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SPECIFICATION FOR THE INSTALLATION OF PRE-INSULATED UNDERGROUND PIPEWORK

AT

CREMORNE ESTATE

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1. INTRODUCTION

1.1 System Description

This Standard Specification details the Clients' requirements for the installation of pre-insulated pipework installation.

1.2 District Heating Design

The District Heating (DH) pipework shall be the pre-fabricated bonded type system employing a steel service pipe insulated with rigid polyurethane (PUR) foam, encapsulated within a high-density polyethylene (HDPE) outer casing, the complete unit being suitable for being installed underground. A non steel system may also be offered but subject to client acceptance.

It shall include a leak detection capable of identifying specific leak points

All pipework installation shall be carried out in strict accordance with the following:

- Design and Installation shall be as detailed in EN 13941:2009+A1:2010
- Pre-insulated pipework manufacturer's specifications.
- All associated current European and British Standards, e.g. EN 253, EN448, EN488 and EN489.
- EN 14419 regarding surveillance systems

Details of equipment, pipework and the distribution system layout indicated on the layout drawing(s) are shown as approximate.

A complete installation capable of performing within the specified design conditions for the duration of the systems design life shall be provided. In addition the system shall be fully designed and installed in accordance with the recommendations and instructions of the pipe component manufacturer.

The Contractor shall ensure that the distribution of forces and pipe movement for the whole piping system shall be assessed and the system designed and installed accordingly.

The Contractor shall ensure that all maximum resultant stresses and movements are accounted for at all critical positions, under all loading conditions, in the proposed piping system. Critical positions shall include bends/changes in direction, branches and building entries.

The Contractor shall prepare designs for thermal expansion calculations for each part of the works in accordance with **EN 13941**.

The Contractor shall liaise with all other utilities in the design and selection of routes.

1.2.1 Operating Parameters

The DH pipework shall be designed and sized such that the flow and return temperatures will facilitate the replacement of the boilers by heat pumps at a later date.

2. GENERAL INFORMATION

2.1 Provision of Health & Safety Plan

The Contractor shall present a completed Pre-Construction Phase Health & Safety

Plan to the Client, for review, prior to commencing work. The Contractor shall not be permitted to commence work until the Pre-Construction Phase Health & Safety Plan has been approved.

The Pre-Construction Phase Health & Safety Plan shall form the basis of the final Construction Phase Health & Safety Plan delivered to the Client, for approval, upon completion of the work.

All Health & Safety Plans shall comply, as a minimum, with the requirements of The Construction (Design and Management) Regulations 2015.

2.2 On-site Management

The Contractor shall ensure that there is a full time resident engineer on site to closely supervise the correct installation of the system. The Contractor's resident engineer shall be experienced and fully trained in all aspects relating to the installation of the pipework system and shall also be qualified to manage the site under the requirements of the New Roads and Street Works Act 1991 and any amendments, as appropriate.

The Contractor shall confirm and provide evidence that the resident engineer shall have previously occupied the same supervisory role on at least 5 projects of similar or larger scale and have used the same pipework manufacturer's materials and equipment. The Client shall reserve the right to request the Contractor's resident engineer be replaced if the Contractor cannot demonstrate that the resident engineer is sufficiently competent to undertake the work or that the resident engineer fails to manage the site in accordance with the requirements of the installation.

The resident engineer shall be required to liaise with the Client, or his engineer, on a daily basis and be available for advice and instruction.

2.3 Manufacturer Support

The Contractor shall ensure, where necessary, that the pipework manufacturer shall provide general and technical assistance throughout the project to support their design and installation.

2.4 Quality Assurance

The underground pipework system being installed shall be expected to have a service life of at least 50 years.

The Contractor shall document and demonstrate that all quality activities throughout the entire project from Client's instruction, development/design, purchase, manufacture and installation to hand-over are carried out in a safe and diligent manner.

As a minimum the Contractor shall forward a quality manual outlining the system in place. The quality system shall be laid out in a manner suitable for the Client, or his representative, to comment on.

The quality system shall be based on the requirements laid down in the international standard for quality systems, the ISO 9001. The Contractor shall present a copy of their certification prior to commencement of work.

Contractor must not close off voids without the approval of RBKC and their consultant.

