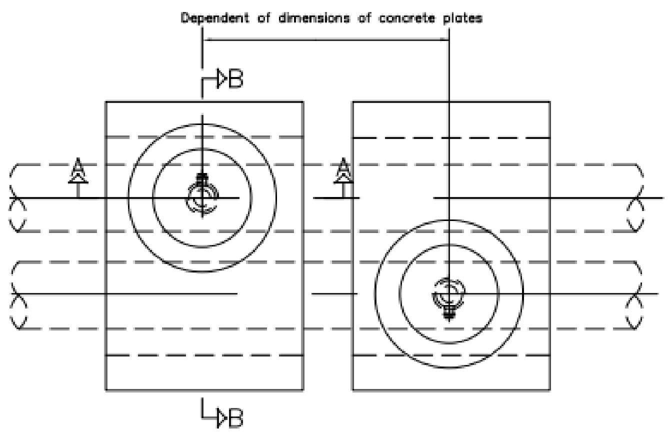
| | | |
|---|---|---|
| Drawn by: TMP | RPS Job No: mde0128 | |
| Checked by: KBAL | COWI Job No: 59318 | |
| Approved by: PWE | File No: mde0128DG0023B01 | |
| RPS approved: OG | Drg. No: DG0023 | Rev: B01 |
| Scale: 1:20 @ A1 | | |
| Date: 24/06/08 | | |




SECTION A–A




SECTION B–B




① Distance between pipes according to drawing no. 59318-002.

② Thickness of concrete walls and top to be dimensioned (type of concrete and reinforcement) to resist all future loads.

③ Walls lead to solid ground.

Client:

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| B01 | 25/06/08 | TMP / KBAL | Issue for Tender | OG | PWE |
| A01 | 24/06/08 | TMP / KBAL | Issue for Approval | OG | PWE |

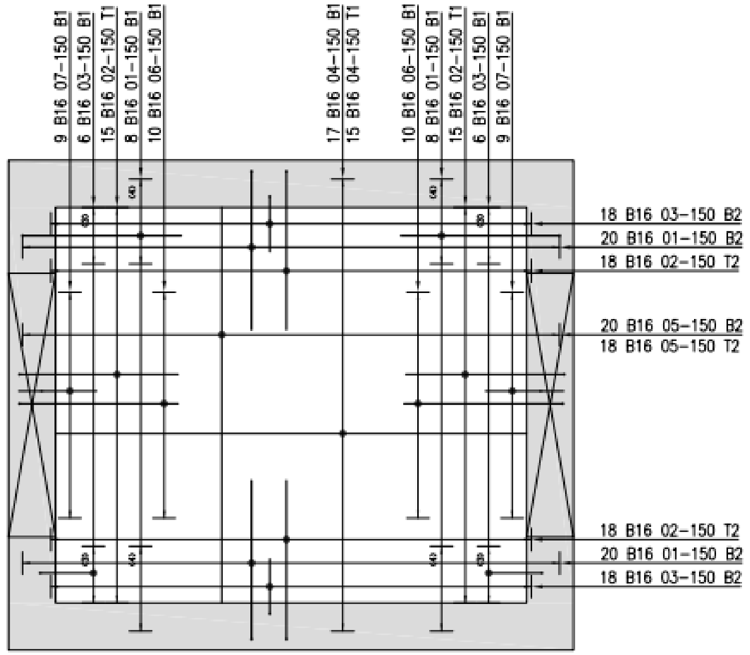
Project:

Dublin District Heating Project

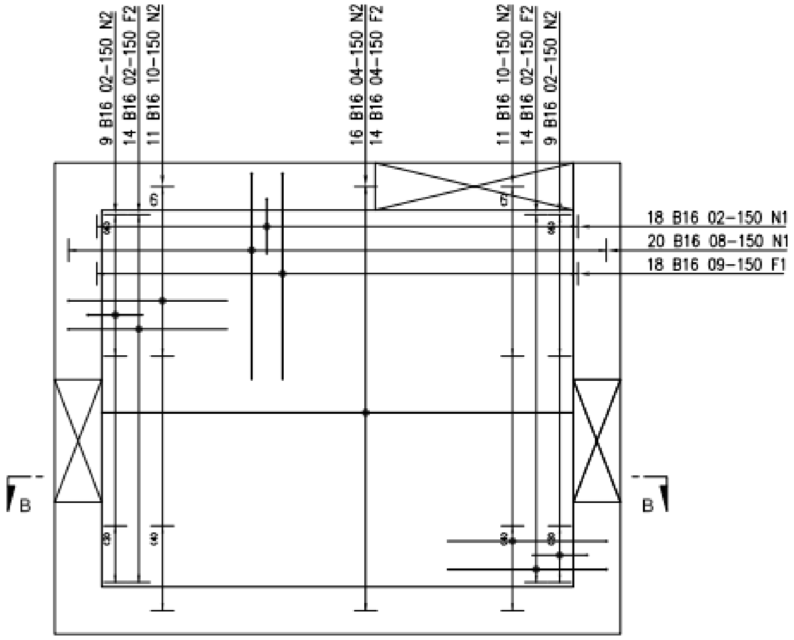
Title:

SPENCER AVENUE
VALVE CHAMBER
VENTING UNIT

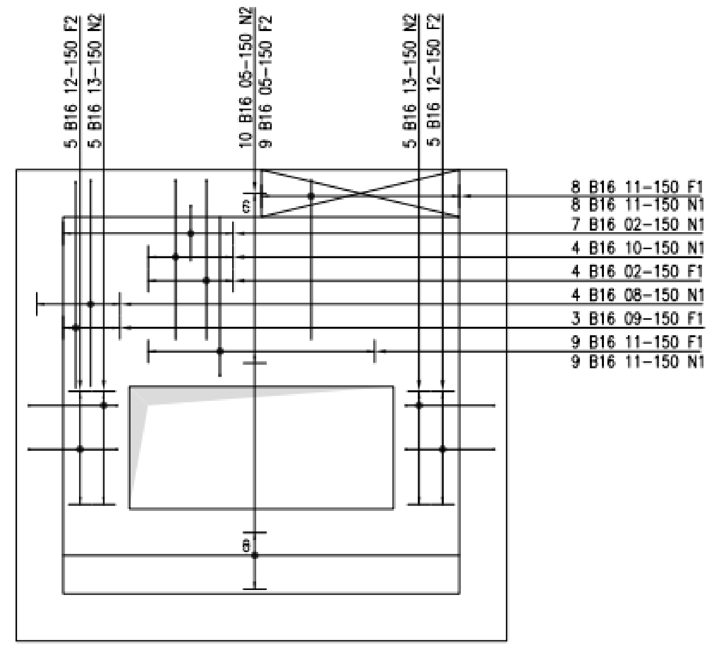
| | | | |
|---|---|---|---|
| Drawn by: | TMP | RPS Job No: | mde0128 |
| Checked by: | KBAL | COWI Job No: | 59318 |
| Approved by: | PWE | File No: | mde0128DG0024B01 |
| RPS approved: | OG | Drg. No: | Rev: |
| Scale: | NTS @ A1 | DG0024 | B01 |
| Date: | 18/06/08 | | |



