Real Estate Investment Partnership

Mechanical Performance Specification

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1 Definitions

In applying the Specification the following words shall have the meanings herein assigned to them unless there is something the subject matter of context inconsistent with such construction.

“EMPLOYER” shall mean the Person, Persons, Company, Authority and their Representatives who are named I the main contract.

“ENGINEER” shall mean the person representing the Building Services Consultant.

“MAIN CONTRACTOR” shall mean the Person, Firm or Company undertaking the Main Contract and shall include their successors, heirs, executors and administrators named as a party to the Main Contract and the Contractor.

“MeC” shall mean the Person, Firm or Company whose quotation for specialist Mechanical Engineering Works forming the subject of this Specification has been accepted and who has entered into a Sub-Contract with the Main Contractor and shall include their or their successors, heirs, executors and administrators.

“EleC” shall mean the Person, Firm or Company undertaking the Electrical Installation Works

“SPECIFICATION” shall mean the Specification on which the Tender is based.

“MATERIALS” shall mean all plant, materials and equipment for incorporation in the works.

“WORKS” shall mean and include all materials to be used and work to be done by the Contractor under the Contract and shall include supplying, fixing, testing, regulating and commissioning of the installations described in the specification.

“EMPLOYERS AGENT (EA)” shall mean the person appointed by the Employer responsible for the administering of the Main Contract.

“PLANNING SUPERVISOR” shall mean the person appointed by the Client (or others) to act as Planning Supervisor in accordance with the Construction, Design & Management Regulations 1994 and any subsequent amendments to same.

“SITE” shall mean the actual place or places to which the materials shall be delivered to where work shall be done by the Contractor, together with so much of the area surrounding the said place, or places, as the Contractor shall actually use in connection with the Works as otherwise than merely for the purpose of access to the said place or places.

“WRITING” shall mean any manuscript, typewritten or printed statement under seal or hand as the case may be.

“SHALL” shall mean mandatory.

“DATE OF TENDER” shall mean the date nominated in the enquiry document for the return of tenders.

“BRITISH STANDARD SPECIFICATION” The term “BSS” or “BS” shall mean British Standard Specification, current edition.

“OTHER DEFINITIONS” OR “EXPRESSIONS” shall have the meanings respective assigned to them in the Main Contract and Sub-Contract Terms and Conditions. Words importing persons include Firms and Corporations.

Words importing the singular only also include the plural and vice versa where the context requires.

The terms “APPROVED” and “DIRECTED” herein shall mean approved and directed in writing by the Contract Administrator.

2 Tender Contract Drawings

The drawings provided as part of the enquiry documentation shall be treated as confidential documents and must not be loaned or copied to any other party without the express permission of the Engineer.

The drawings provided (together with this Specification) are intended to provide sufficient information to enable tenderers to provide a quotation for the required work and provide the basis for working drawings. Not all items or matters referred to in the Specification are indicated on the drawings and similarly not all items detailed on the drawings are described in the Specification.

It is the responsibility of the tenderer for all materials, items of equipment, etc. necessary to provide a complete finished installation as intended and for minor offsetting and alteration of service runs to achieve co-ordination with the building and other services/equipment, etc.

The tenderer shall, upon request, be provided access to all available relevant project drawings.

Claims for additional payment for alterations or additions to the works brought about by conflict between the works and building detail or other services, will not be considered and the MeC shall fully liaise with the main contractor and/or other sub-contractors as necessary.

Unless previously advised by the Engineer the tender drawings are not intended for use as working drawings by the contractor.

3 Working Drawings

The MeC shall provide and prepare a full set of working drawings. The drawings shall be to a scale not less than the tender drawings. The working drawings shall be used to enable installation of the works and to enable other Contractors to produce co-ordinated working details.

Dimensions shall be taken from site measurements only.

The drawings shall be fully co-ordinated with building detail and all other services.

The MeC shall, through the Main Contractor provide duplicate copies of all drawings for the Architect, other Service Contractors, Structural Engineer and Engineer at least prior to commencement of work or fabrication commencing. The Engineer will require at least 5 working days to comment on the proposals. No works will be installed from drawings that have not been commented on by the Engineer or Design Team.

The MeC shall be fully responsible for any errors in these drawings whether or not approved by the Engineer. No additional costs will be payable as a result of error or as a result of lack of co-ordination between building detail and drawings or between services, and, in addition, all costs resulting from disruption to other trades as a result of error or oversight shall be born by the MeC.

The tender documents are not intended for use as working drawings.

A full set of drawings shall be kept on site in order that a record of all service runs, and changes to the working drawings can be maintained. These drawings shall form the basis for the "As Fitted" drawings.

4 As Fitted Drawings

The MeC shall maintain on site, a record of all changes to the tender scheme as works proceed so that "As Fitted" drawings can be produced immediately after the installation has been completed.

The MeC shall produce the "As Fitted" drawings, which shall be based on the tender drawings and shall be equal in quality to the tender drawings.

The drawings shall include all relevant information and shall exclude any information that is relevant only during tender and construction. Each drawing shall be clearly labelled "As Fitted Drawing" and shall bear the MeC's title block.

The Engineer shall stipulate whether "As Fitted" drawings shall be produced on CAD. Full allowance shall be made for this facility if required and specified. The format of the CAD drawings specified shall be strictly adhered to.

Late production of the "As Fitted" Drawings will delay the issue of the Practical Completion Certificate and Final Account Payment.

(See clause for Handover Procedures).

The MeC shall notify the Main Contractor and the EA in writing if for any reason they are unable to complete the "As Fitted" drawings on time for the handover meeting. The EA will then advise the Main Contractor either (a) that the "As Fitted" drawings will be prepared by others and the cost of producing them deducted from any monies due or invoiced directly to the main contractor or the MeC at the sole discretion of the Employer, or (b) that the handover will be delayed until the "As Fitted" drawings have been produced by the MeC, or (c) hand over takes place and a further date is agreed for the production of as fitted drawings.

Further requirements for "As Fitted" drawings are detailed in the accompanying technical section of this specification.

5 Builders Work

The MeC shall provide all information with regard to builders work in connection with the services as and when required.

The MeC shall be responsible for establishing at the start of the contract, the nature of the information that will be required and for providing the information in whatever means that may be agreed.

Generally, all items of builders work other than chases shall be detailed on drawings provided by the MeC. The drawings shall be prepared in good time so as in no way to impair the progress of construction.

6 Liaison with Other Trades

The Main Contractor shall be responsible for co-ordinating the works of all Sub-Contractors. Under the direction of the Main Contractor, the MeC shall fully liaise with all other trades whilst preparing working drawings and whilst installing the works.

Note: The MeC and EleC shall be responsible for continual liaison during the contract period and for keeping the main contractor continually updated with information.

Before carrying out any work on, or making connections to, any plant or equipment supplied by others, the MeC shall verify the exact position and nature of the equipment on site with the appropriate Contractor or Supplier and shall take into account and accommodate positions of services and connections installed by other trades.

The MeC shall ascertain the exact position of all switches, socket outlets, radiators, etc. and to verify the positions of any fixed furniture, or special finishes, the swing of doors, tile layouts and any other such like factors which may affect the arrangement of the works.

No claim for additional payment shall be entertained for abortive work where these procedures have not been carried out.

7 The Contractor to Inform Himself Fully

The MeC shall be deemed to have examined the site, the Specification, drawings and any other documents, which form part of the contract or describe the works.

In the case of an existing building, the MeC shall be responsible for visiting site to carry out a pre-tender survey, to ascertain the conditions under which the work is to be carried out, means of access, requirement for scaffolding, building structure and obtaining full particulars of any part, or parts, of the existing installation which are to be re-used or adapted and make full allowance in their tender for all such like factors.

No allowance shall be made for ignorance due to the MeC's neglect in this respect.

Where the particular specification refers to quotations from specialists/manufacturers/stockists, the references are intended for tender guidance only. The MeC is responsible for ensuring that the quantities, service or equipment, included within their offer satisfies the requirements and intents of the scheme.

Any doubt in this connection must be clarified with the Engineer before tenders are submitted.

8 Conflict

Any contradiction between the Specification and drawings must be brought to the attention of the Engineer and Contract Administrator during the tender period when a ruling will be given.

A discrepancy between the Specification and drawings will not be accepted as a basis for additional payment after receipt of tenders.

If the details given in the Specification, conflict in any way with manufacturers installation instructions or the requirements of British Standards or Codes of Practice, then such conflicts shall immediately be brought to the attention of the Engineer who will issue guidance as to which document is to be followed.

9 Dimensions

Where plant or equipment is to be installed inside or close to buildings and structures, the MeC shall take their own dimensions of the buildings or structures for the purpose of installing any plant and materials supplied under the contract and shall be responsible for the accuracy of such dimensions. These dimensions shall be used in preference to any supplied the Engineer.

Dimensions written on drawings shall in all instances be taken in preference to those measured on a drawing to a given scale.

Any such discrepancies shall be notified to the Engineer before action is taken.

10 Connection to Appliances

The MeC shall be responsible for making all final connections to items of plant and equipment provided and installed by them, except where this is specified to be carried out by others.

The MeC shall be responsible for the satisfactory reconnection of any existing plant or equipment, which they disconnect during the course of the work.

Where specified, the MeC shall also fix and/or connect items of plant and equipment supplied by others.

11 Ease Of Maintenance

In the positioning of all plant and equipment to be installed, the MeC shall at all times give proper consideration to the future maintenance of the plant and shall include for such component parts as are available from the manufacturer of the equipment or plant, to ensure ease of maintenance.

12 Samples for Employers Approval

The MeC shall submit to the Employer, for approval, such samples of the workmanship, materials or equipment that the MeC proposes to use in the execution of the works as the EA shall require.

Where, in the opinion of the Engineer, the samples submitted are not of a sufficiently high standard or are unsuitable for use in the proposed circumstances, they shall have the right to instruct the MeC to obtain alternative materials or equipment from such a source as the Engineer shall decide.

All expenditure in connection with providing samples for approval shall be borne by the MeC.

13 Interference Suppression of Contractors Equipment

All equipment used by the MeC for the erection of the works shall be suppressed to comply with current British Standards, so as to cause no interference with radio, television or electromechanical apparatus.

14 Supervision

The MeC must, during the construction of the works, engage a competent foreman on site to supervise the work, whose identity shall not be changed without the written agreement of the EA.

The foreman must be capable of taking decisions and receiving instructions, which are binding on the MeC.

15 Specialist Trades Attendance On Equipment

The MeC shall arrange and make all payments for specialist tradesmen to visit the site, adjust and put into working order, all items of specialist plant and equipment, as detailed in the Specification.

16 Noise and Vibration

The MeC shall be fully responsible for ensuring the reasonably silent operation of any running machinery installed by them under this contract and shall make all necessary allowances for

fitments required to effectively damp out and insulate noise and vibration from causing any annoyance to the occupants of the building or adjacent premises.

