Decentralised Energy Network Technical Specification Supplementary Planning Document

Decentralised Energy Network SPD:

General Introduction

Introduction

1.1.This SPD is intended to provide more detailed technical guidance relating to those developments required to deliver a decentralised energy network or connecting to an existing/planned decentralised energy network in accordance with the policy objectives in Enfield's Development Management Document (DMD) - as set out below.

DMD 52

Decentralised Energy Networks

Proposals for the development of decentralised energy network infrastructure and related apparatus in the borough will be supported. The Council will support, and in some cases facilitate, the provision of infrastructure to support new and expanding networks including safeguarding routes and land for such use where necessary.

Proposals for major developments which produce heat and/or energy should contribute to the supply of decentralised energy networks unless it can be demonstrated that this is not technically feasible or economically viable.

Connection to a decentralised energy network

All major developments should connect to or contribute towards existing or planned DE networks supplied by low or zero carbon energy.

1. Where the proposed development is adjacent to an existing DE network, it should:

a. Secure the direct connection of all units to that network; and
b. Contribute as necessary to the increased capacity of the DE network to support such connection.

2. Where there is an existing DE network that requires extension in order to supply the proposed development, proposed developments should:

a. Contribute to such extension;
b. Secure the direct connection of all units to the extended network; and
c. Contribute as necessary to the increased capacity of the DE network to support such connection.

3. Where there is a planned DE network within feasible and viable range of future connection, proposed developments should:

a. Commit to connect to the DE network;
b. Incorporate site-wide and/or communal heating systems;
c. Provide sufficient space for on-site energy centres or plant rooms to accommodate DE connection equipment such as pipes, heat exchangers and pumps etc;
d. Locate the energy centre or plant room to ensure the shortest connection distance to the future network, having regard to the requirements of the network as a whole;
e. Maximise the layout, density and mix of development to support identified DE opportunities;
f. Provide pipe connections as appropriate to the site boundary or safeguard an identified route within the site for future DE connection infrastructure; and
g. Where the planned DE network requires extension to supply the proposed development, proposed developments should contribute to such extension.

4. Where there is no connection available to a decentralised energy network and no DE network is planned within range, on-site CCHP or CHP will be expected where the heating demand makes it feasible.

5. Where CCHP or CHP would not be technically feasible or financially viable, developments will be required to be designed to enable its connection to a decentralised energy network in the future, or provide a contribution for the expansion of decentralised energy networks, or other carbon reduction measures within the borough, where reasonable and appropriate.

6. Where technically feasible, buildings with high cooling loads that are connected to a DE network should be designed to meet their cooling demand through heat-fed absorption chilling.

This policy should be read in conjunction with Core Strategy Policy 20.

1.2. The information in this document is provided to ensure that the required decentralised energy infrastructure operates efficiently, has longevity, delivers the intended carbon emission reductions, and reduces the end cost of low carbon heat for customers.

1.3. This document should be read in conjunction with Enfield's Local Plan documents, including the Core Strategy (2010) and Development Management Document (2014).

1.4. This SPD will be considered by the Council's planning officers and Planning Committee when making decisions on planning applications. The requirements in this SPD will be secured by conditions imposed as part of planning decisions or via a Section 106 legal agreement.

What are decentralised energy networks and why are they needed?

2.1. A decentralised heat network is a system of pipes that move energy in the form of hot water and/or steam from where it is created, to where it is needed, much like an electricity network.

2.2. Decentralised energy networks can deliver significant economic, environmental and social benefits for the borough, including low carbon heat to residents, businesses, industries and the public sector – helping to reduce the borough's carbon footprint; and facilitating new investment and jobs.

2.3. Acknowledging these issues, the Council has been working closely with the GLA, North London Waste Authority, central Government and other partners on the development of the Lee Valley Heat Network (LVHN). It is intended that the Lee Valley Heat Network will use heat and steam from the Energy from Waste (EfW) facility at the Edmonton Eco Park – the Strategic Heat Network. In parallel, a number of satellite schemes will be developed, with their own dedicated Combined Heat and Power (CHP) plants or biomass generating plants providing low carbon from on-site/local heat sources. Over time, there will be opportunities to connect the LVHN network to additional heat sources elsewhere in the Lee Valley, including Satellite Schemes.

2.4. The Council has set up a local authority controlled company, Lee Valley Heat Network (LVHN) Ltd, as an ethical operator to help protect local consumers by ensuring fair price and customer service terms to residential customers. This is not always the case elsewhere, as decentralised heating is an unregulated sector of the energy market. The LVHN Ltd would be responsible for managing the design, build and operation of key infrastructure, and customer services for those connected into, its Strategic Heat Network. In addition, it will take on all other viable Satellites schemes in the borough. It will provide heating and hot water to homes, businesses and public bodies in the Lee Valley sub-region. It will also adopt, maintain and operate various energy assets made available by the Council.

2.5. The SPD currently only provides guidance on gas CHP and biomass low carbon fuelled decentralised energy networks. It does not cover other types of low carbon heat sources, and it does not cover cooling technologies. This SPD does not preclude other heating solutions being explored, such as the use of canals and rivers, however, these alternative proposals would have to demonstrate that they are feasible and viable.

The structure of this document

3.1. The structure of this SPD is as follows:

- Part A sets out a specification for the Energy Centre and Primary Heat Network and the building main heat exchanger to supply residential and commercial developments.
- Part B sets out a specification for Secondary Heating Networks, Customer Meters and Heat Interface Units at Residential Developments (including Small Commercial Areas Supplied via the Residential Building Heating System).
- Part C sets out a specification for Secondary Heating Networks at Commercial Developments.

3.2. Parts A, B and C of the SPD should be referred to when DMD 52, Part 4 applies. Parts B and C should be referred to when DMD52, Parts 1, 2 and 3 applies.

3.3. Where it can be demonstrated that the DMD requirements are not technically feasible or economically viable, developments will be required to be designed to enable its connection to a decentralised energy network in future, or provide a contribution for the expansion of decentralised energy networks, or other carbon reduction measures within the borough, where reasonable and appropriate. Please see further guidance on monetary contributions in the Section 106 Supplementary Planning Document.

3.4. This SPD DOES NOT COVER:

- the adoption process for the Energy Centre and Primary Heat Network – this will need to be the subject of a separate legal agreement.
- Information on other consents/agreements likely to be required, including:
  - Building Regulations approvals
  - Environmental Permits
  - Consent for public highway works (i.e. section 50 streetworks licences)
  - Effluent Discharge licences
  - Connection agreements
  - Utility connections
  - Distribution Network Operator compliance
  - Flood Defence Consents
  - Other legal agreements (i.e. leases and easements)

Part A
Decentralised Energy Network SPD:

Specification for the Energy Centre and Primary Heat Network

Contents

Contents

Definitions

The following terms should have the following meanings when used in this Specification:

"Area Wide Network" means a separate large Decentralised Energy Network serving many developments in the London Borough of Enfield.

"CHP" means Combined Heat and Power.

"Developer" or **"applicant"** is the company responsible for the delivery of the Development.

"Development" is the land and buildings (residential and commercial) that will be served by the Decentralised Energy Network following completion of the building phases.

"DNO" means Distribution Network Operator.

"Decentralised Energy Network" means:

- the Energy Centres; and
- the Primary Heating Network.

"Energy" is heat.

"Energy Centre(s)" is the location within the Development where the energy generation plant is located.

"Energy Company" is the supplier of Energy.

"Energy Services" means the heating services.

"Enfield Council" is the London Borough of Enfield and their delegated representatives.

"Heat Customer" means a person who receives Energy Services.

"Heat Interface Unit (or HIU)" means the unit that transfers heat from the Secondary Heating Network to the dwelling heating system.

"Network Meter" means the meter measuring the total supply of Energy Services from the Primary Heating Network to the Secondary Heating Network, installed in the Substation Plantroom.

"Primary Heating Network" means the network, associated service and assets on the primary side of the Substation.

"Residential Unit(s)" means a unit within the Development which is primarily used for residential purposes.

"Secondary Heating Network(s)" means the network, associated services and assets on the secondary side of the Substation to the HIU in residential developments.

"Specification" means this document/specification.

"Substation(s)" is the point of connection between the Primary Heating Network and the Secondary Heating Network. The Substation provides an indirect connection via plate heat exchanger(s) to the Primary Heating Network. A plate heat exchanger is used to transfer heat from the Primary Heating Network to the Secondary Heating Networks installed within the individual buildings within the Development.

"Substation Plantroom(s)" is the room, located within the Development, in which the Substation is installed.

"Technical Design Pack" means a technical design pack containing the following information:

For outline planning applications, should include but not limited to:

- A site layout drawing showing Energy Centre, Energy Centre plant (pumps, thermal stores, pressurisation units, expansion vessels etc.) including space allowed for plant expansion
- A site layout drawing showing Primary Heat Network route to Substation, and Substation location
- Carbon reduction calculations
- Calculated peak heat capacities for the development
- Capacities of key plant items (CHP, gas boilers, thermal store, Substations)
- Location and size of Substation plant room(s)

For full planning applications, should include but not limited to:

- Schematic drawing showing Energy Centre plant (number of pumps, thermal stores, pressurisation units, expansion vessels etc.), and development Primary Heat System to Substations, including heat exchangers and meters
- A site layout drawing showing Energy Centre, Energy Centre plant (number of pumps, thermal stores, pressurisation units, expansion vessels etc.), including both access and maintenance clearances and space allowed for plant expansion
- A site layout drawing showing Primary Heat Network route to Substation, Substation location, Substation and plant layout within Substation
- Outline specification detailing key component parts, system design capacities, design operational parameters, and proposed method of achieving variable volume control philosophy of the system.
- Annual heat loss calculations for the Primary Heat Network
- Carbon reduction calculations
- Calculated peak heat capacities for the development
- Capacities of key plant items (CHP, gas boilers, thermal store, Substations)
- Location and size of Substation plant room(s)
- Operating flows and temperatures on primary heat network

If the details submitted with the planning application are considered to be acceptable and if the LPA are minded to approve the scheme a Detailed Technical Design Pack will be secured by way of s106 agreement (see below).

Submission of further details secured as part of s106 agreement to include but not be limited to:

- Updated schematic drawing showing Energy Centre plant (number of pumps, thermal stores, pressurisation units, expansion vessels etc.), and development Primary Heat System to Substations, including heat exchangers and meters
- Updated site layout drawing showing Energy Centre, Energy Centre plant (number of pumps, thermal stores, pressurisation units, expansion vessels etc.), including access and maintenance clearances, and development Primary Heat System route to Substations
- Updated site layout drawing showing Primary Heat Network route to Substation, Substation location, Substation and plant layout within Substation
- Detailed specification detailing key component parts, system design capacities, design operational parameters, product manufacturers, pipe materials, insulation levels, thermal expansion control, noise & vibration control, and system control philosophy of the system
- Updated annual heat loss calculations for the Primary Heating Network
- Updated carbon reduction calculations
- Updated calculated peak heat capacities for the development
- Updated capacities of key plant items (CHP, gas boilers, thermal store, Substations)
- Updated location and size of Substation plant room(s)
- Access/maintenance/replacement strategy for Energy Centre and Substation(s)
- Noise and vibration strategy for Energy Centre and Substation(s)
- Ventilation strategy for Energy Centre and Substation(s)
- Foul and surface drainage within Energy Centre and Substation(s)
- Ash disposal system if using biomass
- Design of the pipework (also accounting for thermal expansion) within Energy Centre and Substation(s)

Definitions

- Confirming operating flows and temperatures on primary heat network
- Procedures for maintaining water quality requirements
- Pipework pressures on primary heat network
- Materials to be used for underground pipework for primary heat network
- Underground pipework depths
- Vents for underground pipework

By way of condition and s106, details on other relevant matters such as external appearance, transport and access, noise, vibration, ventilation, air quality, and drainage will be subject to assessment and approval process.

2 Introduction

2.1 Introduction

2.1.1 In accordance with policy DMD 52, Part 4, where there is no connection available to a decentralised energy network and no decentralised energy network is planned within range, and the level of heating demand makes it feasible, developments should incorporate the following:

a) Energy Centre

b) Plant and pipework within the Energy Centre

c) Primary Heating Network

d) Substation

e) Substation Plantroom

f) Temporary boiler space

g) Secondary Heating Network

h) Customer metering and Heat Interface Units

2.1.2 Part A provides guidance for items a) – c), Parts B and C provide guidance on the rest of the required items - d) - h) .

2.1.3 The information in this document is provided to ensure that the required decentralised energy infrastructure operates efficiently, has longevity, delivers the intended carbon emission reductions, and reduces the end cost of low carbon heat for customers.

2.1.4 Where Decentralised Energy Networks are provided as part of developments, they also ensure that the systems have the ability to be extended to nearby developments.

2.1.5 With respect to policy DMD 52, Part 4, the Applicant will be responsible for the provision of a complete and operational Decentralised Energy Network and Development heating system, incorporating all plant and equipment necessary for their full and proper operation to meet the energy delivery requirements set out in this Specification.

2.2 Structure of Part A

General Requirements

2.2.1 Section 3 covers general requirements of the scheme including but not limited to carbon savings and the required design life for the Decentralised Energy Network.

Energy Centre

2.2.2 Section 4 details the specific requirements for the Energy Centre design and installation so that it:

- Is suitable for the plant provided as part of the Development
- Has space to allow further plant to be added by the Energy Company to supply future developments nearby
- Allows the Energy Company to operate, maintain and replace all plant
- Is of a construction that minimises ongoing maintenance
- Is of a construction that maximises its life expectancy

2 Introduction

Plant within the Energy Centre

2.2.3 Section 5 details the specific requirements for the plant within the Energy Centre in terms of the product so that they:

- Are suitable for the Energy Services to be provided by the Energy Company
- Can be easily maintained throughout their life and is constructed so as to maximise the ease of maintenance
- Will achieve a life expectancy that is compatible with the long term heat service to be provided to customers

Primary Heat Network

2.2.4 Section 6 details the specific requirements for the Primary Heat Network system design, materials specification and installation workmanship so that it:

- Is efficient in its transfer of heat to the development buildings
- Has capacity to allow further developments nearby to be connected by the Energy Company
- Allows the Energy Company to easily operate, maintain and replace
- Is of a design and installation that minimises ongoing maintenance
- Is of a design and installation that maximises its life expectancy

2.2.5 This section also details water quality treatment standards that are required within the Primary Heat Network at completion of the testing and commissioning process.

2.2.6 For the avoidance of doubt, the design requirement for the Primary Heat Network should be based on:

- **Variable volume, constant temperature** to suit the fluctuations in customer demand and environmental conditions
- **Very low heat loss** to minimise wasted heat and excessive energy bills.

Substation and Metering

2.2.7 Section 7 details the specific requirements for the Substation, including the heat exchanger, heat exchanger controls and network metering system so that they:

- Are suitable for the heat service to be provided by the Energy Company
- Can be easily maintained throughout their life
- Will achieve a life expectancy that is compatible with the long term Energy Services to be provided to customers.

3 General Requirements

3.1 General

3.1.1 Plant and equipment which has been widely used on other similar installations in the UK and can be supported by UK agents or suppliers without recourse to contacting any organisation outside of the UK should be used. No plant or equipment should be bespoke or in any way trialled or demonstrated as a result of being incorporated in this installation.

3.1.2 Furthermore any spare parts which may be required by the Energy Company for operation, maintenance or repair for any installed plant and equipment should be readily available in the UK.

3.1.3 The Decentralised Energy Network should be of a high-quality and robust enough to provide a resilient Energy supply with a life expectancy that befits an industrial process.

3.2 Responsibility

3.2.1 The Development must incorporate a complete and operational Decentralised Heating System, incorporating all plant and equipment necessary for its full and proper operation and to meet the energy delivery requirements set out in this Specification, including but not limited to: security and fire safety systems; heating; lighting; ventilation and cooling; public health services; and mechanical and electrical services associated with the plant.

3.3 Carbon Savings

3.3.1 With respect to policy DMD 52, Parts 1, 2 3 and 4, at the planning stage, detailed design stage and construction stage the Applicant should estimate the carbon reduction provided by the Decentralised Energy Network and Secondary Heating Networks (including system losses) based on the following methodology:

Annual carbon saving = baseline carbon emissions - Anticipated scheme carbon emissions

Annual % carbon saving = Annual carbon saving/baseline carbon emissions

Baseline carbon emissions will assume gas-fired boilers supply all heat and supply of electricity from the national grid.

The anticipated carbon emissions will be calculated including all fuel and energy use required to deliver energy to consumers.

Emissions factors taken from the latest guidance from DEFRA/DECC on greenhouse gas reporting will be used in all calculations of carbon emissions.

3.3.2 Presentation of the carbon saving calculation should include as a minimum:

- Baseline annual carbon emissions
- Anticipated scheme annual carbon emissions
- Annual gas consumption of thermal plant
- Annual electrical consumption of thermal plant
- Annual electrical consumption of all ancillary plant
- Annual losses associated with thermal distribution
- Annual thermal energy delivered to consumers
- Annual gross electrical generation, if applicable.

3.3.3 The Applicant should advise on the designed and installed carbon intensity of heat in $kgCO_2/kWh$ and should produce calculations to demonstrate this.

3 General Requirements

3.4 Sizing, Capacity and Optimising Design

3.4.1 The Decentralised Energy Network should be sized in order to meet the maximum thermal demand from the Buildings including the peak domestic hot water demand. Calculations should be produced showing how the maximum thermal demand including peak domestic hot water demand has been accounted for in the design.

3.4.2 The design should be optimised to suit both winter and summer operating conditions to minimise carbon dioxide emissions and operating costs. This should include modelling a typical operational year on an hourly basis based on a 20 year degree day average year.

3.4.3 The design should be optimised to minimise thermal losses in distribution and pumping power usage. The Applicant should demonstrate this in its technical submissions to Enfield Council.

3.5 Continuity of Supply and Redundancy

3.5.1 The Decentralised Energy Network should be capable of delivering continuous uninterrupted heat to the consumers during operation. All plant and equipment should be designed for continuous duty.

3.5.2 The applicant will be required to demonstrate that their design can be operated and maintained effectively to ensure continuity of supply e.g. by the use of standby plant etc. as required.

3.5.3 Via the duplication of appropriate plant, but not pipework, the Decentralised Energy Network should be designed to have an availability of 100%. The applicant should demonstrate how this is achieved and this should include but not be limited to standby boilers, standby pumps, duplex filters etc. as required.

3.5.4 During construction, the Energy Centre must have a heat supply during winter periods which does not cause damage to the plant or building fabric.

3.5.5 Temporary heating connections must be at a location which can be accessed by the Energy Company for connection of temporary heat supply plant in accordance with this specification to ensure that no building served by the Primary Heating Network is without the supply of heat at any point during the maintenance or replacement of any elements of the scheme.

3.5.6 Meeting the Heat Customer’s demand is of primary importance, therefore there should be allowances made for adequate redundancy by providing an N+1 plant configuration; this should be submitted to Enfield Council for agreement. The Applicant should install sufficient back-up boiler capacity in the Energy Centre to satisfy and guarantee their obligation for meeting 100% of the heat and hot water demand.

3.5.7 Substations should comprise duty and stand-by heat exchangers, each should be sized with capacity to deliver 60% (total in aggregate 120%) of the heating and domestic hot water demand. Suitable automatic shut-off systems should be installed to ensure that during low demands in the summer the standby unit is isolated.

3.5.8 Pressurisation equipment for the Decentralised Energy Network should be designed and installed with 100% primary and 100% back up.

3.5.9 No redundancy is required for the CHP unit.

3.5.10 No redundancy is required for the Primary Heat Network, although capacity within the pipes should be sufficient to satisfy the peak heat and hot water demand requirement plus any future development expansion identified by Enfield Council.

3 General Requirements

3.6 Connection of Future Developments and/or to an Area Wide Network

3.6.1 At a location agreed with Enfield Council at the boundary of the Development, the development should include a heat supply pipe connection (flow and return) to the Energy Centre which may form a part of the Distributed System, sized to the maximum demand of the Decentralised Energy Network to enable a future Area Wide Network to connect.

3.6.2 At Enfield Council specified locations, the Primary Heat Network should be provided with a tap off and valve to allow the Primary Heat Network to be extended to future developments. The Primary Heat Network should be sized to these agreed locations to carry the capacity required for the Development and the future development loads.

3.7 Design Life

3.7.1 It should be noted that as the plant and systems are being used for decentralised heating which is supplied throughout the year, the operating hours for the plant will be considerably greater than those for example in a new build office development. The plant and equipment selected must be capable of such intensive use.

3.7.2 The specific design life requirements for the Energy Centre, plant and equipment are covered in more detail in the relevant sections below, however the following are minimum requirements:

Component	Minimum Design Life
Energy Centre Structure and Civil Works	60 years
Energy Centre Façade	40 years
Energy Centre Roof	40 years
Boilers	30 years
CHP Engines	15 years
Pumps	20 years
Controls	15 years
Pressurisation Units	20 years
Thermal Stores	30 years
Ventilation Plant	25 years
Above Ground Pipework	40 years
Below Ground Pipework	50 years

Table 3.1

3 General Requirements

3.8 Utilities

3.8.1 Each utility connection should be dedicated to the Decentralised Energy Network with its own Connection and Supply Agreement and meter with the relevant DNO/utility provider.

3.8.2 The utilities should be suitable for both the Development and the future expanded capacity of the Decentralised Energy Network.

4 Energy Centre

4.1 General

4.1.1 Dependent upon the actual plant installed, the Energy Centre may need to house plant which is:

- Very noisy, requiring careful acoustic measures (CHP Engines)
- Tall, in comparison to normal plant requiring special design provisions (Thermal Stores and Flues)
- Large, requiring careful design for access both during installation but also replacement (Boilers, CHP Engines, Thermal Stores and Flues).

4.1.2 The Energy Centre should be of a construction that:

- Minimises on-going maintenance and is designed for ease of maintenance
- Maximises its life expectancy
- Is harmonious with the buildings around it
- Has sufficient space within it to allow additional plant to be installed by the Energy Company in the future.

4.1.3 The design of the Energy Centre require careful consideration, and applicants are encouraged to engage with Enfield Council in this respect.

4.1.4 Details, specifications and drawings will be required to demonstrate compliance with the requirements of section 4.

4.2 Spatial Requirements

4.2.1 The following discrete rooms are required within the Energy Centre:

- Boiler room
- Pump room (can be part of boiler room)
- Electrical switchroom
- Transformer room
- CHP Engine enclosure
- Thermal store area (can be part of boiler room)
- Control room/office

4.2.2 Within these rooms the applicant should design, install, test, commission and set to work the plant required to provide a low carbon Decentralised Energy Network for their Development with a plant strategy that has been agreed with Enfield Council. Additional space should be provided within the Energy Centre to allow the Energy Company to add plant to expand the Decentralised Energy Network to other developments. Enfield Council will advise on the amount of additional space to be provided, which should include provision for additional CHP engines, boilers, pumps, controls and associated services. The Energy Centre should be designed to allow such additional plant to be installed without the requirement for additional civil or structural works or the need to install additional flues, piping or, ventilation. The need for plant access for this additional plant should be taken into account when designing and installing the Energy Centre and the plant and equipment contained therein.

4.3 Construction and Materials

4.3.1 The design life of the Energy Centre structure should be a minimum of 60 years and be designed to all relevant British Standards and Codes of Practice. In order to achieve this, the following is recommended:

- All concrete work should be designed with sufficient cover and suitable mix proportions to protect the embedded reinforcement from corrosion/carbonation for the structural design life of the building.

4 Energy Centre

- Applied durability/corrosion protection coatings should protected by barriers where damage is likely to occur e.g. maintenance areas, car park and service areas.
- Sub-structures should be waterproofed, including any sumps and trenches, against ground water, ensuring no damp patches are visible.

4.3.2 Dead loads and live loads should be designed to, but not limited to, the following; suit the construction materials, the location and plant to be installed. Particular attention should be given to floors provided for boilers, CHP engines and thermal stores and lifting beams required for maintenance.

4.3.3 The Energy Centre building fabric should be constructed using materials that require very little maintenance during their life.

4.4 Access and Maintenance/Replacement Requirements

4.4.1 All plant and equipment should be arranged so that components can be installed and operated, accessed, cleaned, maintained, removed and replaced without unreasonable difficulty. Unless it is an integral part of a standard design, i.e. a burner mounted on the front of a boiler, no item of plant should be installed so that it needs to be removed to enable access for normal operation or maintenance of any other item. There should be no requirement to put in place any temporary access towers for normal operation and maintenance for tasks that are required annually or less.

4.4.2 In addition, maintenance and replacement of plant and equipment must be achievable without interrupting heat supplies to the primary network.

4.4.3 Access for plant replacement should be on the ground floor and be through dedicated access routes. This access must be designed so that it can be used 365 days a year and 24 hours a day without any prior approvals or the removal of other plant.

4.4.4 Lifting beams should be installed to negate the use of mobile hoists for the major overhauls required to the CHP engines and replacement of all pumps above 20kW or any plant item which has a weight of greater than 100 KGs.