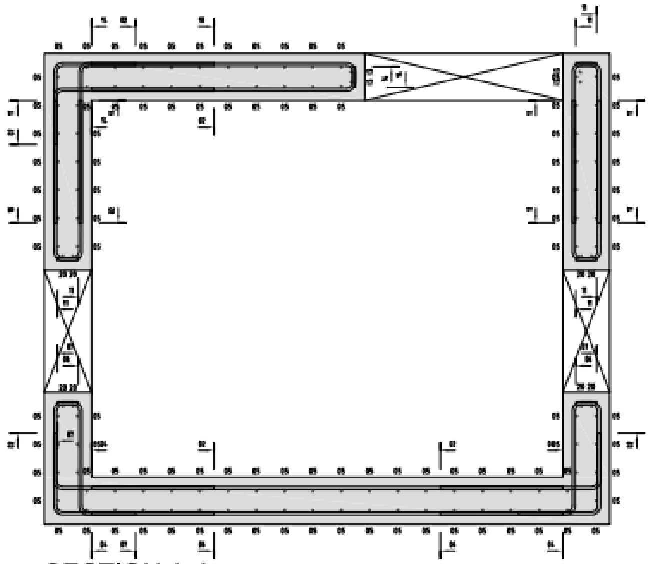

BASE PLAN



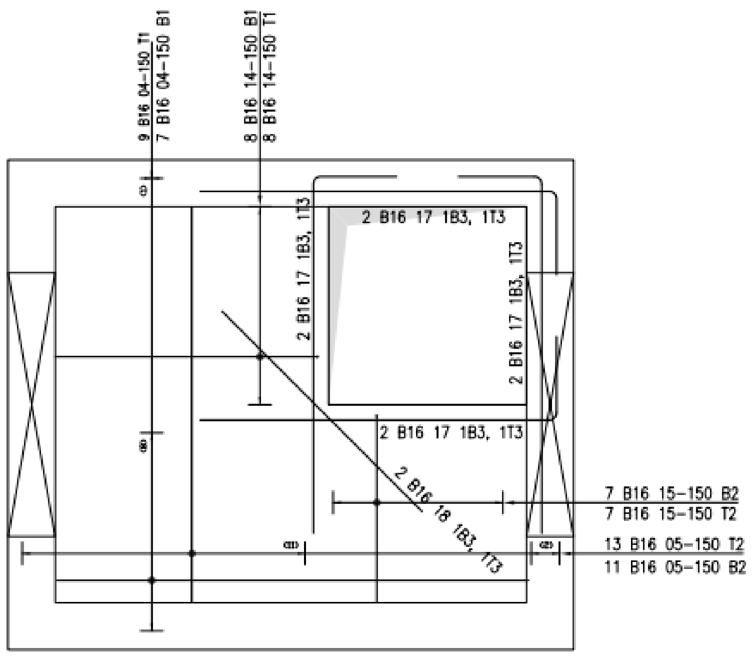

WALL TYPE 1



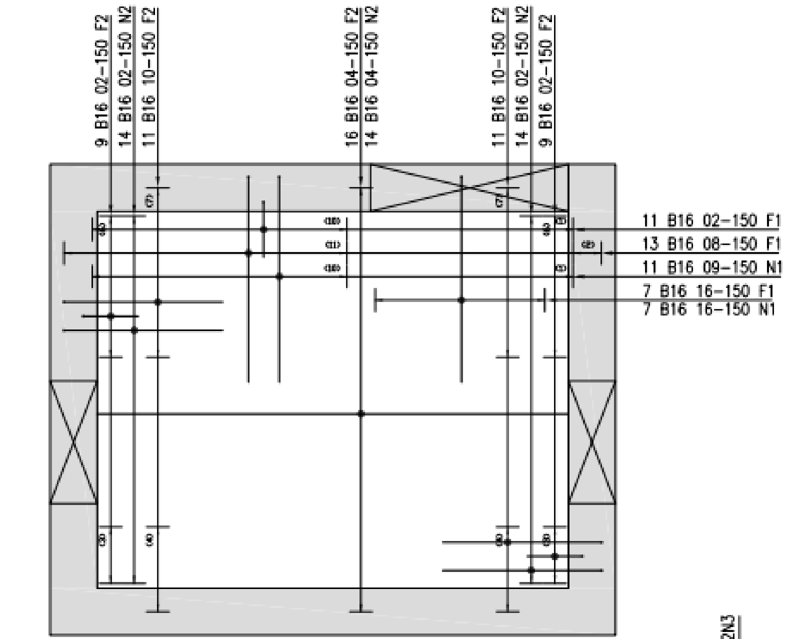

WALL TYPE 3



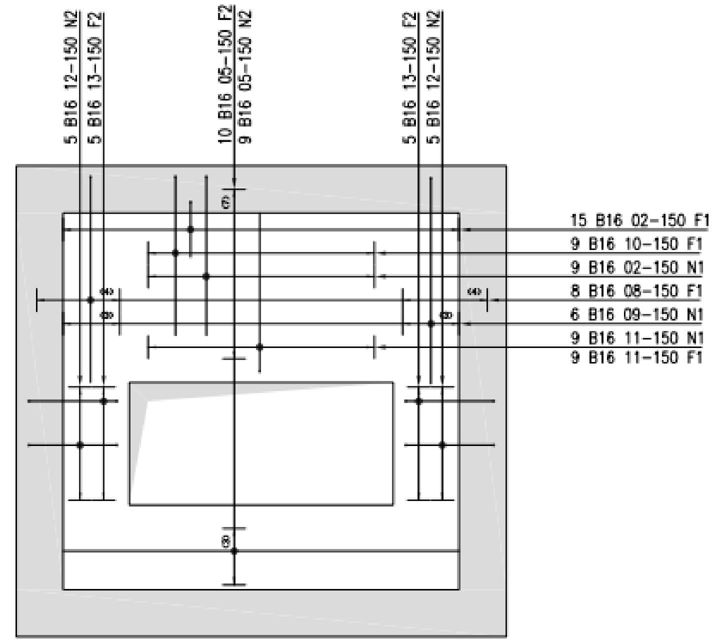
SECTION A-A



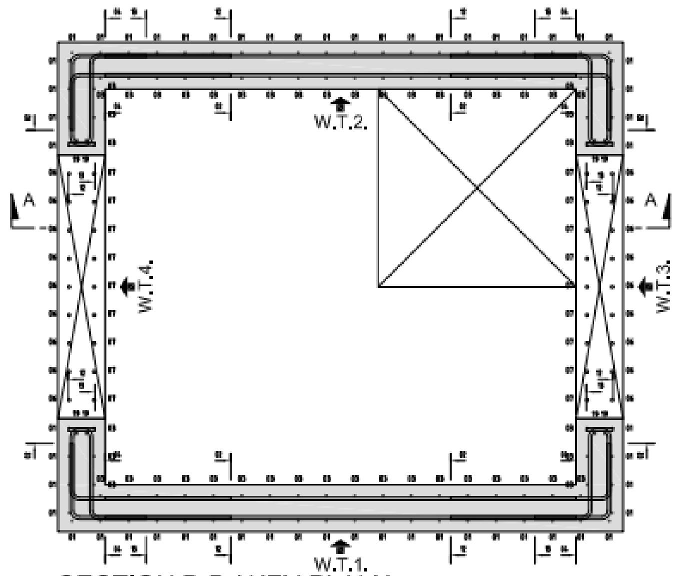

ROOF PLAN



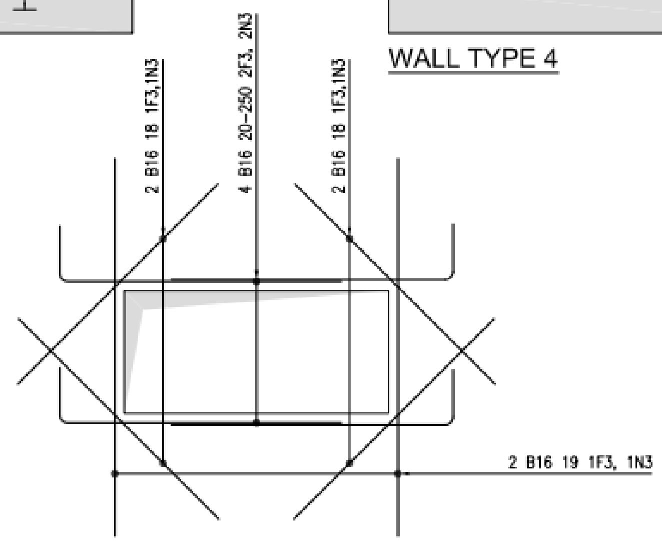

WALL TYPE 2




WALL TYPE 4




SECTION B-B / KEY PLALN




TRIM OPENINGS (x2)

REINFORCEMENT

(1) DETAILING OF STEEL: 21 B25 02-300 B1 DENOTES 21 No. 25mm. TYPE 2 DEFORMED BARS OF GRADE 500 STEEL AT 300mm. CENTRES BOTTOM AND SCHEDULED AS MARK 02.

(2) BENDING OF BARS AND SCHEDULING IS TO CONFORM TO B.S. 4466:2005

(3) TYPE OF REINFORCING STEEL IS REFERRED TO BY THE FOLLOWING ABBREVIATIONS:
R..........ROUND MILD STEEL BARS. COMPLYING WITH REQUIREMENTS OF B.S.4449
B..........TYPE 2 DEFORMED BARS OF GRADE 500 COMPLYING WITH REQUIREMENTS OF B.S. 4449