When work is undertaken within occupied buildings, or in the vicinity thereof, the MeC shall so arrange this work that the minimum amount of noise and inconvenience is caused to the occupants of the buildings.

Noisy mechanical equipment shall only be permitted to be used by prior arrangement with the main contractor and the MeC shall allow for executing the work accordingly.

17 Fire Hazard

The MeC shall be responsible for ensuring that proper precautions are taken to protect the building and its contents where naked flame is used in the course of the installation, commissioning or testing.

They shall ensure that fire extinguishers, fire blankets or other devices required by the local Fire Officer, are available in areas where such hazards exist.

18 Standard of Installation

A suitably high standard of installation shall be maintained to comply with the requirements of this Specification and those of the relevant bodies, as published in the latest editions of their standard requirements and/or regulations.

For example:-

- British standards issued by the British Standards Institute
- Building Regulations
- Requirement of the Health and Safety Executive and CDM Regulations
- Regulations under the Electricity Acts issued by the Department of Energy
- Requirement of the Local Fire Officer and/or Building Control Officer
- Current IEE Wiring Regulations for Electrical Installations and current amendments
- Requirements of the Local Electricity Supply Company
- Model water supply bylaw
- Requirements of the Local Water Supply Company
- Requirements of Local Gas Authority
- CIBSE recommendations
- British Gas Regulations

Any installation or parts thereof, installed by the MeC, deemed by the Engineer to be untidy, installed incorrectly, not in accordance with the above, will be removed and correctly installed

to the satisfaction of the Engineer at the MeC's cost. Any subsequent costs caused by abortive builders works, making good, delay or disruption to other trades will be met by the MeC.

19 Materials

All materials and equipment shall be new unless otherwise stated in this Specification, or on the tender drawings. Where details or descriptions are given, these are for guidance only, and the MeC shall ensure that full allowance is made for all associated materials and equipment to provide a fully complete and operational installation.

Where reference is given to suppliers or manufacturers quotations, the MeC shall ensure that such quotations meet the requirements of the tender scheme with regard to both Specification and quantities and that all terms and conditions forming part of the quotations are acceptable to the MeC and that such terms and conditions will enable compliance with the tender offer.

The MeC must prepare their tender based upon the material specified, but may offer alternative materials to those specified, by listing them on a supplementary sheet to their tender.

Any alternative material offered shall not form part of the tender offer, but will be considered provided there is a benefit to be gained, either in cost, quality, or delivery.

The design responsibility for the change will be rested with the MeC, who will be required to confirm to the Engineer via the Main Contractor, that they (the MeC) indemnifies the Engineer for any time spent and costs incurred by the Engineer as a direct result of changing from the materials originally specified.

The MeC must ensure that all specified materials are correctly applied and installed strictly in accordance with the manufacturer's advice and requirements. Any conflict between information given by the specification and/or tender drawings and given by the manufacturer must be brought to the attention of the Engineer before tenders are submitted.

Any costs incurred by the MeC through not installing materials in accordance with the manufacturer's requirements will not be reimbursed through the main contract.

20 Protection of The Installation, Equipment And Materials

The MeC shall ensure adequate, safe and suitable storage for all materials and equipment provided by and installed by them.

All materials shall be adequately supported and stored under cover, to prevent bending, distortion and corrosion.

All materials or equipment stored in an unsuitable method will be rejected by the Engineer and replaced at no cost to the Main Contractor. It is the MeC responsibility to ensure the protection of all works and materials up to Practical Completion of the Project.

The MeC shall ensure that the condition of all materials and equipment is maintained during the course of the contract and that no damage, corrosion, soiling or deterioration of any kind, affects the materials or equipment.

The MeC shall provide all covers, protection and other means necessary to ensure that all materials and equipment is in a "As New" condition, upon completion of the contract.

21 Existing Materials

The MeC shall not, under any circumstances, re-use existing materials unless permitted in writing by the Contract Administrator or unless specifically stated in the Specification or on the drawings.

Where existing materials are to be re-used the MeC shall take full responsibility for the condition, safekeeping and satisfactory re-use of such materials.

22 Variations

Changes to the scope of works shall only be carried out on receipt of written instructions, in accordance with the general conditions of contract. No order for such alterations, additions, or omissions, will be issued until the MeC has submitted an estimate of cost unless specifically instructed in writing by the EA. Such costs shall be submitted to the Main Contractor, with a copy to the EA and Engineer.

23 Interim Claims for Payment

Interim claims for payment shall include a statement indicating:-

- Value of work complete for each defined price section of work in the Summary of Tender.
- Priced schedule of unfixed materials on site.
- Value of work complete against each agreed variation.
- Value of unfixed materials on site for each agreed variation.
- Application for payment must be made to the Main Contractor for approval, prior to raising a VAT invoice to the main contractor.

Materials stored off site will not be paid for.

24 Measurement of Works

The MeC shall give all necessary assistance to enable the Engineer to examine or measure any of the Works.

No work is to be covered or concealed, or insulation applied, to any section of the works, without seeking prior approval of the Engineer.

The MeC shall give notice to the Engineer, via the Main Contractor, of not less than two working days as to when the works which are to be covered or buried shall be ready for examination and the Engineer or their representative shall carry out such examination and/or measuring without undue delay but in any event within two working days.

25 Engineers Time

Any time expended by the Engineer as a direct result of the Main Contractor or MeC not complying with the terms and condition of the contract, or the specification, will be contra charged by the Client to the Main Contractor and MeC (where applicable).

26 Performance Tests

The MeC shall satisfy the Engineer by means of suitable test procedures, during erection and final test on completion that the whole of their work is carried out in accordance with all rules and regulations applicable to the work, and shall provide at their own expense all testing, apparatus, etc., and shall provide all labour required. The accuracy of the tests must be to the satisfaction of the Engineer whose decision will be final.

27 Practical Completion

Practical Completion will not be achieved until works are complete to the satisfaction of the Engineer and all testing and commissioning is satisfactorily completed.

28 Commissioning And Completion

The MeC shall ensure that the whole of the works is complete, tested and commissioned, before the final inspection is carried out by the Engineer.

The MeC shall clear away all rubbish and surplus materials and ensure that the whole installation is in a clean, sound and satisfactory working order.

When the MeC is confident that the works are complete, they shall inform the Main Contractor, whereupon an inspection will be carried out by the Engineer and a list of outstanding and/or remedial works prepared. The MeC shall attend to all items noted immediately in order that the installation is completed to the Engineer's satisfaction before the handover date.

The MeC shall provide attendance to all commissioning carried out by specialist Contractors and shall be responsible for the satisfactory completion of such works.

The MeC shall also provide attendance during the commissioning of any other site works where they have had a contractual involvement.

The Engineer will not certify completion until all works under the contract have been completed, tested and demonstrated to their complete satisfaction.

The MeC shall, through the Main Contractor, advise when all listed items have been attended to, such that a confirmatory re-examination may be carried out by the Engineer.

If such advice is not received, re-examination will be carried out to suit the Contract requirements, before handover. If the re-examination determines that the MeC has not successfully cleared the list of items, all costs incurred by the Engineer in subsequent inspections will be the responsibility of the MeC and be debited from the final account or invoiced direct to the main contractor at the Employers Sole Discretion.

29 Final Inspection And Handover

Upon completion of all outstanding works and/or remedial works the MeC shall notify the Main Contractor that all works are ready for inspection. An inspection will then be carried out at an agreed date to suit all parties. The inspection will be carried out by the Engineer or their representative and a responsible representative of the MeC shall be present and all spare equipment and drawings shall be on site.

Should it be found that the works are not finally completed and satisfactory, the Employer will contra charge the MeC for the Engineer's abortive time. The "As Fitted" drawings and maintenance manuals shall be handed to the Engineer at the time the final inspection is carried out.

30 Operating And Maintenance Manuals

Operating and Maintenance Manual shall be provided at or before handover, such that the Employer is fully informed of the correct operational techniques necessary for its safe use. The manuals shall be issued to the Planning Supervisor for incorporation into the main manual issue. Failure to comply with this requirement will delay handover.

Manuals shall comprise the information detailed in the technical sections of the Specifications.

The manuals shall be bound and titled, contain an index for ease of reference and prominently display the name and address of the Contractor and the Engineer together with emergency telephone numbers.

31 The Construction (Design & Management) regulation 1994 statutory instrument 1994 no. 3140 health and safety hereinafter referred to as CDM regulations

The MeC shall, before submitting a Tender, be fully aware of the requirements of the above Regulations.

The MeC shall include in their tender for fully complying with all requirements of current UK Health and Safety Legislation, Regulations and Codes of Practice, including the 1994 CDM Regulations and any transitional provision of the regulations and subsequent amendments.

The MeC shall include for all liaison required by the Planning Supervisor and Main Contractor as defined in the CDM Regulations or any other party for the production of all Method Statements, Health and Safety Plans, details, documents, information, etc., as required by the Planning Supervisor, Main Contractor or others, such that the Health & Safety Plans as required under the CDM Regulations, can be produced and the requirements of the regulations can be met.

The MeC shall include for the continual update of documents, etc. as necessary, and for the provision of all record drawings, plans, maintenance procedures, O & M Manuals, details and locations of all materials used during the construction phase, etc., as required by the Health and Safety Executive and any other documents that may be required such that a completed Health and Safety manual can be finally produced and handed to the Client by the Planning Supervisor, Main Contractor or other party in order that the Client has final documentation to satisfy the CDM Regulations and to enable the Client to operate and maintain the "Works" in accordance with HSE legislation.

32 Overtime Working

The tenderer should note that all overtime working (within the constraints of the planning conditions) must be carried out in order to achieve the completion date and that all costs associated with this must be included within the tender sum. No claim for additional costs arising from any overtime working will be entertained.

33 Asbestos Health and Safety

Working with asbestos

Between the 1950's and 1980's asbestos materials have been used in buildings for sealing, insulating and boarding. Since 1985 all forms of asbestos materials for use within the standard construction industry has been banned due to positive links that the material can lead to a number of fatal diseases.

Typical use of asbestos in buildings

The material is likely to be present on many refurbishment projects and all contractors and site operatives should be alert and aware of the possible locations where asbestos may be located. Due to the materials extremely low heat conductivity and fire resistance, asbestos has been used extensively for insulation and fire compartmentation.

During the last 50 years asbestos has typically been used for the following applications:-

- Thermal insulation to steel framed buildings,
- Boiler plant insulation - pipework, calorifiers, flues, boiler construction,
- Ceiling fire breaks,
- Panelling, ceiling tiling, partitions, soffit boards,
- Duct fire proofing - internally and externally,
- Asbestos water tanks, down pipes, gutters, roofing materials.
- Asbestos ropes and cloth.
- Paints, coatings, wood fibre-board facing.

As the material has been used so liberally, asbestos may be present in many other applications which are not listed above.

Typical hazards from asbestos

Left undisturbed asbestos provides little risk to operatives, but care shall be taken to ensure that there is no risk of an operative being contaminated.