4.4.5 All plant must be able to be removed from the building without the need for dismantling parts of the building.

4.4.6 Doors of a sufficient size and number should be provided for all plant and plant components that require removing for maintenance every 5 years or less under normal operation without the need to dismantle or break up the plant that requires removal. For plant and plant components that require removing for maintenance at greater intervals than 5 years under normal operation, either doors or removable panels may be provided as long as there remains no need to dismantle or break up the plant before removal.

4.4.7 Any isolation valves should also be installed so as to be accessible and operable from ground level without requiring any steps, ladder or overreaching etc. and if this is not possible then a permanent safe means of access should be provided which can be used by a lone working operative.

4.5 Noise and Vibration

4.5.1 The applicant should develop a strategy to prevent the transfer of noise and vibration from the Energy Centre to adjacent buildings and areas and submit this to Local Planning Authority for approval.

4.5.2 It is recommended that Residential Units are not designed adjacent to the Energy Centre. An open area or common area is desirable.

4.6 Building Services

Design Criteria

4.6.1 The plant spaces should be designed to be unconditioned; with heat removal by natural ventilation or mechanical ventilation to ensure the above upper temperature limit constraints are achieved.

Testing and Commissioning

4.6.2 All building services systems within the building should be commissioned in line with the Building Services Research and Information Association (BSRIA) and the Chartered Institute of Buidling Services Engineers (CIBSE) guidelines, best practice and current Building Regulations.

Boiler Room Ventilation

4.6.3 The boiler plantroom should be ventilated to provide air for combustion and to dissipate the heat emitted by the boilers.

4.6.4 Unless noise levels require a wholly mechanical ventilation solution, the boiler room ventilation should be via natural ventilation as long as the above upper limit temperature constraints can be achieved.

4.6.5 If upper limit temperature constraints require mechanical ventilation the plantroom should be kept under positive pressure by providing the supply air mechanically and allowing a naturally vented exhaust air solution via acoustic louvres. The supply air should be ducted at low level in a number of locations. The acoustic louvres will be positioned at high level in the external façade for the hot air to be discharged to atmosphere.

4.6.6 Ventilation requirements should be in accordance with BS 6644 and IGE/UP/10.

4.6.7 Any mechanical ventilation should be provided with separate run and standby supply fan ventilation units, each with F7 bag filters, and variable speed drives.

Pump Room Ventilation

4.6.8 The pump plantroom or area should be ventilated to dissipate the heat given off by the pumps and associated heating plant.

4.6.9 At least two temperature sensors connected to the BEMS should be provided within the pump room/area.

4.6.10 If possible the pumps should be ventilated via the same system as the boilers if they are located within the same area and as long as the above upper limit temperature constraints can be achieved.

4.6.11 Any mechanical ventilation should be provided with separate run and standby fan ventilation units, (each with F7 bag filters if supply), and variable speed drives.

Potable Water

4.6.12 A suitably sized potable water supply should be provided to the Energy Centre with break/storage tank and booster pumpset. The storage tank should be sufficient for 24 hours of normal water usage.

4 Energy Centre

4.6.13 All water serving items of equipment or plant in the Energy Centre should be fitted with suitable backflow/ back siphonage devices (subject to fluid category risk).

Foul and surface Water Drainage

4.6.14 The plant within the Energy Centre will use lubricants or oil as part of their operation, all gullies and drains that could collect hydrocarbons should send the waste to an alarmed main interceptor before discharging water to foul sewers; this should be linked to the BEMS. Each drain or gulley that may take hydrocarbons to the main interceptor should be fitted with a smaller interceptor to remove small contaminated spills and allow for easy cleaning and maintenance. All such interceptors should be located so that they can be safely and easily accessed for maintenance purposes.

4.6.15 The materials used for the drainage pipes should pay due regard to the likely chemicals that may be in the foul water drainage.

4.6.16 The foul and surface water drainage system should be designed to comply with policies in the Development Management Document (DMD).

Internal Lighting

4.6.17 Internal lighting should be via very efficient light sources and fittings appropriate to the area. All light fittings in areas other than the control room/office should be to IP54. Lighting levels should be to CIBSE recommendations with the exception of the following areas:

Area	Lighting Level at floor level and front of equipment
Boiler Room	200 lux
Electrical Switchroom	200 lux
Pump Room	200 lux
CHP Engine Room	200 lux

Table 4.1

Emergency Lighting

4.6.18 An emergency lighting system should be provided to BS5266 in all areas.

External Lighting

4.6.19 External lighting should:

- Allow safe pedestrian access and egress from the Energy Centre
- Take in to account effects on neighbouring properties
- Ensure adequate lighting levels for security without the need for infrared lighting and/or extra low light CCTV cameras

4.6.20 The external lighting should use very efficient light sources and fittings, and be easily maintainable.

Fire Alarm

4.6.21 A standalone or extension from an intelligent and addressable fire alarm system should be provided to BS5839 Category P1. If Building Control requires a life safety category, then this should be to Category L1 to provide a similar level of property protection.

4.6.22 The fire alarm panel should be provided with an auto dial facility and phone line.

4 Energy Centre

4.6.23 The types of detectors should be appropriate for the space and easily accessible for maintenance and replacement. Boiler rooms and CHP Engine Rooms should be provided with heat detectors.

4.6.24 All plant areas should be provided with flashing beacons as well as sounders.

4.6.25 The fire alarm system should interface with the relevant plant components that need to be shut down in the event of an alarm, however, the building should be carefully fire compartmented and the fire alarm system zoned to ensure that the main heating plant, pumps and controls are not shut down due to fire alarms in other areas.

Security

4.6.26 An access control and intruder alarm system to EN50131 should be installed to protect the building and restrict access to authorised personnel only.

4.6.27 The access control system and intruder alarm system should be provided with an auto dial facility and phone line that should relay alarms to an Energy Company agreed off site facility.

4.6.28 A CCTV system should be provided with both local and remote site monitoring equipment.

Access Control

4.6.29 Access control to one of the external doors should be by means of proximity card/ PIN readers and electric locks. Egress should be achieved by operating a push button on the secure side of the door which will release the door lock for a predetermined time, after which the door will re-lock. Also on the secure side of the access door, a green break glass should be installed for emergency operation.

Intruder Alarm System

4.6.30 An intruder alarm system should be provided to protect the building from unauthorised or forced entry while the building is unoccupied. The alarm will be set and unset from a main security alarm panel located at the main entrance point. The alarm will be activated if any of the external doors are opened while the alarm is armed. Door contacts will be provided to all external doors and breaking glass sensors to any glazing.

CCTV System

4.6.31 A high quality CCTV system should be installed covering all openings, e.g. doors and louvres, with remote site monitoring. The CCTV system should comply with the Home Office CCTV Operational Requirements Manual.

4.6.32 Each point of entry, exit and any opening should be captured by at least one fixed camera. The cameras should be tamper resistant. At camera points the lighting must be sufficient so that the perception of colour is relatively accurate (a minimum value of 60 on the Colour Rendition Index), be of a white light and be a flat illumination to reduce shadowing.

4.6.33 All CCTV cameras are to be recorded on digital video CCTV recorder(s). Good quality CCTV images must be captured with a minimum image capture rate of 12 frames per second and a minimum resolution of 2CIF. The recorder must be capable of continued recording when replay of images takes place. Images must be retained for a period of 14 days and should then be overwritten. A system of loss-less compression should be provided.

4.6.34 The CCTV system should include a method for viewing and reviewing images. This should be a 17" CCTV monitor or better, which can be switched to view each CCTV camera individually and located within the Energy Centre control room.

4.6.35 In addition, the CCTV system should relay real time images via a suitable communication connection to an offsite facility agreed with the Energy Company.

4 Energy Centre

Telephones

4.6.36 Telephone lines should be provided for the relevant equipment specified as requiring a telephone line in this specification, plus at one line to the control room/office.

5 Plant and Pipework within Energy Centre

5.1 General

5.1.1 The sizing of plant should be undertaken by the applicant and approved by Enfield Council, however, with respect to the sizing of the CHP, gas boilers and thermal stores, the table below states the plant size and numbers that should be provided.

5.1.2 Third party manufacturer controls will be permitted on the following plant: CHP engines, boilers and pump controllers subject to approval by Enfield Council, however, note BEMS control and monitoring interfaces required within the controls section below.

5.1.3 The Decentralised Energy Network should use plant and equipment which has been widely used on other similar installations in the UK and can be supported by UK agents or suppliers without recourse to contacting any organisation outside of the UK. No plant or equipment should be bespoke or in any way trialled or demonstrated as a result of being incorporated in this installation.

5.1.4 The following table outlines the required size and number for the following key plant items; CHP, gas boilers and thermal stores. These have been based on the calculated peak heat capacities for a Development and should be the basis of the design unless agreed otherwise with Enfield Council. The table determines the plant sizes based on the number of dwellings that correspond to these peak capacities when built to Code for Sustainable Homes (CfSH) Level 4 and assumes network losses are to the Specification. Should the homes not be designed to CfSH Level 4, and/or non residential buildings form part of the development, early engagement with the Council is encouraged so advice can be provided on the revised the CHP, gas boiler and thermal store requirements when information is provided to Enfield Council.

Peak Heat Demand (kW)	No. of Dwellings	CHP Size (kWe)	No. of CHP	Thermal Store (m3)	Gas Boiler (number & size)
1000	200	100	1	25	3 x 500 kW
2000	400	200	1	40	3 x 1000 kW
3000	750	400	1	70	3 x 1500 kW
4000	1000	500	1	100	3 x 2000 kW
5000	1250	650	1	120	3 x 2500 kW
6000	1500	725	1	135	3 x 3000 kW

Table 5.1

5 Plant and Pipework within Energy Centre

5.2 CHP Engines

5.2.1 All CHP plant should be designed to achieve, as a minimum, the requirement of 'Good Quality CHP' as specified by the Combined Heat & Power Quality Assurance (CHPQA), with a CHPQA index of 105 or greater.

5.2.2 All electrical equipment within the Energy Centre should be supplied from the CHP unit when the unit is operating, minimising imported power consumption. The CHP should also be connected to supply power via a private wire network to appropriate commercial buildings within the development where provided.

5.2.3 CHP engines should be gas fuelled and suitable for industrial applications with all necessary controls to provide a fully automated CHP system without the need for manual intervention.

5.2.4 The entire CHP installation should be designed and installed in such a manner that a minimum availability of 94% can be achieved over the life of the CHP.

5.2.5 The CHP should be capable of a life expectancy in accordance with this Specification; operating continuously with a return water temperature of 70°C, subject to normal maintenance.

5.2.6 The CHP should be low NOx with an output of no greater than 250 mg/m^3 (5% O_2) and have an efficiency of no less than 80% at full load based on the gross calorific value of gas.

5.2.7 The CHP will normally operate at 100% output but should also operate down to 60% of its maximum continuous rating (MCR). This modulation between 100% and 60% should be undertaken automatically by the control system as heat load on the network fluctuates across the day/year.

5.2.8 The CHP should operate in parallel with the electrical DNO network ensuring full compliance with ER G59/1. All necessary approvals, testing and certification to enable the CHP to synchronise with the grid, export electricity and supply electricity to any on site private wire network should be obtained from the electrical DNO.

5.2.9 Flues should generally be stainless steel, fully welded, twin wall, high grade, with stainless steel grade 316 inner lining and stainless steel grade 304 outer lining. The flue should be compliant with BS EN 1856 and should be suitable for use in a pressurised CHP flue without any leakage or degradation. It should be designed fully in accordance with the manufacturer's specification, particularly in relation to minimising back pressure on the engine.

5.2.10 Where the CHP unit is located in an acoustic enclosure the panels should be easily demountable and remountable repeatedly by a lone working operative in a safe manner.

5.2.11 The enclosure should be designed for ease of maintenance of the plant contained therein and it should not be necessary to remove sections of the acoustic enclosure frame for normal operation and maintenance tasks which would occur within one year of normal operation.

5.2.12 Viewing windows should be added to the enclosures to enable the operatives to safely view the engine whilst in operation on both sides from ground level.

5.3 Biomass Boilers

5.3.1 Should it be agreed by Enfield Council that a biomass boiler solution is preferred in lieu of a CHP based solution, the following should apply.

5.3.2 The boiler and associated plant should be specified, designed, installed and tested to ensure that it fully complies with the requirements to receive and maximise Renewable Heat Incentive (RHI) support for the scheme.

5 Plant and Pipework within Energy Centre

5.3.3 Boilers should be steel shell and tube suitable for industrial applications with controls that are compliant with the latest edition of the Building Regulations Part L, exempt from the Clean Air Act, with a valid emissions certificate in the form required by OFGEM for claiming the RHI using the intended fuel (if an onsite test is required this should be at the sole cost of the supplier), and provided with an RHI compliant ultrasonic heat meter.

5.3.4 The boiler and all associated systems should comply with all best or recommended practices contained within CGT012 as published by the Carbon Trust.

5.3.5 The burner should have full modulating control from 100% to 30% output with no loss in performance, with a power control derived from thermal store charge status. Up to 1MW the boiler should shut down when there is no load and restart automatically when there is, based again on store charge. Above 1MW due consideration should be given to how the boiler operation is to be conducted at times of low load and agreed with Enfield Council.

5.3.6 The boiler should not require internal inspection or maintenance requiring shutdown from normal automatic operation at intervals of less than one month.

5.3.7 The fuel should be wood pellet for all boilers of less than 1 MW and for boilers above this size the fuel should be wood chip, unless agreed otherwise with Enfield Council. The fuel delivery system should be automatic and include sufficient capacity to run the boiler for at least 3 days without the need for further fuel delivery.

5.3.8 The fuel storage should be in an adjacent area to the boiler and should be appropriate for the size of boiler and type of fuel selected. The methods of wood storage and supply should as a minimum comply with the following:

- Be robust and not prone to failure under normal operation and have been widely used in the UK
- Be tolerant of a reasonable variation of fuel supply quality as would normally be expected within the UK, (for chip typically ONORM 7133 grades G50/W50 or G100/W50, for pellet EN Plus A2 or B grades)
- Considering the above, be capable of working with fuels from at least three different UK suppliers who have fuel storage/production facilities within 100 miles of the Development
- Be capable of taking, where required, the weight of any delivery vehicle or equipment
- For wood chip, stores should be designed to prevent bridging or jamming and a dual scraper floor or top-loader type system should be used unless otherwise agreed with Enfield Council
- should not use a method to fill the store or transport the fuel to the boiler which:
    - requires manual intervention except for supervision of the delivery
    - repeatedly blocks or jams under normal operation
    - is incapable of receiving standard size loads and requires a specific vehicle delivery mechanism or size which is only available from one wood fuel supplier; and
- Should have suitable safety detectors, interlocks and systems to prevent operator accidents arising from CO build up and to prevent operator injury during inspection.

5.3.9 The boiler should be designed and equipped such that in the event of mains power failure, thermal runaway is prevented by means of mains water fed cooling coils with failsafe valves, UPS powered cooling pumps or equivalent means.

5.3.10 Prevention of burn-back from the boiler to the fuel feed should be provided by means of:

- Spring close flap, rotary valve or guillotine valve, and
- Water dousing not dependant on mains power, and
- Vertical drop or temperature sensing.

5 Plant and Pipework within Energy Centre

5.3.11 An ash disposal system should be provided which should be suitable and appropriate for the type and size of boiler and should require minimal operator intervention. It should have the facility on site to allow ash not to need to be removed more than once per month. Where practical the system should be fully automatic.

5.3.12 The boiler should be capable of a life expectancy as detailed in this Specification operating continuously at an operating temperature of 95°C, subject to normal maintenance.

5.3.13 The boiler should be provided with the necessary emissions abatement technologies to meet local EHO & RHI PM/NOx requirements, such as multicyclones. If additional filtration is required for EHO or RHI purposes then this should be included in the boiler package and fully coordinated with the boiler supply, for example bag, ceramic or electrostatic filters.

5.3.14 The boiler should have a gross seasonal efficiency of greater than 90% at full load with a nominal return temperature of 60°C.

5.3.15 The boiler should be provided with back end boiler protection and be connected to the heating system in a manner intended to maximise the contribution of the biomass boiler to overall heat energy production, with the thermal store being located between the boiler and the heating system.

5.3.16 The boiler design should be such so as to demonstrably minimise standing losses and provide high efficiency operation, including the provision of a minimum of 100mm of glass fibre insulation, or equivalent, such as heat recovery air jacketing.

5.3.17 Flues should generally be stainless steel, fully welded, twin wall, high grade, with stainless steel grade 316 inner lining and stainless steel grade 304 outer lining. The flue should be compliant with BS EN 1856. The flue should be designed, including access provisions, as recommended by the boiler manufacturer and industry good practice to enable inspection and cleaning without special access equipment. A sealed type draught stabiliser with explosion relief should be located at the point of lowest pressure in the flue.

5.3.18 The following table sets out the required boiler numbers and sizes based on calculated peak heat capacities for the Development, unless agreed otherwise with Enfield Council. To assist, the likely number of dwellings that correspond to the peak capacity when built to CfSH Level 4 is provided for guidance, assuming network losses are to the Specification:

Peak Heat Demand (kW)	No. of Dwellings	Biomass Boiler Size (kW)	No. of Biomass Boilers	Thermal Store (m3)	Gas Boiler (number & size)
1000	200	330	1	25	3 x 500 kW
2000	400	660	1	50	3 x 1000 kW
3000	750	1000	1	75	3 x 1500 kW
4000	1000	1350	1	100	3 x 2000 kW
5000	1250	1700	1	125	3 x 2500 kW
6000	1500	2000	1	150	3 x 3000 kW

Table 5.2

5 Plant and Pipework within Energy Centre

5.4 Gas Boilers

5.4.1 The boilers will supply heat to the decentralised heating network. The boilers will supplement the heat generation from the CHP during high demand and during any periods of low demand when the CHP is unable to operate, or it is being maintained.

5.4.2 Boilers should be of shell and tube steel condensing type with burners suitable for industrial applications and controls that are compliant with the latest edition of the Building Regulations Part L. The burners should be fully modulating.

5.4.3 The boilers should be capable of a life expectancy as detailed in this Specification operating continuously at an operating temperature of 95°C, subject to normal maintenance.

5.4.4 The boilers should be low NOx and have a gross seasonal efficiency of greater than 93% at full load with a nominal return temperature of 60°C.

5.4.5 The boilers should be designed to minimise standing losses and provide high efficiency operation, including the provision of a minimum of 100mm of glass fibre insulation, or equivalent.

5.4.6 Flues should generally be stainless steel, fully welded, twin wall, high grade, with stainless steel grade 316 inner lining and stainless steel grade 304 outer lining. The flue should be compliant with BS EN 1856. For condensing boilers, if the boiler recommends a single wall flue instead of twin wall, then it should be stainless steel, fully welded, single wall, high grade, stainless steel grade 316. The flue should be designed, including access provisions, as recommended by the boiler manufacturer.

5.5 Pumps

5.5.1 Multiple high efficiency motor pumps should be provided each with its own inverter. The number of pumps provided should ensure that they can turn down to the minimum necessary flow rate to circulate water around the Decentralised Energy Network without any demand from the buildings and without the pumps needing to cycle on and off for each phase of the Development. As a minimum, three pumps plus a standby pump unit should be provided.

5.5.2 Twin head pumps should not be used.

5.5.3 The pumps are to free floating supported by the pipework to negate the need for inertia bases, complete with flexible connections if necessary.

5.6 Thermal Stores

5.6.1 Thermal storage vessels should be manufactured in accordance with the European Commission Pressure Equipment Directive PED/97/23/EC.

5.6.2 Thermal stores should be pressurised to the same level as the Decentralised Energy Network.

5.6.3 The thermal store should be vertical and have a height to diameter ratio of no less than 2:1, ideally 2.5:1.

5.6.4 Internally, baffle plates should be provided to modulate water mixing and sparge pipes should be provided to achieve optimum circulation of water stored within the store.

5.6.5 To prevent the upper part of the shell and roof construction from corroding, an inactive atmosphere in the form of a nitrogen cushion should be provided.

5.6.6 The insulation for the stores should consist of 300mm thick, compressed mineral wool, or equivalent.

5 Plant and Pipework within Energy Centre

5.6.7 The thermal store(s) should be provided with several temperature sensors connected to the BEMS at different levels within the store, which with control valves and relevant control connections to the CHP engines should allow monitoring of the temperature stratification within the store and allow the optimisation of the automated running of the CHP engines.

5.7 Pipework, Ancillaries and Insulation

5.7.1 The pipework should be constructed of heavy grade steel pipe with welded joints and flanges at valves, pumps, etc. Threaded joints may be used up to DN50mm. Alternatively 316 grade stainless steel pipework may be used.

5.7.2 No aluminium, copper, or plastic pipework should be used for the primary heating pipework.

5.7.3 Pipe and plant making up the heating network should be properly supported taking into account movement due to thermal expansion and the need to retain support when dismantling for maintenance and repair. The support system should comply with BS3974.

5.7.4 Test points should be fitted upstream & downstream of all pumps, heat exchangers, filters, control valves etc.

5.7.5 Isolation valves should be manufactured to a standard that suits the pipework with a specific pressure-temperature rating and should be capable of giving a positive shut-off to allow the removal of any section of the system without drain down or reduction in system pressure.

5.7.6 Ball type valves should be used for isolation purposes.

5.7.7 All plant, pipework and pipeline ancillaries should be fully insulated. The insulating materials should be applied in accordance with BS 5970 and should include all pipe ends. Removable insulated valve covers should be fitted to all valves and all other pipework fittings which should be of a type which are attached with hook and eye fasteners or as otherwise approved by Enfield Council.

5.7.8 Note that insulation to plant, valves, expansion devices should be of a type that enables easy removal for inspection and maintenance, e.g. wrap around jackets or similar. Insulation should not interfere with the cooling of motors and other electrical electronic components.

5.7.9 All above ground heating pipework should be provided with 50mm thick foil faced phenolic foam with an insulation value of no less than 0.025 W/mK, or equivalent.

5.7.10 Great care should be given to ensuring the continuity of insulation to pipework, supports and plant.

5.7.11 Thermal imaging of the installation should be undertaken and ensure continuity issues are corrected.

5.8 Water Softener, Pressurisation and Filtration

5.8.1 The Energy Centre should contain a duplex water softener which should be capable of an output of softened water which would fill the network with softened water within 24 hours from empty. Suitable dosing equipment and dosing points should also be installed within the Energy Centre.

5.8.2 A run and standby pressurisation unit should be provided.

5.8.3 Suitable dosing equipment and dosing points should be installed within the Energy Centre. Automatic dosing connections should be provided for at least two chemicals with automated dosing metering control systems to allow the correct amount of chemical to be added automatically when manually initiated.

5.8.4 Inline side stream filters should be installed with a small percentage water pass through. They must not be installed across the flow and return since this will compromise low return water temperatures. The side stream filter should be capable of continuous operation capable of providing side stream filtration to less than 5 microns.

5 Plant and Pipework within Energy Centre

5.9 Vents and Draining

5.9.1 Manual air vents should be fitted to all pipework where necessary for correct system operation and maintenance and at all system high points. Care should be taken to ensure that such vents are fitted to the highest point of the sections they are intended to vent.

5.9.2 Separate lever operated ball type isolation valves should be installed before automatic air vents enabling the air vents to be disconnected without any system downtime.

5.10 Thermal Expansion of Pipework

5.10.1 Movement and forces due to thermal expansion should be accounted for in the design of the pipework. Expansion should be accommodated by flexing of the pipe wherever possible and expansion joints should only be used where this is not possible.

5.11 Noise and Vibration

5.11.1 Careful attention should be accounted for in the design of the Decentralised Energy Network with respect to the transfer of noise and vibration from the plant via the structure and pipework.

5.11.2 The applicant should develop a noise and vibration strategy to prevent the transfer of noise and vibration and submit this to the Local Planning Authority for approval.

5.12 Metering

5.12.1 All metering should be automatic, provide an output for remote monitoring and be remotely monitored. The meter reading systems should be capable of reading and remotely monitoring all data being recorded by the meters, i.e. an M-Bus system, and should not just be capable of monitoring pulses of consumption.

5.12.2 Meters will monitor, on at least a half hourly basis:

- Input for each utility
- Fuels used by each heat generator
- Fuels used by each CHP plant, if present
- Heat produced by each heat generator
- Flow and return temperatures of each heat generator
- Electricity produced by each CHP, if present
- Heat network flow and return temperatures
- Heat network supply of heat (instantaneous and cumulative)
- Heat exchanger substations secondary flow and return temperatures
- Heat exchanger substations supply of heat (instantaneous and cumulative)

5.12.3 Heat meters are calibrated assemblies and in many instances will be used for billing purposes. Accordingly, each meter must be installed in strict accordance with the manufacturer's instructions.

5.12.4 Temperature sensors supplied with heat meters are calibrated leads which must not be damaged or cut. The leads cannot be extended and therefore the location of all heat meter parts should be checked prior to installation to ensure that the sensor leads will reach from pocket to calculator and that the calculator can be mounted at a readable location.

5.12.5 Flow meters should be installed in areas of undisturbed flow following the manufacturer's installation instructions.