S..........STAINLESS STEEL BARS ALL STAINLESS STEEL REINFORCEMENT WSHALL BE GRADE 500 DESIGNATION NUMBER 14436 RIBBED BARS TO BS EN 10088

(4) NORMAL COVER TO REINFORCEMENT 50mm

LEGEND:

F1 DENOTES OUTER LAYER OF FAR FACE BARS
F2 DENOTES INNER LAYER OF FAR FACE BARS
N1 DENOTES OUTER LAYER OF NEAR FACE BARS
N2 DENOTES INNER LAYER OF NEAR FACE BARS
T1 DENOTES OUTER LAYER OF TOP BARS
T2 DENOTES INNER LAYER OF TOP BARS
B1 DENOTES OUTER LAYER OF BOTTOM BARS
B2 DENOTES INNER LAYER OF BOTTOM BARS
EF DENOTES BARS ON EACH FACE
AB DENOTES ALTERNATE BARS
AS DENOTES ALTERNATE BARS STAGGERED
AP DENOTES ALTERNATE BARS PLACED

CONCRETE:
CONCRETE TO BE GRADE: C40/50

Client:
.\crests\Dublin City Council.jpg

.\crests\COWI.tif

RPS Consulting Engineers

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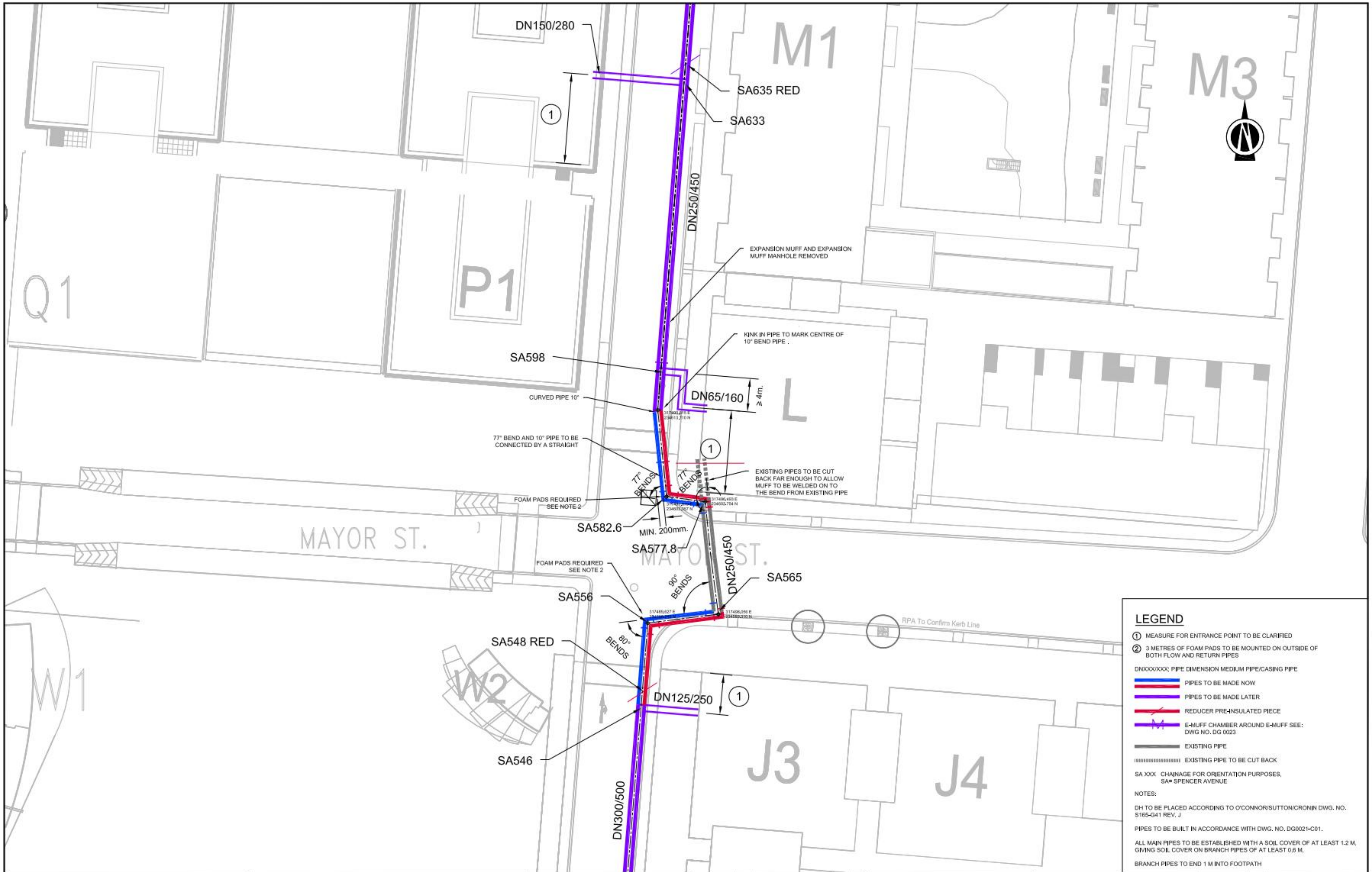
| No. | Date | Drn/Chk | Amendment / Issue | RPS App. | App. |
|---|---|---|---|---|---|