Before any work begins on site any asbestos-containing materials should have been located and identified. The MeC must have asked the Main Contractor whether an asbestos survey has been carried out and be fully satisfied with the response/result before beginning any works.

<u>If any operative is in any doubt of the material, they shall not disturb it and shall seek further professional advice.</u>

Asbestos fibres can be released and pose hazardous if the material is:-

- Drilled,
- Cut,
- Dropped,
- Broken,
- Impacted on etc.

Although not dangerous to touch, the material fibres can be fatal when inhaled.

Asbestos hazard reduction

If there is any risk of any tools, equipment, personnel or plant accidentally damaging a suspected or known asbestos material, the material shall either be adequately protected or removed by a specialist HSE licensed contractor.

No unlicensed contractor shall attempt to remove the material

The appropriate action of how to eliminate the risk of contamination shall be decided by the design and construction team with the help of a professional advisor.

More information

For further information regarding asbestos you can contact:-

- Company Health and Safety Officer,
- Project Health and Safety Consultant,
- Local Health and Safety Executive,
- Local Environmental Health Department,

Publications can be obtained from the HSE.

In the first instance, the MeC shall at any sign of asbestos, stop all works and identify the area in question to the Main Contractor.

Section 2

Standard Mechanical Specification

Section 2

Standard Mechanical Specification

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1 Introduction

The Mechanical Contractor (MeC) must within his tender bid, make all due allowances for the complete installation and integrity of the proposed scheme. The MeC prior to submitting a bid shall have been deemed to have investigated all site conditions, statutory requirements and obligations associated with the scheme, such that a fully operational system is produced to both the Employer and Engineers satisfaction.

The MeC is advised that the Engineer has been retained to undertake installation quality inspections and to report accordingly upon findings.

If for any reason a MeC does not feel confident in carrying out the installation, then he should advise in writing that he is unable to submit a fully comprehensive tender bid, and is not in any circumstance to accept award of a contract under false pretences, as this will be deemed as gross breach of Contract, and the MeC will suffer the financial consequences.

The Engineer will be available for telephone discussions during the tender period to clarify any potential queries, but will not hold these discussions until such time as the MeC has a clear understanding of the project.

2 Pipework General

All pipework shall be erected with continuous and uniform gradients to effect efficient venting and draining of the service.

All piping shall be erected to present a neat and orderly appearance, arranged parallel to or at right angles to structural members of the building, and to give a maximum headroom not obstructing windows and doorways. All pipe drops shall be plumb. No joints shall be formed in the thickness of walls, floors and ceilings. It shall be the responsibility of the MeC to ascertain the thickness of plaster and other wall finishes, skirting heights, sill heights and floor finishes. Pipework shall generally be set around all piers and columns and shall follow the contour of the building.

In laying out pipe runs etc., the MeC shall be responsible for obtaining information from the main contractor and other sub-contractors to ensure adequate space is left available for the fitting and maintenance of all equipment. All pipework valves, fittings and equipment forming the piping installation shall be erected so that they can be dismantled and are accessible for repair and replacement. At all low points in the system a drain cock shall be neatly fitted. At all high points provision shall be made for the release of air entrained in the medium.

All work on Natural Gas pipework installations must be carried out by CORGI registered, fully trained personnel. CORGI registration cards shall be kept available for inspection at any time during the progress of the works. Failure to provide requested identification on demand will necessitate the removal of that operative from the works.

2.1 Tubing

Unless specified to the contrary during the Tender period, tubing associated with the various pipework systems shall conform with the following:-

Service	Tube Type
Heating and Natural Gas in Plantrooms, ceiling voids, service voids, floor ducts, roof spaces or located externally (external pipework to be galvanised).	Sizes 15mm to 42mm Copper tubing to BS2871 Table X Sizes 50 mm and above:- Black Medium - weight quality mild steel tubing to BS 1387 Sizes above 150mm:-Black mild steel tubing to BS3601
Above ground Cold Water Services, Domestic Hot Water, Drains from Safety Valves and air vents, Heating Cold Water Feeds	Copper tubing to EN 1057 Table X
Below ground Cold Water	Medium Density Polyethylene (MDPE) blue to BS 6572 & BS 3284
Below ground Natural Gas	Medium Density Polyethylene (MDPE) yellow to ISO 4437

2.2 Piped Services Jointing Methods

Service	Location/Conditions	Method
Steel Pipework	Up to 7 bar g. working pressure and Exposed to view, or In accessible locations, or In plant Areas	Up to and including 80mm nominal bore:- Screwed taper threads to BS 21. Above 80mm nominal bore - Welded with flanged joints (kept to a minimum for servicing) to BS 4504
Copper Services	In all locations	Capillary soldered joints on sizes up to 108mm. Sizes 67mm and above may alternatively be Bronze Welded to the requirements of BS 1724. Connections to equipment etc. to be taper threads to BS 21 or parallel threads to BS 2779 as necessary.
Medium Density Polyethylene Services	Below ground.	Fusion welded either socket, butt or saddle as applicable. MDPE to metal pipework connections to be by purpose made compression joint bspt threaded fusion socket or loose steel flanged adapter. Ferrous metal shall be protected against corrosion by Denso wrapping.

2.3 Jointing Materials

Where stated, trade names are used to illustrate type and quality. Equivalent products of equal performance may be substituted.

Screwed Joints

Service	Compound
Heating	Boss White and Hemp; PTFE tape

Natural Gas	Hermetic sealant formulated for use with gas (e.g. Plasticoll X10G). PTFE tape, heavy grade formulated for use with gas, unsintered to BS 5292 type C.
Domestic Water Services	Boss Blue and Hemp. PTFE tape unsintered to BS 5292 type C.

Flanged Joints

All Services	Composite asbestos free material (e.g. Klingerite) graded to suit the relevant service. Brass corrugated Taylors Ring with relevant jointing compound to both faces. N.B. Flat-faced flanges to have full face joint rings.

Soldered Joints

All EN 1057/X Copper Pipework	All fittings to be end feed, or have integral lead-free solder ring. Topping up by end feeding is not preferred but where necessary and on potable services, only lead-free solder shall be used. Flux to be WRC approved on potable services.

In all cases, all excess jointing compound and material shall be cleaned from the joint at the time it is made. Similarly excess flux shall be removed before the area local to the made joint cools. All jointing materials used on hot and cold water services shall be WRC approved.

2.4 Fittings for use with Steel Tube

Screwed fittings for use with heating and gas services using mild steel tubing shall be beaded or banded, malleable iron, manufactured to BS 143 by either George Fischer Ltd or Crane Ltd.

Steel tubulars shall be of medium quality to BS 1387.

All fittings for use with black mild steel tubing shall be natural, black finish. Fittings for use with galvanised mild steel tubing shall be hot dipped galvanised.

Welding fittings for use with black mild steel tubing shall be black, medium quality, for butt welding, manufactured to BS 1965.

Flanges for use with mild steel tubing shall be of mild steel, faced and drilled in accordance with the relevant BS table to suit the working conditions. Flanges shall have either screwed taper threads to BS 21 or be of the slip-on type for welding as applicable. All malleable iron unions shall be of spherical bronze to iron seat pattern.

All junctions and changes in direction shall be carried out using short sweep pattern fittings. Square fittings shall only be incorporated when venting and draining necessitates and where approved by the Engineer.

Reduction in pipe diameters shall be made by using one fitting only e.g. reducing socket, bend, tee. Sockets shall reduce eccentrically when fitted in horizontal pipework and concentrically when in vertical pipework. Bushes will not be permitted.

2.5 Fittings for use with Copper Tube

Fittings for use with copper tubing to EN 1057 shall be manufactured from copper, high quality copper alloys or gunmetal and be non-dezincifiable, suitable for either end feed solder capillary jointing or incorporating lead-free solder rings. All such fittings shall be manufactured to BS 864 pt 2 and carry BS Kitemark.

On all sizes above 108mm and where necessary on sizes between 67mm and 108mm inclusive, bronze welding fittings, “Brazoweld”, as manufactured by Donald Brown (Brownall) Ltd shall be used.

Flanges for use with copper tubing shall be of gunmetal or bronze dependant upon size and jointing method specified before. All flanges shall be faced and drilled in accordance with the relevant BS table to suit the working conditions. Brass nuts, bolts and washers shall be used wherever non-ferrous flanges are employed on copper services.

Flanges on sizes above 54mm may be two piece comprising a copper alloy centre joint face and a coated mild steel backing ring.

Unions for use with copper tubes shall incorporate brass to brass conical seals.

Sockets shall reduce eccentrically when fitted in horizontal pipework and concentrically when in vertical pipework.

2.6 Fittings for use with MDPE Tube

All fittings used with medium density polyethylene tube are to be manufactured by the relevant tube manufacturer and be of the same base colour and material except for transition couplings (MDPE to metal tube) which shall be of non-dezincifiable brass/gunmetal.

Where possible, all changes in direction shall be performed using the natural flexibility of the material in preference to the use of fittings. Cold bending minimum radii shall be 15 x nom. pipe diameter where no joints are included or 25 x nom pipe diameters where joints are within the arc.

2.7 Screwed Pipework

Screwed joints shall be made in accordance with the provisions of BS 21 “Pipe threads” and shall be clean threaded, pulled tightly and made with approved jointing material (clause 3.2.3).

Tubing shall be free of mill scale, rust or deformation. Threading is to be carefully performed to produce an accurate concentric thread tapered to relevant BS, clear and free from all burrs, snags and swarf. Subject to these provisions threading may be carried out by hand or by automatic machine. Any exposed threads or joints on black tubing shall be painted with red-oxide, exposed threads or joints on galvanised tubing shall be painted with galvanised paint (e.g. galvafroid).

Where tube is galvanised care shall be taken to ensure that threads are carefully cut so that the number of exposed threads is minimised.

Where pipes are held in vices, as when screwing, care should be taken to ensure that the pipe surface and fittings, beads etc. are not damaged. Any pipework so damaged shall not be fitted.

No screwed joint shall be located within the thickness of the building fabric. Where joints in such locations are inevitable, they shall be welded and tested prior to building-in or covering over.

2.8 Flanged Steel Piping

All flanges shall be manufactured from mild steel to BS 4504 to the table appropriate for the pressure specified. Flanges shall be machine faced and trimmed at the edges. Bolt holes shall be drilled and not punched. Flanges on screwed work shall be screwed bspt.

Flanges for welded pipework shall be of the type known as “Welding neck” or “Slip-on” flanges. All flanges are to be fitted true and square with the pipe axis.

All flanged joints shall be flush and truly aligned and shall employ full face joint rings. Nuts, bolts and washers shall be bright mild steel and the bolts shall be of the correct length, threaded to ISO metric coarse, with a maximum of two threads extending above the face of the nut. Washers shall be fitted beneath both bolt head and nut.

2.9 Welded Pipework

Welding shall be to Class II by electric arc process to BS 2971 using welding materials to BS639 or to Class II by oxy-acetylene process to BS 2640 using welding materials to BS 1453.