5.12.6 Any calibration certification delivered with the heat meter should be retained for the Energy Company.

5 Plant and Pipework within Energy Centre

5.13 Building and Plant Energy Management System

5.13.1 All plant, equipment and building services systems should be controlled and monitored by an integrated Building Energy Management System (BEMS) to provide a fully automated Energy Centre without the need for manual intervention, including full UPS support to maintain operation and alarm functions in the event of a power failure.

5.13.2 The BEMS should monitor and control all elements of the Decentralised Energy Network including the following systems:

- All ventilation plant
- Boilers
- CHP engines
- Pumps
- Pump controllers (inverters)
- Control Valves
- Pressurisation units
- Thermal Stores

5.13.3 Third party manufacturer controls will be permitted on the following plant: CHP engines, boilers, pump controllers and pressurisation units; however, they must include a BEMS interface that allows at least the following to be monitored and controlled:

- Command on/off (enable/disable) via BEMS
- Command status to plant (BEMS)
- Command status to plant (local third party controller)
- Actual running status of plant (not just command status)
- Actual partial load running status, percentage of full output (not just command status)
- Each circuit input and output operating temperatures and pressures
- Individual alarms (not common alarms)

5.13.4 All control functions should be performed by the BEMS control system with field level set points (e.g. flow temperature, pressure). All normal plant operations such as plant scheduling/duty standby etc. should be adjustable via the graphics by the Energy Company's operator from the BEMS operator station installed in the Energy Centre control room. As a minimum the following graphical displays should be supplied:

- Overall system – showing energy generated and key network parameters wherever measured, e.g. pressures, temperatures etc.
- Each substation should be viewable either on a combined graphic or a graphic per page depending in the complexity of the Development. This graphic should show all of the information being gathered by the BEMS from that substation
- Energy Centre key plant and equipment – showing which plant is operating (down to individual pump level) and at what output (i.e. boiler output or position of a motorised valve) and whether any failure conditions have been experienced. This schematic should show the quantity of heat being delivered to consumers in total by the network, which plant is producing this energy and at what level
- CHP plant – showing an energy balance using data captured from the heat, electricity and gas meters
- Thermal store – showing temperatures, energy flows, amount of energy stored and whether in charge or discharge mode of operation etc.

5.13.5 All analogue inputs and outputs should have a graphical trend created, with sample intervals no less frequent than 5 minutes. Such trends should be viewable by the operator over periods varying from one hour to one month. There should be sufficient "live" data storage provided to enable the logging of these inputs and outputs for these recording periods for a one month period, together with a backup system

5 Plant and Pipework within Energy Centre

which should be set to store one year of data. The system will be capable of producing historical data, without modification or input from any data specialist, which can be extracted and exported to Excel for further analysis.

5.13.6 The control system should monitor plant and equipment for a healthy condition. Fault alarms and fault conditions should be recorded centrally with fault details, start time and end time.

5.13.7 Heat metering data should be collated and recorded at the operator’s station at the following intervals:

- Half-Hourly Usage
- Daily Usage
- Weekly Usage
- Monthly Usage
- Quarterly Usage

5.13.8 All monitored data should be logged and presented in tabular and graphical form, required as a standard feature of the monitoring and control system.

5.13.9 Controls required for safety, safe operation and interlocking of plant and equipment should be hardwired. All hardwired controls should be duplicated in software. The software selector switch commands should be overridden in software by other life or plant safety signals e.g. fire, fireman overrides, system pressure and frost shutdown.

6 Primary Heat Network

6.1 Provision of Substations

6.1.1 The interface between the Primary Heating Network and the Secondary Heating Network is achieved via the Substation located in a Substation Plantroom within the Development.

6.1.2 The Substation is provided to separate the Decentralised Energy Network Primary Heat Network that may serve several developments, either now or in the future, with differing operational parameters from each development's Secondary Heating Network.

6.1.3 The number of Substations is to be kept to a minimum, ideally with one Substation per Development. However, to allow the Decentralised Energy Network to be routed off the Development, Substations should be located to ensure that the Primary Heat Network can operate at higher operating temperatures to the Secondary Heating Networks routed within buildings and houses. It should be assumed that three connections are required at the boundary of the Development for extension of the Decentralised Energy Network to other developments, and these should be submitted for approval. Applicants should engage with Enfield Council to receive advice on the location of these connections.

6.1.4 Under no circumstances will the higher operating temperatures of the Primary Heat Network be permitted to be routed within buildings or houses other than to be routed to the Substation Plantroom serving that part of the Development. The Substations should be located to ensure this requirement.

6.2 Operating Flows and Temperatures

6.2.1 This Section details the specific requirements for the Primary Heat Network system design, materials specification and installation workmanship.

6.2.2 The design requirement for the Primary Heat Network should be based on:

- **Variable volume, constant temperature** to suit the fluctuations in customer demand and environmental conditions
- **Very low heat loss** to minimise wasted heat and excessive energy bills

6.2.3 The Primary Heat Network should be delivered to the following design criteria. Failure to comply with these Primary Heat Network design criteria will hinder the efficient operation of the Decentralised Energy Network and reduce the levels of carbon reduction as a result. It is therefore essential that Primary Heat Networks are designed accordingly.

6.2.4 The Primary Heating Network requires a large difference between the flow temperature and the return temperature, although the return temperature is dependent upon the operation of the Development Secondary Heating Networks. The Primary Heating Network should be designed based on a flow temperature of:

- 95°C, but should be designed to be capable of operation in the range 60°C – 100°C which should be configurable via the control systems by the operator

and a return temperature of:

- 70°C, but should be designed to be capable of operation in the range 40°C – 100°C and will be a function of the flow temperatures and heat demand[1].

6.2.5 The reasons for maintaining a low return water temperature and a wide differential between flow and return temperatures are:

1 A flow and return of 95°C/70°C has been selected to allow existing development heating systems to be connected to the Decentralised Energy Network.

- To increase the heat carrying capacity of the network and hence reduce its size
- To reduce energy required for pumping the network
- To maximise the use of high efficiency heat sources e.g. CHP and condensing boilers
- To maximise the capacity of the thermal storage and thereby increase the utilisation of the higher efficiency and low carbon heat sources e.g. CHP and/or Biomass.

6.3 Variable Flow, Constant Temperature Design Principles

6.3.1 One of the key design principles of the Decentralised Energy Network is that it must operate as a variable volume system and with a large temperature differential between flow and return pipes at all times.

6.3.2 Whilst by-pass arrangements should be kept to an absolute minimum, they may be necessary during low demand periods. Continual flow by-passes should not be utilised. By-passes should be installed at each Substation, or end of pipe run if necessary.

6.3.3 At potential index points of the system, differential pressure sensors should be installed which should be linked to the BEMS system to control the speed of the district pumps via variable speed drives (VSD) to ensure the design differential pressure is maintained at all times.

6.4 Temporary Plant

6.4.1 In order that the Energy Company can supply temporary heating plant if required, e.g. due to plant failure or the need to replace plant/pipework, the Development must provide the following facilities for each Substation connection to the Primary Heating Network as well as the Energy Centre(2):

- A 15m x 6m space for the Energy Company's temporary plant(3). The location provided should:
  - Permit the boiler(s) to operate without the erection of a chimney other than that supplied with the packaged plantroom and do so whilst operating on 35 sec heating oil
  - Provide a flat base capable of taking the load presented by the temporary boiler plant and its ancillary equipment
  - Be within 20m of the Substation or connection point to the Primary Heating Network and allow a flexible connection to be installed and remain in place between the boiler and the substation (subject to suitable protective covering) for an extended period, i.e. not crossing the only access route into a building.
  - Permit delivery of plant and fuel on a 24/7 basis without restrictions.
- A valve connection in a manhole on the flow and return pipework of the Primary Heating Network after a Substation connection to the Primary Heating Network.

6.5 Water Quality Requirements

During Construction

6.5.1 To protect the Primary Heat Network from damage and fouling, including the Substation, the Primary Heat Network should be cleaned and flushed in accordance with BSRIA standards.

6.5.2 Water treatment procedures on newly cleaned closed systems should be in accordance with BSRIA BG29/2012, or later standard as relevant, plus as stipulated further below.

6.5.3 Dosing equipment should be installed to allow the safe and effective addition of chemicals to the circulating water.

6.5.4 The final system fill should use softened water.

2 This space can be car parking spaces or similar, as long as they can be "closed" for the Energy Company's use in the future
3 The Energy Company's plant will include containerised boiler plant, electrical generator, fuel tanks for boilers and ancillaries which will be used throughout the period the boiler plant is in operation

6 Primary Heat Network

Initial Operation

6.5.5 Prior to the commencement of Primary Heat Network Services the following procedures must be carried out to ensure the water quality of the system is acceptable:

- Samples should be taken of the water in the Primary Heat Network
- The number and location of samples are to be in accordance with BS8552:2011 but must also include one sample from each heat exchanger in the Substation
- All samples must be analysed by a UKAS accredited laboratory.

6.5.6 The minimum parameters for sampling results are as follows:

BACTERIA	
TVC's @ 22oC	<100,000 cfu/ml and no upward trend
Pseudomonas	<10,000 cfu/100ml and no upward trend
SRB's	Absent
NRB's	For information only dependent on the inhibitor employed
CHEMICAL	
Ph	9.8 + 0.2
Suspended Solids	<10 mg/l
Chloride	<250 mg/l
Ammonia	<0.02 mg/l
Soluble Iron	<5 mg/l
Total Iron	<15 mg/l
Total Copper	<1 mg/l
~~Oxygen Concentration~~ Hardness	~~0.02 mg/l~~ <10 ppm
Conductivity at 25°C	<1,500 microS/cm
Oil and grease content	<1 mg/l
Inhibitor	As recommended by the water treatment specialist
MAKEUP WATER	
Softened water	Softening plant with low salt alarm to BEMS

Table 6.1

6.5.7 Parameters for all other analysis from across the system are to be in accordance with BS8552:2011.

Ongoing Operation

6.5.8 Under no circumstances must flushing of the Primary Heat Network be undertaken though the Substation. A flushing bypass should be installed in the Primary Heat Network, bypassing the heat exchanger.

6 Primary Heat Network

6.5.9 High and/or continuous usage of make-up water will increase fouling. A meter should be fitted on the water makeup system, as should water softening plant, and should be monitored by the BEMS to identify leaks and manage water usage. Any increase in water usage for a closed system should be investigated and reported to the Energy Company and rectified immediately.

6.6 Pipework Design and Product Parameters

6.6.1 The Primary Heat Network pipework and all associated fittings and valves etc. should be specified to meet the following maximum requirements:

- Design pressure (max. allowable operational pressure) - 16 Bar
- Design maximum temperature - 120°C
- Maximum pressure loss within distribution mains pipework - 125 Pa/m
- Maximum pressure loss within branch pipework - 250 Pa/m

6.6.2 The pipework should comprise flow and return pipes, installed as a system locked/restrained by friction, in which the temperature variations in the pipe system are absorbed either as axial stresses in the carrier pipe, by reduced expansion movements, or by a combination of both axial and longitudinal stresses.

6.7 Underground Pipework

General

6.7.1 The quality of the pipework materials and installation is critical. Pipework will last in excess of 50 years when the right products are used and the installation is to a high standard.

6.7.2 Each pipework joint installer for the specific joints to be used should have been trained by the pipework manufacturer, achieved certification via the training process and installed such joints for at least 2 years.

Material

6.7.3 The pipework should be a factory manufactured composite pre-insulated steel pipe, polyurethane foam insulation with integral copper alarm wires and an outer casing of high-density polyethylene (HDPE).

6.7.4 The pre-insulated pipework installation should be able to operate at continuous temperatures of up 95°C for 50 years.

6.7.5 Wherever possible, composite twin pipe pipework shall be used. In such circumstances the following table shall apply to ensure the insulation thickness is to an acceptable standard (aligned with Series 2 pipework to EN 253 for pipes up to 40mm and Series 3 to EN 253 for pipes above 40mm, and such standards shall be followed for larger and smaller pipe sizes not covered within the table below):

Nominal Internal Bore of Steel Carrier Pipe (mm)	Diameter of Outer Casing (mm)	EN 253
20	110	Series 2
25	125	Series 2
32	125	Series 2
40	180	Series 2
50	250	Series 3
65	280	Series 3
80	315	Series 3

6 Primary Heat Network

Nominal Internal Bore of Steel Carrier Pipe (mm)	Diameter of Outer Casing (mm)	EN 253
100	400	Series 3
125	500	Series 3
150	560	Series 3
200	710	Series 3

Table 6.2

6.7.6 In the unlikely event that single pipe has to be used, single pipe pipework shall comply with the following table to ensure the insulation thickness is to an acceptable standard (aligned with Series 3 pipework to EN253 and such standards shall be followed for larger and smaller pipe sizes not covered within the table below):

Nominal Internal Bore of Carrier Pipe (mm)	Diameter of Outer Casing (mm)	EN 253
50	160	Series 3
100	250	Series 3
150	315	Series 3
200	400	Series 3
250	500	Series 3
300	540	Series 3

Table 6.3

6.7.7 The polyurethane insulation should have a maximum λ value of 0.29 W/mK.

Standards and Codes of Practice

6.7.8 The design, construction, installation, testing and commissioning should be accordance with current best practice European and British Standards, including, but not limited to:

Standard	Description
EN 13941	Design and installation of Pre-insulated bonded pipe systems for district heating
EN 253	Polyurethane thermal insulation and outer casing of polyethylene
EN 448	Fitting assemblies of steel service pipes, polyurethane thermal insulation and outer casing of polyethylene
EN 488	Steel valve assembly for steel service pipes, polyurethane thermal insulation and outer casing of polyethylene
EN 489	Joint assembly for steel service pipes, polyurethane thermal insulation and outer casing of polyethylene

6 Primary Heat Network

Standard	Description
EN 14419	Surveillance systems
EN 15632-2	District heating pipes. Pre-insulated flexible pipe systems. Bonded plastic service pipes. Requirements and test methods
EN15698-1	District heating pipes. Pre-insulated bonded twin pipe systems for directly buried hot water networks

Table 6.4

6.7.9 In addition, although not directly applicable to decentralised heating, the pipework should be installed in accordance with the general requirement of the National Joint Utilities Guidelines (NJUG) Volume 1 and 2, The New Road and Street Works Act, and the Specification for Highway Works (DoT).

Pipe Welding

6.7.10 All steel pipe welding is to be undertaken by certified coded welders. Certification should be in compliance with current British and European Standards.

Pipe Weld Identification

6.7.11 The progress of the welding process will be followed on a graphic display. The data of the process should be continuously saved on an external memory device and internally in the welding machine on its Hard Disk.

6.7.12 The saved data will form the basis of documentation of each weld by means of a computer-based monitoring program.

6.7.13 Every pipe weld should be labelled with a unique identifier during the welding process, to be applied using durable ink.

6.7.14 Each weld will have a unique number for identification during the welding process and for later documentation. The information should include but not be limited to:

- Welder name
- Weld date
- Weld time
- Weather conditions at weld time

6.7.15 Any weld not properly identified in the final documentation, will need to be exposed and subject to inspection and non-destructive testing.

6.7.16 On completion of the welding process, it should be possible to document a fault-free welding procedure.

Pipe Weld Testing

6.7.17 Testing of pipework will be as detailed in EN 13941 and relevant Project class.

6.7.18 At least one weld per welder per phase of the project should be cut out and destructively tested. The weld should be selected by the Energy Company and if found to fail then 2 more welds should be cut out and if found to fail then 2 more should be cut out and so on until no failures are found.

6.7.19 All steel pipe welding is to be undertaken by certified coded welders. Certification must be in compliance with current British and European Standards. Original Certificates for individual welders are to be made available to the Energy Company upon request.

6 Primary Heat Network

6.7.20 A testing regime for welded joints should be developed e.g. dye penetration tests of 10% of welds as detailed in EN 13941. Visual inspection of welds is required the opportunity to witness weld tests.

Insulation Joints

6.7.21 All joints should comply with EN489:2003. The choice of joint type should be compatible with the pipe material and pipe type.

Installation of Insulation Joints

6.7.22 The joints should be insulated, fitted and pressure tested as a complete operation within the same working day.

Insulation Jointing

6.7.23 Joint assemblies for the steel pipe systems, polyurethane thermal insulation and outer casing of polyethylene should comply with BS EN 489. The joint assemblies should be installed by specially trained personnel according to the instructions given by the manufacturer. The jointer should be experienced and each jointer should produce a test joint which should be destructively tested.

6.7.24 The pipework manufacturer must approve the method of jointing and must provide and underwrite all jointing materials.

6.7.25 Notwithstanding the robustness of the jointing procedure, protection from adverse weather should be provided during the welding procedure.

6.7.26 Electrofusion welding type jointing is the preferred type of jointing. If shrinkable casing type joints are to be installed, additional reassurances with respect to quality of installation and durability, and extra supervision and quality controls for this operation must be provided.

Pipe Insulation Joint Identification

6.7.27 Every pipe joint should be labelled with a unique identifier during the jointing process.

6.7.28 The identifier should be applied using durable ink and be identified on the provided as-installed drawings.

6.7.29 Each weld will have a unique number for identification during the welding process and for later documentation. The information should include but not be limited to:

- Jointer name
- Joint date
- Details of tightness test
- Insulation type
- Alarm wire jointing test

General Pipework Requirements

6.7.30 Pipework should be laid at a minimum depth of 600mm to the top of the pipe.

6.7.31 The manufacturer’s design and installation guidelines for the selected pipe system should be obtained and complied with.

6.7.32 All changes in pipe direction should be achieved by the use of either pre-fabricated bends or curved pipe.

6.7.33 All pre-fabricated bends should be factory prepared and should be constructed in accordance with EN 448:2003.

6.7.34 The use of site constructed mitred joints is not permitted.

6 Primary Heat Network

Stress and Expansion Requirements

6.7.35 Any stress calculations to calculate how the design of the network will deal with expansion and contraction should, if not undertaken by the manufacturer of the pipework system, be approved by the manufacturer, and submitted to the Local Planning Authority.

6.7.36 Branches should not move by more than 40 mm.

6.7.37 Double reducers should not be used for carrier pipes above 150 mm nominal bore.

6.7.38 All branches less than 12 m in length can be branched off at 90 degree from the spine, above this length a dog leg should be used or the branch should be initially taken off in line with the main spine.

Isolation Valves

6.7.39 Isolation valves should be delivered as pre-insulated units like all other components and should be supplied and manufactured by the same supplier and manufacturer as the insulated pipes. Insulation and outer casing material should fulfil the same quality requirements as described previously in this specification and which apply to all other components in the system.

System Venting

6.7.40 The design and installation of the underground pipework should not normally require the use of venting components. Where unavoidable pre-fabricated units should be of the same manufacturer as the pipe system and be in accordance with EN 488.

6.7.41 Air release will be achieved through the installation of pre-insulated ball valves suitable for use in this location and compatible with the pipe system.

6.7.42 The design should include suitable equipment for venting in a safe manner. This should include extended valve spindles, stand-pipes, pipe clamps and heat resistant hoses.

6.7.43 The design used to construct a sealed duct or valve pit or access chamber around the pre-insulated valve or air vents should be developed and installed in such a way that rain/ground water drains away from the pipework to ensure the valve stem is not located in standing water.

Monitoring and Control System (including ducts)

6.7.44 To enable the remote monitoring of all remote heat meters and all BEMS controllers located at each Substation, three ducts should be installed alongside the underground pipework and terminated inside of the Energy Centre and each Substation to enable unobstructed access to the exit points of these ducts.

6.7.45 These ducts should be encased within the sand surround in which the underground pipework is located. Draw pits should be installed every 100 metres as well as any significant change in direction of the ducts to enable cables to be drawn in.

6.7.46 The ducts should be 110 mm outer diameter and should be installed with care to ensure that either during installation or subsequent back fill they are not crushed causing water ingress, cable damage or preventing the draw cords from being used. Each section of duct should be jointed to the other in a manner which prevents water ingress.

6.7.47 A cable should be installed in one duct suitable for creating a LAN for the BEMS system, and in another duct a cable suitable for creating a site wide M-Bus network (specification supplied by the company supplying and installing the metering system) which should connect all remote heat meters to a main metering terminal in the control room of the Energy Centre. The third should remain empty of cables.

6.7.48 All ducts should be fitted with draw cords suitable to pulling cables over the lengths set out above.

6 Primary Heat Network

Trench Installation

6.7.49 Pipes should be installed into trenches in accordance with the manufacturer’s recommendations.

6.7.50 The excavations should be graded flat and the trench floor compacted (without the introduction of sand). If ground conditions require it, a concrete blind should be laid and graded to provide a firm trench bottom.

6.7.51 Suitable bedding and surround in which the pipes are to be laid should be provided and should ensure that the friction layer backfill complies with the sieve curve set down in EN13941.

6.7.52 The friction layer around the pipe should be compacted to a Procter value of not less than 95% (percentage of compression against max possible compression). For the Friction Zone, (the section which is not locked by virtue of length) the grading of backfill is extremely important and should not be homogenous in size as this will create a tunnel in the back fill, allowing the pipe to slide.

6.7.53 Trenches and newly installed pipework are to be closely inspected immediately prior to backfill to ensure that the outer casing of the pipework is undamaged in any way.

6.7.54 Sand backfill should commence immediately following the successful inspection of both the trenches and newly installed pipework. Closures are to be left exposed until a pressure test has been successfully completed. Care should be given to ensure no damage is caused to the trench or installation pipework during the backfill process.

6.7.55 The backfill sand is manually compacted down (to prevent voids occurring) in layers of 100mm, ensuring that a 150mm layer of compacted sand is provided around and above the pipework outer casing. Each layer is to be hand tamped and completely compacted before the next layer is laid. The compacted sand layer should provide a complete support to the pipes around their entire circumference. Careful and even compaction is essential.

6.7.56 A warning mesh should be placed 250mm above the crown of each pipeline. Warning tapes should be of polythene not less than 500mm wide and 0.1mm thick. They should be purple in colour and bear the continuously repeated legend “DISTRICT HEATING” in block letters not less than 30mm high.

6.7.57 Above the sand surround, an approved backfill with selected material not exceeding 50mm in size, free from rubble, half bricks, sharp objects and building rubbish, should be placed in 150mm layers. Each layer should be hand tamped and compacted to give a minimum cover of 450mm between the crown of the underground mains and the base of the road layer or the ground level of grassed areas.

Connections & Entries to Buildings

6.7.58 Pre-fabricated pipe components shoule be used when making final connections to buildings.

6.7.59 In all circumstances, the design should ensure that all joints are accessible for future maintenance and inspection.

Pipework Alarm & Monitoring System

6.7.60 The underground pipework should be monitored by an alarm wire circuit with a documented, proven technique.

6.7.61 The alarm system should be in accordance with EN 14419:2009.

6.7.62 The applicant should prepare a complete and clear diagram for the alarm wire circuit and position of components. This should be located on the wall in the control room adjacent to the alarm panel. The design of the system must be completed before installation commences on site to ensure that the alarm system is carefully planned and then installed accordingly.

6.7.63 The alarm indication panel should be located in the control room within the Energy Centre and should have a common alarm link to the BEMS.

6 Primary Heat Network

6.7.64 The alarm system should be designed on the basis of copper wires moulded into the thermal insulation of the pipework. The system should be able to detect the ingress of moisture in the foam insulation by a measurement between copper wire and steel pipe and it should be able to accurately locate the fault before damage leads to corrosion of the steel pipe.

6.7.65 Where the alarm wires are jointed they should be compressed together and then soldered.

6.7.66 Whilst plastic supports are acceptable to prevent the alarm wires from touching the pipework, it must be ensured that prior to foaming the joint these wires are not excessively slack and could be pushed onto the steel carrier pipe when foaming takes place.

6.7.67 The alarm system should be capable of locating a break of the measuring wire.

6.7.68 Reference points should be introduced by plotting waypoints for each building entry.

6.7.69 The applicant will be responsible for ensuring that upon completion of installation a continuity test of the alarm wire circuit is completed and recorded using a reflectometer.

Pipework Testing

6.7.70 Testing of pipework will be as detailed in EN 13941.

6.7.71 Installed pipework should be leak tested to 1.3 times the maximum operating pressure of the pipework (16 bar) for a period of 24 hours and will include a visual inspection of the welds. Pressure testing requires good venting and monitoring of water temperature changes.

6.7.72 After adequate venting, installed pipework should be hydrostatically pressure tested to 1.5 times the maximum operating pressure of the pipework (16 bar) for a period of 24 hours with water temperatures being monitored during the test.

Pipework System Flushing, Draining and Filling

6.7.73 The newly installed pipework system should be fully flushed prior to final filling, using a suitable cold water main supply until water is seen to run clear.

6.7.74 The flushing procedure should be sufficiently robust to remove debris from the pipe system.

6.7.75 After the hydrostatic pressure test and the flushing procedure have been completed the pipework should be fully drained.

6.7.76 Following draining, the pipe system should be filled with softened and treated water, and then follow the requirements of section 6.5. The treatment process should be compatible with the Energy Company's proposed future water treatment regime.