2.5 As-Installed Documentation

Within 15 days of completion of the pipework installation, the Contractor shall provide the Client with a full set of As-Installed documentation for approval. This shall include, but not be limited to;

- A complete set of As-Installed drawings of the pipe network
- A complete set of original pipe design calculations
- A complete set of As-Installed pipe design calculations
- A complete set of As-Installed drawings of Surveillance system
- A full set of manufacturers operation and maintenance manuals
- A copy of the Pre-Construction Phase Health & Safety Plan
- A completed Construction Phase Health & Safety Plan

2.6 Materials Guarantee

All pipe and associated components, including the surveillance system, shall be covered by a 20/30 year guarantee against pipe and component failure due to manufacturing defect.

2.7 Installation Guarantee

The Contractor shall provide a 10-year guarantee against the installation of pipe and components.

2.8 Bonded Pre-Insulated Pipe System

The prefabricated pipes and other pipework components shall be made of steel pipe, polyurethane foam insulation with integral surveillance system and an outer casing of high-density polyethylene (HDPE). The materials shall be bonded together to form a solid unit in accordance with EN253:2009.

The pre-insulated pipework installation shall be able to operate at continuous temperatures of up to 140°C for 30 years.

The pre-insulated pipe system shall be installed using the 'Compensated Method'. The Contractor shall ensure that the entire pipe system is suitably buried before heat is applied.

2.9 Pre-Insulated Steel Pipe Welding

All prefabricated steel pipe welding is to be undertaken by certified coded welders. Certification shall be in compliance with current British and European Standards. Current original certificates for individual welders are to be made available to the Client or his representative upon request and signed copies are to form part of the Pre-Construction Phase Health & Safety Plan. Welders may be submitted to a welding test with at least the same acceptance criteria as the criteria for the finished work, with reference to EN ISO 5817, quality level B.

2.10 Installation

The Contractor shall install the pipes into trenches in accordance with the manufacturer's recommendations and the design detail on the enclosed drawings

The Contractor shall be responsible for ensuring the width and depth of the trench is in accordance with the manufacturer's recommendations, the

design detail on the enclosed drawings and Technical Specification - TS30.

2.11 Pipe Weld Identification

Every pipe weld shall be labelled with a unique identifier during the welding process. The identifier shall be applied using a durable marker.

All weld identifiers shall be recorded and presented as part of the final documentation package by the Contractor. The information should include but not be exclusive to;

- Name of Welder
- Date of Weld
- Time of weld
- Weather conditions at time of weld

Any welds not properly identified in the final documentation, the Contractor shall be responsible for exposing the weld for inspection and subject to non-destructive testing.

2.12 Pipe Joints

All joints shall comply with EN489:2003.

The choice of joint type shall be compatible with the pipe material and pipe type. The Contractor shall ensure that the manufacturer of the joint is the same manufacturer of the pipe system. If the Contractor proposes the use of different manufacturers of pipe and joint systems, he must first seek approval from the Client, or his representative.

All jointing materials shall be received on site in their original packaging and maintained in an environment that is free from cold, dust and moisture until immediately before use. Packaging shall not be removed from the joint components until immediately before the joint installation is commenced.

The choice of joint shall be agreed with the Client or his representative prior to ordering of materials.

2.13 Quality Assurance

The Contractor shall make available current original certificates for individual joint installers, for each type of joint proposed, to the Client or his representative upon request and signed copies are to form part of the Pre-Construction Phase Health & Safety Plan.

The Contractor may only replace joint installers once current original certificates have been presented for the replacement installer and permission sought from the Client or his representative.

2.14 Installation

The Contractor shall apply the joint and insulation material as soon after welding as possible to avoid the ingress of dirt and moisture to the foam insulation and the pipe. The Contractor shall ensure that joints are insulated, fitted and pressure tested as a complete operation and within the same working day.

The Contractor shall ensure that the time between pipe weld, weld test and completed joint is kept to an absolute minimum.

The joint installation shall be undertaken under dry atmospheric conditions and surrounding conditions that are free from standing water and/or dust. The joint installation shall not commence if the pipe system, in the immediate area of the joint, is wet or damp; work can proceed if the Contractor can demonstrate a safe and adequate drying methodology. If, during joint installation, the site is subject to prolonged conditions or rain, joints may be installed under a protective cover provided the pipe and joint materials are suitably dried before work is commenced.

The Contractor shall ensure that sufficient space is provided to undertake the joint procedure. Contractor to ensure co-ordination with the Civil Engineering Contractor to specify the space required at each joint if jointed in the pipe trench.