Oxy-acetylene welding shall not be used for pipework above 100mm n.b. or for flanges above 50mm n.b.

All welders employed on the work, both on and off site, shall hold a currently valid Heating, Ventilating and Domestic Engineers N.J.I.C. Certificate of Competency for Oxy-acetylene Welding grade A or Metal Arc Welding as appropriate to the work in hand, or alternatively a currently valid welders performance certificate issued by the Associated Offices Technical Committee.

Any welder may, at the Engineers discretion be required to carry out a specimen butt and branch pipe connection fusion test at site in accordance with BS 4872 part 1 Procedures and Acceptance Levels for which a Welder Approval test record to Appendix B of the standard shall be kept for each test. Welders shall not be allowed to continue welding on the work either on or off site if their standards of workmanship prove to be unsatisfactory.

In all cases, pre-formed heavy weight welding fittings, in accordance with BS 1965 part 1 and amendments shall be used. Pipework shall be properly profiled to receive the fittings with end faces

machined and bevelled (not flame cut) at right angles to the axis of the bore. Profiled entries into tubing for branch connections may be flame cut but the cut edges must be filed smooth and all swarf and cuttings removed from the bore of the tube before the fitting is offered up for welding. Segmental or cut-and-shut bends will not be permitted.

No improper weld penetration shall be allowed into the bore of the tube or fitting. Upon completion of the weld, the proper degree of post weld heat treatment shall be applied to normalise the weld. The weld shall then be hammered, properly dressed and painted with red-oxide. Adjacent to each weld, the welder shall stamp his Certificate of Competency Number.

No welding shall be carried out in extremely cold or severe weather conditions that are likely to affect weld quality.

All pipework and fittings shall be completely free from rust of foreign matter.

In welded pipework, flanged joints shall be provided at intervals of not more than 12 metres. All sets, double sets and springs shall be formed on long lengths of tube without joints and shall be free from distortion, the full pipe bore being maintained throughout.

Any faulty weld sections removed shall be made good by welding in lengths of pipe not less than 300mm long, subject to the Engineers instructions.

The Engineer reserves the right to have up to 2% of the site made welds removed for examination. Any welds removed shall be made good by welding in lengths of pipe not less than 300mm long. The MeC shall make no extra charge for such re-instatement.

Should a test piece prove to be unsound or not made as specified, then the Engineer shall be entitled to cut further test pieces of work performed by the welder responsible for the faulty test piece up to an additional 2% without charge to the Client. If these further samples also show evidence of faulty work, the Engineer reserves the right to instruct the MeC to cut out and re-make all welds carried out by the welder responsible for the faulty work and this shall be done without charge to the Client.

It must be understood that permission to weld may be refused on any contract and that the Engineers decision in this respect will be final and binding upon the MeC.

2.10 Copper Pipework

Copper tubing shall be light gauge with ends prepared for capillary type fittings. Pipe ends shall be cut square and cleanly using purpose made cutters. All irregularities and swarf are to be dressed off to produce a smooth bore and butt end with outer surfaces free from deep scratches.

The cleaning of pipe ends and fittings sockets prior to soldering shall be carried out using wire wool, emery cloth or purpose made wire brushes.

Springs and sets shall be formed on a light gauge tube bender using the correct size formers, or in small bore tubing may be made by hand using a correctly sized internal spring. All springs and sets shall be to a true radius and shall be free from deformation in the bore, excessive thinning of the outer arc tube wall or any kinking of the inner arc tube wall. All unsatisfactory pipe bends, sets or springs will be rejected.

Extreme care shall be taken to ensure that no damage is caused to the pipework by vice jaws, clamps, hand tools etc. Minor scratches etc., shall be removed by dressing with wire wool etc. Any sections or fittings showing major damage shall be replaced as instructed by the Engineer.

2.11 MDPE Pipework

Medium density polyethylene tubing up to 63mm nom. shall be supplied in coil form to minimise the number of joints necessary during construction. Sizes 90mm and above shall be supplied in 6m straight lengths. All open ends shall be protected and fitted with purpose made caps or plugs until jointing is carried out.

Jointing shall be performed by a qualified and certified specialist in accordance with the manufacturer's recommendations.

Generally, polyethylene pipework for gas services shall be laid to a depth giving a minimum cover of 600mm whilst water bearing pipework shall have a minimum cover of 900mm.

Trenching shall be excavated to a depth of 100mm below pipeline base level and a 100mm sharp sand bed laid before the pipework is installed. After the pipework installation has been completed and tested as specified elsewhere, a further layer of sharp sand to a depth of 100mm over the top surface of the pipe shall be added before the trench is back-filled to ground level. Care shall be taken to ensure that no large objects e.g. bricks, concrete blocks, are included with the back-filling exercise. Unless specified to the contrary, the above trenching and filling will be carried out free of charge to the MeC by the Main Contractor. The MeC shall, however, be fully responsible for ensuring that the work is properly executed including whatever costs are necessary to cover for the necessary supervision.

During the back filling operation, the MeC shall supply and lay a continuous, 150mm wide proprietary plastic warning marker tape, or mesh, positioned between 150mm and 250mm below ground level. The marker tape shall include written identification of the service covered and shall incorporate a stainless steel wire for detector sensing.

2.12 Brackets and Supports

All pipework shall be adequately supported. Supports shall be arranged as near as possible to joints and changes in direction. The spacing of supports shall not exceed the following:-

Steel Pipework

Nom. Size	Horizontal Spacing	Vertical Spacing
mm	m	m
15	2	2.5 *
20	2.5	3 *
25	2.5	3 *
32	2.5	3
40	2.5	4
50	2.5	4
65	3.0	5
80	3.0	5
100	3.0	5
125	4	5
150	4.5	5

Copper Pipework

Nom Size	Horizontal Spacing	Vertical Spacing
mm	m	m
15	1.2	1.8 *
22	1.2	1.8 *
28	1.5	2.5 *
35	1.8	3
42	1.8	3
54	1.8	3
67	2.4	3.7
76	2.4	3.7
108	2.4	3.7
133	3.0	3.7
159	4.0	3.7

* To a minimum of 2 brackets for each normal room height drop.

Where two or more pipes are supported together, the support spacings are to be based on the centres required for the smallest bore pipe.

Vertical pipes shall be supported in such a manner that no strain is imposed on horizontal branches.

Under no circumstances shall pipework depend upon a wall through which it passes for support. Gas pipes shall not be supported from any other pipe, nor shall any other pipe be supported from a gas pipe.

Fixing to the building structure shall be selected to be compatible with the strength and construction of the building fabric. Details shall be agreed with the Engineer before installation work commences.

Supports shall be selected to suit the duty required and the area in which the pipe is to be installed, special attention being paid to ensure the free expansion and contraction of the pipework.

Two piece split ring type brackets shall be used. Brackets shall be purpose made and be of malleable iron or zinc plated steel for ferrous pipework and either brass or plastic for copper pipework.

Brass screw-on clips shall be fitted with brass screws, malleable iron screw-on clips shall be fitted with BZP steel screws. If the clip is counter drilled, counter-sunk screws shall be used, otherwise round head shall be used.

2.13 Pipework Clearances

Pipework shall generally be arranged to give the following minimum clearances between the pipe or lagging surface (as applicable) and adjacent items.

Walls	-	25mm
Ceilings	-	100mm
Finished Floors	-	100mm
Adjacent Pipework	-	25mm
Ductwork	-	75mm
Conduit or Electrical Trunking	-	100mm
Electrical Cables	-	150mm
Lighting Fittings	-	150mm

The MeC shall advise the Engineer before work commences of any locations where the above clearances cannot be maintained.

2.14 Pipe Sleeves

All pipes passing through walls, floors, ceilings, partitions etc. shall be provided with sleeves of similar material to the pipe.

Sleeves shall be free of internal burrs and shall have an internal diameter sufficient to allow free movement of the pipe.

Under no circumstances shall sleeves be used as pipe supports and pipes shall be fitted concentrically within the sleeve.

Sleeves shall be cut to the correct length such that they protrude not less than 2mm but not more than 6mm proud of the finished surface. The MeC shall be responsible for ensuring that sleeves are correctly located and built in.

The annular gap between pipes and sleeves passing through external walls, ducts, subways etc., shall be caulked with an approved flexible sealant to provide an effective permanent vermin and weatherproof barrier. Where passing through firewalls and/or smoke barriers, the gap shall be caulked with a flexible, fire-proof sealant, of the appropriate rating.

2.15 Refrigeration Pipework

Pipeline routes shall generally be chosen to minimise both length and directional changes.

Pipework shall be correctly sized to ensure the pipe distributions to evaporators allow the oil to return to the compressors with no liquid refrigerant drainage into the compressors during neither shut-down, nor liquid entry during operation.

The installation shall have a minimum of pipework joints in order to avoid the possibility of refrigerant emissions to atmosphere.

Pipework shall be delivered to site internally degreased.

Pipework shall be stored in clean and dry conditions with ends sealed until required for installation.

The refrigerant pipework installation shall be executed in accordance with good refrigerant practice and latest standards. Refrigerant quality pipework (material C106 to EN 1057 Part 2 Table 2) shall be fully annealed for pipes up to 28 mm diameter and half hard for the remainder. All joints are to be brazed in accordance with HVCA "Jointing of Copper and its Alloys" Code of Practice 1990. On copper to copper joints a filler rod of copper-phosphorous alloy with a minimum of 15% silver content (CPI as table 3 of BS 1845) shall be used. On copper to ferrous joints a fluxless copper-silver filler rod with 42% minimum silver content (AG2 as table 2 of BS 1845) shall be used with separate flux.

On completion all excess flux is to be removed from the joint. Pipework below 19mm OD may be connected by flared joints. All joints to be flared are to be deburred and cleaned prior to mechanical flaring.

Dry nitrogen is to be passed through the pipework during brazing operations to prevent oxidation and reduce scaling.

Pipework shall have flexible couplings to prevent vibration transmission where pipework connects to the compressors and air cooled condensers. Gas pulsation dampers shall be fitted where appropriate to minimise noise and vibration transmission.

Pipework shall be designed to maintain refrigerant velocities and gradients to prevent trapping oil and sludging ensuring that oil is returned to the compressor under all conditions. (i.e. even at the lowest stage of capacity unloading.)

All horizontal discharge lines shall be sloped away from the compressor to prevent oil return into the discharge heads.

Open ends during progress of work shall be protected with purpose made plugs, caps and blank flanges.

Joints shall not be buried or concealed within the thickness of the building structure. Where pipework passes through the structure, a sleeve of similar materials shall be provided. On completion of installation the pipework shall be pressure tested using dry nitrogen and leak tested.

A pressure test of 1.5 times the working pressure shall be carried out over a minimum period of 24 hours and the initial and final pressure readings shall be noted and handed to the Engineer.