6.7.77 The treatment should be evenly distributed during the filling process.

6.7.78 The water in the system should then circulated for at least 6 hours each week.

7 Substation and Network Metering

7.1 Substation

7.1.1 The Primary Heating Network should be hydraulically separate from the Secondary Heating Network through a Substation in a building within the Development. Heat transfer across the Substation will be achieved by means of a 2-port control valve which will modulate to maintain a constant Secondary Heating Network flow temperature in a +/- 5°C margin around its nominal value under all normal load conditions.

7.1.2 The Substation should be located in a Substation Plantroom within a building within the Development.

7.1.3 Each Substation should include the following equipment:

- Isolating valves
- Filter
- Heat exchanger(s)
- Motorised regulation valve(s)
- Energy meter
- Temperature sensors
- Control panel
- Hydraulic connections
- Power and instrumentation (fibre) connections

7.1.4 The schematic on the following page indicates these requirements:

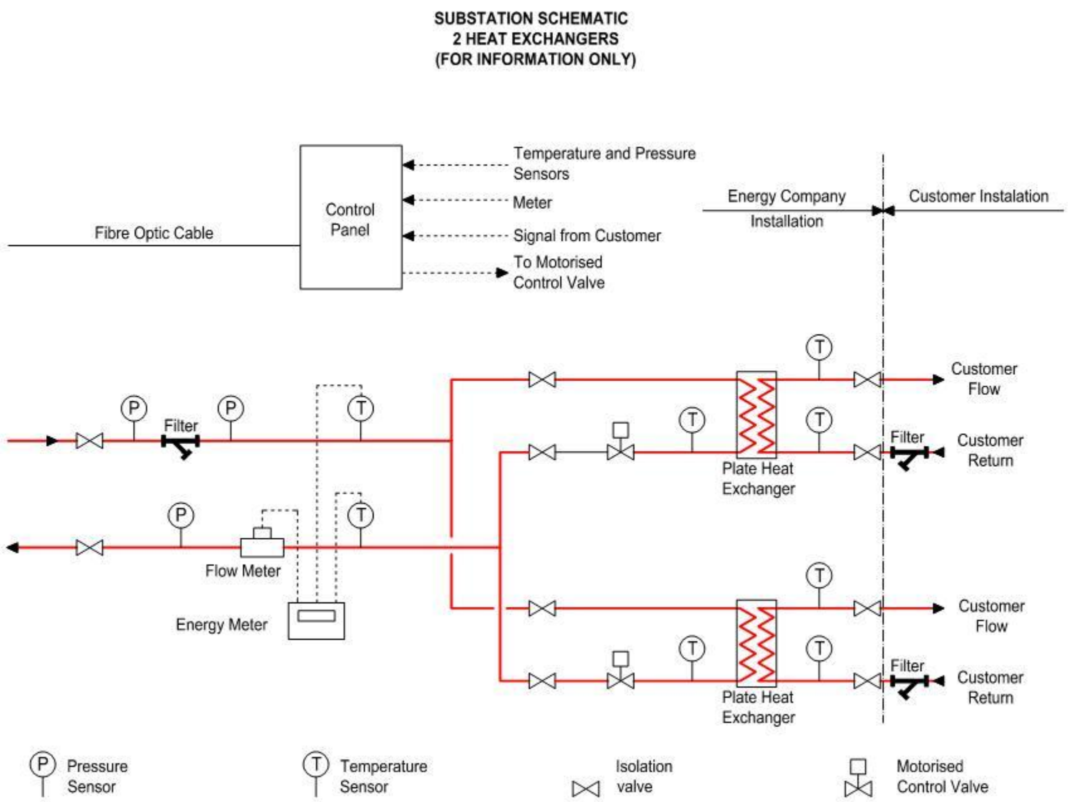

Figure 7.1

7 Substation and Network Metering

7.1.5 All Heat exchangers should be fitted with removable insulation jackets complying with the following specification as a minimum:

- Silicone coated glass fabric coated on one side with a water resistant flexible coating
- Insulation - 50 mm mineral fibre foil coated
- Fastenings - Fire retardant Velcro of a type which can be repeatedly removed and replaced to enable the entire jacket to be removed or replaced within 2 minutes by a maintenance operative
- Maximum Operating Temperature - 220°C
- Thermal Conductivity - 0.033 W/mK
- Non flammable conforming to BS 476.

7.1.6 All heat exchangers should be fitted with local isolation valves to enable removal of the heat exchanger without compromising or affecting the operation of the system where a duty exchanger has been installed in accordance with the system design or this specification. Braised units should not be used.

7 Substation and Network Metering

7.2 Design of the Substation and Control Interface

7.2.1 See Part B of this Specification.

7.3 Substation Plantroom

7.3.1 See Part B of this Specification.

7.4 Primary Metering

7.4.1 A Network Meter should be installed on the primary side of the Substation to record flow volumes and energy delivered by the Primary Heating Network. The Network Meter will comply with the European Standard EN 1434.

7.4.2 The meter will comprise:

- an electromagnetic or ultrasonic flow meter (measuring tube)
- temperature sensors
- a heat calculator with display
- electrical supply and a 15 year battery

7.4.3 The Network Meter should be connected to the Energy Centre to allow remote reading of the Network Meter.

8 Testing and Commissioning

8.1 General Requirements

8.1.1 Pre-commissioning, commissioning and testing should be in accordance with the relevant CIBSE Commissioning Codes, BSRIA Guides and this Specification.

8.1.2 All records of commissioning and testing activities should be kept.

8.1.3 All plant, equipment and system components should be installed, adjusted and set in accordance with the manufacturer's instructions.

8.1.4 Commissioning and testing should only be carried out after the installed systems have been statically tested and certified complete, including:

- Works testing of plant
- Leakage and pressure testing of pipe work
- Air leakage testing of ductwork
- Electrical tests to BS 7671.

8.1.5 All monitored data should be logged and presented in tabular and graphical form required as a standard feature of the monitoring and control system.

8.1.6 The automatic operation of all plant, equipment and systems should be demonstrated over a predefined period with all monitored data logged and output and efficiencies calculated. It is critically important that the hand over to the Energy Company is of a complete system and not items of equipment which are each individually commissioned. These items of plant and equipment must operate together as originally conceived and designed and in a way which delivers the required levels of service at the design carbon intensity, taking into account parasitic loads.

8.1.7 Commissioning of the control system should commence once all systems and associated items are completely installed and operational. All devices should be calibrated and tuned during commissioning to allow for efficient operation of all systems.

8.2 Labelling and Plantroom Drawings

8.2.1 All plant and equipment should be fitted with a label marked with an agreed unique reference code. The reference code should include the following components:

- Building reference
- Equipment type
- Application
- Item number.

8.2.2 All packaged plant and equipment should have a label fitted by the manufacturer describing key information, including:

- Manufacturer
- Location of manufacture
- Date of manufacture
- Key performance data
- Model reference
- Serial number.

8.2.3 In each plant area a laminated general arrangement and schematic should be affixed to the wall showing the plant in that area, e.g. each thermal substation, CHP plant, boiler systems etc.

8 Testing and Commissioning

8.3 Performance Testing

8.3.1 The following tests should be undertaken:

- Emissions to atmosphere
- Noise and vibration levels
- Boiler thermal output
- Boiler efficiency
- CHP electrical output
- CHP thermal output
- CHP electrical efficiency
- DHN capacity
- Heat substation capacity
- Integrated systems test
- Reliability

Emissions to Atmosphere

8.3.2 The test should demonstrate that the installation is in compliance with modelled air quality impacts.

Noise and Vibration

8.3.3 Noise and vibration levels inside the Energy Centre, at the CHP ventilation air inlet and outlet, as well as at any other required locations should be measured to ensure compliance with noise level thresholds specified in the noise and vibration strategy.

8 Testing and Commissioning

DNO Compliance

8.3.4 The Developer would be responsible for complying with any compliance criteria required by the DNO. This would include any additional criteria that the Developer agrees with the DNO at the time of design and installation, and obtaining sign-off of the design and installation by the DNO whilst ensuring there are no on-going constraints imposed with respect to the operation of the CHP plant.

Boiler Efficiency Tests

8.3.5 Testing should demonstrate that each boiler is capable of delivering the stated thermal efficiency of the boilers at 25%, 50%, 75% and 100% maximum continuous rating, or as is possible with the load available for the test. This should be demonstrated by the recording, over a 3 hours period, of the gas input to and the heat output from the boiler from permanent calibrated and certified gas and heat energy meters which should be installed for each boiler.

CHP Efficiency Tests

8.3.6 The electrical and thermal efficiency of the CHP engine should be stated and calculated on the gross calorific value of the fuel.

8.3.7 Testing should demonstrate that each CHP engine is capable of delivering the stated electrical and thermal efficiency at 25%, 50%, 75% and 100% maximum continuous rating, or as is possible with the load available for the test. This should be demonstrated by the recording, over a 3 hours period, of the gas input to and the electrical and heat output from the CHP from permanent calibrated and certified heat, electricity and gas energy meters which should be installed for each CHP engine.

Decentralised Energy Network Capacity

8.3.8 Tests should demonstrate that the design volumetric flow rates and temperatures at all points in the system can be and are being achieved following completion of the commissioning.

8.3.9 Testing should demonstrate that each Substation is operating in accordance with and able to meet the design parameters and that volumetric flow rates and temperatures on the secondary heating network are being achieved.

Integrated System Testing (including reliability)

8.3.10 The integrated systems test (IST) is to ensure that the operation of all systems installed as part of the Decentralised Energy Network function as a whole following the successful completion of the individual system commissioning procedures, and is proven to run reliably over an extended period of time of at least 2 weeks.

8.3.11 Adequate time should be allowed in the construction and commissioning programmes for the IST to be carried out.

8.3.12 The test is to prove the many interfaces and interactions with all other systems and their cause and effect. The test is to confirm the Decentralised Energy Network operation under different failure conditions to ensure that the correct operation and start up procedures occur and that all systems interact correctly with each other. Failure conditions include but are not limited to:

- Complete power fail
- Partial power fail
- Failure of UPS systems

8.3.13 All fire conditions to test the cause and effect strategy for the Decentralised Energy Network:

- Smoke extract systems and their zoning
- Critical cooling systems
- Fire protection systems – sprinklers, wet risers, gas suppression systems etc.

8 Testing and Commissioning

- Correct system return of all plant following reinstatement/correction of the above scenarios.

8.3.14 A detailed event procedure for each system should be compiled detailing the expected reaction under each scenario and provide adequate resources to manage and control this testing procedure.

8.3.15 Mains failure conditions should encompass the failure of the incoming service and all sub main failures. Failures of UPS should also be simulated. This should be carried out before the reliability tests.

8.3.16 The test should demonstrate the continuous running of the Decentralised Energy Network for an uninterrupted period of 14 days. This test must take place during a period when the CHP is designed to be operational and there is sufficient load in the network to demonstrate the operation of the CHP and thermal store in conjunction with the boilers.

8.3.17 As an outcome of the IST, it should be demonstrated that for the period of this combined test:

- the percentage of heat from the CHP (kWh of heat delivered to total kWh of heat consumed) was in accordance with the design parameters for the heat loads presented during the test, and that this percentage of heat was delivered with the correct operation and interaction of the thermal store
- The parasitic electrical consumption (kWh) was in accordance with the design for the level of heat consumed (kWh) and should not be greater than 2% of heat consumed
- The primary total gas fuel consumption in the CHP and boilers (kWh) for the quantity of total heat consumed (kWh) was in accordance with the agreed design
- The combined return temperature to the Energy Centre and each Substation is in accordance with Specification and the approved design
- The thermal store correctly cycled and stratified and the charging and discharging of the thermal store was in accordance with the system design.

8.3.18 A report following completion of these tests should be prepared to demonstrate compliance.

8.3.19 During the test on an hourly basis, as a minimum, the following and any other relevant data is recorded to enable these points to be demonstrated:

- Total heat metered to all consumers (kWh)
- Heat consumed by customer (kWh)
- Heat generated and delivered in total by the Energy Centre (kWh)
- Heat generated by each boiler (kWh)
- Heat generated by the CHP (kWh)
- Heat stored from the CHP
- Heat discharged from the store into the system (kWh)
- The flow and return temperature to the Energy Centre and each Substation
- Gas input to each item of plant (kWh or m3 with an agreed GCV).

8.3.20 This should include the operation of all sub-systems including, but not limited to:

- Boilers
- CHP
- Thermal Store
- Primary Heat Network
- Heat exchanger Substations
- Heat Interface Units

8 Testing and Commissioning

8.3.21 The tests should demonstrate that the Decentralised Energy Network is operating correctly, controls are properly adjusted, systems interact as intended, and that the systems maintain conditions within the network in accordance with the Specification.

8.3.22 Successful completion of the reliability run test is required and therefore this should be accounted for in programming of the works.

Final Settings

8.3.23 All commissioning set points should be recorded for inclusion in the handover documents.

8.3.24 No regulating valve should be adjusted in excess of the manufacturer's recommendations.

8.3.25 All water regulating devices should be locked in their final positions in accordance with the manufacturer's approved method.

8.3.26 Final positions of water regulating devices should be recorded on the particular system commissioning record sheet.

9 Handover, Operation and Maintenance

9.1 General Requirements

9.1.1 The necessary documentation, training and records necessary to enable the plant to be operated and maintained by the Energy Company in a healthy, safe and efficient manner should be provided to the Energy Company.

- Health & Safety File
- Record Drawings
  - complete copies of as built record drawings in hard copy and electronically, operator schematics which can be used by the future operators/maintenance providers of the system and for site inductions. Such simplified schematics should be understandable without any prior knowledge of the system and should show the key plant items, piping systems and flow directions, together with such information as is required for the daily operation of the plant. The schematic and associated GAs should show on one drawing all isolation points which would be used in the event of failure of a plant item or section of network either in or external to the energy centre.
- Asset Register
  - an asset register/equipment schedule in electronic format describing the type, model number, serial number, capacity, location and manufacturer/supplier of all plant and equipment, itemised down to each air vent or drain point) and to show plant location and the system/family to which it belongs by an agreed hierarchy e.g. valve linked to gas pipe, linked to CHP, linked to Energy Centre.
- Statutory Examinations
  - statutory examinations should be arranged required prior to plant handover to the Energy Company.
- Training of Operational & Maintenance Staff
  - suitable, detailed training, including during commissioning for familiarisation with the equipment, to ensure that the Energy Company's personnel are fully conversant with the new equipment both operationally and for maintenance purposes should be provided prior to completion. Draft O&M manuals, training schedule and materials and other handover information should be issued for acceptance prior to the commencement of training.
  - Training dates will be arranged at mutually convenient times
  - The degree of detail and emphasis of the training will be different in all cases and training should be structured to meet the various needs. Training should be of sufficient depth and content such that that attendees of the training course should be capable of operating, maintenance and repairing the plant and equipment installed without recourse to further training, subject to such attendees having qualifications equal or equivalent to a BTEC certificate and diploma in operations and maintenance engineering or a City & Guilds certificate in engineering.

Spares & Consumables

9 Handover, Operation and Maintenance

9.1.2 Providing a supply of spares and consumables as recommended by the manufacturer of the equipment concerned which are required to operate and maintain the plant.

10 Implementation Guidance

10.0.1 **Pre application stage:** All proposals for major developments which are providing and connecting to a decentralised energy network (DEN) are encouraged to discuss the requirements for this with the Council prior to the submission of a planning application. Developers should use the Decentralised Energy Networks Technical Specification SPD and discussion with Council officers/representatives to establish what is likely to be required, to inform an understanding of whether it is feasible and viable to implement a DEN as part of their proposals.

10.0.2 **Planning application stage:** All proposals for major developments which are capable of providing and connecting to a heat network must submit an Energy Statement outlining the strategy for achieving the required carbon reduction targets. Where it is feasible and viable to meet DEN requirements, as part of this Applicants should submit a Technical Design Pack.

Part B
Decentralised Energy Network SPD:

Specification for the Substation Plantroom, Secondary Heating Network, Customer Meters and Heat Interface Units at Residential Developments (including Small Commercial Areas Supplied via the Residential Building Heating System)

Contents

Contents

Definitions

The following terms should have the following meanings when used in this Specification:

"**AMR System**" means the system (including but not limited to any relevant wiring, wireless equipment, remote antennae, SIMs, data collecting and/or processing equipment, other equipment, telephone line connection) to provide a fully operational remote reading of Customer Meters at the Development.

"**Capacity**" means the Heating Services Capacity.

"Combined Services Equipment" means the Secondary Heating Network, the Customer Meters, the AMR System, the HIUs and their connections to the Secondary Heating Network.

"**Commercial Customers**" means customers who receive Energy Services at a Commercial Unit pursuant to a Commercial Supply Agreement.

"Commercial Unit" means a part of the Development which is primarily used for business or commercial purposes and any other non-residential use including community facilities'.

"Commercial Unit Point of Connection" means the point at which a Commercial Unit is connected to the Secondary Heating Network at the demarcation point set out in the Commercial Unit Point of Connection (CUPC) Drawing.

"Common Parts" means any part of the Development or the premises at the Connection Address which is neither a Commercial Unit nor a Residential Unit.

"**Connection Address**" is the registered address in the supply agreement to which Energy Services is to be provided.

"Customer" means an individual, business, organisation or other body who, by way of a Heat Supply Agreement, consumes or requires the availability of Energy Services, or as the context requires the counterparty to the Master Supply Agreement.

"Customer Meter" means the Customer Metering Equipment used to meter the Energy Services provided to any Residential Unit, Commercial Unit or in any Common Parts.

"Developer" or **"applicant"** is the company responsible for the delivery of Development.

"Development" is the land and buildings (residential and commercial) that will be served by the Decentralised Energy Network at completion of the building phases.

"DHW" is domestic hot water.

"DHWS" is domestic hot water supply.

"Decentralised Energy Network" means:

- the Energy Centres; and
- the Primary Heating Network

"Energy" is heat.

"Energy Company" is the supplier of Energy.

"Energy Services" means the Heating Services.

"Enfield Council" is the London Borough of Enfield and their delegated representatives.

Definitions

"Heat Supply Agreement" means an agreement between the Energy Company and an occupier of a Residential Unit for the supply of Energy Services.

"Meter" means a Customer Meter, Network Meter or any other measuring device used to record the consumption of energy.

"Network Meter" means the meter measuring the total supply of Energy Services from the Primary Heating Network to the Secondary Heating Network, installed in the Substation Plantroom.

"Primary Heating Network" means the network, associated services and assets between the Energy Centre and the secondary side of the Primary Heating Network heat exchanger.

"Residential Unit" means a unit within the Development which is primarily used for residential purposes.

"Secondary Heating Network" means the network, associated services and assets between the secondary side of the Primary Heating Network heat exchanger and each Residential Unit's HIU and Common Parts' HIU and each Commercial Unit Point of Connection, including but not limited to pumps, speed controllers, pressurisation units, pipes (including insulation), pipeline ancillaries (including insulation), electrical supplies to components of the Secondary Heating Network from the first distribution board upstream and controls relating the Secondary Heating Network (including but not limited to; control panels, control devices, and associated control wiring), but not including the Customer Meters or the Network Meter.

"Specification" means this document/specification.

"Substation" is the interface between the Primary Heating Network and the Secondary Heating Networks. The Substation provides an indirect connection via plate heat exchanger(s) to the Primary Heating Network. A heat exchanger is used to transfer heat from the Primary Heating Network to the Secondary Heating Network(s) installed within the within the Development.

"Substation Plantroom" is the room, located within the Development, in which the Substation is installed.

"Temporary Boiler Space" means an area for the energy company to locate its temporary boiler(s) in the event that the energy company is required to provide heat through temporary boiler(s).

"Technical Design Pack" means a technical information pack containing the following information:

For outline planning applications, should include but not limited to:

- A site layout drawing showing the Secondary Housing System route from the Substation to the apartment blocks and houses
- Secondary Heating Network plantroom layout, showing the Substation and all main plant components of the Secondary Heating Network
- The outline location of the Temporary Boiler Space

For full planning applications, should include but not limited to:

- A layout showing Substation Plantroom layout, including access and maintenance clearances, showing the Substation and all main plant components
- Schematic drawing showing Substation(s), Secondary Heating Network Plant (number of pumps, pressurisation units, etc.), and development Secondary Heating System to apartment blocks and houses, including HIUs and meters
- Schematic drawing showing a typical apartment block heating system, showing risers, laterals and connections to each dwelling, including HIUs and meters
- A site layout drawing showing Primary Heat Network route to Substation, Substation location and Secondary Heating System route to apartment blocks and houses
- Secondary Heating Network plantroom layout, including access and maintenance clearances, showing the Substation and all main plant components of the Secondary Heating Network

Definitions

- Outline specification detailing key component parts, system design capacities, design operational parameters, and proposed method of achieving variable volume control philosophy of the system
- Annual head loss calculations for the Secondary Heating Network
- A layout showing the location of and access to the Temporary Boiler Space
- Design of the Secondary Heating Network (temperatures and pressures, also accounting for thermal expansion)

If the details submitted with the planning application are considered to be acceptable and if the LPA are minded to approve the scheme a Detailed Technical Design Pack will be secured by way of s106 agreement (see below).

Submission of further details secured as part of s106 agreement to include but not be limited to:

- Updated schematic drawing showing Substation(s), Secondary Heating Network plant (number of pumps, pressurisation units, etc.), and development Secondary Heating System to apartment blocks and houses, including HIUs and meters
- Updated schematic drawing showing a typical apartment block heating system, showing risers, laterals and connections to each dwelling, including HIUs and meters
- Updated site layout drawing showing Primary Heat Network route to Substation, Substation location and Secondary Heating System route to apartment blocks and houses
- Updated Secondary Heating Network plantroom layout, including access and maintenance clearances, showing the Substation and all main plant components of the Secondary Heating Network
- Detailed specification detailing key component parts, system design capacities, design operational parameters, product manufacturers, pipe materials, insulation levels, thermal expansion control, noise & vibration control, and system control philosophy of the system
- Updated annual heat loss calculations for the Secondary Heating Network
- A plan of the Temporary Boiler Space detailing the access route to, location of and size of the Temporary Boiler Space, the access route for temporary pipes and connections into a valve termination pit
- Design of the Secondary Heating Network (temperatures and pressures, also accounting for thermal expansion)
- Materials to be used for underground and above ground pipework for Secondary Heating Network
- Underground pipework depths
- Vents for underground pipework

By way of condition and s106, details on other relevant matters such as external appearance, transport and access, noise, vibration, ventilation, air quality, and drainage will be subject to assessment and approval process.

-

Definitions

2 Introduction

2.1 Introduction

2.1.1 In accordance with policy DMD 52, Part 1, 2 and 3, where a connection is available to an existing or planned future decentralised energy network, developments should incorporate the following:

a) Substation Plantroom

b) Temporary boiler space

c) Secondary Heating Network

d) Customer metering and Heat Interface Units

2.1.2 This part of the Specification has been provided to ensure that connected developments:

- Are compatible with the Decentralised Energy Network
- Allow a suitable interface to the Decentralised Energy Network by providing a Substation Plantroom within the Development to the spatial and technical standards required
- Operate very efficiently to enable energy costs to customers to be minimised and to ensure that carbon savings are delivered by the Decentralised Energy Network
- Provide a reliable and maintainable heating system
- Provide the metering and customer interface required

2.1.3 With respect to policy DMD 52, Parts 1,2 & 3, the applicant will be responsible for the provision of a complete and operational Development heating system, incorporating all plant and equipment necessary for their full and proper operation to meet the energy delivery requirements set out in this Specification. Please note also that the applicant is also likely to be responsible for funding a proportion of the extension of the existing Decentralised Energy Network (i.e. the off site extension of a DEN into the site (Substation Plantroom) that would be needed to complete the connection). This will be in the form of a connection charge likely to be based on the number of dwellings and the area of any commercial units to be connected.

2.1.4 The information in this document is provided to ensure that the required decentralised energy infrastructure operates efficiently, has longevity, delivers the intended carbon emission reductions, and reduces the end cost of low carbon heat for customers.

2.1.5 The Decentralised Energy Network should be of a high-quality and robust enough to provide a resilient Energy supply with a life expectancy that befits its intended use.

2.1.6 IT DOES NOT COVER:

- If being provided by the Applicant, the requirements for the Energy Centre and Primary Heating Network, see Part A of the Specification for such details.
- Building heating systems for commercial buildings, schools and hotels (e.g. non-residential buildings), see Part C of the Specification for such details.

2.2 Structure of Part B

Connected Capacity of the Development and Substation

2.2.1 Section 4 details the requirements that need to be considered when determining the connected capacity of their Development and the subsequent design of the Substation.

2 Introduction

Substation Plantroom

2.2.2 Section 5 details the specific requirements for the Substation Plantroom design and installation so that it may be provided with plate heat exchangers to allow the transfer of heat from the Primary Heating Network to the Development's Secondary Heating Network.

Secondary Heating Networks

2.2.3 Section 6 details the specific requirements for the Secondary Heating Network system design, materials specification, and installation workmanship to allow a development to receive Energy Services.