Project:
DUBLIN DISTICT HEATING PROJECT

Title:
E-Muffs Manhole Reinforcement Details

| | | |
|---|---|---|
| Drawn by: | P.O'C. | RPS Job No: MDE0128 |
| Checked by: | P.B. | COWI Job No: |
| Approved by: | P.W.E. | File No: MDE0128DG3001 |
| RPS approved: | | Drg. No: DG3001 |
| Scale: 1:20 @ A1 | | Rev: D01 |
| Date: 09/19/08 | | |




## LEGEND

① MEASURE FOR ENTRANCE POINT TO BE CLARIFIED

② 3 METRES OF FOAM PADS TO BE MOUNTED ON OUTSIDE OF BOTH FLOW AND RETURN PIPES

DNXXX/XXX: PIPE DIMENSION MEDIUM PIPE/CASING PIPE

- PIPES TO BE MADE NOW
- PIPES TO BE MADE LATER
- REDUCER PRE-INSULATED PIECE
- E-MUFF CHAMBER AROUND E-MUFF SEE: DWG NO. DG 0023
- EXISTING PIPE
- EXISTING PIPE TO BE CUT BACK

SA XXX CHAINAGE FOR ORIENTATION PURPOSES, SA= SPENCER AVENUE

NOTES:

DH TO BE PLACED ACCORDING TO O'CONNOR/SUTTON/CRONIN DWG. NO. S165-G41 REV. J

PIPES TO BE BUILT IN ACCORDANCE WITH DWG. NO. DG0021-C01.

ALL MAIN PIPES TO BE ESTABLISHED WITH A SOIL COVER OF AT LEAST 1.2 M, GIVING SOIL COVER ON BRANCH PIPES OF AT LEAST 0.6 M.

BRANCH PIPES TO END 1 M INTO FOOTPATH

Client:

Dublin City Council
Comhairle Cathrach Bhaile Átha Cliath

COWI
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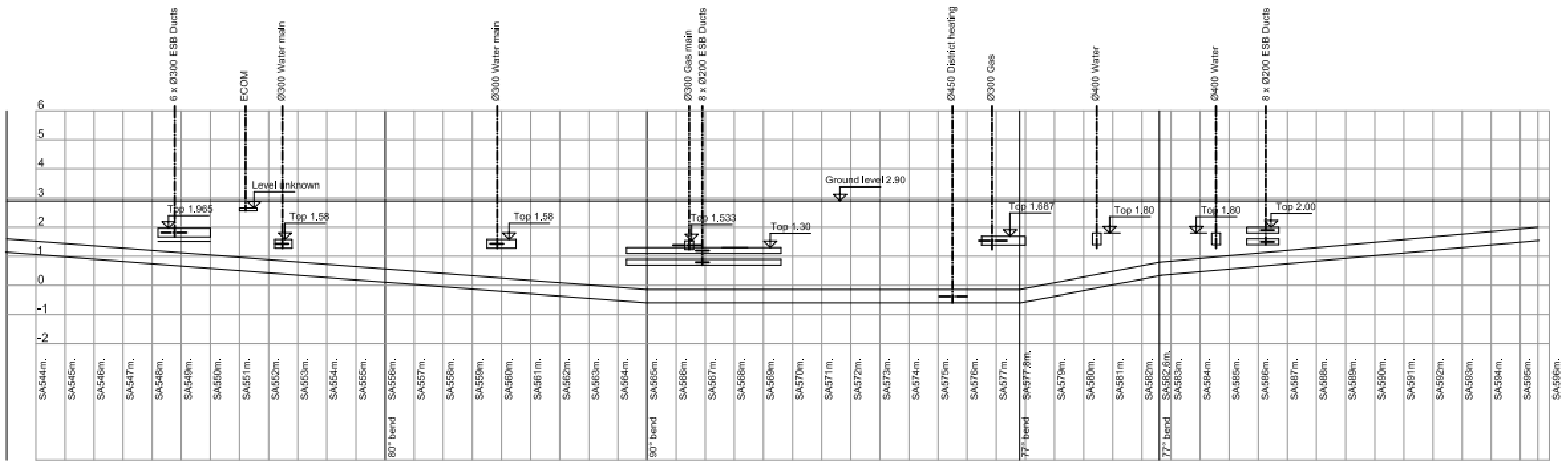
| No. | Date | Drn. / Chk. | Amendment / Issue | RPS App. | App. |
|---|---|---|---|---|---|
| C01 | 04/12/08 | TMP / KBAL | Revised for Construction | OG | PWE |

Project: Dublin District Heating Project

Title: SPENCER AVENUE BOATYARD LANE JUNCTION LAYOUT

| | | | |
|---|---|---|---|
| Drawn by: | TMP | RPS Job No: mde0128 | |
| Checked by: | KBAL | COWI Job No: 59318 | |
| Approved by: | PWE | File No: mde0128DG0026C01 | |
| RPS approved: | OG | Drg. No: DG0026 | Rev: C01 |
| Scale: | 1:200 @ A1 | | |
| Date: | 03/12/08 | | |




Client:

Dublin City Council
Comhairle Cathrach Bhaile Átha Cliath

COWI

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2. All Levels refer to Ordnance Survey Datum, Malin Head.
3. DO NOT SCALE, use figured dimensions only, if in doubt ask.

| No. | Date | Dr. / Ch. | Amendment / Issue | RPS App. | App. |
|---|---|---|---|---|---|
| C01 | 04/12/08 | TMP / KBAL | Revised for Construction | OG | PWE |

Project:

Dublin District Heating Project

Title:

SPENCER AVENUE
BOATYARD LANE JUNCTION
CROSS SECTION

| | | | |
|---|---|---|---|
| Drawn by: | TMP | RPS Job No: mde0128 | |
| Checked by: | KBAL | COWI Job No: 59318 | |
| Approved by: | PWE | File No: mde0128DG0027C01 | |
| RPS approved: | OG | Drg. No: DG0027 | Rev: C01 |
| Scale: 1:100 @ A1 | | | |
| Date: 03/12/08 | | | |

# APPENDIX C* - SAMPLE OPERATING MANUAL FOR APARTMENT UNITS

Sample Operating Manual is an example of the unit utilised for Spencer Dock.

The manual is given for information purposes only.

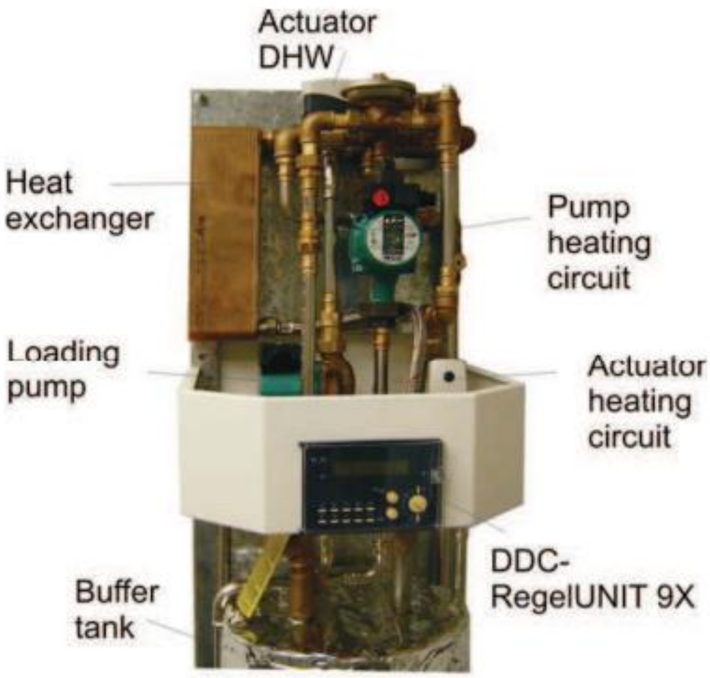
# thermoUNIT
## X40B

# Compact Energy Center

# SSP
# OPERATING MANUAL

## Index

## 0. Components



## 1. Operating Manual and Maintenance Manual for compact energy centre thermoUNlT X4OB with central heating and decentralized domestic hot water production

| | |
|---|---|
| project: | Spencer Docks, Dublin |
| | **type: thermoU NIT X4OB** |
| max. capacity: | 35 kW |
| Order No. | 51513/3 |

Symtech Systems & Products
Unit F3,
Riverview Business Park,
Nangor Road,
Dublin 12
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(F) +353 1 4600 664
(M)+353 87 7997840

Producer:
STS Energietechnik GmbH
Charlotte-Bühler-StraBe 1
01099 Dresden

Riccius+Sohn GmbH
Haynauer Str. 49
12249 Berlin

Berlin, 16. of June 2006

## 1. Preconditions

The compact energy centre has a capacity of **35 kW.**

The production of the domestic hot water is buffered in a 40l buffer tank

### 1.1 Handling and Storage:

The Units are packaged on a wooden pallet, mounted on a metal rack in pairs and enveloped in plastic foil. They are shipped in the Horizontal position. Before Installation, the Units should be stored in a dry damp free environment in the horizontal position.

### 1.2 Installation Location of Unit:

The Unit should be located in a dry, damp free environment. The Unit should be fixed to a secure wall in the Vertical Position. Sufficient access space needs to be allowed for future maintenance of the Unit. The Supporting structure for the Unit should be able to handle the Laden Weight of the Unit as called out in the Technical Specification.

### 1.3 Before the commissioning the following conditions have to be fulfilled:

Connections and installation elements have to be tested for tight fitting and have to be tightened if necessary.

The electrical connections of the controllers, the power supply and the remote control unit have to be connected according to the electrical safety standards of the country, where the thermoUNIT is installed.

It needs to be ensured, that the pipe work are dirt free during installation to prevent the system from clogging. If necessary the thermoUNIT should be cleaned by running water through the pipe work, before it is connected to the main system.

The pressure in the system should be according to the pressure range provided in the technical specification of the thermoUNIT. **The system should be completely filled.**

## 2. Technical Data

2.1. Safety System (PT Safety Relief Valve)

| | | |
|---|---|---|
| Maximum Operating Temperature: | 99 | °C |
| Maximum Operating Pressure: | 5,2-10,3 | bar |

Note: There is no Valve fitted between the Cylinder and the Safety Relief Valve.

| | | |
|---|---|---|
| Connection for discharge of water: | ¾” | |

2.2. Primary Media (District Heating Circuit)

| | | |
|---|---|---|
| Capacity | 35 | kW |
| Max. Operating Temperature | 95 | ° C |
| Max. Design Temperature for Heat Exchanger | 95 | ° C |
| Mm. Differential Pressure | 0,7 | bar |
| Max. Differential Pressure | 4,0 | bar |
| Max. Operating Pressure | 10 | bar |

2.3. Heating Circuit

| | | |
|---|---|---|
| Capacity | 20 | kW |
| Max. Operating Temperature | 95 | °C |
| Max. Operating Pressure | 10 | bar |
| Mm. Differential Pressure | 0,1 | bar |
| Max. Differential Pressure | 0,5 | bar |

2.4. Domestic Hot Water Circuit

| | | |
|---|---|---|
| Capacity | 35 | kW |
| Max. Operating Temperature | 95 | °C |
| Max. Operating Pressure | 10 | bar |
| Size of BufferTank | 40 | l |
| Material of Tank | 1,4571 | |
| Max. Amount of DHW @ 55 °C | 12 | l |
| Provision for Electric Immersion (Pocket) | NA | |

2.5. General

| | |
|---|---|
| Connections | ¾” |
| Dimensions | 1620/400 I 400 mm |
| Weight (filled) | 61 Kg |
| Power supply | 230V /16 A |
| Insulation on Buffer Tank | yes |

## 6. Function of the compact energy centre

The apartment is supplied with heat via the compact energy centre thermoUNIT X4OB. The heating components of the apartment (radiators, under floor heating or capillary heating) are connected directly to the primary district heating supply. The production of the domestic hot water is done indirectly inside the compact energy centre thermoUNIT X4OB, using the heat of the primary district heating supply. The primary district heating supply is separated from the domestic hot water circuit by a heat exchanger. To ensure an immediate heat supply the compact energy centre thermoUNlT X4OB is supplied with a 401 buffer tank.