It is the responsibility of the Contractor shall ensure that the Client or his representative is offered the opportunity to inspect all or any joint installations at any stage. Failure to do so may require the joint to be removed and installed in the presence of the Client or his representative.

2.15 Insulation of Pipe Joints

Wherever possible liquid foams shall be used to insulate a joint. The foams shall be created by the mixing of one or more foaming materials to create a liquid foam for injection into the joint assembly. Pre-prepared foams injected by either canister or machine shall be permitted to be used but the Contractor shall demonstrate that the foam material and injection method proposed are suitable for use in the pipe system. The use of pre-formed insulation shells is not permitted.

The Contractor shall ensure that sufficient liquid foam is prepared for each type and size of joint. The foam shall completely fill each joint type and size.

The liquid foam mixing and application/injection procedure shall be carried out in a method that does not expose the operators or the general public to either the individual or mixed foam compounds.

The Contractor shall undertake testing of all joints to ensure an airtight seal has been achieved. This is to be carried out using air or other suitable gas, before the air gap between the steel pipe and casing is insulated. The test pressure applied shall depend on the type of joint used and in line with the manufacturer's recommendations.

Tightness is to be checked by use of a suitably sized pressure gauge and suitable fluid indicator. The test fluid shall not be detrimental to the casing, joint material or the surroundings. The test period should be for a minimum of 1-minute duration.

2.16 Testing of Pipe Joints

The Contractor shall, at the Client's request, demonstrate that the jointing procedure meets the required standard of installation. The Contractor shall be required to undertake a destructive test procedure on up to 5% of finished joints. Where more than one joint installer is used on a site, the Contractor shall ensure that the Client is made aware of this and can identify each joint by installer.

The destructive test will require the finished joint to be visually inspected externally, opened allowing inspection of the foaming quality, surveillance system wiring joint, sealing plugs (in situ) and steel pipe weld. No part of the destructive test shall be carried out in the absence of the Client or his representative. Should any of destructive tests expose a quality of installation below the requirements of the manufacturer, the Contractor shall undertake an investigation into the poor quality workmanship. The

Contractor shall, at the request of the Client, also expose a further 5% of joints undertaken by the same operative. Should these further joints also show a quality of installation below the requirements of the manufacturer, all joints installed by this fitter/these fitters shall be identified and replaced by the Contractor.

The Contractor shall ensure that the Client is offered the opportunity to undertake any such destructive test prior to the pipe system being covered.

The Contractor shall be able to demonstrate, prior to any joint installation, that their joint installers possess sufficient training and experience to undertake each type of joint; failure to do so will require the Contractor to replace the joint installer with one suitably qualified and experienced.

2.17 Pipe Joint Identification

Every pipe joint shall be labelled with a unique identifier during the jointing process. The identifier shall be applied using a durable marker and be identified on the As-built drawings.

All joint identifiers shall be recorded and presented as part of the final documentation package by the Contractor. The information should include but not be exclusive to;

- Name of joiner
- Date of joint
- Tightness test (if appropriate)
- Type of insulation
- Alarm wire jointing test (which should correspond to the requirements of Section 3.6)

The Contractor to arrange and pay for 20 random lab tests on welds

2.18 Pipe Branching

2.18.1 Pre-Fabricated Branches

All branches shall be created using pre-fabricated branches. In instances where pre-fabricated branches cannot be used the Contractor shall present a clear and full report explaining the rationale behind the need and demonstrate the method of work to the Client, or his representative.

The branch types permitted to be used are;

- 90° perpendicular (to the main pipe)
- 45° perpendicular (to the main pipe)
- 90° parallel (to the main pipe)

All branches types shall be clearly identified on the As-Installed drawings and should include any information such as the use of reinforcement pieces.

All branches shall be installed so that the branch connects to the top of the main pipe. In instances where pre-fabricated branches cannot be connected to the top of the pipe, the Contractor shall present a clear and full report explaining the rationale behind the need and demonstrate the method of work to the Client, or his representative. Any branch connections that deviate from the agreed standard details shall be clearly identified on the As-Installed drawings.

2.18.2 'Hot Tap' Connections

'Hot tap' connections shall not be permitted throughout the construction phase

unless a connection is required that was not detailed at the start of the Contract and that pipe in the vicinity of the new connection has already been installed.

Any 'Hot tap' connections shall be agreed in writing with the Client, or his representative, prior to any works commencing.

Any 'Hot tap' connections shall be clearly identified on the As-Installed drawings.