2.2.4 This section also details water quality treatment standards that are required within the Secondary Heating Network at completion of the testing and commissioning process and throughout the life of the asset.

2.2.5 In addition, this section details the domestic heating design strategy to be employed in buildings.

2.2.6 For the avoidance of doubt, the design requirement for the Secondary Heating Network should be based on:

- **Variable volume, constant temperature** [(1)] to suit the fluctuations in customer demand and environmental conditions[(2)]; and
- **Very low heat loss** to minimise wasted heat to the building, excessive energy bills, and overheating in summer.

Heat Interface Units (HIU)

2.2.7 Section 7 details specific requirements for the HIU design, materials specification, and installation workmanship to allow a Residential Unit, Commercial Unit and Common Part to connect and receive Heating Services from the Secondary Heating Network.

Customer Meters & Customer Interface

2.2.8 Section 8 details specific requirements for the Customer Meter and Customer Interface design, materials, specification, installation workmanship within the Secondary Heating Network to allow Residential Units, Commercial Units and Common Parts to be metered and billed.

---

1 Temperature set points will be varied to suit the demands and seasons.
2 Return temperatures may in practice be lower than the nominal value but as far as reasonably practicable shall not be higher.

3 General Requirements

3.1 General Requirements

3.1.1 **Carbon Savings**

3.1.2 With respect to policy DMD 52, Parts 1, 2 3 and 4, at the planning stage, detailed design stage and construction stage the applicant should estimate the carbon reduction provided by the Decentralised Energy Network and Secondary Heating Networks (including system losses) based on the following methodology:

Annual carbon saving = baseline carbon emissions - Anticipated scheme carbon emissions

Annual % carbon saving = Annual carbon saving/baseline carbon emissions

Baseline carbon emissions will assume gas-fired boilers supply all heat and supply of electricity from the national grid.

The anticipated carbon emissions will be calculated including all fuel and energy use required to deliver energy to consumers.

3.1.3 Emissions factors taken from the latest guidance from DEFRA/DECC on greenhouse gas reporting will be used in all calculations of carbon emissions.

3.1.4 Presentation of the carbon saving calculation will include as a minimum:

- Baseline annual carbon emissions
- Anticipated scheme annual carbon emissions
- Annual gas consumption of thermal plant
- Annual electrical consumption of thermal plant
- Annual electrical consumption of all ancillary plant
- Annual losses associated with thermal distribution
- Annual thermal energy delivered to consumers
- Annual gross electrical generation, if applicable.

3.1.5 The Applicant should advise on the designed and installed carbon intensity of heat in kgCO2/kWh and should produce calculations to demonstrate this. These calculations should be submitted to Enfield Council for approval.

4 Connected capacity of the Development and Substation (Primary Heating Network and Secondary Heat Exchanger Interface)

4.1 General

4.1.1 The interface between the Primary Heating Network and the Secondary Heating Network is achieved via the Substation located in a Substation Plantroom within the Development.

4.1.2 The Substation is provided to separate the Decentralised Energy Network Primary Heat Network that may serve several developments, either now or in the future, with differing operational parameters from each development Secondary Heating Network.

4.1.3 The number of Substations is to be kept to a minimum with ideally one Substation per Development. Under no circumstances will the higher operating temperatures of the Primary Heat Network be permitted to be routed within buildings or houses other than to be routed to the Substation Plantroom serving that part of the Development. The Substations should be located to ensure this requirement is met.

4.1.4 Each Substation should include the following equipment:

- Isolating valves
- Filter
- Heat exchanger(s)
- Motorised regulation valve(s)
- Energy meter
- Temperature sensors
- Control panel
- Hydraulic connections
- Power and instrumentation (fibre) connections

4.2 Connected Capacity of the Development

4.2.1 The applicant should determine the Capacity that they require for the Development to size the Substation. This is determined in a similar way to an electrical connection from a utility provider. The size of the Connection will determine the ongoing Availability Charge for the Development.

4.2.2 The Capacity should be determined by considering the individual capacities of each Residential Unit, residential Common Parts, each Commercial Unit and commercial Common Parts and then applying a diversity to result in a required connected Capacity.

4.2.3 It is important that Capacities are not overstated for a Development connected to a Substation otherwise good control at low demands can be difficult.

4.2.4 For Residential Unit hot water demands, Danish Standard DS439 should be used for determining diversity. In Residential Units that are designed to Code for Sustainable Homes (CfSH) Level 4 or greater, it is highly unlikely that heating and hot water demands will last simultaneously for long periods.

4.3 Selected Operating Temperatures of the Secondary Heating Network

4.3.1 The default Secondary Heating Network operating temperatures should be 70°C flow and 40°C return.

4.4 Number of Heat Exchangers

4.4.1 Each Substation should contain two heat exchangers for resilience.

4 Connected capacity of the Development and Substation (Primary Heating Network and Secondary Heat Exchanger Interface)

4.5 Schematics Showing Substation Arrangement and Developer Interface

4.5.1 The following schematics generally show the arrangement, component parts and interface point with the Developer.

4.5.2 The Substation schematic for a 2 heat exchanger installation is shown below:

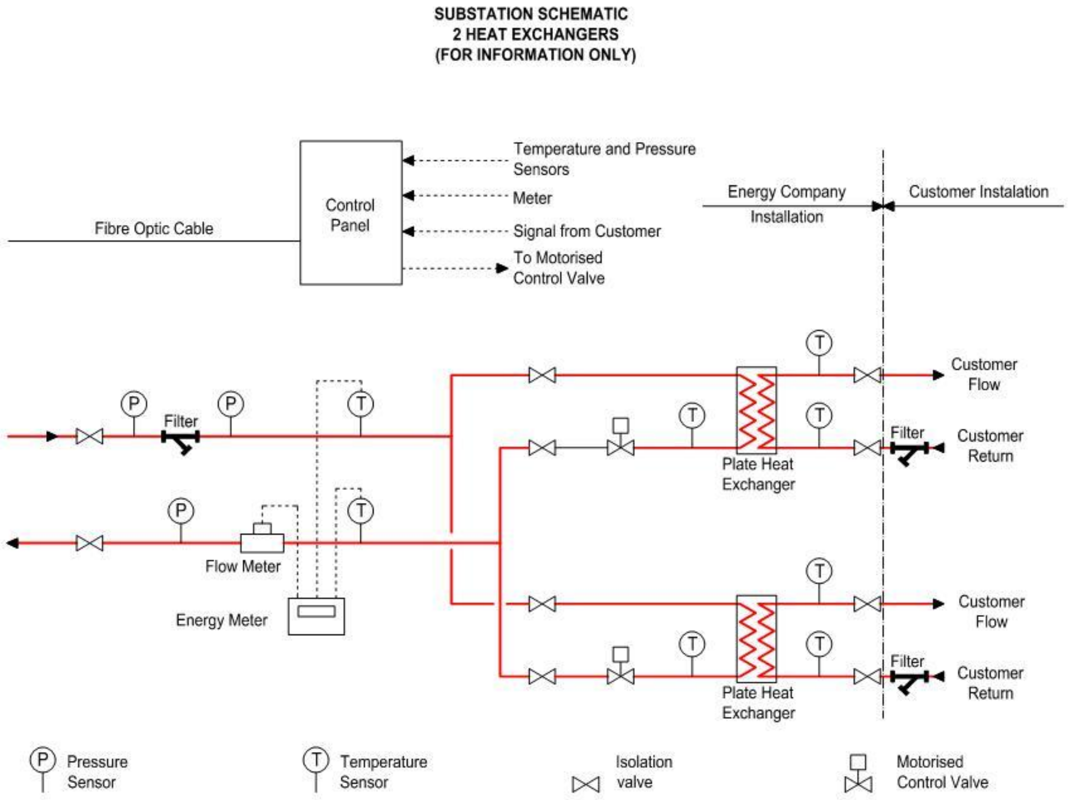

Figure 4.1

4.6 Design of the Substation and Developer Control Interface

4.6.1 Binder test points should be provided within the Secondary Heating Network immediately after the Substation valves to allow the verification of the pressure drop.

4.6.2 Filters (strainers) should be installed in the Secondary Heating Network at the inlet to the heat exchanger within the Substation to protect them from fouling. The filter should have a mesh size of no greater than 500 microns (0.5mm).

4.6.3 A control signal (digital output) should be provided giving the operational status of the Secondary Heating Network (e.g. from pumps or open/closed position of motorised control valves) at the Secondary Heating Network side of the heat exchanger within the Substation for use in the control systems associated with the primary side of the Substation. When the Development does not require heat, this digital signal should be "0". When the Development does require heat, this digital signal should be "1".

4.6.4 This digital signal is not intended to frequently change state to suit load variation within the Development. It is an "enable" signal for the Development stating that a heat service is required. Variation in demands must be accommodated within the design of the Secondary Heating Network.

4.6.5 If at any time the systems in the Development do not create flow in the Secondary Heating Network side of the heat exchangers within the Substation (for example; pumps shut-down or flow is diverted away from the heat exchanger) the signal should be set to "0" until such time as flow is restored.

4.6.6 In the event of a power loss the signal should fail to "0".

5 Substation Plantroom

5.0.1 A Substation Plantroom(s) should be provided within the Development in which the Substation(s) will be installed.

5.0.2 The Substation Plantroom must be located so that the Energy Company has free and safe access to it, that equipment (including the Substation) can be operated and maintained, and if necessary replaced in its entirety without the need for removing any structure or walls. The Substation Plantroom location should be on the ground floor of the Development or in the basement if step free access can be provided. The Energy Company will require permanent access to the Substation Plantroom and the Primary Heating Network routed to the Substation Plantroom.

5.0.3 The following table details the Substation Plantroom requirements:

Item	Provision
Maintenance Space	No less than 1.2m clear space around the Substation
Maintenance Electrical Socket	230 V Ac to earth / 32 A – Commando Wall Socket 230 V Ac to earth / 13A – Wall Socket
Electrical Supply For Control Panel	230 V, 50 hz - fused switch spur or distribution board – supplied by dedicated radial circuit with MCB 16A Type C
Lighting	Minimum of 150 lux
Water Supply	Temporary: DN 50 (for flushing) Permanent: DN 25, with quick release coupling (used for maintenance only, and suitable for use of a WRC approved pressure water jet)
Water Drainage	Provide floor gully connected to foul drain for waste water removal
Concrete Plinths	Provide concrete plinths for heat exchangers and control panel (100mm high)
Ventilation	Provide mechanical or natural ventilation, with a minimum of three air changes per hour, or greater so as to limit the air temperature with the Substation Plantroom to below 35°C at all times
Health & Safety	The Substation Plantroom should not have elements that introduce risk to health and safety, e.g. sharp metallic objects, holes in roof or floor without protection Plan showing evacuation route in case of fire, located in a visible place Fire extinguishers CO^2 and Foam A floor plan of the installation identifying all valves that should be isolated in case of emergency
Anti-Slip Floor Finish	Surface roughness required to provide a low risk environment. Minimum surface roughness required is 26 microns (painted or sealed slab finish)

5 Substation Plantroom

Item	Provision
Signal From The Secondary Heating Network	The Development is required to provide a signal showing the operational status of the Secondary Heating Network for use in the control systems associated with the primary side of the Substation. A 24 V DC signal to the control panel via a volt free contact in the Development's control system. When the Development's contact is closed the system is "enabled". When the Development's contact is open the system is "disabled"
Door Locks	Single key for Substation Plantroom, but with a master key for multiple locks or multiple substations within a Development
Trench/Pit Covers	GRP egg crate for Primary Heating Network and any other floor trenches
Building/Substation Plantroom	The Substation Plantroom must be water tight and any penetrations sealed
Protection Of The Substation Equipment	The Substation should be protected whilst any third party works are completed within the Substation Plantroom to prevent damage to the equipment (including the Substation)
Doors	The Substation Plantroom should be provided with lockable doors sized to allow safe access for the plant (including the Substation)
Fire Detection	Provide fire detection system and breakglass to meet regulations
Fire Compartmentalisation	Provide necessary structures, seals and finishes to meet regulations
Noise and Vibration	The Substation Plantroom (s) should be designed and constructed to prevent noise and vibration
Emergency Push Button	Should be located adjacent to door and should isolate power supply to Substation Plantroom

Table 5.1

6 Secondary Heating Networks

6.1 Introduction

6.1.1 This Section details the specific requirements for the Secondary Heating Network system design, materials specification, and installation workmanship to allow a Development to connect and receive heating services from the Primary Heat Network.

6.1.2 The design requirement for the Secondary Heating Network should be based on:

- **Variable volume, constant temperature** [3] to suit the fluctuations in customer demand and environmental conditions[4]
- **Very low heat loss** to minimise wasted heat to the building, excessive energy bills, and overheating in summer.

6.1.3 The Secondary Heating Network should be delivered to the following design criteria. Failure to comply with these Secondary Heating Network design criteria will hinder the efficient operation of the Decentralised Energy Network and reduce the levels of carbon reduction as a result. It is therefore essential that Developments connecting to the Decentralised Energy Network are designing their Secondary Heating Networks accordingly.

6.1.4 The Primary Heating Network requires a large difference between the flow temperature and the return temperature (the return temperature being dependent upon the operation of the Development Secondary Heating Networks).

6.1.5 The reasons for maintaining a low return water temperature and a wide differential between flow and return temperatures are:

- To increase the heat carrying capacity of the network
- To reduce energy required for pumping the network
- To maximise the use of high efficiency heat sources e.g. CHP and condensing boilers
- To maximise the capacity of the thermal storage and thereby increase the utilisation of the higher efficiency, low carbon heat sources e.g. CHP and Biomass.

6.2 Variable Flow, Constant Temperature Design Principles

6.2.1 One of the key design principles of the Decentralised Energy Network is that it operates as a variable volume system with a large temperature differential between flow and return pipes at all times. Because the Primary Heating Network return temperature can never be lower than the Secondary Heating Network return temperature it is imperative that the Secondary Heating Networks are designed and operated with a low return temperature at all times.

6.2.2 Designed return temperatures should be no greater than 45°C for dwelling heating systems and no greater than 25°C for dwelling hot water systems.

6.2.3 The schematic in the figure below details the basic concept of variable speed pumping and two-port control strategy.

---

3 Return temperatures may in practice be lower than the nominal value but as far as reasonably practicable shall not be higher.
4 Guidance may be found in BSRIA GUIDE BG12/2011, and although this is not specific to district heating, many of the principles apply.

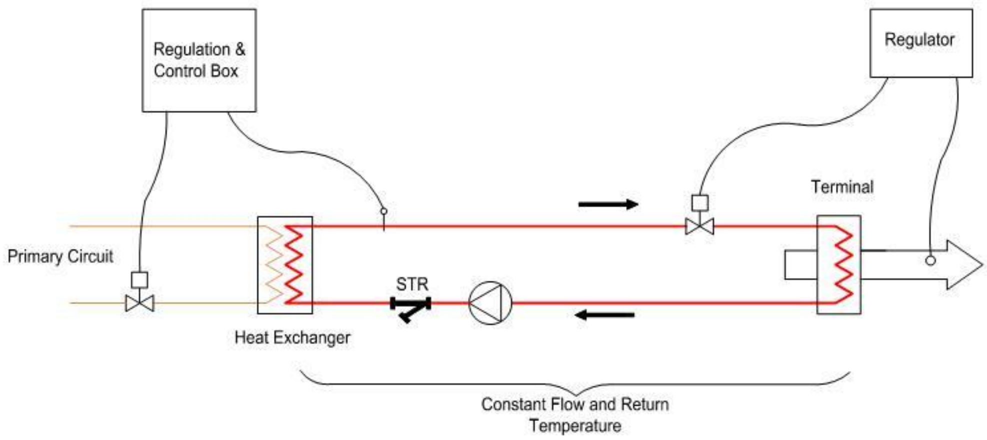

Figure 6.1

6.2.4 The required terminal load should be used to regulate the control valve opening, ensuring that the pump is kept at the optimum operation point for the overall circuit. This keeps the electrical consumption of the pump to a minimum and maintains a maximum temperature differential between the flow and the return.

6.2.5 The pump speed regulation should be controlled through the differential pressure measured at the secondary circuit index run.

6.2.6 Due to the possibility that all the regulation valves may be closed it is necessary to install an automatic bypass valve adjusted to keep a minimal flow within the circuit as shown in the schematic below. Correct set up and commissioning of the automatic bypass valve is critical to ensure that the volume of water that is bypassed is kept to a minimum. This is sometimes ignored due to the pace of commissioning prior to Development completion. This must be carefully supervised and monitored during commissioning and will be reviewed by the Energy Company during witnessing.

6 Secondary Heating Networks

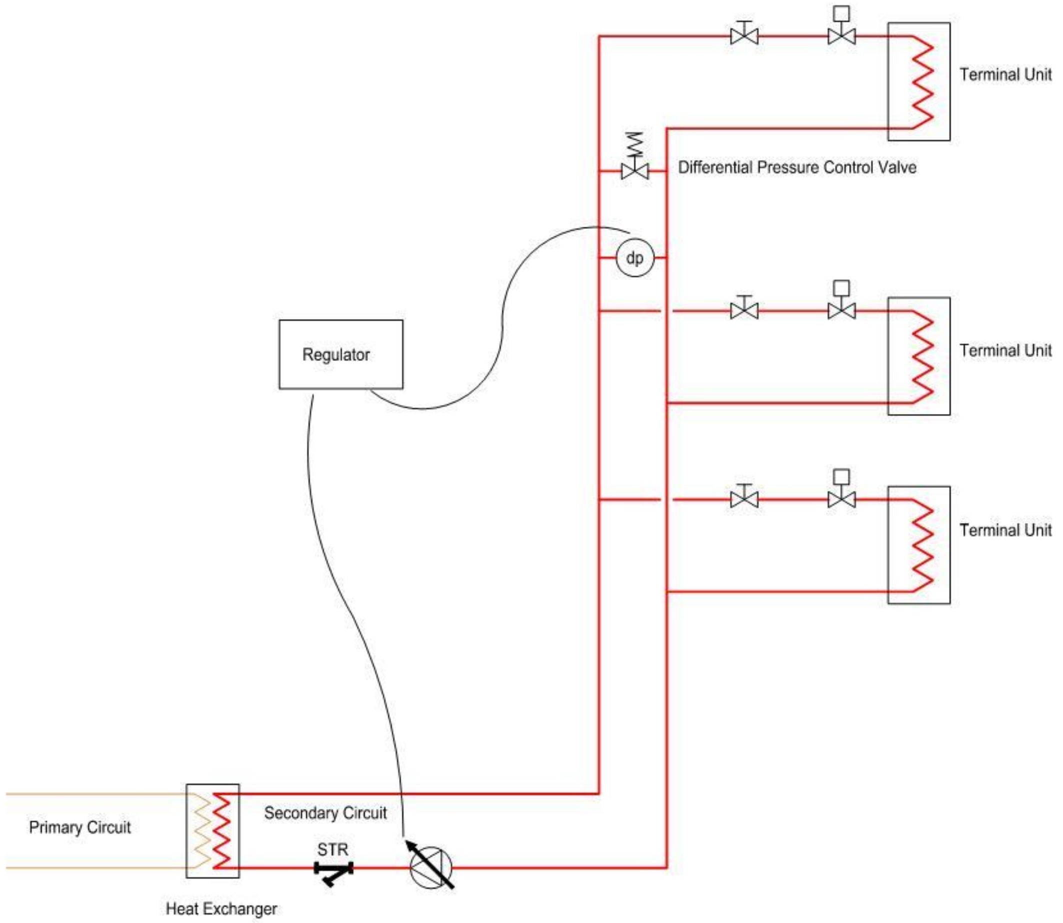

Figure 6.2

6.2.7 The differential pressure set value for the bypass valve should be nominally the same as the set point of the pressure sensor. Alternatively a controlled by-pass can be incorporated and linked to the differential pressure set point and the minimum flow rate requirement of a single pump operation.

6.2.8 The probability that the bypass will open should be minimised by adjusting the secondary flow temperature downwards at low loads such that some of the terminal unit valves always remain open.

6.2.9 The bypass should be regarded as a safety control for the pump and should not be open under normal conditions.

6.2.10 Flow regulating valves should be installed on the Secondary Heating Network side of the heat exchanger to adjust the maximum flow at the maximum load. In case of two or more heat exchangers, regulating valves on each heat exchanger should be provided to achieve balance.

6.2.11 Whilst by-pass arrangements should be kept to an absolute minimum, they may be necessary during low demand periods, when the supply temperature on the Primary Heating Network and Secondary Heating Network deteriorates due to control valves remaining closed for a period of time. Continual flow by-passes should not be utilised. Self-acting temperature control by-passes should be installed at the end of main branch legs or at any remote equipment connection. These should be adjusted so that they open at a temperature midway between the flow temperature set point and the required return temperature (40°C). This will allow a small flow to occur during low demand periods, to prevent the occurrence of “dead legs”.

6.2.12 Temperature indicators or test points should be installed at the end of the main branches in order to make correct adjustments of the by-pass flows.

6 Secondary Heating Networks

Pump and Valve Arrangements

6.2.13 *Shunt Pump Not Permitted:* A shunt (primary) pump and low loss header arrangement should not be used within Secondary Heating Networks connected to the Primary Heating Network.

6.2.14 *Two Port Control Valves & Variable Speed Pumps:* Two port control valves with variable speed pumps, in conjunction with differential pressure control valves, should be provided.

6.2.15 *Balance Flow:* A balance flow control system should be installed on each branch to adjust the flows (see the schematic above). This helps ensure a correct supply of heating to all the parts of the installation (especially at the ends) and avoids excessive flow and low temperature drops.

6.2.16 This system should be made up of regulating valves in each branch of the circuit. The maximum flow of these valves should be adjusted for the maximum load.

6.2.17 Alternatively, automatic differential pressure control valves may be used, which can provide a best balance control and constant pressure conditions for the temperature control valves to work under.

6.2.18 It is also possible to use a mix of the two options e.g. automatic differential pressure valves on the main branches and regulating valves on sub-branches.

6.2.19 Further guidance on balancing variable flow water systems is available from BSRIA e.g. AG16/2002.

6.2.20 *Pumping System:* For heating, the required pumps should be installed in parallel within the flow circuit just before the heat exchanger, as indicatively shown in the diagram below, to avoid the risk of cavitation in the heat exchanger. Differential pressure control should then be incorporated in each sub-circuit after the pumps to provide system balance during all demand scenarios and flow / pressure fluctuations.

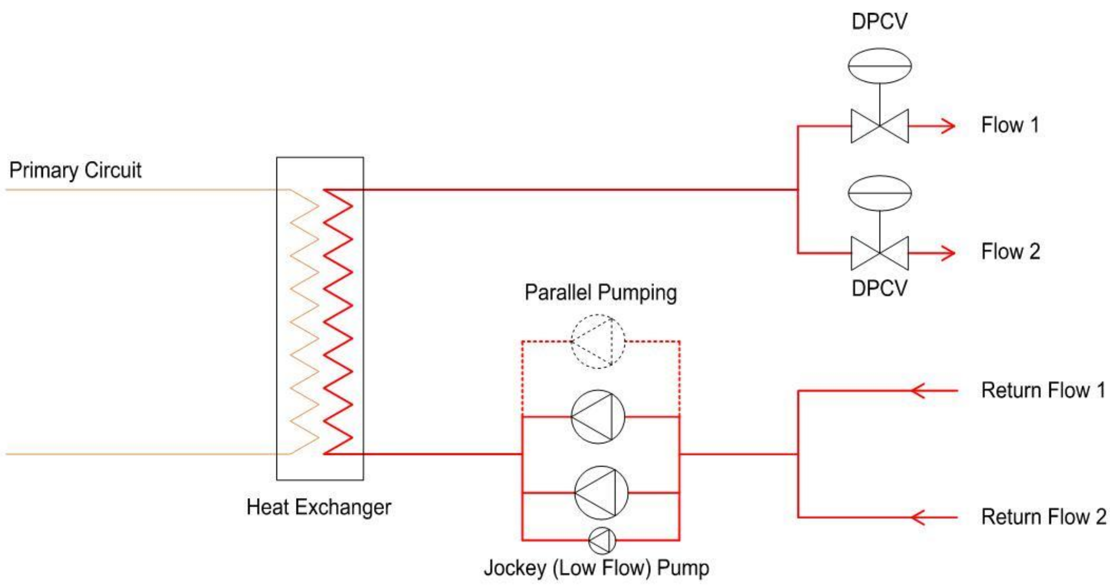

Figure 6.3

6.2.21 *Pump Selection Methodology:* The number of pumps selected will depend on the maximum and minimum flow rates at which the system will operate throughout the day/year and the characteristics of the inverter of the variable speed pump. For most connections the difference in loads throughout the day and year is significant and therefore, to be able to meet the required return temperature at all times, the use of parallel multiple pumping should be adopted. Depending on the flow rate differences between the daily and annual maximum and minimum demands, multiple pumps will be required. The applicant should

6 Secondary Heating Networks

determine the number of pumps required, but no less than three "run" pumps and the incorporation of a low flow (jockey) pump should be provided, with the addition of a standby pump. A standby low flow (jockey) pump is not required.