The compact energy centre thermoUNlT X4OB is equipped with all necessary components including sensors, controllers, pumps, flow and pressure controllers, heat meter, heat exchanger and safety equipment.

The Safety Kit provided is a PT Safety kit. The Safety Valve releases water (and thus relieves pressure) if either the temperature or pressure in the tank gets too high.

The controller will not only give the apartment user optimal comfort but also a very efficient operation of the complete heating system. (Room temperature control). The enclosed heat meter will measure the exact heat consumption in the apartment. The heat meter is connected to the controller and can be read via a building management software.

The apartment owner can not only influence the occupation times in his apartment but can also set the temperature set point or activate an overtime via a remote control unit in the apartment.

More information can be found in the operating manual of the controller.

## 4. The basic concept

See Functional Schematic (Section 7) and Technical Drawing (Section 8).

The compact energy centre thermoUNlT X4OB is connected to the main power supply of the apartment. The controller at the front of the unit is the main operating element between the thermoUNlT and the user. For further information please read the operating manual of the controller.

### 4.1 Commissioning

- Open shut-off valves for all incoming and outgoing pipes.

- Fill the system with water

- Switch on the power supply to the unit

### 4.2. Service

- Switch off power supply to the unit

- close all shut-off valves.

### 4.3. Error messages

- Error messages are on the display of the controller.

- further information can be found in the operating manual of the controller

## 5. Service

### 5.1 Personal

The service and maintenance should only be done by authorized personal. They should fill, empty, ventilate and optimize the system. They should switch on the electrical components and check the system for flawless technical operation.
**The service and maintenance of safety relevant components should only be done by authorized personal.** The reprogramming and configuration of the controller should only be done by authorized personal.

### 5.2. Qualification

It is assumed, that only personal for service and maintenance are used, and that the personel have a good knowledge of the operation of district heating stations.

### 5.3. Maintenance

The pipe work should be checked visually for any kind of leakage, change of position or condition of fixation.
Actuators and other components should be checked for leakage (The insulation doesn't have to be removed.) If a filter is installed, the filter should be cleaned regularly.
The insulation should be checked. Missing or open insulation should be fixed immediately, because there may be a danger of burning. While maintaining the system, the system should be shut down, so that work can be carried out in a safe environment.
The maintenance of the compact energy centre should be done regularly by authorized personal. It is recommended as part of preventative maintenance that an inspection and Maintenance is carried out on the Unit at least once per year. The guarantee for the thermoUNIT X4OB is only valid, if there is proof of regular maintenance.

It is recommended that the valve lever of the PT-Safety-Valve should be operated at least once per year by the maintenance personnel to ensure the waterways are clear. When the lever is operated, hot water will discharge. Before operating the lever, check to see, if a discharge line is connected to the valve, directing the flow of hot water from the valve to the proper place of disposal. If no water flows from the valve, the valve should be replaced. Failure to inspect this valve could result in an unsafe Temperature or Pressure build-up within the system.

## 6. Commissioning

Commissioning of the Unit should be done in accordance and agreement with the personal responsible for the heat supply.

All actuators with the exception of the differential pressure controller should be closed.

The Electronic Controller should be in manual operation.

Open shut-off valves for flow and return.

Open control valve by hand or in automatic operation

During the commissioning the pressure and temperature in the unit should be checked. It needs to be confirmed, that the given limits are not exceeded.

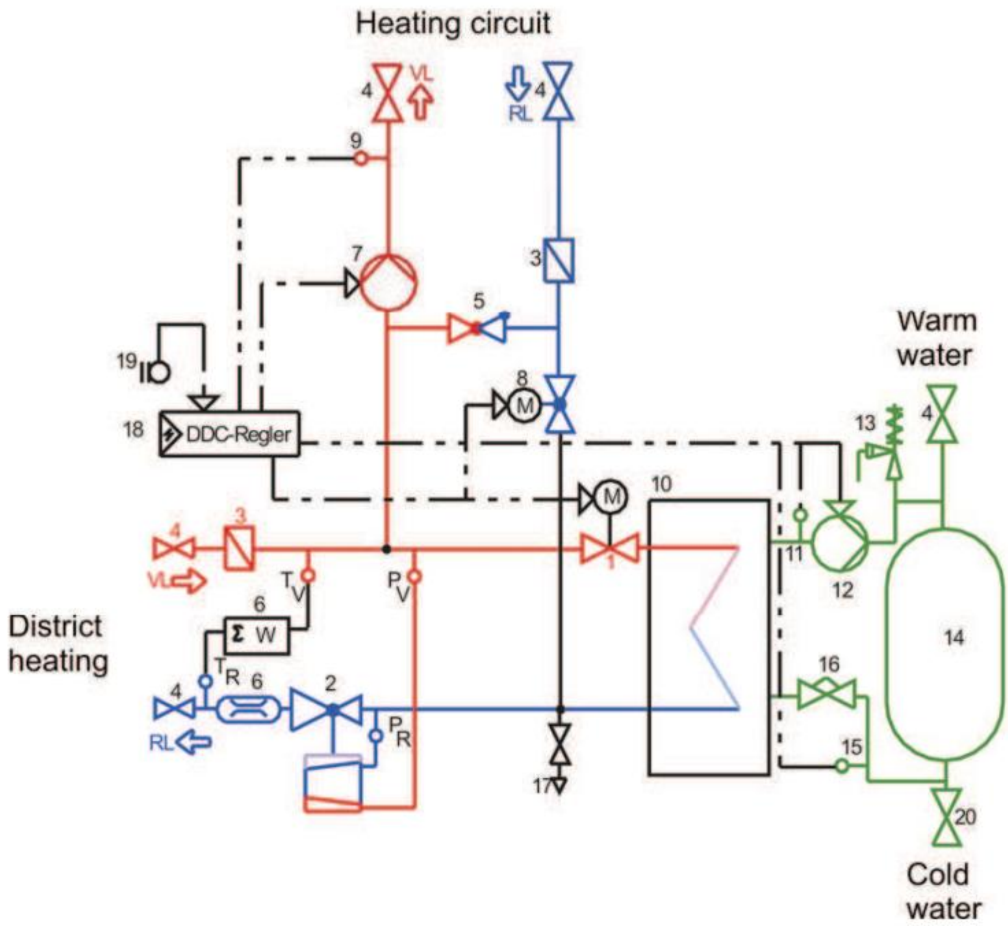
Before filling the unit, it needs to be confirmed, that all the components including: actuators, pipe work and other components are clean.