Following the pressure test, the system contents will be released to atmosphere and the complete installation will be triple evacuated, with the final stage being over a period of 24 hours minimum. Final Torr readings shall be taken for vacuum pump switched off and isolated. The Torr readings will then be checked after a period of 2 hours and both sets of reading handed to the Engineer.

i) Pipework Supports

Pipework supports shall be arranged at intervals not greater that those indicated in the following tables. Where two or more pipes of dissimilar sizes are fixed to common bracket, then the spacing shall be for the shorter distance.

All refrigeration pipework shall be fixed to suitable cable tray using proprietary plastic tie wraps

Where wall fixings are not possible/practical then refrigeration pipework shall be fixed to a suitable sized cable tray provided by the MeC. The cable tray shall be hot dip galvanised, heavy duty with a return flange. All bends, tee sections etc., shall be made using the proprietary manufacturer's fittings, no site made fittings shall be allowed.

Cable tray shall be supported at regular interval in accordance with the manufacturer's recommendations and the spacing of supports shall be such that no 'sag' is apparent when the tray is fully loaded.

Size (mm)	Spacing for Horizontal runs (lagged bare pipes [mm])	Spacing for Vertical runs (lagged bare pipes[mm])
15 and below	1200	1800
22	1200	1800
28	1500	2400
35	1800	3000

ii) Thermal Insulation

All refrigerant pipework shall be thermally insulated using 13mm thickness Class 'O' AF/Armaflex (colour to be grey).

No insulation materials are to be applied to any part of the installation until the prescribed tests have been carried out and declared satisfactory by the Engineer. Before the insulating material is applied, all surfaces to be insulated shall be clean and all scale, rust and dirt shall be removed by means of a wire brush.

iii) Commissioning

The refrigeration pipework shall be pressure tested by a Specialist and the MeC shall issue all necessary certificates following successful testing.

The MeC via a Specialist shall also produce a certificate of conformity clearly indicating that all equipment has been installed in accordance with the manufacturers recommendations and is operating as designed and intended.

iv) Demonstration

The MeC shall include for demonstrating to the Client full systems operation and shall identify plant location, safety precautions etc.

2.16 Electrolytic Action

All connections between copper pipework and ferrous pipework or equipment shall include an inert material barrier in the form of a non-metallic fitting or joint ring to prevent direct contact and the setting up of electrolytic or any other deleterious action.

2.17 Dezincification

All pipework, fittings, valves, cocks and brazing materials used shall be made from non dezincifiable materials whether specified in particular or not.

2.18 Expansion of Pipework

Wherever possible expansion of pipework shall be taken up by natural off-sets and changes in direction of the pipe runs. Where this cannot be achieved, expansion shall be accommodated by the inclusion of fabricated expansion loops or purpose made expansion bellows.

Wherever expansion bellows or compensators are incorporated, guide brackets to control the pipe movement in the vertical and lateral planes shall be fitted. Where the expansion unit is adjacent to an anchor point at least two such guides shall be fitted, 1xtwo pipe diameters and 1xfifteen pipe diameters distant on the free side.

3 Valves and Cocks - General

The MeC shall supply and install all valves and cocks as called for in the specification and deemed necessary to provide a workable installation.

All valves and cocks shall be installed in positions that permit easy access for operation and maintenance but shall not be located where a leaking gland may drip onto electrical equipment.

All items of plant and equipment (including motorised valves, pumps, water heaters, boilers, etc.) shall be fitted with sufficient isolating valves such that they may be individually isolated and removed from the relevant system with minimum drain down.

All control valves shall be isolated at each port in a symmetrical arrangement with union couplings between each isolating valve and the control valve. On three port modulating control valves, the mixing/diverting port leg shall additionally be fitted with a characterised plug regulating valve for balancing the parallel pressures. Double regulating valves may be used in lieu of separate isolating and regulating valves in these instances.

All distribution mains shall be isolated at their source e.g. plant room, plant headers etc. Where distribution mains form circulation circuits, the return connections shall be similarly valved but

utilising regulating valves for balancing, or ball isolation valves where accurate regulation is not required on domestic water services.

Isolating valves shall incorporate hand wheels, or be ¼ turn ball valves with handles. Regulating valves shall have lock shield covers.

Where necessary to achieve proper balancing, regulating valves shall be of the commissioning type having characterised plugs and proportional flow adjustment with pressure tappings. Commissioning valves shall be fitted to each heating circuit and each individual heater battery.

Three keys shall be provided for each size of lock shield valve.

Pressure/flow charts shall be included within the operating manuals for each commissioning valve.

Immersion type temperature gauges shall be provided within LTHW heating system installations. Gauges shall be located within boiler flow and return headers.

An immersion type temperature gauge shall be provided within the domestic hot water flow pipe within the plant room.

3.1 Valves and Cocks - Service Selection

Unless specified elsewhere, valves shall be as listed types, or to equal style and performance from approved manufacturers and distributors (e.g. Tour & Anderson, Cimbero, BSS), or equal and approved. (Such approval must be obtained from the Engineer in writing before the equipment is obtained).

All valves shall be suitable for the system medium and test pressure specified.

Service	Description	Manufacturer	Fig. No.
LTHW Heating	Wheel valve 15mm to 42mm	Hattersley Yorkshire	30C 416
	Wheel valve 50mm and above	Hattersley Crane	33X D151
	Lockshield valve 15mm to 42mm Lockshield valve 50mm and above	Hattersley Yorkshire Hattersley Crane	30CLS 416LS 33XLS D237
	Double regulating 15mm to 42mm	Hattersley Crane	1432C D920
	Commissioning 15mm to 42mm	Hattersley Crane	2432C D941
	Check valves 15mm to 50mm	Hattersley Crane	47 D138
	Drain cocks on Equipment	Hattersley Crane	81HU with lever D344 1/2 & lever
	Drain cocks on Pipework	Hattersley Crane	371 D340
	3 way vent cocks	Hattersley Nabic	85 175

Service	Description	Manufacturer	Fig. No.
Natural Gas	Isolation of branch mains and appliances	Yorkshire Hattersley Crane	YL203 - 12mm 100 D171 - 15mm up
	Mains - screwed to 65mm	Hattersley	200m
	Mains - flanged to 65mm	Hattersley	201m
	Mains - flanged 80 and above	Hattersley	M519
Mains fed Hot and Cold Water (Copper Pipework)	Stopcocks - mains/branches 15mm to 54mm	Hattersley Yorkshire	13 YP514 DZR/GM
	Servicing valves (fitted to all draw offs)	Yorkshire Ballofix Hattersley	480 - 100
	Single check valves	Yorkshire	Socla 421/423
	Double check valves	Hattersley Yorkshire	249 Socla 4421/4423
	Drain cocks	Hattersley Crane	371 D340
	Thermostatic Blending Valves (to be set at 43ºC)	Reliance Water Controls Ltd Tel: 01386 47148/9	Heatguard Range to BS1415 Part 2 14mm to 2 basins. 22mm 3 basins and above
	Appliance Valves (e.g. Dishwasher)	Yorkshire	Kuterlite 634
	Hose Union Tap Outlets within Building	Pegler	Fig. 141 HU FGK matt brass finish with ferrule guard and key. Tap to be mounted using Pegler 57X wall plate

	Hose Union Tap external within bin store	Pegler	Fig. 141 HU FGK matt brass finish with ferrule guard and key. Tap to be mounted using Pegler 57X wall plate. (Double check valve to be located within beer store.

Service	Description	Manufacturer	Fig. No.
Mains fed Cold Water (Polyethylene Pipework)	Stopcocks to 63mm	Yorkshire	771 DZR/GM
	Stopcock on incoming connection (20mm & 25mm sizes)	Yorkshire	787 DZR
Tank fed Hot and Cold Water	Isolating valves - Mains/Branches up to 54mm	Hattersley Yorkshire	33X 415GM
	Isolating valves – Mains 67mm and above	Hattersley	35 PN16
	Servicing valves (fitted to all draw offs)	Yorkshire Ballofix	480 -
	Drain cocks	Hattersley Crane	371 D340
	Non Return Valves 15-54mm 54 and above	Hattersley Holden & Brooke	47 Senflux

3.2 Valves for Air Release

All high points on heating and hot water systems shall be provided with an automatic air vent as the means of venting.

Automatic air vents shall be Brefco Flexvent Super or Armstrong equivalent. A lockshield pattern gate valve shall be fitted immediately before each A.A.V. and a copper drip pipe shall be run from the eliminator outlet to discharge in an approved position.

3.3 Strainers

All two port and three port automatic control valves fitted to water systems shall be protected from ingress of foreign matter by strainers fitted to the upstream side of all inlet ports. (e.g. Wash Hand Basin blending valves.)

Strainers shall also be fitted upstream of all items of plant where requested by respective manufacturers.

Strainers shall be of bronze construction, Y pattern, full bore pipe size fitted with a stainless steel screen as BSS Ltd fig 47N sizes 15mm to 50mm and fig 48XN above 50mm.

Strainers fitted to thermostatic blending valves shall be of 'Y' pattern. Integral 'top-hat' type strainers will not suffice and should be removed if supplied with blending valve.

3.4 Temporary Strainers

During pre-commissioning filling and testing all water systems shall be fitted with temporary strainers to remove construction debris such as nuts, bolts, weld splash etc. which would otherwise damage the system equipment or block the conventional strainer screen. The temporary strainers shall be positioned in agreed locations wherever necessary to protect the system, each being fitted between two flanges in a purpose made stool piece.

The temporary strainers shall be removed before final commissioning and balancing by systems and be available for inspection by the Engineer.

3.5 Safety Relief Valves

All heat generating equipment and all vessels/pipework subjected to a pressure greater than atmospheric, shall be fitted with a Safety Relief Valve. Valves shall be sized in accordance with the relative manufacturer's recommendations to suit the heating capacity and/or pressure limitations of the system/equipment. In no cases shall valves of less than 20mm nom bore be used.

Safety Relief Valve set pressures shall be adjusted at commissioning stage to 125% of maximum working pressure on Liquid Services.

All valves shall incorporate a padlock or lead seal to lock the set pressure and to obviate unauthorised tampering.

On the open vented systems, valves shall be of the enclosed pattern with an outlet pipe of at least equal bore to the inlet connection, routed to discharge in a safe but obtrusive position. On sealed system the outlet bore shall be at least one size greater than that of the inlet. Outlet pipes shall be arranged to drain naturally including where site conditions or valve type demands, a separate small bore drain tube routed to a gully.

Safety Relief Valves shall be mounted vertically and fitted directly to the equipment/system with the minimum possible length of pipe and no intervening valve or other restriction.

Dischargers from relief valves fitted to systems operating at up to 90°C shall be routed to terminate 200mm above floor level with an anti-drip profile. Discharges from relief valves fitted to systems operating above 90°C shall be routed to terminate in a safe but unconcealed location to be agreed on site with the Engineer.

4 Boilers - General

All boilers shall be installed strictly in accordance with the manufacturer's recommendations and instructions so as not to infringe or curtail the makers guarantee.