2.19 Directional Changes

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

All changes in direction shall be clearly identified on the As-Installed drawings. In the case of curved pipes the length and arc shall also be identified.

2.19.1 Pre-Fabricated Bends

All pre-fabricated bends shall be factory prepared and shall be constructed in accordance with EN448:2003. Pre-fabricated bends of angles other than 90° are not to be used without prior written consent from the Client or his representative.

2.19.2 Curved Pipes

All curved pipes should, whenever possible, be curved during manufacture to ensure the quality of the material is maintained.

The site curving of pipes is only permitted if undertaken strictly within the tolerances and specification of the pipe manufacturer and using the correct bending tools.

Site curving of pipes larger than DN80 is not permitted.

2.19.3 Mitred Pipework Joints

The use of site constructed mitred joints is not permitted.

2.19.4 Irregular Bends

The use of irregular bends ($\neq 45^\circ$, $\neq 90^\circ$) is generally not permitted. Where circumstances dictate otherwise, the Contractor shall present a clear and full report explaining the rationale behind the need and demonstrate the method of work to the Client, or his representative.

The Contractor shall use the appropriate method of work and materials identified by the manufacturer. If the Contractor cannot demonstrate that the manufacturer of the pipe system has a suitable method of work and materials to achieve an irregular bend, the Contractor shall not be permitted to install such a bend.

The Contractor shall ensure that the integrity of the pipe system is not compromised by the inclusion of an irregular bend and shall identify any restrictions in future expansion of the pipe system in the vicinity of the irregular bend.

2.20 Surveillance System

The district heating pipe network shall be monitored by a surveillance system designed in accordance with EN 14419:2009.

The surveillance system shall be designed and installed by the Contractor to

allow both active and passive methods of monitoring.

The Contractor shall ensure that sufficient reference points are installed along the route of the pipe system to enable the correct monitoring of the entire system. All reference points shall be placed in normally accessible positions to allow pedestrian access.

The Contractor shall design the system to include for a single central point of monitoring for all/any remote monitoring detectors. The method of such data transfer and location of central monitoring shall be agreed with the Client or his representative.

A complete surveillance system survey report from the construction phase shall form part of the final documentation.

2.20.1 Installation of Surveillance System Wiring

The Contractor shall present the preliminary surveillance system design to the Client, or his representative, for approval prior to the installation of the pipe system. The Contractor shall agree the number, type and location of active surveillance detectors, with the Client or his representative, prior to construction.

The Contractor shall ensure that tools and materials required to undertake the surveillance system installation are suitable for the system type.

The Contractor shall present to the Client, or his representative, a method of continuous surveillance system checking throughout the installation. As a minimum, the Contractor shall ensure that the surveillance wires in all pipe lengths and pipeline components e.g. valves, bends, branches, have been tested for their completeness prior to installation. During installation the Contractor shall be able to demonstrate that the surveillance wire joints are robust at each weld location.

In pipe systems that contain four wires the Contractor shall ensure that the correct pairing of surveillance wires is chosen prior to jointing.

When remote monitoring locations are proposed the Contractor shall whenever possible avoid installing cable take-off positions from the pipe system. The Contractor shall make reasonable endeavours to install remote monitoring locations at normal pipe termination points, e.g. in connected buildings.

If cable take-off positions have to be installed (for remote monitoring), the Contractor shall ensure the exact location of such take-offs is recorded on the As-Installed drawings. Leak detection to be accurate to 2 metres max.

2.20.2 Operating Instructions

The Contractor shall prepare a complete set of diagrams for the surveillance system which shall be separate from the general pipe layout.

The drawings shall clearly identify all individual system circuits and position of components. When the installation is complete, a full instruction manual for the surveillance system and its components shall be provided to the Client.

The Contractor shall provide a requisite portable measuring device to be supplied to the Client at hand-over and provide instruction to the Client.

2.21 Receipt, Handling and Storage

The Client, or his representative, shall be invited to inspect all pipe materials and

components for quality; any materials found to be of sub-standard quality shall be rejected. Pipe materials shall also be checked for the required markings and certification, e.g. manufacturers and national standards markings, works certificates, time of production, etc. If any materials are found not to have the correct marking and certification, they shall be rejected and the Contractor shall be responsible for their replacement.

During storage, prior to and during installation, the Contractor shall ensure that the insides of the pipes and components are clean, dry and free from foreign bodies. All free steel pipe ends shall be protected from the intrusion of dirt and foreign bodies by suitable means, e.g. plastic caps.