The unit has to be securely mounted and a pressure check should be done before filling the system.

During the time of commissioning, the unit should be checked for leakage, expansion due to heat and functionality. If there are any irregularities, the unit should be shut down.

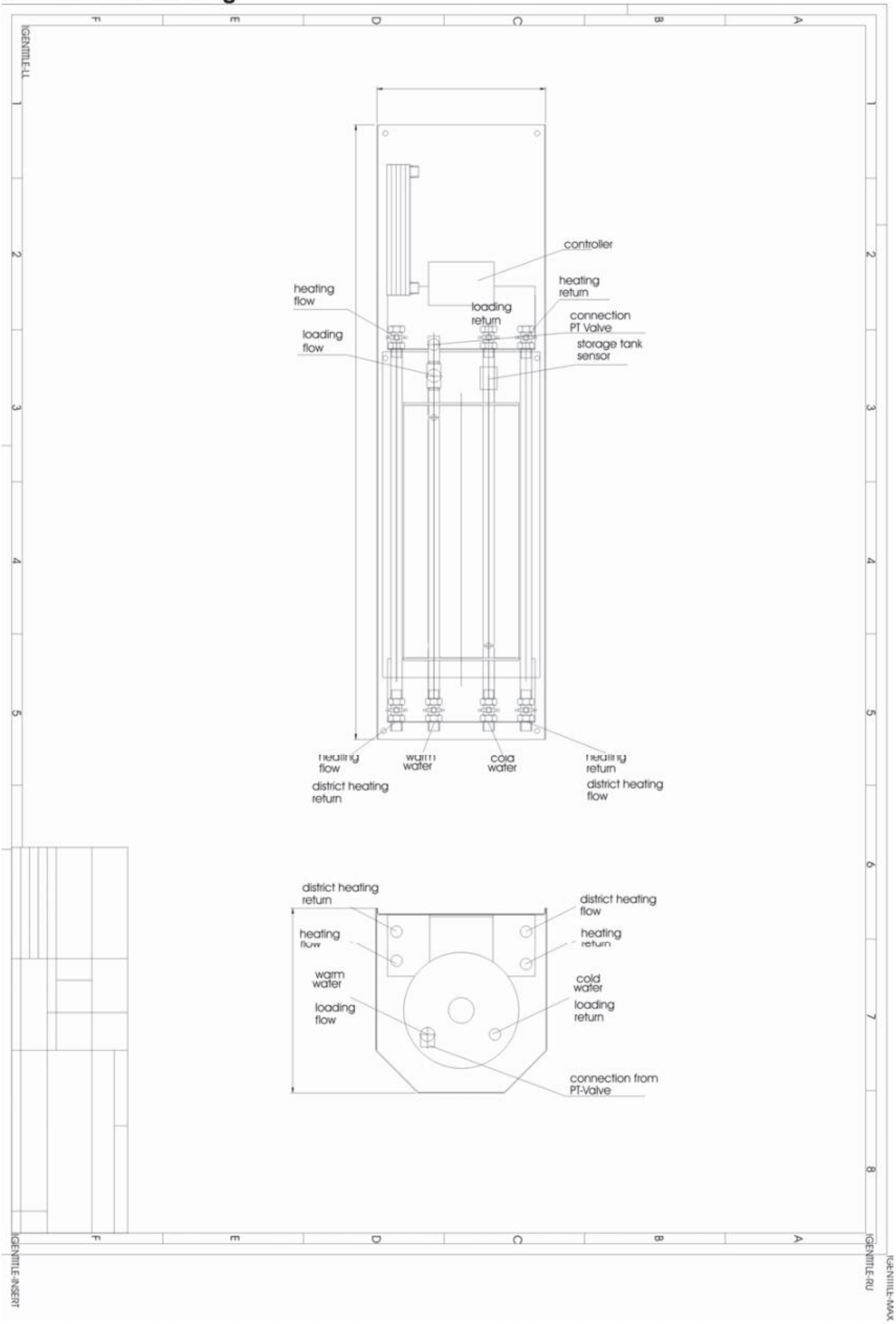
The electric wiring and the functionality of the sensors, the heat meter, the remote control unit, the controller, the pump and the actuators (valves) should be checked. Please refer to the operating manual of the controller for further information.

## 7. Functional Diagram




| | |
|---|---|
| 1 | Actuator with valve warm water |
| 2 | Differential pressure controller |
| 3 | Pollution filter |
| 4 | Shut-off valve (ball valve) |
| 5 | Non-return valve |
| 6 | Heat meter |
| 7 | Pump heating circuit |
| 8 | Actuator with valve heating circuit |
| 9 | Flow sensor heating circuit |
| 10 | Heat exchanger for DHW |
| 11 | Flow sensor DHW |
| 12 | Loading pump |
| 13 | Safety valve (safety kit) |
| 14 | DHWbuffertank |
| 15 | Buffer tank sensor |
| 16 | Flow limiter |
| 17 | Valve (emptying, filling) |
| 18 | DDC-RegelUNIT 9X |
| 19 | Outside sensor (optional) |
| 20 | Flow limiter |

# 8. Technical Drawing



# EU-Konformitätserklärung nach DIN EN 54015

Die

STS Energietechnik GmbH
Am Lagerplatz 4
**D-01099 Dresden**

erklärt in alleiniger Verantwortung, dass die Produkte

- **Fernwärme-Kompaktstation**
- **Speicherlademodul**

**Fabrikat: STS Energietechnik**

auf welche sich diese Erklärung bezieht, mit den im Anhang aufgeführten Normen und normativen Dokumenten übereinstimmen.

Dresden, Januar 2005

Steffen Stiller
Geschäftsführer

Klaus Jacob
Qualitätssicherung

Anlagen

Anhang 1
(Aufführung von Normativen und normativen Dokumenten

ENERGIETECHNIK

# Normenübersicht

## DIN EN 292, Teil 1 und 2

Über die Sicherheit von Maschinen (grundlegende Sicherheits- und Gesundheitsanforderungen

## DIN 4747-2, Teil 1

**Fernwärmeanlagen**

Sicherheitstechnische Ausrüstung von Unterstationen, Hausstationen und Hausanlagen zum Anschluss an Heizwasser-Fernwärmenetze

## DIN 4751, Teil 1

**Wasserheizungsanlagen**

Offene und geschlossene physikalisch abgesicherte Wärmeerzeugungsanlagen mit Vorlauftemperaturen bis 120°C, sicherheitstechnische Ausrüstung

## DIN 4751, Teil 2

**Wasserheizungsanlagen**

Geschlossene, thermostatisch abgesicherte Wärmeerzeugungsanlagen mit Vorlauftemperaturen bis 120°C, sicherheitstechnische Ausrüstung