Where boilers are of sectional construction requiring on-site erection, such erection work shall be carried out to the manufacturer's instructions by specialist engineers approved by the manufacturer and shall include hydraulic pressure testing and flushing of the erected boiler before final pipework connections are made.

All boilers shall be positioned on a concrete or brickwork base. Packaged boilers shall also incorporate a fabricated base frame.

Where two or more boilers or modules are coupled, each shall be provided with isolating valves on flow and return connections, separate isolation of fuel source and where used with a static open feed and expansion system, separate open vent connections routed through three port vent cocks to a common open vent riser.

All boiler assemblies shall include any necessary control and safety devices whether specified in particular or not.

All water boilers shall be fitted, as a minimum, with an adjustable control thermostat and a hand reset limit thermostat. Where necessary the limit thermostat shall be separately fitted in the boiler flow outlet pipe before the isolating valve. Boilers shall also be factory fitted with volt free contacts to indicate a boiler high temperature cut-out fault condition at the H & V control panel.

All water boilers shall be fitted with the temperature and pressure gauges, a drain cock and enclosed pattern safety valve. The safety valve shall be piped to the nearest drain, in copper tube and shall not discharge onto the boiler room floor.

5 Flues and Flue Pipework

Appliance flue outlets shall be connected to vertical chimneys be means of purpose made flue pipework and fittings. In all cases, supports shall be arranged such that no flue weight is taken on the appliance.

Flue pipework at negative to zero operating pressure on atmospheric gas appliances shall be twin wall, 304 grade stainless steel, with insulated annulus and socket/spigot liner joints, clamp band casing joints.

Flue pipework on pressurised combustion equipment or where fan assisted flues are used, e.g. condensing boilers, shall be twin wall, 304 grade stainless steel, with insulated annulus and flanged linear joints, clamp band casing joints.

Clean out doors shall be provided at necessary locations to enable efficient maintenance and inspection of the plant to be carried out.

Care shall be taken in laying out and grading flue pipework to ensure the removal of internal moisture. All gas fired installations shall incorporate a drain tee with trapped U.P.V.C. drain tube run to a convenient discharge position.

Flue pipework bracketing shall generally conform with the relevant manufacturers recommendations. In all cases due allowances shall be made for expansion movement. Brackets fitted in internal locations shall be painted gloss black, external bracketing shall be either stainless steel or galvanised finish.

All flues passing through fire compartment divisions shall be fitted with the manufacturer's purpose made fire stop closure plates.

6 Domestic Hot Water Generation

6.1 Indirect Cylinders - Vented Secondary System

All cylinders shall be of vertical configuration, copper construction for dual feed as BS 1566 pt 1 1984, and, unless specified to the contrary, pre-insulated. All cylinders shall incorporate an aluminium protection rod/sacrificial anode.

Secondary side shell connections shall be factory provided bosses with b.s.p. female threads. Primary connections shall be b.s.p. male.

Cylinder shells shall have the standard tappings plus 2No. G2¼ boss for 2No. electrical immersion heaters.

Tappings shall be used as follows:-

- Secondary flow from dome top. Safety valve and thermometer to be fitted into secondary flow before open vent take-off and isolating valve. (Unless integral part of calorifier.)
- Cold water feed into bottom of shell side. Secondary return and drain valve to be taken into cold water feed pipework before cylinder and isolating valve. Separate valve to be fitted to secondary return line.
- Primary flow and return connections to be connected to primary heat source incorporating 3 port temperature control valve and isolating valves. Temperature sensor on cylinders up to 200L capacity to be clamp-on type fitted at ⅔ cylinder height.
- Indirect cylinders are to be mounted on a builders work timber plinth of a sufficient height to provide working access to the drain valve. Cylinders shall be located so as to afford sufficient working access for on-going maintenance repairs and replacement.

6.2 Indirect Cylinders – Unvented

Unvented cylinders shall be of vertical configuration and constructed from either copper or lined mild steel in accordance with BS 7209 1990. Cylinders shall be factory pre-insulated and shall incorporate an internal aluminium protective rod/sacrificial anode.

The cylinder manufacturer shall also supply as part of a complete package the following safety and control equipment which shall be fitted as directed by the manufacturer.

Safety devices:-	Temperature relief valves as BS 6283 pt 2 or pt 3 complete with piped discharge incorporating an air-break tundish.
	Thermal cut-out over-riding primary heating control as BS 3955. (Can be two port on/off valve arrangement.)
Control devices:-	Pressure reducing valve as BS 6283 pt 4 on cold water feed.
	Check valve as BS 6282 pt 1 on cold water feed.
	Expansion valve as BS6283 pt 1 on branch from cold water feed and including a piped discharge with air-break tundish.
	Expansion vessel as BS 6144 on branch from cold water feed.

All isolating and drain valves shall be incorporated as required for indirect cylinders. The cold water feed isolating valve must not be fitted between the cylinder and the expansion valve. Unvented cylinders shall be installed as described for indirect cylinders. Connections to units of non copper construction shall include dielectric interface nipples.

6.3 Direct Gas Fired Storage Water Heaters

All units shall include a non-sacrificial anode device such as the Andrews Correx powered anode, or equivalent.

Atmospheric gas burners shall be either fully automatic including auto ignition and fault signalling to H & V panel or permanent pilot with piezo ignition. All usual safety and control devices including adjustable control thermostat, hand reset limit thermostat and flame failure shut-off shall be included.

Flue systems for direct fired water heaters shall be as specified under clause 3.5.

Mountings and connections shall be as specified for hot water storage calorifiers with the addition of de-stratification pumps/controls where recommended by the unit manufacturer.

All direct fired water heaters shall be mounted on builderswork concrete bases to the dimensions recommended by the unit manufacturer positioned to afford adequate access space for on-going maintenance, repairs and replacement.

Unvented direct fired water heaters shall be installed with safety and control equipment as described under clause 3.5.3.

7 Pumps

All circulating pumps shall be installed such that they do not impart any mechanical vibration to either the fabric of the building or to the relevant pipework system.

Pipeline mounting pumps shall be supported on purpose made steel platforms incorporating suitable anti-vibration material or mountings.

Where pump connections differ from the actual pipework sizes, purpose made taper pieces shall be provided at the pump connection. All surrounding valves, strainers etc. shall be to pipeline not pump connection size.

All individual pumps are to be fitted with either flanged or union joints to enable individual removal and replacement.

The suction and discharge connections to each pumpset shall each be fitted with a binder pressure test point (self sealing) for pressure drop measurement purposes.

Each pump unit shall be provided with a driving motor suitable for the available electrical supply and the applicable working environment.

Care shall be taken to ensure that the shaft orientation of glandless pumps conforms with the relevant manufacturers recommendations.

8 Cold Water Storage Tanks

All tanks to store cold water for domestic purposes shall be constructed to conform with the requirements of the relevant water supply authority for potable water storage under bylaw 30 of the Model Water Bylaws.

Unless specified to the contrary, structural supports for cold water storage tanks will be provided and fixed free of cost to the MeC. (MeC to advise Structural Engineer regarding weights etc.) Where the supports are steel beams for steel tanks, the MeC shall ensure that hardwood bearers of the same dimension as the steelwork face and of equivalent thickness to the tank insulation, are provided and fitted beneath the tank. Composite construction tanks shall be supported by a marine quality plywood platform of dimensions conforming with the plan size of the tank.

All supplies to tanks shall be controlled by a float operated valve of low or high pressure type dependant upon the supply conditions and fitted with a copper float on an adjustable drop arm. Type of valve to be in accordance with Water Bylaws.

All storage tank outlet connections shall be individually valved. As a minimum requirement, each tank shall have the following tappings/connections.

- Make-up water connection for float operated valve
- Overflow connection of 2 times the bore of make-up or 32mm whichever is the greater and fitted with insect screen
- 22mm warning overflow pipe if tank capacity is greater than 1000 litres, or if main overflow discharges in a concealed position. Tell-tale to be fitted with insect screen.
- Drain connection in base of tank of same size as main overflow, piped to gulley position
- Outlet connection from side of tank
- Screened vent
- Sealed inspection access over float valve

Further tappings shall be provided as required.

If the tank is used to feed a potable quality domestic hot water system, the open vent from this secondary system shall be piped to a purpose made tapping in the tank lid. The vent shall include, immediately above the tank connection, a 400mm long flanged stool piece and a notice fixed adjacent

worded “DISTANCE PIECE TO BE REMOVED BEFORE ENTERING TANK”. No vents from non-potable quality water systems shall be taken to potable quality water storage tanks.

9 Heating Header Tanks

Heating header tanks shall be of either plastic or galvanised mild steel construction and be complete with a close fitting slotted as necessary to accept any over-tank discharge and extended to cover the elevated float controlled inlet valve (where applicable).

Tanks shall be supported on purpose made mild steel brackets or gantry supplied and fitted by the MeC. Hardwood timber bearers shall be placed between the brackets/gantry and the tank to obviate corrosion.

Tanks located in situations likely to be subject to temperatures below 5^{o}C or where humidity levels are likely to cause condensation on the tank surfaces shall be fully insulated as described elsewhere within this specification.

Make-up feed to the tank is to be controlled by a float operated valve to BS 1212 pt 2 for 15mm bore and pt 1 for larger valves unless specified to the contrary, installed to maintain a type ‘A’ air gap as required by the Model Water Bylaws. The float valve shall include a copper float and a vertically adjustable drop arm set to ensure that the depth of water in the tank when the system is cold does not exceed 100mm.

Method of forming connections shall be as required for cold water storage tanks and all water outlets shall include an isolating valve adjacent to the tank.

As a minimum each header tank shall have the following tappings/connections:-

- Make-up water connection for float operated valve
- Overflow connection of 2 times the bore of make-up or 32mm whichever is the greater
- Drain connection, with plug, in base of tank sized as overflow
- Outlet feed to system taken from side of tank, lowest level.

10 Closed Feed and Expansion Unit

Closed feed and expansion units shall be all mounted within a single cabinet, including a cold water break tank with float controlled mains cold water feed inlet valve incorporating a class ‘A’ air gap, duty pressure pump and control equipment all mounted within a single cabinet. Expansion vessels, sized to suit system, shall have diaphragm separation of system water and fixed volume air cushion.

The link line from the pumpset to the system shall include a non return valve at the pump discharge, a tee connection to the expansion vessel and 2 metre high anti-gravity loop with auto air vent at high point and isolating stop valve at the system connection. The system connection shall be made into the suction side of the main circulation pumpset.

The systems served by a closed feed and expansion unit shall include the following:-

- Full bore air purger with auto air vents, fitted into main system flow pipe. Air Purger c/w auto-air vent (Armstrong).

- Quick-fill tee connection into system return incorporating a stop valve with loose flexible hose and union connectors. A corresponding stopcock with double check valve shall be provided from the mains cold water system adjacent to the quick-fill point. The size of the quick-fill facility shall be not less than 15 mm n.b.

11 Heat Emitters

11.1 Radiators (LTHW)

All radiator locations are to be agreed with the Architect prior to installation. The MeC is to verify the available height and length at each position before ordering.