6.2.22 The pump manufacturer's minimum operating conditions should be determined with care as speed and flow rate are not proportional in a variable volume systems. (See BSRIA BG-12:2011)

6.2.23 If the flow on the Secondary Heating Network side of the Substation is to be stopped e.g. the pumps are stopped, then the heat exchanger should be shut down by means of the Secondary Heating Network control output as detailed above in section 3.

6.2.24 *Pumps:* Individual pumps should be installed. Twin headed pumps should not be used. If pumps are not controlled by the BEMS i.e. they are provided with integral package controls, sufficient interfaces to the BEMS should be provided to ensure that the pump status, alarms and analogue values are available on the BEMS as required by section 7 below.

6.3 Temperature Design Parameters

6.3.1 The Secondary Heating Network flow temperature at the secondary outlet of the Substation will be maintained at the agreed flow temperature (maximum temperature to be no greater than 70°C) under all load conditions by the regulation system of the Substation, subject always to the heat demand being less than or equal to the Capacity.

6.3.2 The nominal return temperature from the Secondary Heating Network at the Substation should be at the agreed return temperature. This should nominally be 40°C.

6.3.3 The Secondary Heating Network must be designed and installed in order to achieve the nominal secondary flow and return temperatures.

6.3.4 Low temperature operating systems should be selected to significantly reduce return temperatures such as under floor heating systems, or if preferred, radiator circuits that are designed to operate satisfactorily at low temperatures, e.g. 70°C flow and 40°C return.

6.3.5 The Secondary Heating Network should be used to generate DHW within Residential Units and should be designed to ensure that the mix of return temperatures from the DHWS and the other heating circuits will provide the overall required return temperature. An instantaneous hot water generation heat exchanger should be used to achieve lower return temperatures, e.g. 25 °C, and realise other benefits such as space reduction and reduction of Legionella infection risk.

6.4 Pressure Design Requirements

6.4.1 The pressure on the Secondary Heating Network side of the Substation should not exceed 7 bar g. The Secondary Heating Network must be designed and installed to prevent a pressure of 7 bar being exceeded. A suitable pressurisation system and relief pressure valves should be installed in the immediate vicinity of the heat exchanger. On a development with multiple floors that would otherwise prevent this system pressure limit being maintained, system pressure break heat exchangers should be designed on appropriate floors to maintain this upper limit pressure requirement.

6.5 Water Quality Requirements

6.5.1 To protect the Secondary Heating Network from damage and fouling, including the Substation and in particular the heat exchanger, the Secondary Heating Network must be cleaned and flushed in accordance with BSRIA standards.

6.5.2 Water treatment procedures on newly cleaned closed systems should be in accordance with BSRIA BG29/2012 (or later standard as relevant).

6 Secondary Heating Networks

6.5.3 Dosing equipment should be installed to allow the safe and effective addition of chemical to the circulating water.

6.5.4 Inline side stream filters should be installed with a small percentage water pass through. They must not be installed across the flow and return since this will compromise low return water temperatures.

6.5.5 The final system fill should be using softened water.

6.5.6 Prior to the commencement of Secondary Heating Network Services the following maintenance procedures must be carried out to maintain water quality to ensure the integrity of the closed system.

6.5.7 The number and locations of samples are to be in accordance with BS8552:2011 but must also include the following as a minimum:

- one sample from each heat exchanger in the Substation
- one sample at the pump
- one sample within each riser
- one sample from 2% of the number of HIUs installed

6.5.8 All samples must be analysed by a UKAS accredited laboratory.

6.5.9 The minimum parameters for sampling are as follow at the heat exchangers within the Substation:

BACTERIA	
TVC's @ 22oC	<100,000 cfu/ml and no upward trend
Pseudomonas	<10,000 cfu/100ml and no upward trend
SRB's	Absent
NRB's	For information only dependent on the inhibitor employed
CHEMICAL	
Ph	Between 7.5 and 10 dependent on the inhibitor employed
Suspended Solids	<30 mg/l
Chloride	<250 mg/l
Soluble Iron	<5 mg/l
Total Iron	<15 mg/l
Total Copper	<1 mg/l
Hardness	A downward trend until levels plateau

Table 6.1

6.5.10 Samples from the heat exchangers within the Substation should be taken from the inlet to the plate heat exchanger.

6.5.11 Parameters for all other analysis from across the system are to be in accordance with BS8552:2011.

6.5.12 Unless the water treatment specialist recommends more frequent sampling, the sampling period should be quarterly and a final set of samples should be taken prior to the Energy Company commencing operation and maintenance responsibility.

6 Secondary Heating Networks

6.5.13 Should remedial actions be required, then a further complete set of samples should be taken 7 days after completion of the remedial works, and if acceptable, the normal sampling pattern resumed.

6.5.14 All records of action, results and planned sampling dates must be kept in an on-site log book and must include a graphic trend pattern on results, details of which can be found in BS8552:2011 and BSRIA BG29/2012. The make-up water consumption should be recorded at weekly intervals and should be negligible with no rising trend.

6.5.15 The water quality parameters must be compatible with the Secondary Heating Network. Evidence of compliance with these water quality requirements should be provided prior to water being allowed to flow through the Secondary Heating Network side of the heat exchanger within the Substation.

6.5.16 In addition the following apply:

- Extended periods of no flow can promote fouling and/or deterioration of the heat exchanger and measures to prevent this should be taken
- A water treatment specialist is employed to manage the water quality of the Secondary Heating Network
- Any additional monitoring deemed appropriate by the water treatment specialist for the water treatment regime should be undertaken
- A corrosion monitoring regime should be implemented
- Ongoing Secondary Heating Network water treatment/maintenance records and water quality laboratory analysis should be retained and will be made available to the Energy Company on request

6.5.17 Under no circumstances must flushing of the Secondary Heating Network be undertaken though the Substation. A flushing bypass should be installed in the Secondary Heating Network, bypassing the heat exchanger as shown below:

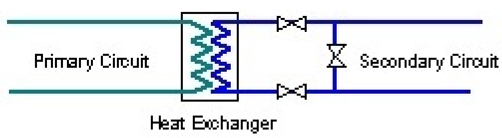

Figure 6.4

6.5.18 Any activities must not foul, corrode or compromise the performance of the heat exchangers within the Substation. To meet this obligation, additional monitoring parameters may be required to according to the system design, operation and treatment regimes. The trending and interpretation of data will assist in determining the correct course of action.

6.5.19 High and/or continuous usage of make-up water will increase fouling. A meter should be fitted on each water makeup system and should be monitored by the BEMS to identify leaks and manage water usage. Any increase in water usage for a closed system should be rectified immediately.

6.5.20 Prior to handover to the Energy Company for operation and maintenance, the water hardness should be less than 60 ppm.

6.6 Design Capacity

6.6.1 The design capacity of the building heating system should not be oversized by using appropriate diversity factors. Whilst diversity factors vary depending upon the number of Residential Units and Commercial Units to be supplied, for hot water diversity to Residential Units, Danish Standard DS539 should be used.

6 Secondary Heating Networks

6.7 Heat Losses, Insulation and Operating Temperatures

6.7.1 This Specification has been developed expressly to drive down the carbon intensity of energy consumption.

6.7.2 If the Secondary Heating Networks are insulated to the requirements of BS5422 or NES Y50 then energy losses in the region of 25%-40% of the useful thermal energy would result, leading to a significantly increased footprint for the Development.

6.7.3 Consequently, insulation standards well beyond BS5422 must be designed and built into the Secondary Heating Networks.

6.7.4 Three fundamentals drive energy loss; the length of pipework, the level of insulation applied and the temperature of water in the pipe. All three issues must be carefully considered within the design. Insulation thickness can only be increased to a certain point after which a de-minimis limit is reached where further insulation brings little extra benefit. Therefore, reducing pipework lengths must be the first priority in any design. This can be achieved by:

- Avoiding unnecessary bends and taking the most direct route
- Providing risers in locations that minimise long pipe runs down corridors

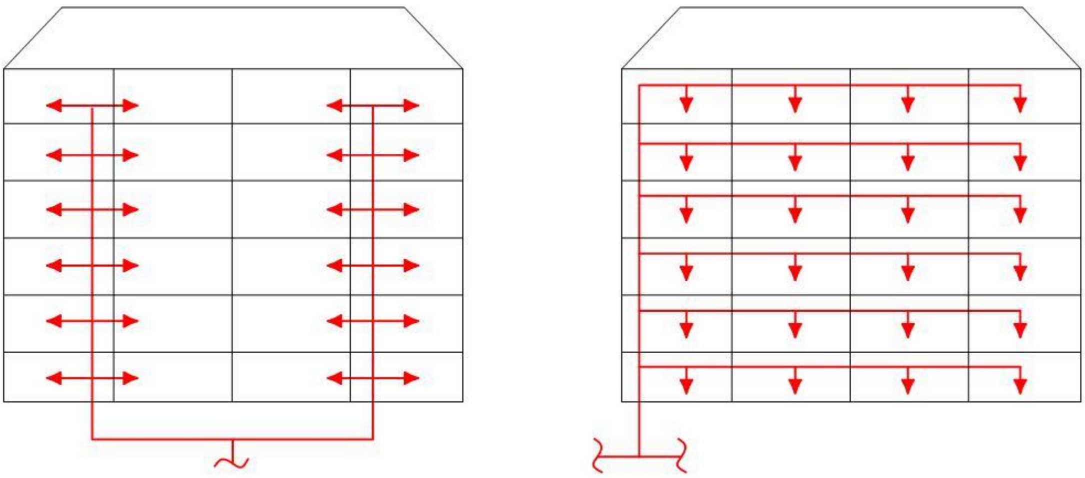

Figure 6.5

6.7.5 The diagram above shows that serving multiple Residential Units via multiple risers with short horizontal pipe runs (left) will result in a much shorter overall pipe length than serving multiple Residential Units from single risers with long horizontal pipe runs along corridors.

6.7.6 To ensure that Secondary Heating Network energy losses are clearly understood and mitigated against, at a very early stage of the design detailed energy loss calculations for the whole Secondary Heating Network based on one year of consumption should be provided. This should then be compared to the predicted annual heat energy consumption for the Development. All assumptions in the calculations should be clearly identified. The design energy loss for the Secondary Heating Network should be no greater than 10% of the predicted Development annual heat energy demand.

6.7.7 Within the calculation, a heat consumption of 5000 kWh per year should be assumed per Residential Unit, not SAP calculation values.

6 Secondary Heating Networks

6.7.8 The heat loss calculation methodology to follow is provided within Appendix 1. The methodology example is for two fictitious buildings S7 and S8, and it is the methodology that is to be followed, not the insulation thicknesses, pipe lengths or operating temperatures.

6.7.9 Insulation: The following minimum insulation should be applied to the pipework and pipework supports:

Pipe Size (nominal bore)	Phenolic Insulation (0.021 W/m-K)Thickness Required
Plantrooms: 40mm – 300mm	50mm
Plantroom to risers: 40mm – 300mm	50mm
Risers: 65mm – 200mm	50mm
Branches from Risers: 32mm - 80mm	50mm
Short sub branches from corridor branches to Residential Unit HIUs: 20mm – 32mm	40mm (30mm at pipe crossovers)

Table 6.2

6.7.10 System Operating Temperature: Within residential developments, peak heat demands usually only occur in the morning and evening. This means that for the long periods of the day and night the system return temperature will be similar to the flow temperature even though variable flow technologies have been carefully designed in to the system. If flow temperatures are permitted to remain at normal levels of around 70°C, losses will remain high, even with the pipework insulation levels required in the table above.

6.7.11 Therefore, variable flow temperatures should be employed within the design to help minimise heat losses as follows:

- Flow temperature reduced between 10:00 hrs – 16:00 hrs
- Flow temperature reduced between 23:00 hrs – 05:00 hrs
- Flow temperature reduced between May – October inclusive

6.7.12 Revised flow temperatures should be as follows:

Time	Reduced Secondary Heat Network Flow Temperature
10:00 hrs – 16:00 hrs	60°C
23:00 hrs – 05:00 hrs	55°C
May – October inclusive	60°C

Table 6.3

6.7.13 Each of the above times and temperatures should be variable via the BEMS. This variable temperature control regime should be achieved by providing three additional signals to the Substation control panel on the primary side of the main heat exchanger. The control valves on the primary side of the Substation will regulate the Secondary Heat Network flow temperature accordingly.

6.7.14 *In Practice:* It should be noted that actual energy loss in practise may be in excess of the design calculated figures due to imperfections in the installation process, e.g. non-continuity of insulation between pipework and pipeline ancillaries.

6 Secondary Heating Networks

6.7.15 To reduce energy loss the following should be provided:

- Any pipework supports must not make direct contact with pipework, i.e. supports must include an equivalent level of insulation between pipe and support as is being provided to the pipework
- All valve ancillaries should be fully insulated, e.g. valves, vents, drain point, strainers, flanges expansion devices, anchors, pipe ends, etc.
- All plant should be insulated, e.g. pumps, dirt separators, expansion vessels, etc.

6.7.16 Insulation to plant, valves and expansion devices should be of a type that enables easy removal for inspection and maintenance, e.g. wrap around jackets or similar. Insulation should not interfere with the cooling of motors and other electrical electronic components.

6.7.17 As noted below, there should be a requirement to undertake thermal imaging of the installed insulation to demonstrate a high quality of installation.

6.8 Locking Isolation Valves outside each Residential/Commercial Unit

6.8.1 Lockable isolation valves (including locks) should be installed in the common parts of an apartment building, e.g. corridor, car park etc., to allow the secondary heating serving individual Residential Units/Commercial Units to be isolated without gaining access into the Residential Unit/Commercial Unit etc.

6.9 Venting and Drains

6.9.1 Manual air vents should be fitted to all pipework where necessary for correct system operation and maintenance and at all system high points. Care should be taken to ensure that such vents are fitted at the highest point of the sections they are intended to vent.

6.9.2 All risers from which branches connect should be installed at a higher point than the highest branch pipework connected to it to ensure that the uppermost floor connecting in to the riser vents in to the riser.

6.9.3 Branch connections to risers should rise within the riser before making connection to assist with the self-venting of branches.

6.9.4 Branches from the risers along corridors to Residential Units may be designed horizontally but sub-branch connections from the branches to Residential Units must drop from the branch (not be horizontal or rise). At no time must any sub-branch pipework forming part of the Secondary Heating Network within the corridor or Residential Unit be higher than the branch in the corridor. This is to ensure that access to the Residential Unit is not required for Secondary Heating Network system venting.

6.9.5 At the end of a branch and at any high point within the branch along its route, a manual vent valve should be provided.

6.9.6 Where air vents are inaccessible or are located more than 1.8m above floor level, discharge pipes should be fitted from each vent and taken down to approximately 600mm above floor level with a second valve located at an accessible height. Under no circumstances must air vents for the Secondary Heating Network be located within Residential Units or there be a requirement to access Residential Units to undertake venting.

6.9.7 Separate lever operated ball type isolation valves should be installed before automatic air vents enabling the air vents to be disconnected without any system downtime.

6.9.8 Drain points should be of 1/2” or 3/4” diameter dependent upon the volume to be drained. These should be fitted to all pipework where necessary for correct system operation and maintenance to allow the draining of each isolatable system section. Drain points should consist of a ball valve and should be plugged when not in use. In plantrooms and at the base of risers drains should be line size and in any case no less than 50mm in size.

6 Secondary Heating Networks

6.9.9 Pipework should be suitably graded in accordance with the service being carried out to facilitate venting and draining. Horizontal pipes are to have a gradient, set to clear air at the vent pipe of not less than 1 in 240 (25mm per 6m length). Where horizontal pipes are routed within a corridor ceiling void from a riser to Residential Units, the pipework may be laid without a fall as long as accessible vents are provided at each end of the horizontal run provided without a fall.

6.9.10 All items of plant with permanently open drain connections, such as safety valves, should be installed with a trap or tundish as appropriate, and be run to terminate over the closest suitable floor gulley.

6.10 Thermal Expansion of Pipework

6.10.1 Movement and forces due to thermal expansion should be accounted for in the design of the Secondary Heating Network in risers and on horizontal pipe runs. Expansion should be accommodated by flexing of the pipe wherever possible. Expansion joints should only be used where absolutely necessary. A strategy to cater for pipework expansion, including the requirement for anchors, throughout the Secondary Heat Network should be developed.

6.11 Noise and Vibration

6.11.1 Careful attention should be accounted for in the design of the Secondary Heating Network with respect to the transfer of noise and vibration from the Secondary Heating Network plant via the structure and pipework. A strategy to prevent the transfer of noise and vibration from the Secondary heating plant to adjacent areas via the structure and pipework should be developed.

6.11.2 Special attention must be taken to ensure that there are no “bridges” between the pipework and structure within the plantroom that bypass spring hangers and allow the transfer of vibration to the structure.

6.12 Materials and Workmanship

General

6.12.1 The Secondary Heating Network should be installed in accordance with requirements in the Specification, Good Industry Practice, Chartered Institution of Building Services Engineer’s Guidelines, Building Regulations and all applicable laws. The requirements of this Specification should take precedence with the exception of applicable laws.

Above Ground Pipework

6.12.2 The Secondary Heating Network within the Substation Plantroom should be constructed of medium or heavy grade steel pipe. Alternatively 316 grade stainless steel pipework may be used.

6.12.3 The Secondary Heating Network outside of the Substation Plantroom should be constructed of carbon steel pipework with an galvanised or polypropelene outer coating. Alternatively 316 grade stainless steel pipework may be used.

6.12.4 Alternatively, the Secondary Heating Network outside of the Substation Plantroom shall be constructed of "press fit" style carbon steel pipework with a galvanised or polypropelene outer coating. Where such systems are used, any jointers shall have been trained on the manufacturer's joint to be used, and shall have at least two year's installation experience of this joint. The location of each joint shall be clearly marked on the as installed drawings and provided with a unique identifier that indicates which jointer installed the joint. Each joint shall be inspected by a supervisor experienced in such joints before insulation is applied, and the supervisor shall create a schedule of joints that have been inspected including the date and time of the inspection. The schedule shall be issued to the Council.

6.12.5 No plastic pipework should be used in the Secondary Heating Networks.

6 Secondary Heating Networks

6.12.6 Pipe and plant making up the Secondary Heating Network should be properly supported taking into account movement due to thermal expansion and the need to retain support when dismantling for maintenance and repair. The support system should comply with BS3974.

6.12.7 Flexible connectors may be used but only in circumstances where it is to cater for pipe expansion, and in such circumstances they should have a demonstrated life expectancy in excess of 20 years under its installed operating environment. It should be insulated to similar standards as normal pipework to reduce heat loss; nitrile rubber would be a better insulator than phenolic.

Insulation

6.12.8 All pipework and pipeline ancillaries should be fully insulated. The insulating materials should be applied in accordance with BS 5970.

6.12.9 The physical characteristics of insulating materials should generally meet the requirements of BS 5422, however, the insulation thickness to limit heat loss must be in accordance with the requirements of this Specification.

6.12.10 Great care should be given to ensuring the continuity of insulation to pipework, supports and plant. Thermal imaging should be undertaken to ensure errors are corrected. Where insulation is demonstrated by thermal imaging to be non-continuous or not to the same high standard, then errors in workmanship will need to be corrected.

6.12.11 Insulation to plant, valves and expansion devices should be of a type that enables easy removal for inspection and maintenance, e.g. wrap around jackets or similar. Insulation should not interfere with the cooling of motors and other electrical electronic components.

Pressure Test

6.12.12 The Secondary Heating Networks should be pressure tested to 1.5 times design pressure for at least 2 hours in accordance with HVCA TR/6 Guide to Good Practice for Site Pressure Testing of Pipework & HSE GS4. Pressure test certificates for all systems to be operated should be provided.

Sectioning

6.12.13 With the exception of pipework and valves, the Secondary Heating Networks should be designed and installed such that all items requiring maintenance or replacement within the design lifetime of the system can be safely isolated and removed without interruption to the supply of heating or cooling to the Customer.

6.12.14 Sufficient isolation valves should be installed to allow plant to be maintained or removed with minimum loss of water. Each section between such valves should be fitted with a means of draining and a vent at the high point.

6.12.15 Items with electrical power supplies should be fitted with individual means of safe isolation allowing safe removal without loss of service to the Customer.

Accessibility

6.12.16 Safe access should be provided to all plant including valves and vents. Plant layout should be such that all access can be gained without requiring scaffolding, lifting equipment and whilst maintaining the heat/cooling supply to the Customer at all times.

Underground Pipework

6.12.17 The requirements of section 6.7 in Part A of this specification should be followed and have not been re-produced in Part 2 of the specification. However, as long as the secondary heating network operates at no greater than 70°C and 6 bar, PEX pipe alternatives to steel pipe will be acceptable to facilitate lower costs and a quicker installation.

7 Heat Interface Units and Dwelling Heating Controls

7.1 Heat Interface Units

7.1.1 A simple wall mounted twin plate Heat Interface Unit (HIU) which will provide indirect heating and indirect instantaneous hot water, all supplied via the Secondary Heating Network with a minimum 2 year parts warranty, should be installed and commissioned.

7.1.2 The HIU should consist of a primary side, a secondary heating side and a domestic hot water side, and should be mounted on a galvanized mounting plate with all pipes being stainless steel and all fittings should be brass.

7.1.3 The twin plate units will comprise of 2 plate heat exchangers; one for heating and another for the instantaneous production of domestic hot water. The plate outputs are to be sized according to the primary supply conditions and the heating and hot water demand. Both plate heat exchangers should be fitted with factory made insulation jackets.

7.1.4 HIUs should:

- Be of high quality pre-fabricated manufacture for installation and connection on site
- Be installed in such a position that access to repair, maintain and replace components can be easily achieved
- Incorporate adequate means of isolation to allow component parts and the HIU to be replaced
- Be manufactured using components which can be readily sourced for replacement
- Incorporate a high efficiency, variable speed pump
- Have a heating heat exchanger with inlet/outlet parameters of 70°C/40°C
- Have a hot water heat exchanger with inlet/outlet parameters of 70°C/25°C
- Have an incoming differential pressure control valve
- Have two control valves to control temperature (one for heating, one for domestic hot water), with the domestic hot water being of a very high quality e.g. a Samson valve
- Have a motorised valve for the heating circuit which should be linked to the dwelling time programmer
- Ensure domestic hot water takes priority over heating
- Be provided with a low pressure electronic pressure switch with pressure sensor on the secondary heating side that shuts down the pump to prevent system damage and signals low pressure via the metering communication system
- Have a dirt strainer in the primary side of the HIU
- Have a dirt strainer in the secondary side of the HIU
- Have a dirt strainer in the cold water feed to the HIU
- Have all parts included within a white enamel coated, insulated metal casing
- Have a casing that is physically and securely fixed to reduce tampering by Customers
- Be provided with safety labelling on the metal case warning Customers not to remove the case
- Contain the Customer Meter
- Have an inbuilt heating circuit expansion vessel
- Have an external filling loop from the incoming cold water feed to the HIU
- Include a cut out on the metal case to allow the Customer to be able to see and operate the Customer Meter and its display
- Contain a motorised isolation valve, (powered open, spring closed), that will be connected to a remote Customer Interface
- Provide a 5A fused spur to supply power to the remote Customer Interface
- Be provided with an MBus lead from the Customer Meter to the remote Customer Interface

7.1.5 All pipework within the HIU should be insulated to BS 5422 (non-domestic installations) as a minimum.

7.1.6 The heat exchangers should be provided with removable insulation jackets

7 Heat Interface Units and Dwelling Heating Controls

7.1.7 Flushing loops incorporating isolating valves should be installed close to the HIU to allow effective flushing of the Secondary Heat Network and dwelling heating system without passing water through the HIU.

7.2 Dwelling Controls

7.2.1 At least one heating controller should be provided within the Residential Unit heating system to ensure that a complete and operational heating control system is provided within each Residential Unit, including controlling the HIU.

7.2.2 The following features are to be provided within the controllers:

- Simple to operate and easy to read programmer with backlit display
- Multiple time period programming per day for heating and hot water
- Multiple programmable temperature set points to allow night temperature control set back, etc.

7.2.3 Each controller should be pre-programmed with a set of time and temperature parameters, agreed with the Energy Company, and create a memory stick (or similar) of these parameters so that the controller can be easily re-programmed to its default settings when required by a maintenance engineer.

8 Metering

8.1 Metering System General Arrangements

8.1.1 Customer Meters are required to record the individual energy consumption of Customers to enable separate energy bills to be issued. To enable individual bills to be issued, it is necessary to install separate meters on the supplies to:

- Each Commercial Unit
- Each Residential Unit
- All residential Common Parts heating systems
- All commercial Common Parts heating systems

8.1.2 Meters should be installed and commissioned as part of the Secondary Heating Network.

8.1.3 Customer Meters must provide a means of measuring the energy consumed, measured in kilowatt hours (kWh), and the volume of water, measured in cubic metres (m^3). A heat meter will be used for this purpose and will incorporate an integrator calculator unit (which should be provided with an electrical supply within the HIU with a battery back-up), and temperature sensors on the flow and return pipes of the Secondary Heating Network within the HIU.