## DIN 4751, Teil 3

**Wasserheizungsanlagen**

Geschlossene, thermostatisch abgesicherte Wärmeerzeugungsanlagen bis 50 kW Nennwärmeleistung mit Zwangsumlauf-Wärmeerzeugern und Vorlauftemperaturen bis 95°C, sicherheitstechnische Ausrüstung

## DIN 4752

**Wasserheizungsanlagen**

Sicherheitstechnische Ausrüstung und Aufstellung von Heisswasser-Heizungsanlagen mit Vorlauftemperaturen von mehr als 110°C

Gruppe I a:
Absicherung der höchstzulässigen Vorlauftemperatur von 130°C durch Druckbegrenzung

Gruppe I b:
Absicherung der höchstzulässigen Vorlauftemperatur von 130°C durch Temperaturbegrenzung

Gruppe II:
Absicherung von Anlagen mit einer höchstzulässigen Vorlauftemperatur von über 130°C

## DIN 4753, Teil 1

**Wassererwärmer und Wassererwärmungsanlagen für Trink- und Betriebswasser**

Anforderungen, Kennzeichnung, Ausrüstung und Prüfung

ENERGIETECHNIK

DIN 3440

**Temperaturregel- und –begrenzungseinrichtungen für Wärmeerzeugungsanlagen**

Sicherheitstechnische Anforderung und Prüfung

DIN 32730

**Stellgeräte für Wasser und Wasserdampf mit Sicherheitsfunktion in heiztechnischen Anlagen**

Sicherheitstechnische Anforderungen und Prüfungen

DIN EN 1268, Teil 1

**Sicherheitseinrichtungen gegen unzulässigen Überdruck**

Sicherheitsventile

DIN EN 1268, Teil 7

**Sicherheitseinrichtungen gegen unzulässigen Überdruck**

Allgemeine Daten

DIN EN 12828

**Heizungssysteme in Gebäuden**

Planung von Warmwasser-Heizungsanlagen

DIN-EN 764, Teil 1

**Druckgeräte**

Terminologie – Druck, Temperatur, Volumen, Nennweite

ENERGIETECHNIK

## DIN-EN 764, Teil 2

**Druckgeräte**

Größen, Symbole und Einheiten

## DIN-EN 764, Teil 7

**Druckgeräte**

Sicherheitseinrichtungen für unbefeuerte Druckgeräte

## EN 287-1

**Schweißverfahren**

- Lichtbogenschweißen – E 111
- Metall-Aktivgasschweißen – MAG 135
- Wolfram-Inertgasscheißen – WIG 141
- Gasschweißen – G 311

## Energieeinsparverordnung (EnEV)

## 10. Manufacturer Recommendations:

1. It is recommended that a Copy of this manual is left with the Householder upon successful installation and commissioning of the Unit.

2. It is recommended as part of preventative maintenance that an inspection and Maintenance is carried out on the Unit at least once per year.

## Warning:

**Do not remove or adjust any component part of this system, please contact the Installer.**

## WARNING:

**It is recommended that the valve lever of the PT-Safety-Valve should be operated at least once per year by the maintenance personnel to ensure the waterways are clear. When the lever is operated, hot water will discharge. Before operating the lever, check to see, if a discharge line is connected to the valve, directing the flow of hot water from the valve to the proper place of disposal. If no water flows from the valve, the valve should be replaced. Failure to inspect this valve could result in an unsafe Temperature or Pressure build-up within the system.**

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Dublin 12, Ireland
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F: +353 1 4600664

# APPENDIX D - GENERAL STANDARDS

## General Design Standards

Typically the DH network shall be designed according to following main standards including standards for bonded preinsulated steel service pipe-system and for plastic service pipe systems:

| Standard number | Standard name |
|---|---|
| DIN 16892 16893 | PEX carrier pipes in heating pipes made of plastic. |
| DIN 4726 | Oxygen proof layer ii carrier pipes of heating pipes made of plastic. |
| EN 10204 | Metallic products. Types of inspection documents |
| EN 10217: | Welded steel tubes for pressure purposes. |
| EN 13480 | Metallic industrial piping. Design and calculation |
| EN 13941 | Design and installation of preinsulated bonded pipes for district heating. |
| EN 188 | Preinsulated bonded pipe systems for underground hot water networks. Steel valve assembly for steel service pipes, polyurethane thermal insulation and outer casing of high-density polyethylene. |
| EN 253 | Preinsulated bonded pipe systems for underground hot water networks. Pipe assembly of steel service pipes, polyurethane thermal insulation and outer casing of high-density polyethylene. |
| EN 448 | Preinsulated bonded pipe systems for underground hot water networks. Fining assemblies of steel service ‘pipes, polyurethane thermal insulation and outer casing of high-density polyethylene. |
| BS EN ISO 9606-1 | Qualification testing of welders – Fusion welding |
| EN ISO 9712 (Formally EN 473) | Non-destructive testing. Qualification and certification of NDT personnel. |
| EN 489 | Preinsulated bonded pipe systems for underground hot water networks. Joint assembly for steel service pipes polyurethane thermal insulation and outer casing of high-density polyethylene. |
| EN ISO 1587S-1 | Plastic piping systems for hot and cold water installations. Cross-linked [polyethylene (PE-X). |
| ISO 5817 | Welding -- Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) -- Quality levels for imperfections |
| ISO 6761 | Steel tubes -- Preparation of ends of tubes and fittings for welding |

## Norms and Standards for Heat Metering

All the Specified material requirements should be understood as minimum requirements. Equipment suppliers should provide DH pipeline systems that meet the requirements of this specification.

| | |
|---|---|
| EN 1434-1:en: | Heat meters. Part 1: General requirements |
| EN 1434-2:en: | Heat meters. Part 2: Constructional requirements |
| EN 1434-3:en: | Heat meters. Part 3: Data exchange and interfaces |
| EN 1434-4:en: | Heat meters. Part 4: Pattern approval tests |
| EN 1434-5:en: | Heat meters. Part 5: Initial verification tests |
| EN 1434-6:en: | Heat meters. Part 6: Installation, commissioning. operational monitoring and maintenance |

Communication systems for meters and remote reading of meters:

| | |
|---|---|
| EN 13757-1:en | Communication system for meters and remote reading for meters. Part 1: Data exchange |
| EN 13757-2:en | Communication system for meters and remote reading for meters. Part 2: Physical and link layer |
| EN 13757-3:en: | Communication system for meters and remote reading for meters. Part 3: Dedicated application layer |
| EN 13757-4:en | Communication system for meters and remote reading for meters. Part 4: Wireless meter readout (Radio meter reading for operation in the 868 MHz to 870 MHz SRD band) |