If during the installation process a free pipe end is left unsupervised, the Contractor shall have to demonstrate to the Client or his representative that the pipe or component has been thoroughly cleaned and suitable protection applied to prevent further intrusion of dirt. If the Contractor fails to remedy pipe or components left unprotected, the Client shall be able to reject the pipe or component and the Contractor shall be responsible for its replacement.

2.21.1 Delivery & Storage

The Contractor shall be responsible for the safe delivery of all pipe system materials and in line with the construction plan.

The Contractor shall be responsible for detailing the site compound requirements for pipe storage at each agreed location; such location shall be chosen to ensure other site activities do not impinge on either the space for storage or that required for handling. The storage of pipes shall be in accordance with the manufacturer's recommendations. Any variation to these recommendations shall be agreed with the Client or his representative prior to delivery.

The Contractor shall be responsible for the safe off-loading of pipes and materials. The pipes shall be stacked to ensure they are not prone to damage or exposed to standing water or unsuitable ground conditions. All pipe ends must be capped at all times to prevent ingress of dirt and other foreign bodies. The pipes shall be supported in such a way that they are not subject to forces which may cause distortion or damage.

Parts and materials that are sensitive to temperature and/or moisture shall be stored in a suitable location.

2.21.2 Handling

The Contractor shall ensure that all pipes, when handled, shall be suitably supported using lifting straps of at least 100mm wide and spaced to avoid any deflection occurring in the pipe. No metallic straps, chains or wires shall be used to move pipes. Pipes shall at all times be handled in accordance with the manufacturers guidelines.

Manual handling of pipes shall be avoided.

2.21.3 Winter Measures

In the event that the pipe system installation occurs during winter months, the Contractor shall present a full method statement covering special measures employed to counter the effects of low ambient air temperature on the pipe system and jointing.

2.22 Pipe Expansion

In general, the Contractor shall design the pipe system with the use of 'single use compensators'. Expansion shall also be designed so to be absorbed through changes in direction, e.g. bends but such expansion is to be limited wherever possible.

Expansion movements at bends and branches shall be absorbed by providing an extra wide sand layer and/or foam pads between the outer casing of the pipes and the trench walls. The Contractor shall indicate the thickness of the sand layer and/or extent of foam pads on the detailed design and As-Installed drawings.

2.23 Isolating, Draining and Venting

All isolation, draining and venting valves shall be of the pre-fabricated pre-insulated type.

All valves shall be constructed to include a maintenance-free ball valve with an all-welded valve body and a stainless polished valve ball placed in spring-loaded Teflon seats, they shall meet current European Standard and in accordance with EN 489:2003 and be fully compatible with the operating parameters of the system.

Valve arrangements shall be so installed to ensure a problem free operation regardless of their position in the pipe system. All valves shall have clear and permanent open and closed position indicators.

Under no circumstances shall pre-fabricated isolation, draining or venting valves be modified.

Where required, the Contractor shall provide extended valve spindles to ensure safe operation and resistance to corrosion.

In all instances the Contractor shall ensure that any isolating, venting and draining pipe and pipe components not pre-insulated at manufacture shall be made of non-corrosive steel.

2.23.1 System Venting

The design and installation of the pipe system shall ensure that the use of venting components within the pipe system is not required. Where their installation cannot be avoided, pre-fabricated units shall be employed and be consistent with the pipe system being installed.

The system venting units shall be of the same manufacture as the pipe system and be in accordance with EN 488. If the Contractor proposes an alternate manufacturer, he must seek approval from the Client or his representative.

Whenever a system vent is required but the main pipe is installed in a highway, the Contractor shall, wherever practical, instead install a pre-fabricated branch connection and run a suitably sized pre-insulated pipe (to be agreed with the Client or his representative) to a valve chamber location outside of the highway that can be easily accessed by the operators. 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.

The Contractor shall provide suitable equipment for venting in a safe manner. This should include extended valve spindles, stand-pipes, pipe clamps and heat resistant hoses. The Contractor shall propose such equipment to be agreed with the Client or his representative prior to hand-over.

2.23.2 System Draining

The design and installation of the pipe system shall ensure that the use of draining components within the pipe system is minimised. Where their installation cannot be

avoided, pre-fabricated units shall be employed and be consistent with the pipe system being installed.

The system draining units shall be of the same manufacture as the pipe system and be in accordance with EN 488. If the Contractor proposes an alternate manufacturer, he must seek approval from the Client or his representative.