8.1.4 The calculator unit should provide both real-time and cumulative Energy Services consumption information including:

- Real-time heat consumption (kW)
- Real-time flow rate (m^3/hr)
- Real-time temperature (°C)
- Cumulative energy consumption (kWh)
- Cumulative flow (m^3)

8.1.5 All metering equipment and the installation must comply MID Class 2 and an initial certified accuracy of ±3%.

8.1.6 Customer Meters should have an MBus port that should be connected via an MBus cable to a remote Customer Interface.

8.2 Customer Meters and Components

8.2.1 Customer Meters are to be installed in within the HIU accordance with the manufacturer's installation instructions.

8.2.2 Customer Meters should be installed so adequate space is available around the Meter to allow unobstructed access to perform maintenance duties. Customer Meters should also be provided with local isolation to allow simple disconnection and replacement.

8.2.3 The Customer Meters should be from meter manufacturers that are compatible with the remote Customer Interface Unit.

8.2.4 *Flow Meters:* Flow meters measure volume flow rates and supply/return temperatures to provide an accurate record of Energy Services consumed. All flow meters should be ultrasonic. These solid state devices are less susceptible to deposits and debris in the water as they contain no moving parts and their accuracy is superior to other mechanical meters.

8.2.5 The flow meter must be installed on the return pipe section of the Secondary Heating Network within the HIU. Customer Meters will have threaded connections (not flanged) and will support a continuous temperature of 90°C.

8 Metering

8.2.6 Each Customer Meter requires isolating valves to be installed on each side of the meter to facilitate removal. Customer Meters also require a straight section of inlet and outlet pipework to allow accurate measurement of flow. The specifications of the meter supplier must be complied with in all circumstances.

8.2.7 The range of flow rates that the flow meter can accurately record are dependent on the physical size of each Commercial Unit or Residential Unit and the estimated consumption of Energy Services.

8.2.8 The flow meter must operate to a minimum pressure lower than the system pressure.

8.2.9 Temperature Sensors: MID Class 2 compliant to measure the quantum of Energy Services consumed, it is necessary to measure the temperature on the flow and return pipes either side of the meter using temperature sensors. The temperature sensors must be positioned close to the flow meter.

8.2.10 Four temperature sensor pockets should be provided within each Residential Unit; two within the HIU and two empty pockets external to the HIU for calibration purposes. The pockets must be installed in the upper section of horizontal pipes, leaning at an angle of 45°, opposite to the direction of flow through the pipe. Pockets will be of “dry” type to enable simple removal without the need to isolate and drain the HIU and will provide tamper proofing in the form of wire seals loops.

8.2.11 The insertion length of the temperature sensors must be such that the active portion of the sensor is positioned in the centre of the pipe (the bleeder must be long enough so that the active part of the sensor is in the centre of the pipe and its end protrudes far enough from the insulation).

8.2.12 Sensor pockets must be removable so that it possible to remove them when they become worn while minimising the disruption of Energy Services. Sensor pockets must be manufactured from stainless steel.

8.2.13 The sensors must be paired and supplied with the integrator unit, and comply with EN-1434. A delta T minimum sensitivity of 3°C is required and the sensors must be sealed.

8.2.14 *Calculator:* The calculator unit will be of Environmental Class A, with an enclosure protection of IP55. The calculator will provide an output display in English and must display:

- Alarms and error codes
- A correction table for density and enthalpy
- The instantaneous flow rates with at least 1 month’s storage which can be stored for 12 months on the device
- The monthly cumulative energy consumption
- Flow temperature and instantaneous delta T
- Missing time data
- Operating time data

8.2.15 The ambient temperature in which the calculator operates must be between 5°C and 55°C.

8.2.16 The calculator is to be electrically and battery powered and must have a battery life of at least 10 years plus 1 year.

8.3 Automatic Meter Reading

8.3.1 For each Residential Unit, each Customer Meter should be connected via communication cabling according to the EN 1434 standard and should accept the MBus protocol to a Customer Interface Unit.

8.3.2 For each Commercial Unit and Common Parts Meter, each Customer Meter should be provided with an MBus wireless connection to appropriately positioned wireless collecting units which in turn should be provided with a SIM card to allow remote interrogation of the system. This collectively should be referred to as the Automatic Meter Reading system (AMR).

8 Metering

8.4 Customer Interface Unit

8.4.1 The location of the Customer Interface should be agreed with the Energy Company, although it cannot be located in, on or too near the HIU due to it acting as a screen to sending data via its SIM to the Energy Company.

8.5 Meter, AMR and Customer Interface Commissioning

8.5.1 The Customer Meters, AMR and Customer Interface units should be commissioned following installation. All metering devices and Customer Interfaces must be operational and proven to be functioning correctly when the system is installed; this will include at least 14 days of historical data. Final commissioning activities should verify the following:

- The integrity of the installation and correct meter component position
- The initial reliability and accuracy of the meter
- The electrical insulation of the installation
- The parity of the temperature sensors
- Correct security sealing of meters, valves (within the HIU) and Customer Interface
- Wireless communication to the collector units work reliably
- Appropriate data files are sent from the collector unit SIM and it can be remotely interrogated; and
- That the Customer Interface unit communicates with the Customer Meter and sends and receives data reliably, all with the technical assistance of the Energy Company.

9 BEMS Controls

9.1 BEMS Controls

9.1.1 Controls for the Secondary Heating Network and any other works to be operated by the Energy Company should be independent of controls for other systems not to be operated by the Energy Company. Such controls should include; power supplies, metering, controllers, cables, panels, displays, computers and software.

9.1.2 The control system should comply with the following:

- An operator interface is required
- A web based remote access is to be provided to allow the Energy Company to monitor and adjust the controls and to receive alarms including supervisor software
- A set of comprehensive system graphics to show each of the monitored points and alarms below for each Secondary Heating Network should be provided on the supervisor
- All software files to be handed over (including .SET files)
- Usernames, passwords and PINs should be disclosed
- BEMS network is to be an Ethernet network
- Actuators for valves etc. should be 24V, not 240V
- Any 24V circuit outside panel should have its own MCB
- Temperature sensors should be 10kOhm thermistor sensors
- Strategies should include Sensors and Plots for control values, e.g. calculated setpoints, valve position demands, etc, and not just for connected Sensors
- Control Panels should have:
    - Open slot type trunking
    - Top hat DIN rail for field terminals
    - Cable entry at bottom of panel only in plantrooms where there is a possibility of water leaks at high level
    - Control panels able to be opened without turning them off first, e.g. defeatable isolators
    - A UPS to allow power failure alarms to be transmitted to the Energy Company.

9.1.3 Alarms/Status/Analogue Values should be provided for the following as a minimum:

- UPS mains failure
- Heating system low pressure (per sensor)
- Pressurisation fault
- High make-up water alarm
- Pressurisation unit healthy
- Pump speed (each pump)
- Pump fail (each pump)
- Pump commanded to run (each pump)
- Pump flow proving dp switches (each pump)
- Heating system low temperature
- Heating system high temperature
- Filter(s) blocked
- Pressure sensor analogue value (each sensor)
- Pressure across main heat exchanger(s) (secondary side)
- BEMS enable command status to main heat exchanger control panel
- Heat exchanger plantroom temperature with high and low limit alarm
- Secondary heating system plantroom temperature with high and low limit alarm

9 BEMS Controls

10 Implementation Guidance

10.0.1 **Pre application stage:** All proposals for major developments which are capable of connecting to a decentralised energy network (DEN) are encouraged to discuss the requirements for this with the Council prior to the submission of a planning application. Developers should use the Decentralised Energy Networks Technical Specification SPD and discussion with Council officers/representatives to establish what is likely to be required, to inform an understanding of whether it is feasible and viable to implement a DEN as part of their proposals.

10.0.2 **Planning application stage:** All proposals for major developments which are capable of connecting to a heat network must submit an Energy Statement outlining the strategy for achieving the required carbon reduction targets. Where it is feasible and viable to meet DEN requirements, as part of this Applicants should submit a Technical Design Pack.

Appendix 1

Appendix 1

Pipework Lengths

The lengths of all sections of LTHW pipework have been scheduled from the Revit models for residential buildings S7 and S8. The lengths of the flow and return pipework for each pipe size, as well as the total combined length, are displayed below.

	Total Pipe Lengths		
Nominal Pipe Size (mm)	**Total Flow Length (m)**	**Total Return Length (m)**	**Total Length (m)**
22	378.7	450.7	829.4
25	1786.4	1697.5	3483.9
32	113.9	109.1	223.0
40	6.1	6.1	12.2
50	15.7	15.7	31.4
65	30.5	30.5	61.0
80	65.7	51.6	117.3

Table .1 Pipe lengths in building S7

	Total Pipe Lengths		
Nominal Pipe Size (mm)	**Total Flow Length (m)**	**Total Return Length (m)**	**Total Length (m)**
22	172.0	195.3	367.3
25	870.9	818.7	1689.6
32	82.43	85.4	167.8
40	3.4	3.4	6.8
50	15.2	15.2	30.4
65	72.1	61.8	133.9

Table .2 Pipe lengths in building S8

Benchmarking the 3D Revit Model

In order to verify the accuracy of the schedules taken from Revit, the lengths of the LHTW Flow pipes on level 2 of building S7 have been measured from elevations and 2D plan drawing (specified in Appendix B). A comparison between teh ,esaured values and those taken from the Revit schedule is shown below.

Appendix 1

Nonimal Pipe Size (mm)	Scheduled LHTW Flow Length (m)	Measured LTHW Flow Length (m)	Percentage Difference
22	14.0	14.0	0.1
25	64.1	63.6	0.6
32	4.5	4.4	1.2

Table .3 Comparison between schedule and measured pipe lengths on level 2 of building S7

The scheduled Revit data when compared to measured data from drawings is very similar, with a maximum discrepancy of 1.2%. This affirms that the scheduled data is suitable accurate for the purposes of this study.

Calculating Heat Loss Coefficients

The heat losses for each nominal pipe size has been calculated using the equations shown in section 1.4. The following values were used in the calculations:

- LTHW Flow = 70°C, LTHW Return = 30°C
- Ambient Temperature = 20°C
- Insulation Thickness = 40mm
- Insulation Thermal Conductivity = 0.025$Wm^{-1}K^{-1}$

The equations used require an initial estimate for the surface temperature of the insulation to be made. The true surface temperature can be found iteratively to deliver an accurate value for the surface heat transfer coefficient. The calculated surface heat transfer coefficients for insulated flow and return pipes of each nominal size are shown below.

Nominal Pipe Size (mm)	Flow Pipe Insulation Surface Temperature (°C)	Flow Pipe Surface Heat Loss Coefficient (Wm^{-1})	Return Pipe Insulation Surface Temperature (°C)	Return Pipe Surface Heat Loss Coefficient (Wm^{-1})
22	21.5	4.97	20.3	1.99
25	21.7	6.27	20.3	2.51
32	21.8	7.2	20.4	2.88
40	21.9	7.81	20.4	3.12
50	22	8.99	20.4	3.60
65	22.1	10.26	20.4	4.10
80	22.3	11.79	20.5	4.71

Table .4 Surface heat transfer coefficients for insulated flow and return pipes (40mm insulation)

Calculating Heat Loss

The heat loss has been calculated by multiplying the surface heat loss coefficient by the total length of the pipes for each pipe size. For example, the heat loss from the 25mm flow pipework in building S7 has been calculated below:

1786.40	x	6.27	= 11208.02
(Total Length of 25mm 70°C flow pipework in building S7 (m)		(Surface heat loss coefficeint for 25mm 70°C flow pipework) (Wm^{-1})	(Heat loss in 25mm 70°C flow pipework in building S7) (W)

The heat loss for all of the LTHW pipework in building S7 is shown below:

	Total Heat Loss (W)		
Size (mm)	**70°C Flow**	**30°C Return**	**Total**
22	1882.5	448.1	2230.6
25	11208.0	2129.7	13337.7
32	820.7	157.1	97708
40	47.6	9.5	57.1
50	141.2	28.2	169.4
65	312.30	62.4	374.7
80	77408	121.7	896.5
Total	15187.0	2956.8	18143.8

Table .5 Heat loss from LTHW pipework in building S7

The same process has been carried out for the pipework in building S8. The results are shown below:

	Total Heat Loss (W)		
Size (mm)	**70°C Flow**	**30°C Return**	**Total**
22	855.1	194.2	1049.3
25	5464.3	1027.2	6491.6
32	593.7	122.9	716.6
40	26.5	5.3	31.8
50	136.9	27.4	164.3
65	739.7	126.7	866.5
Total	7816.4	1503.7	9320.1

Table .6 Heat loss from LTHW pipework in building S8

Annual Heat Loss

The total annual heat loss can be calculated in terms of kWh by multiplying the totals from Table .5 'Heat loss from LTHW pipework in building S7' and Table .6 'Heat loss from LTHW pipework in building S8' by the number of hours in a year (8760):

Appendix 1

Annual heat loss for building S7 = 158,940kWh

Annual heat loss for building S8 = 81, 644kWh

Annual Energy Usage

There are 219 dwellings in building S7 and 114 in building S8. Based on an average annual energy consumption of 5000kWh per dwelling, this gives total annual energy usages of:

S7 1,095,000kWh

S8 570,000kWh

This means that the estimated heat loss from building **S7** is **14.52%** of its annual energy usage. The estimated heat loss from building **S8** is **14.32%** of its annual energy usage.

Part C
Decentralised Energy Network SPD:

Specification for the Substation Plantroom and Secondary Heating Network at Commercial Developments

Contents

Definitions

The following terms should have the following meanings when used in this Specification:

"Capacity" means the Heating Services Capacity.

"Developer" or "applicant" is the company responsible for the delivery of Development.

"Development" is the land and buildings (residential and commercial) that will be served by the Decentralised Energy Network at completion of the building phases.

"Decentralised Energy Network" means:

- the Energy Centres; and
- the Primary Heating Network.

"Energy" is heat.

"Energy Company" is the supplier of Energy.

"Energy Services" means the Heating Services.

"Enfield Council" is the London Borough of Enfield and their delegated representatives.

"Network Meter" means the meter measuring the total supply of Energy Services from the Primary Heating Network to the Secondary Heating Network, installed in the Substation Plantroom.

"Primary Heating Network" means the network, associated services and assets between the Energy Centre and the secondary side of the Primary Heating Network heat exchanger.

"Residential Unit" means a unit within the Development which is primarily used for residential purposes.

"Secondary Heating Network" means the network, associated services and assets between the secondary side of the Primary Heating Network heat exchanger.

"Specification" means this document/specification.

"Substation" is the interface between the Primary Heating Network and the Secondary Heating Networks. The substation provides an indirect connection via plate heat exchanger(s) to the Primary Heating Network. A heat exchanger is used to transfer heat from the Primary Heating Network to the Secondary Heating Networks installed within the individual buildings within the Development.

"Substation Plantroom" is the room, located within the Development, in which the Substation is installed.

"Technical Design Pack" means a technical information pack containing the following information:

For outline planning applications, should include but not limited to:

- Secondary Heating Network plantroom layout, showing the Substation and all main plant components of the Secondary Heating Network
- The outline location for the Temporary Boiler Space

For full planning applications, should include but not limited to:

- A layout showing Substation Plantroom layout, including access and maintenance clearances, showing the Substation and all main plant components
- Schematic drawing showing Substation(s), Secondary Heat Network Plant (number of pumps, pressurisation units, etc.)
- Schematic drawing showing the design of the Secondary Heating Network

Definitions

- Outline specification detailing key component parts, system design capacities, design operational parameters, and proposed method of achieving variable volume control philosophy of the system
- A layout showing the location of and access to the Temporary Boiler Space

If the details submitted with the planning application are considered to be acceptable and if the LPA are minded to approve the scheme a Detailed Technical Design Pack will be secured by way of s106 agreement (see below).

Submission of further details secured as part of s106 agreement to include but not be limited to:

- Updated layout showing Substation Plantroom layout, including access and maintenance clearances, showing the Substation and all main plant components
- Updated schematic drawing showing Substation(s), Secondary Heating Network Plant (number of pumps, pressurisation units, etc.)
- Updated schematic drawing showing the design of the Secondary Heating Network
- Detailed specification detailing key component parts, system design capacities, design operational parameters, and proposed method of achieving variable volume control philosophy of the system
- Updated layout showing the location of and access to the Temporary Boiler Space

By way of condition and s106, details on other relevant matters such as external appearance, transport and access, noise, vibration, ventilation, air quality, and drainage will be subject to assessment and approval process.

2 Introduction

2.1 Introduction

2.1.1 In accordance with policy DMD 52, Part 1, 2 and 3, where a connection is available to an existing or planned future decentralised energy network, developments should incorporate the following:

a) Substation Plantroom

b) Temporary boiler space

c) Secondary Heating Network

d) Customer metering and Heat Interface Units

2.1.2 This part of the Specification has been provided to ensure that connected commercial developments:

- are compatible with the Decentralised Energy Network
- Allow a suitable interface to the Decentralised Energy Network by providing a Substation Plantroom within the Development to the spatial and technical standards required
- Operate efficiently to ensure that carbon savings are delivered by the Decentralised Energy Network.

2.1.3 With respect to policy DMD 52, Parts 1,2 & 3, the applicant will be responsible for the provision of a complete and operational Development heating system, incorporating all plant and equipment necessary for their full and proper operation to meet the energy delivery requirements set out in this Specification. Please note also that the applicant is also likely to be responsible for funding a proportion of the extension of the existing Decentralised Energy Network (i.e. the off site extension of a DEN into the site (Substation Plantroom) that would be needed to complete the connection). This will be in the form of a connection charge likely to be based on the number of dwellings and the area of any commercial units to be connected.

2.1.4 The information in this document is provided to ensure that the required decentralised energy infrastructure operates efficiently, has longevity, delivers the intended carbon emission reductions, and reduces the end cost of low carbon heat for customers.

2.1.5 The Decentralised Energy Network should be of a high-quality and robust enough to provide a resilient Energy supply with a life expectancy that befits its intended use.

2.1.6 IT DOES NOT COVER:

- If being provided by the Applicant, the requirements for the Energy Centre and Primary Heating Network (see Part A of the Specification for such details).
- Building heating systems for residential developments (including residential developments with small commercial areas supplied with heat via the residential building secondary heating network), (see Part B of the Specification for such details).

2.2 Structure of Part C

Connected Capacity of the Development and Substation

2.2.1 Section 4 details the requirements that need to be considered when determining the connected capacity of their Development and the subsequent design of the Substation.

Substation Plantroom

2 Introduction

2.2.2 Section 5 details the specific requirements for the Substation Plantroom design and installation so that it may be provided with Heat Exchangers to allow the transfer of heat from the Primary Heating Network to the Development's Secondary Heating Network.

2 Introduction

Secondary Heating Networks

2.2.3 Section 6 details the specific requirements for the Secondary Heating Network system design, materials specification and installation workmanship to allow a development to receive Energy Services.

2.2.4 This section also details water quality treatment standards that are required within the Secondary Heating Network at completion of the testing and commissioning process and throughout the life of the asset.

2.2.5 For the avoidance of doubt, the design requirement for the Secondary Heating Network should be based on:

- **Variable volume, constant temperature** to suit the fluctuations in customer demand and environmental conditions(1)
- **Low heat loss** to minimise wasted heat to the building.

2.2.6 Failure to comply with these Secondary Heating Network design criteria will hinder the efficient operation of the Decentralised Energy Network and reduce the levels of carbon reduction as a result. It is therefore essential that Secondary Heating Networks are designed accordingly.

1 Return temperatures may in practice be lower than the nominal value but as far as reasonably practicable shall not be higher

3 General Requirements

3.1 General Requirements

Carbon Savings

3.1.1 With respect to policy DMD 52, Parts 1, 2 3 and 4, at the planning stage, detailed design stage and construction stage the Applicant should estimate the carbon reduction provided by the Decentralised Energy Network and Secondary Heating Networks (including system losses) based on the following methodology:

Annual carbon saving = baseline carbon emissions - Anticipated scheme carbon emissions

Annual % carbon saving = Annual carbon saving/baseline carbon emissions

Baseline carbon emissions will assume gas-fired boilers supply all heat and supply of electricity from the national grid.

The anticipated carbon emissions will be calculated including all fuel and energy use required to deliver energy to consumers.

Emissions factors taken from the latest guidance from DEFRA/DECC on greenhouse gas reporting will be used in all calculations of carbon emissions.

3.1.2 Presentation of the carbon saving calculation will include as a minimum:

- Baseline annual carbon emissions
- Anticipated scheme annual carbon emissions
- Annual gas consumption of thermal plant
- Annual electrical consumption of thermal plant
- Annual electrical consumption of all ancillary plant
- Annual losses associated with thermal distribution
- Annual thermal energy delivered to consumers
- Annual gross electrical generation, if applicable.

3.1.3 The Applicant should advise on the designed and installed carbon intensity of heat in kgCO2/kWh and should produce calculations to demonstrate this. These calculations should be submitted to Enfield Council for approval.

4 Connected Capacity of the Development and Substation (Primary Heating Network and Secondary Heating Network Heat Exchanger Interface)

4.1 General

4.1.1 The interface between the Primary Heating Network and the Secondary Heating Network is achieved via the Substation located in a Substation Plantroom within the Development.

4.1.2 The Substation is provided to separate the Decentralised Energy Network Primary Heat Network that may serve several developments, either now or in the future, with differing operational parameters from each development Secondary Heating Network.

4.1.3 The number of Substations is to be kept to a minimum with ideally one Substation per Development. Under no circumstances will the higher operating temperatures of the Primary Heat Network be permitted to be routed within buildings other than to be routed to the Substation Plantroom serving that part of the Development. The Substations should be located to ensure this requirement.

4.1.4 Each Substation should include the following equipment which should be provided by the Developer responsible for the Energy Centre and Primary Heat Network:

- isolating valves
- filter
- heat exchanger(s)
- motorised regulation valve(s)
- energy meter
- temperature sensors
- control panel
- hydraulic connections
- power and instrumentation (fibre) connections

4.2 Connected Capacity of the Development

4.2.1 The Applicant should determine the Capacity that they require for the Development to size the Substation. This is determined in a similar way to an electrical connection from a utility provider. The size of the Connection will determine the ongoing Availability Charge for the Development.

4.2.2 It is important that Capacities are not overstated for a Development connected to a Substation otherwise good control at low demands can be difficult.

4.3 Selected Operating Temperatures of the Secondary Heating Network

4.3.1 The default Secondary Heating Network operating temperatures for the design should be 70°C flow and 40°C return.

4.4 Number of Heat Exchangers

4.4.1 Each Substation should contain two heat exchangers for resilience.

4 Connected Capacity of the Development and Substation (Primary Heating Network and Secondary Heating Network Heat Exchanger Interface)

4.5 Schematics Showing Substation Arrangement and Developer Interface

4.5.1 The following schematics generally show the arrangement, component parts and interface point with the Developer.

4.5.2 The Substation schematic for a 2 heat exchanger installation is shown below:

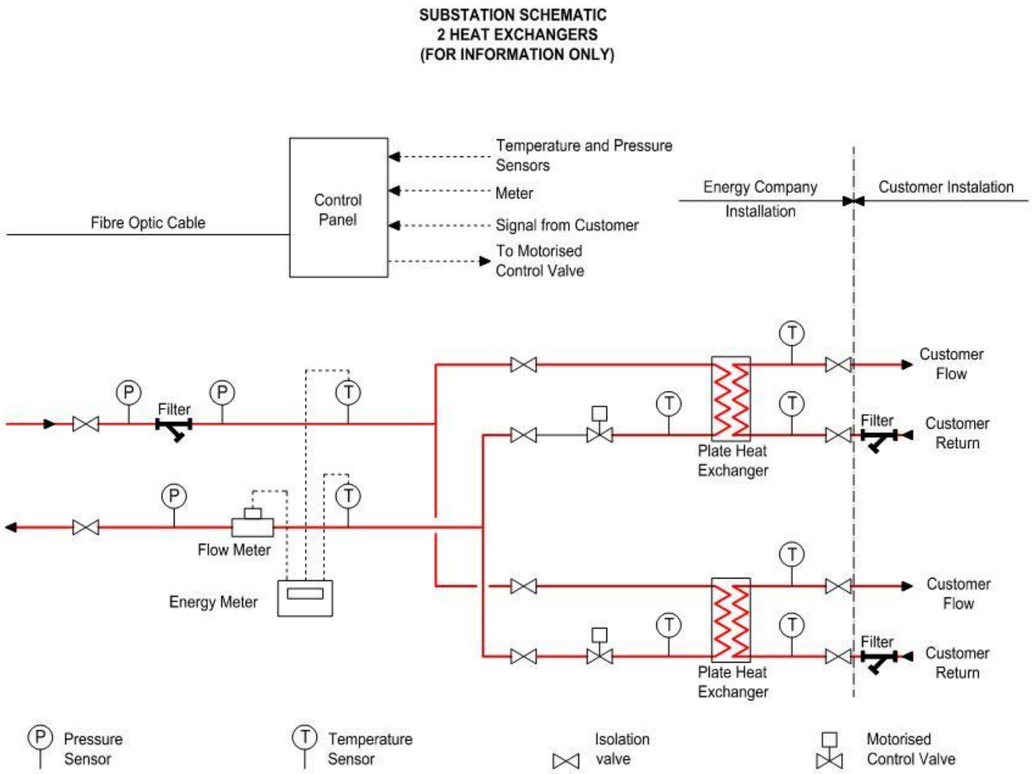

Figure 4.1

4.6 Design of the Substation and Developer Control Interface

4.6.1 Binder test points should be provided within the Secondary Heating Network immediately after the Substation valves to allow the verification of the pressure drop.