All radiators shall be of the make, size and type described in the schedules and/or shown on the drawings.

Radiators shall be fitted clear of skirting finishes. Where pipework is fitted below radiators there shall be a space of 100mm below the lowest pipe and a space of 75mm between the topmost pipe and the bottom of the radiator. No radiator shall project above the underside of any windowboard.

Radiators shall be arranged with bottom opposite end flow and return connections. Radiator valves shall be provided as described in the valve Schedules. Valves shall be of the angle or straight pattern as dictated by the individual arrangement. An air venting plug shall be fitted in the top corner connection at the return end of the radiator.

All radiators shall be fitted on the manufacturers brackets properly secured to the building fabric. Where applicable, anti-squeal inserts shall be fitted between the radiator lugs and the hanging brackets.

Where radiators are to be finally decorated by others, they shall be left fitted by the MeC in a clean and un-marked condition. When required, radiators shall be un-coupled and dropped, to allow the decoration of the rear of the heater and the wall behind, and subsequently re-fitted, filled and re-vented.

Pre-finished radiators shall be protected by the MeC against damage and marking once fitted by adapting the manufacturers packing to suit or encasing in cardboard sheeting. Protection shall be completely removed immediately prior to final handover.

12 Galvanised Steel Ductwork for Ventilation Systems

All sheet metal ductwork shall be manufactured and installed in accordance with HVCA Specification DW 144 including Addendum A.

12.1 Ductwork Drawings/Allowances

The MeC shall allow for gathering all site dimensions, obtaining certified drawings of all plant and equipment and producing detailed manufacturing and installation drawings incorporating all necessary offsets, bends and adjustments to provide a fully co-ordinated installation conforming with the design intent.

12.2 Volume Control Dampers

Volume control dampers shall be provided wherever necessary in all ducted ventilation systems to enable efficient control and regulation of air movement. As guidance to the expected minimum requirements they should be positioned as follows:-

- At all main duct divisions, to each leg
- At all branch connections off main ducts
- At all duct terminations to grilles, diffusers, etc. (These dampers may be integral with the terminal).

Dampers shall be multi-leaf opposed blade operation in independent housing with spigots or flanges sized to suit the relevant duct. Dampers shall be manufactured from galvanised mild steel or stainless steel with side linkages, blade shaft air seals and on operating temperature up to 70^{o}C nylon bearings, on temperatures above 70^{o}C oilite bearings.

Bearings on dampers with vertical blades shall be suitable for end loading without any reduction in working life.

Hand balancing dampers shall be fitted with a locking adjuster that indicates degree of opening.

Motorised dampers shall be complete with any necessary motor mounting platform and extended linkages and shall be capable of tight shut-off.

Multi-damper arrangements shall include all necessary linking actuation rods etc.

Multiple assemblers shall include all necessary mullion joining plates, seals and fixings.

All dampers shall be of rigid construction and be free of vibration or excessive noise production in their operating positions.

12.3 Fire Dampers

Fire dampers shall be fitted to ventilation ductwork that passes through designated fire barriers and shall have fire tested certification at least equal to the barrier in which they are fitted.

Fire dampers shall be of the spring loaded curtain type with blades packed out of the air stream held by a fail-safe fusible link rated at 72°C. External indication of blade status shall be provided. Damper sizes shall be to suit duct sizes and shall have galvanised steel casings and stainless steel shutters with side seals.

It shall be appreciated that the damper forms part of the fire barrier and as such must be rigidly fixed and fire sealed to the building fabric. Wherever the building construction allows, dampers must be mounted in a HEVAC installation frame positioned centrally in the wall or floor thickness. Although the attendant builders work will be carried out by others, the MeC shall be responsible for ensuring the correctness of the work. Where it is proposed to use other methods of fixing, drawn details shall be submitted to the Engineer for comment prior to the work being undertaken.

All fire dampers shall be tested to show correct operation after installation and reset prior to handover.

All fire dampers shall carry the Loss Prevention Certification Board (LPC) marking.

12.4 Smoke Dampers

Where fire dampers are also designated as smoke control dampers they shall be constructed from similar materials but be of the parallel multi-blade type and incorporate fail-safe closing and motorised re-setting.

All smoke dampers shall carry the Loss Prevention Certification Board (LPC) marking.

12.5 Access Doors

Access doors shall be provided in all ventilation ductwork above 250mm equivalent diameter. Access doors shall be located in the following locations;

- Control dampers (both sides).
- Fire dampers (one side).
- Heating/cooling coils (both sides).
- Attenuators, rectangular (both sides).
- Attenuators, circular (one side).
- Filter sections (both sides).
- Air turn vanes (both sides).
- Changes in direction (one side)
- In duct fans/devices (both sides).

Other than in the locations detailed above, panels should also be located as a minimum every 10m in horizontal ductwork systems for the purpose of normal usage. In the case of vertical ductwork, an access opening at the top and bottom of each riser should be provided as a minimum for the purpose of normal usage.

In kitchen extract systems or other areas deemed by the specifier to require greater access, panels shall be installed at a maximum of 3m centres in horizontal ductwork and at each floor level in vertical ductwork.

All doors shall be manufactured from galvanised mild steel and be of sufficient size to facilitate the necessary access and view. Where physical size is limited, multiple doors shall be provided.

Doors shall be provided with a matching frame and incorporate an air tight seal with cam type fasteners to all sides (except hinge side on hinged doors). A captive chain shall be fitted between door and frame where doors are not hinged.

Door and frame shall be fitted flush on un-insulated ductwork sized 300mm x 300mm or greater. On un-insulated ductwork sized less than 300mm x 300mm and on all insulated ductwork, door and frame shall be surface fitted. Ductwork apertures to receive access door frames shall be suitably re-reinforced to obviate distortion of the door frame and poor seal performance.

13 Flexible Ducting

- Flexible ducting shall be used for final connections to false ceiling mounted grilles and diffusers and also for small duty toilet extraction systems of limited duct length where detailed.
- Flexible ducts shall be supported at 1m intervals and unless specified to the contrary, shall not exceed 2m in length.
- Where fire rated, flexible ducting shall be manufactured from vinyl coated fibreglass fabric with a coated spring steel inner wire helix.
- Where used in general positions including non-fire rated above ceiling locations, flexible ducting shall be manufactured from an aluminium/polyester/aluminium laminate enclosing a high tensile steel continuous unit helix.
- Where thermally insulated, flexible ductwork shall be manufactured as described for general use with an additional external layer of fibreglass insulation having an outer jacket of re-reinforced aluminium laminate to provide a vapour barrier and a class 1 resistance to fire spread.
- Joints between flexible and rigid ducting shall be secured by worm drive metal clips.
- Flexible ducting shall not be used for anti-vibration joints to fans or other oscillating equipment.

14 Ductwork Flexible Connections

Ductwork connections to all fans, air handling units or other items of plant that may produce vibration, shall be made using a flexible connection.

Unless requiring special qualities, e.g. fireproof, noise break-out attenuation etc., flexible connectors shall be purpose made from machine stitched heavy weight canvas trapped to the adjacent rigid duct and plant by mild steel angle and/or flat iron continuous girth clamps. The canvas shall not be fitted unduly tight not slack and shall be air sealed to the rigid duct and plant with non hard setting sealant mastic.

The free gap between rigid items shall be not less than 50mm nor more than 100mm.

15 Grilles/ Diffusers & External Louvres

All terminals shall be fitted square and level with the building fabric and finishes. Grilles and diffusers fitted to suspended false ceilings and served from the main distribution by flexible ducting (see Clause 3.15) shall be mounted to purpose made plenum boxes with circular spigot connection. The whole assembly shall be independently supported from the building structure and not reliant upon the suspended ceiling. Plenum boxes shall be painted internally matt black.

Grilles and diffusers shall have integral opposed blade volume control dampers operated by key through the face of the terminal.

Where visible screw fixings are used these shall be of cross head countersunk pattern with a non rusting finish to compliment the specified terminal finish.

All external louvres are to be suitably sized for the ducting/installation and are to be finished in a weather resistant coating of colour acceptable to the Architect. All louvre blades shall be set at 45° complete with an integral rain lip. Intake and discharge louvres shall be positioned such that cross-contamination of air does not occur. Bird mesh guards should be fitted to the rear of the louvres.

16 Heat Pump Installations

The unit condensate drain shall be rigid solvent welded PVC arranged to drain by gravity to a ground level discharge point either over a drain or soft ground. In situation where a gravity fall is not practical the MeC shall install a condensate pump within the indoor unit as recommended by the manufacturer. The power supply to the condensate pump shall be derived from the indoor unit but must be from a permanent live supply terminal. The initial 2 meters of condensate pipework from the unit shall be insulated.

The heat pump installation shall be complete with all necessary refrigeration pipework, communication wiring etc.

Refrigeration pipework shall be installed in accordance with Clause 3.2.15.

The units are generally to be 3 phase, the power supply to the outdoor unit being provided by the appointed Electrical Contractor.

To promote on/off switching of the unit from a remote time clock the indoor unit is to be fitted with a 24 volt relay that is to “make” upon receipt of the time clock signal. (Relay provided by Controls Specialist described elsewhere).

All heat pump units installed shall be provided with a heat pump remote controller capable of the following minimum functions.

- On/Off

- Auto heating/cooling
- High/Low speed control
- Cooling only control
- Heating only control
- Variable damper control (to fresh air)
- Re-circ air facility
- Dirty filter indication
- Self diagnostic fault finding facility.

17 Thermal Insulation

- No insulation materials are to be applied to any part of the installation until the prescribed tests have been carried out and declared satisfactory by the Engineer.
- Before installation materials are applied, all surfaces must be clean, dry and free of all rust and scale and where specified, painted with rust inhibiting paint.
- Insulation materials must not be delivered to site until the works are ready and once on site must be stored in the manufacturer's cartons in a dry and clean condition.
- No insulation material shall contain asbestos.
- All insulation materials shall be CFC free.
- It is stressed that the greatest care must be taken to achieve a first class appearance to the final product and any work that, in the opinion of the Contract Administrator, is sub-standard shall be removed and replaced at no charge.

17.1 Pipework Insulation (Service Temperatures up to 120°C)

Thermal insulation shall be applied to the following pipework services.

- All heating pipework not forming a controllable, useful heating surface or in locations liable to freezing.
- All domestic hot water service pipework and circulation pipework (except where on view in sanitary and/or Kitchen areas) together with any concealed dead-legs and any dead-legs liable to freezing.
- All cold water pipework except where on view in sanitary and/or kitchen areas.
- Pipework insulation shall either be Rockwool H & V pipe sections (having a nominal capacity of not less than 100 kg/m^3, with factory applied reinforced aluminium foil finish providing a 'Class O' rated finish), or shall be closed cell insulation with taped or sealed joints having class "O" finish.

- Thermal conductivity at 50°C mean temperature shall be at least 0.037 W/mK.
- Sectional thickness shall be at least as described in the following table. (Conforming to BS 5422 : 1990).