Whenever a system draining unit is required but the main pipe is installed in a highway, the Contractor shall, wherever practical, instead install a pre-fabricated branch connection and run a suitably sized pre-insulated pipe (to be agreed with the Client or his representative) to a valve chamber location outside of the highway that can be easily accessed by the operators. Water release will be achieved through the installation of pre-insulated ball valves suitable for use in this location and compatible with the pipe system.

The Contractor shall provide suitable equipment for draining in a safe manner. This should include extended valve spindles, stand-pipes, pipe clamps and heat resistant hoses. The Contractor shall propose such equipment to be agreed with the Client or his representative prior to hand-over.

2.23.3 Valve Chambers

At each isolation, venting or draining position, the Contractor shall construct a chamber suitable for containing the valve components. The chamber shall be sufficiently large enough to allow for operational and maintenance activities, such as valve operation, greasing and cleaning. The proposed chamber construction shall be designed to ensure the prevention of water penetration from any external source particularly in ground with a known high water table or drainage issues. If the chamber design cannot be made sufficiently water-tight, the chamber design must prevent the occurrence of standing water through natural drainage.

Lifting equipment suitable for each chamber cover type shall be provided by the Contractor prior to hand-over. The Contractor shall clearly identify the lifting constraints for each cover type.

The valve chamber design shall be agreed with the Client or his representative prior to construction.

2.23.4 Valve Operating Equipment

The Contractor shall suitably provide operating equipment for all types valves, including isolation, venting and draining.

For isolating valves of size DN200 and below the Contractor shall provide, for each valve size (nominal diameter) one operating key per 10 valves.

All keys shall be clearly and durably marked with the diameter size suitable for valve operation.

For valves of a size greater than DN200, the Contractor shall provide either an electro-mechanical operating device or one based on compressed air; the type to be agreed with the Client or his representative. The unit shall be provided complete with gearing and keys suitable for operating valves throughout the range of sizes (greater than DN200).

2.24 Connections and Entries to Buildings

The Contractor shall use pre-fabricated pipe components when making final connections to buildings. The method of entry to a building shall be agreed with the Client, or his representative, the building owner or building designer and be generally

in accordance with one of the standard detail drawing(s).

In all circumstances the Contractor shall ensure that all joints are accessible for future maintenance and inspection. Joints found to be wholly or partly contained within the fabric of the building shall be rejected and the Contractor shall be responsible for their replacement. The use of extended length pipe components is permitted but these shall be factory made pre-fabricated sections.

2.25 Testing

2.25.1 Steel pipework weld testing

Testing shall be as detailed in EN 13941 and relevant Project class.

2.25.2 Strength Testing

Testing shall be as detailed in EN 13941 and relevant Project class.

2.25.3 Hydrostatic Pressure Test

The Contractor shall be required to hydrostatically pressure test part or all of the pipe system to 1.5 times the systems operating pressure for a period of 2 hours. Should the Contractor fail to demonstrate this test he shall be responsible for investigating, rectifying the pipe system and repeating the pressure test until satisfactory result can be demonstrated.

2.26 Flushing, Draining and Filling the Pipework System

The newly installed pipework system shall be fully flushed or pigged, the flushing water shall be from a suitable cold water main supply (the Contractor to arrange and provide suitable mains water connection/supply), prior to final filling. It is the responsibility of the Contractor to demonstrate that any flushing procedure will be sufficiently robust enough to remove debris from the pipe system.

After the hydrostatic pressure test and the flushing procedure have been completed to the Client's or his representative's satisfaction, the Contractor shall drain the pipework. The draining procedure shall ensure that the water is safely sent to drain and that such draining does not detrimentally impact on the trench and any pipework installed.

Following draining and in agreement with the Client or his representative, Contractor shall fill the pipe system with treated water suitable for a period of up to 6 months before being set to work for district heating use. The Contractor shall demonstrate that the treatment is evenly distributed during the filling process. If the heating system is not to be set to use for a period of more than 3 months the Contractor shall sample the water in the pipes to ensure a suitable level of water treatment exists. If the level of water treatment is too low the Contractor shall add further water treatment to the system ensuring it is evenly distributed throughout the pipe system.

2.27 Remedial Works

Any remedial works required to the pipework system prior to backfilling shall be carried out in strict compliance with the pipework manufacturer's recommendations. All repairs shall be completed to the Client's or his representative's satisfaction.

Contractor must not close off voids without the approval of RBKC and their consultant.