4.6.2 Filters (strainers) should be installed in the Secondary Heating Network at the inlet to the heat exchanger within the Substation to protect them from fouling. The filter should have a mesh size of no greater than 500 microns (0.5mm).

4.6.3 A control signal (digital output) should be provided giving the operational status of the Secondary Heating Network (e.g. from pumps or open/closed position of motorised control valves) at the Secondary Heating Network side of the heat exchanger within the Substation for use in the control systems associated with the primary side of the Substation. When the Development does not require heat, this digital signal should be “0”. When the Development does require heat, this digital signal should be “1”.

4.6.4 This digital signal is not intended to frequently change state to suit load variation within the Development. It is an “enable” signal for the Development stating that a heat service is required. Variation in demands must be accommodated within the design of the Secondary Heating Network.

4.6.5 If at any time the Development's systems do not create flow in the Secondary Heating Network side of the heat exchangers within the Substation (e.g. pumps shut-down or flow is diverted away from heat exchanger) the signal should be set to ”0” until such time as flow is restored.

4.6.6 In the event of a power loss the signal should fail to “0”.

5 Substation Plantroom

5.1 Substation Plantroom

5.1.1 The applicant is responsible for the provision of the Substation Plantroom within the Development in which the Substation will be installed.

5.1.2 The Substation Plantroom must be located so that the Energy Company has free and safe access to it, and such that Equipment (including the Substation) can be operated and maintained and if necessary replaced in its entirety without the need for removing any structure or walls. The Substation Plantroom location should be on the ground floor of the Development or in the basement if step-free access can be provided. The Energy Company should require permanent access to the Substation Plantroom and the Primary Heating Network routed from the Development boundary to the Substation Plantroom, and within the Substation Plantroom.

5.1.3 The following table details the Substation Plantroom requirements to be provided as part of the development where the Substation is to be located:

Item	Provision
Maintenance Space	No less than 1.2m clear space around the Substation
Maintenance Electrical Socket	230 V Ac To Earth / 32 A – Commando Wall Socket 230 V Ac to earth / 13A – Wall Socket
Electrical Supply For Control Panel	230 V, 50 hz - fused switch spur or distribution board – supplied by dedicated radial circuit with MCB 16A Type C
Lighting	Minimum of 150 lux
Water Supply	Temporary: DN 50 (for flushing) Permanent: DN 25, with quick release coupling (used for maintenance only, and suitable for use of a WRC approved pressure water jet)
Water Drainage	Provide floor gully connected to foul drain for waste water removal
Concrete Plinths	Provide concrete plinths for heat exchangers and control panel (100mm high)
Ventilation	Provide mechanical or natural ventilation, with a minimum of three air changes per hour, or greater so as to limit the air temperature with the Substation Plantroom to below 35°C at all times
Health & Safety	The Substation Plantroom should not have elements that introduce risk to health and safety, e.g. sharp metallic objects, holes in roof or floor without protection Plan showing evacuation route in case of fire, located in a visible place Fire extinguishers CO^2 and Foam A floor plan of the installation identifying all valves that should be isolated in case of emergency

5 Substation Plantroom

Item	Provision
Anti-Slip Floor Finish	Surface roughness required to provide a low risk environment. Minimum surface roughness required is 26 microns (painted or sealed slab finish).
Signal From The Secondary Heating Network	The Development is required to provide a signal showing the operational status of the Secondary Heating Network for use in the control systems associated with the primary side of the Substation. A 24 V DC signal to the control panel via a volt free contact in the Development's control system. When the Development's contact is closed the system is "enabled". When the Development's contact is open the system is "disabled"
Door Locks	Single key for Substation Plantroom, but with a master key for multiple locks or multiple substations within a Development
Trench/Pit Covers	GRP egg crate for Primary Heating Network and any other floor trenches
Building/Substation Plantroom	The Substation Plantroom must be water tight and any penetrations sealed
Protection Of The Substation Equipment	The Substation should be protected whilst any third party works are completed within the Substation Plantroom to prevent damage to the Equipment (including the Substation)
Doors	The Substation Plantroom should be provided with lockable doors sized to allow safe access for the plant (including the Substation).
Fire Detection	Provide fire detection system and breakglass to meet regulations.
Fire Compartmentalisation	Provide necessary structures, seals and finishes to meet regulations.
Noise and Vibration	The Substation Plantroom (s) should be designed and constructed to prevent noise and vibration.
Emergency Push Button	Should be located adjacent to door and should isolate power supply to Substation Plantroom.

Table 5.1

6 Secondary Heating Networks

6.1 Introduction

6.1.1 This Section details the specific requirements for the Secondary Heating Network system design, materials specification, and installation workmanship to allow a Development to connect and receive heating services from the Primary Heating Network.

6.1.2 The design requirement for the Secondary Heating Network should be based on:

- Variable volume, constant temperature to suit the fluctuations in customer demand and environmental conditions[2]
- Low heat loss to minimise wasted heat to the building.

6.1.3 The Secondary Heating Network should be delivered to the following design criteria. Failure to comply with these Secondary Heating Network design criteria will hinder the efficient operation of the Decentralised Energy Network and reduce the levels of carbon reduction as a result. It is therefore essential that Developments connecting to Decentralised Energy Networks have designed their Secondary Heating Networks accordingly.

6.1.4 The Primary Heating Network requires a large difference between the flow temperature and the return temperature (the return temperature being dependent upon the operation of the Development Secondary Heating Networks).

6.1.5 The reasons for maintaining a low return water temperature and a wide differential between flow and return temperatures are:

- To increase the heat carrying capacity of the network
- To reduce energy required for pumping the network
- To maximise the use of high efficiency heat sources e.g. CHP and condensing boilers
- To maximise the capacity of the thermal storage and thereby increase the utilisation of the higher efficiency, low carbon heat sources e.g. CHP and Biomass.

6.2 Variable Flow, Constant Temperature Design Principles

Two Port Valves and Bypass

6.2.1 One of the key design principles of the Decentralised Energy Network is that it operates as a variable volume system and with a large temperature differential between flow and return pipes at all times. Because the Primary Heating Network return temperature can never be lower than the Secondary Heating Network return temperature it is imperative that the Secondary Heating Networks are designed and operated with a low return temperature at all times.

6.2.2 The schematic in the figure below details the basic concept of variable speed pumping and two-port control strategy[3].

2 Return temperatures may in practice be lower than the nominal value but as far as reasonably practicable shall not be higher.
3 Guidance may be found in BSRIA GUIDE BG12/2011, and although this is not specific to district heating, many of the principles apply.

6 Secondary Heating Networks

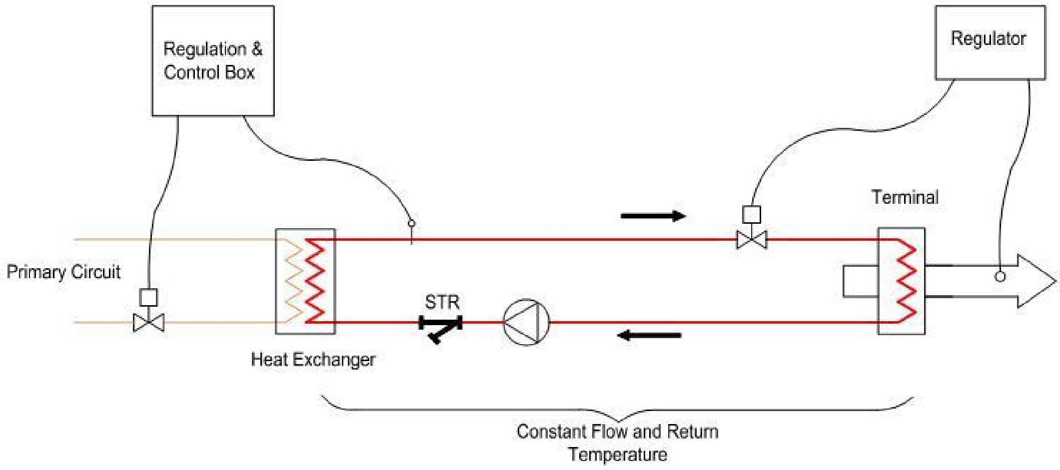

Figure 6.1

6.2.3 The required terminal load should be used to regulate the control valve opening, ensuring that the pump is kept at the optimum operation point for the overall circuit. This keeps the electrical consumption of the pump to a minimum and maintains a maximum temperature differential between the flow and the return.

6.2.4 The pump speed regulation should be controlled through the differential pressure measured at the secondary circuit index run.

6.2.5 Due to the possibility that all the regulation valves may be closed it is necessary to install an automatic bypass valve adjusted to keep a minimal flow within the circuit as shown in the schematic below. Note that the correct set up and commissioning of the automatic bypass valve is critical to ensure that the volume of water that is bypassed is kept to a minimum. This is sometimes ignored due to the pace of commissioning prior to Development completion. This must be carefully supervised and monitored during commissioning.

6 Secondary Heating Networks

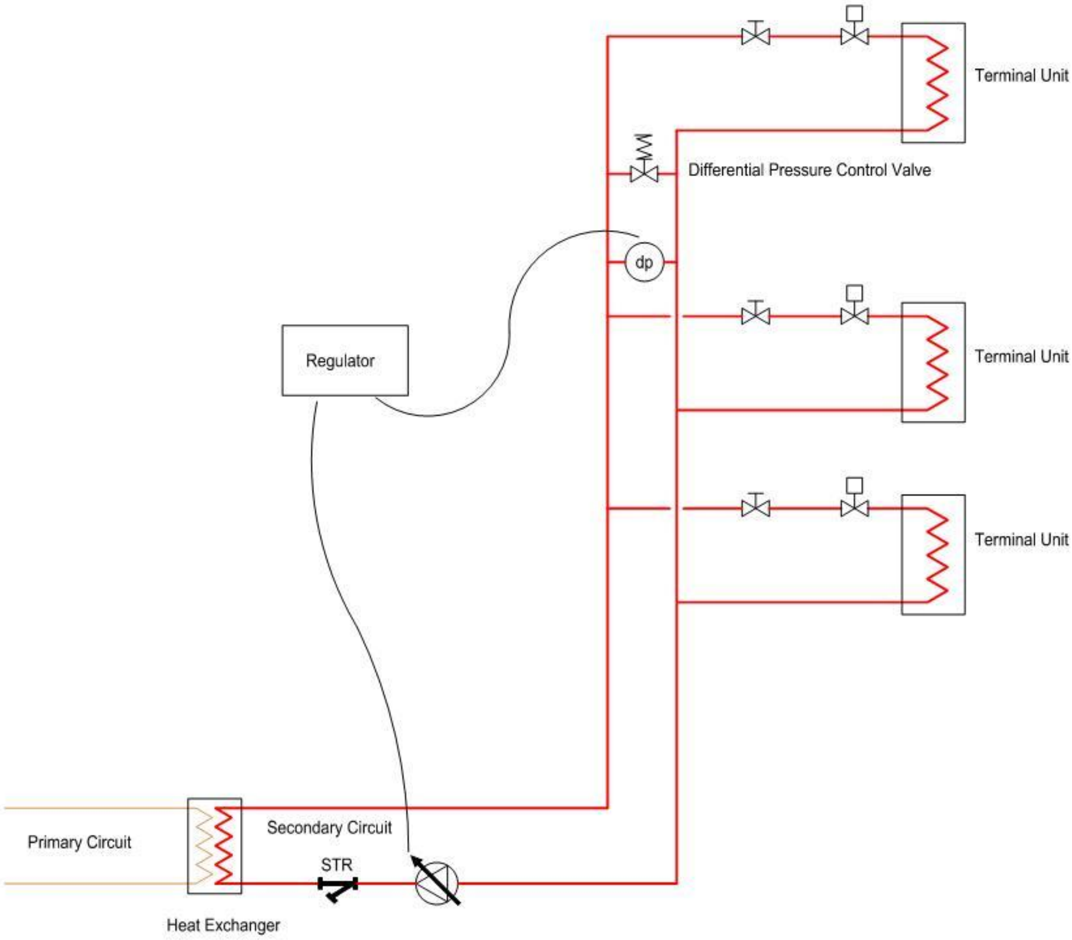

Figure 6.2

6.2.6 The differential pressure set value for the bypass valve should be nominally the same as the set point of the pressure sensor. Alternatively a controlled by-pass can be incorporated linked to the differential pressure set point and the minimum flow rate requirement of a single pump operation.

6.2.7 The probability that the bypass will open should be minimised by adjusting the secondary flow temperature downwards at low loads such that some of the terminal unit valves always remain open.

6.2.8 The bypass should be regarded as a safety control for the pump and should not be open under normal conditions.

6.2.9 Flow regulating valves should be installed on the Secondary Heating Network side of the heat exchanger to adjust the maximum flow at the maximum load. In case of two or more heat exchangers, regulating valves on each heat exchanger should be provided to achieve balance.

6.2.10 Whilst by-pass arrangements should be kept to an absolute minimum, they may be necessary during low demand periods when the supply temperature on the Primary Heating Network and Secondary Heating Network deteriorates due to control valves remaining closed for a period of time. Continual flow by-passes should not be utilised. Self-acting temperature control by-passes should be installed at the end of main branch legs or at any remote equipment connection. These should be adjusted so that they open at a temperature mid-way between the flow temperature set point and the required return temperature (40°C). This will allow a small flow to occur during low demand periods to prevent the occurrence of “dead legs”.

6 Secondary Heating Networks

6.2.11 Temperature indicators or test points should be installed at the end of the main branches in order to make correct adjustments of the by-pass flows.

Pump and Valve Arrangements

6.2.12 *Shunt Pump Not Permitted:* A shunt (primary) pump and low loss header arrangement should not be used within Secondary Heating Networks connected to the Primary Heating Network.

6.2.13 *Two Port Control Valves & Variable Speed Pumps:* Two port control valves with variable speed pumps, in conjunction with differential pressure control valves should be provided.

6.2.14 *Balance Flow:* A balance flow control system should be installed on each branch to adjust the flows (see the schematic above). This helps ensure a correct supply of heating to all the parts of the installation (especially at the ends) and avoid excessive flow and low temperature drops.

6.2.15 This system should be made up of regulating valves in each branch of the circuit. The maximum flow of these valves should be adjusted for the maximum load.

6.2.16 Alternatively, automatic differential pressure control valves may be used, which can provide a best balance control and provide constant pressure conditions for the temperature control valves to work under.

6.2.17 It is also possible to use a mix of the two options e.g. automatic differential pressure valves on the main branches and regulating valves on sub-branches.

6.2.18 Further guidance on balancing variable flow water systems is available from BSRIA e.g. AG16/2002.

6.2.19 *Pumping System:* For heating, the required pumps should be installed in parallel within the flow circuit just before the heat exchanger, as indicatively shown in the diagram below, to avoid the risk of cavitation in the heat exchanger. Differential pressure control should then be incorporated in each sub-circuit after the pumps, to provide system balance during all demand scenarios and flow/pressure fluctuations.

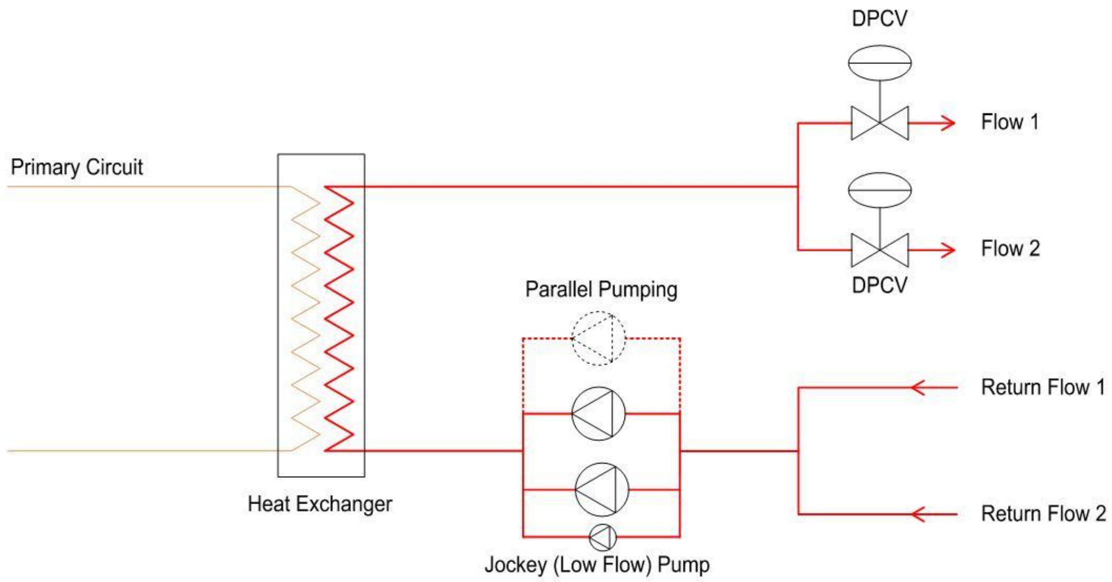

Figure 6.3

6 Secondary Heating Networks

6.2.20 *Pump Selection Methodology:* The number of pumps selected will depend on the maximum and minimum flow rates at which the system will operate throughout the day and year and the characteristics of the inverter of the variable speed pump. For most connections the difference in loads throughout the day and year is significant and therefore, to be able to meet the required return temperature at all times, the use of parallel multiple pumping should be adopted. Depending on the flow rate differences between the daily and annual maximum and minimum demands, multiple pumps will be required. The number of pumps required should be determined, but no less than three “run” pumps and the incorporation of a low flow (jockey) pump should be provided, with the addition of a standby pump. A standby low flow (jockey) pump is not required.

6.2.21 The pump manufacturer’s minimum operating conditions should be determined with care as speed and flow rate are not proportional in a variable volume system (See BSRIA BG-12:2011).

6.2.22 If the flow on the Secondary Heating Network side of the Substation is to be stopped e.g. the pumps are stopped, then the heat exchanger should be shut down by means of the Secondary Heating Network control output.

6.3 Temperature Design Parameters

6.3.1 The Secondary Heating Network flow temperature at the secondary outlet of the Substation will be maintained at the agreed flow temperature (maximum temperature to be no greater than 70°C) under all load conditions by the regulation system of the Substation, subject always to the heat demand being less than or equal to the Capacity.

6.3.2 The nominal return temperature from the Secondary Heating Network at the Substation should be at the agreed return temperature. This should nominally be 40°C.

6.3.3 The applicant is responsible for the design and installation of the Secondary Heating Network in order to achieve the nominal secondary flow and return temperatures.

6.3.4 Low temperature operating systems should be selected to significantly reduce return temperatures.

6.3.5 The Secondary Heating Network should be used to generate DHW and should be designed to ensure that the mix of return temperatures from the DHWS and the other heating circuits will provide the overall required return temperature. An instantaneous heat exchanger hot water generation should be used to achieve lower return temperatures, e.g. 25°C, and realise other benefits such as space reduction and reduction of Legionella infection risk.

6.4 Pressure Design Requirements

6.4.1 The pressure on the Secondary Heating Network side of the Substation should not exceed 10 bar g. The Secondary Heating Network must be designed and installed to prevent a pressure of 10 bar being exceeded. A suitable pressurization system and relief pressure valves should be installed in the immediate vicinity of the heat exchanger. On a development with multiple floors that would otherwise prevent this system pressure limit being maintained, system pressure break heat exchangers should be designed on appropriate floors to maintain this upper limit pressure requirement.

6.5 Water Quality Requirements

6.5.1 To protect the Secondary Heating Network (including the Substation), in particular the heat exchanger, from damage and fouling the Secondary Heating Network must be cleaned and flushed in accordance with BSRIA standards.

6.5.2 Water treatment procedures on newly cleaned closed systems should be in accordance with BSRIA BG29/2012 (or later standard as relevant).

6.5.3 Dosing equipment should be installed to allow the safe and effective addition of chemical to the circulating water.

6 Secondary Heating Networks

6.5.4 If inline side stream filters are used, they should be installed with a small percentage water pass through. They must not be installed across the flow and return since this will compromise low return water temperatures.

6.5.5 The final system fill should be using softened water.

6.5.6 Prior to the commencement of Secondary Heating Network Services the following maintenance procedures must be carried out to maintain water quality to ensure the integrity of the closed system.

6.5.7 The number and locations of samples are to be in accordance with BS8552:2011 but must also include the following as a minimum:

- one sample from each heat exchanger in the Substation

6.5.8 All samples must be analysed by a UKAS accredited laboratory.

6.5.9 The minimum parameters for sampling are as follows at the heat exchangers within the Substation.

BACTERIA	
TVC's @ 22°C	<100,000 cfu/ml and no upward trend
Pseudomonas	<10,000 cfu/100ml and no upward trend
SRB's	Absent
NRB's	For information only dependent on the inhibitor employed
CHEMICAL	
Ph	Between 7.5 and 10 dependent on the inhibitor employed
Suspended Solids	<30 mg/l
Chloride	<250 mg/l
Soluble Iron	<5 mg/l
Total Iron	<15 mg/l
Total Copper	<1 mg/l
Inhibitor	As recommended by the water treatment specialist
Hardness	A downward trend until levels plateau

Table 6.1

6.5.10 Samples from the heat exchangers within the Substation should be taken from the inlet to PHE.

6.5.11 Parameters for all other analysis from across the system are to be in accordance with BS8552:2011.

6.5.12 All records of action, results and planned sampling dates must be kept in an on-site log book and must include a graphic trend pattern on results, details of which can be found in BS8552:2011 and BSRIA BG29/2012. The make-up water consumption should be recorded at weekly intervals and should be negligible with no rising trend.

6 Secondary Heating Networks

6.5.13 The water quality parameters must be compatible with the Secondary Heating Network. Evidence of compliance with these water quality requirements should be provided to the Energy Company prior to water being allowed to flow through the Secondary Heating Network side of the heat exchanger within the Substation.

6.5.14 In addition the following apply:

- Extended periods of no flow can promote fouling and/or deterioration of the heat exchanger and measures to prevent this should be taken
- A water treatment specialist is employed to manage the water quality of the Secondary Heating Network
- Any additional monitoring deemed appropriate by the water treatment specialist for the water treatment regime should be undertaken
- A corrosion monitoring regime should be implemented
- Ongoing Secondary Heating Network water treatment/maintenance records and water quality laboratory analysis should be retained and will be made available to the Energy Company on request.

6.5.15 Under no circumstances must flushing of the Secondary Heating Network be undertaken though the Substation. A flushing bypass should be installed in the Secondary Heating Network, bypassing the heat exchanger as shown below:

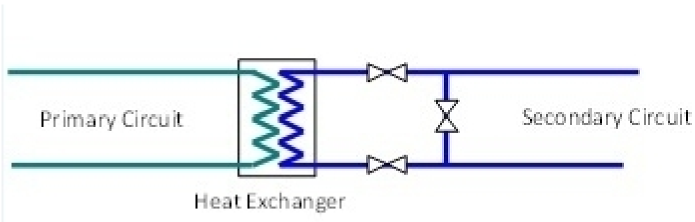

Figure 6.4

6.5.16 Any activities must foul, corrode or compromise the performance of the heat exchangers within the Substation. To meet this obligation, additional parameters may be required to be monitored according to the system design, operation and treatment regimes. The trending and interpretation of data will assist in determining the correct course of action.

6.5.17 High and/or continuous usage of make-up water will increase fouling. A meter should be fitted on each water makeup system and should be monitored by the BEMS to identify leaks and manage water usage. Any increase in water usage for a closed system should be rectified immediately.

7 Metering

7.1 Primary Metering

7.1.1 The company responsible for the Decentralised Energy Network will install a Network Meter on the primary side of the Substation to record flow volumes and energy delivered by the Primary Heating Network. The Network Meter will comply with the European Standard EN 1434.

8 Implementation Guidance

8.0.1 **Pre application stage:** All proposals for major developments which are capable of connecting to a decentralised energy network DEN are encouraged to discuss the requirements for this with the Council prior to the submission of a planning application. Developers should use the Decentralised Energy Networks Technical Specification SPD and discussion with Council officers/representatives to establish what is likely to be required, to inform an understanding of whether it is feasible and viable to implement a DEN as part of their proposals.

8.0.2 **Planning application stage:** All proposals for major developments which are capable of connecting to a heat network must submit an Energy Statement outlining the strategy for achieving the required carbon reduction targets. Where it is feasible and viable to meet DEN requirements, as part of this Applicants should submit a Technical Design Pack.