Insulation Thickness - millimetres (Surface temperatures up to 120°C).

Pipe size	Heating	DHWS	CWS	Chilled Water	Ext CWS
15/15	40	40	40	25	140
20/22	40	40	40	25	140
25/28	40	40	25	25	50
32/35	50	50	25	30	30
40/42	50	50	25	30	25
50/54	50	50	25	30	25
65/67	50	50	25	40	25
80/76	60	60	25	40	25
100/108	60	60	25	50	25
125/133	60	60	25	50	25
150/159	70	70	25	50	25
Vessels	80	80	25	80	50

- Pipework insulation shall be applied in accordance with the recommendations of BS 5970 : 1992.
- All longitudinal and radial joints shall be tightly butted and sealed with 50mm wide adhesive foil tape to provide a permanent and continuous vapour-proof barrier over the insulation. All insulation terminations shall be sealed with tape to maintain the vapour barrier and a purpose made aluminium end cap to maintain a neat appearance.
- Security of sectional insulation shall be re-reinforced by additional 50mm wide aluminium foil tapes at 330mm centres.
- Bends, elbows, branch connections etc., shall be fully insulated with carefully site fabricated and mitred sections of pipework insulation finished with a neat and fully sealed covering of aluminium tape.
- In all locations on cold water installations and in locations where freezing is likely to occur on other water services, flanges and valves shall be insulated to the same standard as the adjacent pipework using oversize sections neatly cut, jointed and taped.
- In all locations on cold water insulated pipelines and all other services where located external to the building, high density load bearing inserts of the same overall diameter as the adjacent

insulation and complete with re-reinforced aluminium foil jacket, shall be introduced between the pipe and the pipe support arranged to continuously maintain the vapour barrier.

- Pipes or cylindrical vessels requiring to be insulated and having a diameter greater than 325mm, shall be treated using Rockwool Lamella Mat insulation protected with 22 gauge stucco embossed aluminium cladding secured with pop-rivets at 225 mm centres.

17.2 Ductwork Insulation

The following ductwork shall be thermally insulated:-

- All fresh air intake ductwork connections between the external air terminal and the air handling unit (only applicable to internally located AHU's)
- All ductwork carrying air heated above ambient conditions and not providing useful heating surface.
- All ductwork conveying air at a temperature below internal ambient conditions and liable to condensation.
- The insulation material for all ductwork conveying air below 120^{o}C shall be 25mm thick Rockwool Ductwrap, or equal approved, with factory applied re-reinforced aluminium foil vapour barrier giving a class 'O' rated finish.
- The material shall have a nominal density of 45 kg/m^3 for normal applications, increased to 70 kg/m^3 where located in a position liable to contact damage.
- General principles of application etc. shall be as described under Clause 3.19.1 for pipework applications.
- Insulation and vapour seal shall be continuously maintained through non fire-rated walls or other barriers. Similar ducts passing through fire-rated walls or barriers shall have the insulation and vapour barrier stopped and sealed at the fire damper.

17.3 Finishes – External

- Insulated pipework located externally to building, or within areas subject to external conditions of humidity, shall be weatherproof finished using 0.8mm thick polyisobutylene (P.I.B.) sheeting having a tensile strength of not less than 3.4Nm/m^2 with all joints overlapped 40mm and sealed using the manufacturers own solvent welding agent. All joints shall be arranged to shed water. PIB shall be carefully applied ensuring no creasing or sagging, with bends etc., spirally wrapped. All bracketing shall be kept to the outside of the weatherproof finish using insulation thickness high density support blocks at the relevant loading points.

- Insulated ductwork in locations described above, shall also be finished in PIB sheeting with extra care paid to the underside of the duct to overcome bagging. Rectangular insulated ductwork requiring a PIB finish shall have reinforced corner angle strips.

18 Painting

- Before painting, all surfaces shall be thoroughly cleaned and wire brushed.

- Where located within a building, all mild steel pipework, brackets and equipment, except that which is galvanised, shall be painted with one coat of grey oxide priming paint prior to the application of any specified insulation.

- Where located external to a building, all mild steel, pipework, brackets and equipment, except that which is galvanised, shall be painted with two coats of grey oxide priming paint, one before erection and one after erection.

- In addition to rust-proofing etc. as described above, Natural Gas pipework shall be painted one coat of undercoat and one coat yellow ochre.

19 Labelling And Identification

19.1 Pipework

Except where exposed to view and decorated, all piped services shall be identified in accordance with BS 1710 using adhesive tapes to BS 4800 colours. The basic identification colour and code indications shall be placed at junctions, at both sides of valves, serviced appliances, bulkheads, wall penetrations and at any other place where identification is necessary.

Alternatively, pipework shall be identified with propriety self adhesive service identity bands with black writing on white background and flow direction arrows.

The bands of tape shall be applied to oil and dirt free surfaces only. The length of tape shall be trimmed to suit the circumference of the pipe or insulation, as applicable, allowing for a nominal overlap on the blind side.

19.2 Valves

All valves located in plant rooms, service voids or where adjacent to plant shall be identified. In plant areas the identification shall be in the form of either a brass or traffolite disc, permanently chained to the valve with chromium plated brass chain, bearing an engraved and painted reference number corresponding with that on the framed and glazed valve chart (for valve charts see also clause 3.35).

20 Vibration Isolation

All plant and equipment involving rotating or reciprocating parts shall be effectively isolated from the pipework/ductwork installation and the building structure as follows:-

i) Pumps

Where deemed necessary flexible bellows with tie-bars, suitable for the operating medium and pressure, shall be fitted directly to each pump water-side connection. Pump brackets shall incorporate anti-vibration feet, springs, cork or packing as applicable.

ii) Fans

Flexible ductwork connections manufactured from canvas, neoprene or other suitable material shall be fitted to both inlet and discharge ports of each fan. Cross-sectional dimensions shall be at least equal to the relative fan connection sizes and a minimum spacing between rigid faces of 50mm shall be maintained. Care must be taken to ensure air-tightness between rigid and flexible materials.

Fan supports shall incorporate anti-vibration feet and/or springs as recommended by the relevant manufacturer.

iii) Air Handling Units

Air handling units shall be treated as one-piece fans insofar as ductwork connections are concerned.

In cases where the integral fan/motor assembly is not entirely isolated from the unit frame, the whole air handling unit shall be mounted on anti-vibration feet or packing and all pipework connections shall incorporate either flexible bellows or metal braided hose connections.

21 Urinal Flow Water Saving Device

Urinal flow water saving devices shall be as defined in the particular specification.

22 Equipment Guards & Bolts

Every rotating, reciprocating or moving part of equipment supplied by the MeC shall be properly protected by means of manufacturers standard or purpose made guards conforming with the requirements of the current Health and Safety legislation.

The MeC shall provide adequate holding down bolts for all machinery whether motive or not and shall be responsible for ensuring that, where applicable, all grouting in of holding down bolts is properly carried out.

23 Fire Resistance

All materials used in connection with or as part of the installation should be incapable of spontaneous combustion, nor shall they support combustion once ignited and they shall ideally be self-extinguishing.

24 Connections to Water Draw-Off Points

The MeC shall make the final connection of water services to all sanitary ware, domestic appliances, and all other draw-off points etc., both hot and cold, except in main kitchens where the final 300 mm will be installed by the Kitchen Specialist.

All terminations shall include a service valve as specified in Clause 3.3.

Hot water dead-legs to draw-offs and appliances from circulation mains should be kept as short as practicable but in any case must not exceed 5m total length. Dead-legs from blending valve outlets must not exceed 2m total length.

25 Pressure Tests

The MeC shall pressure test all systems installed and issue test certificates for all.

25.1 Wet Services

Each system shall be thoroughly flushed through to remove all scale, dirt and other foreign matter prior to carrying out the testing and commissioning.

On completion of the installations, the systems are to be filled with water, completely sealed from the atmosphere, and tested hydraulically to a pressure of 4 bar or twice the normal working pressure whichever is greater. These tests are to be carried out before any pipe ducts have been covered in or any insulation applied or any ceilings closed in.

If required, the system is to be tested in sections during the progress of the work, to avoid interference with the progress of the building works. Any additional valves, tappings, plugs etc., necessitated by sectional testing shall be provided by the MeC at no additional cost. Such facilities shall, where practicable, shall be removed from the final arrangement.

Each section shall be tested for a minimum period of one hour when no fall in pressure shall be observed. When a system has been tested in sections, the installation shall be tested out as a whole following the completion of all works.

If the systems are not to be used immediately after the hydraulic test, the MeC shall, if so required, empty down the systems and shall return to site and refill the systems when instructed to do so.

25.2 Natural Gas

Gas pipework installations shall be soundness tested and purged before being brought into commission.

Soundness testing shall be carried out in accordance with the following procedure that is based on the recommendations of British Gas Publication IM/5 latest edition.

All tests must be carried out under steady state conditions. If the pipework is inside a building then the internal temperature should be stable. If the pipework is external then the weather conditions should be stable although the pipeline should not be exposed to heavy sun.

i. Estimate the total volume of the installation to be tested. (Guidance on this can be obtained from tables 1 and 2 in IM/5)

ii. Determine the test period. This shall be 4 minutes plus an additional minute for each 80 dm^3 (or part thereof) over 360 dm^3

iii. Cap off or otherwise isolate the section of the installation to be tested and fit a water gauge to the purge point test nipple

iv. Apply a nitrogen supply to the test section and raise the installation pressure to 50 mbar

v. Allow the installation to stabilise for 5 minutes and re-establish 50 mbar pressure as necessary

vi. Isolate the nitrogen source and observe the water gauge reading for the period of time determined in ii) above. If there is any perceptible movement in the gauge reading then the test is failed. The source of leakage must be identified and repaired and the whole test repeated from iii) to vi)

vii. When the test has been completed with no perceptible gauge movement, that part of the installation can be regarded as safe and the test certificate completed

viii. The tested work is then to be purged as recommended in British Gas Publication IM/5 using the Direct Purging method to replace the test nitrogen/air mixture with fuel gas

ix. Once fully purged, the work can be brought into commission. The connections to items of equipment or plant not included within the test due to pressure limitations etc., should be examined using leak detection fluid whilst the system is under operating conditions

x. Three to four days after putting to use, joints in ill-ventilated or unoccupied areas and ducts should be re-examined using a suitable gas detector (the use of leak detection fluid is not acceptable for this purpose).

26 Sterilisation Of Domestic Hot Water Services

Prior to handover, all new and interrupted existing domestic hot water services shall be sterilised and flushed in accordance with BS 6700.

27 Commissioning

All engineering services systems are to be thoroughly commissioned and tested to prove that they are capable of achieving the specified performance, to prove the correct and stable operation of all control systems and are safe to operate and maintain. The correct operation of each system is to be demonstrated on completion of the commissioning and testing.

The work shall be considered to consist of three separate sections of activity, namely Pre-Commissioning, Commissioning and Post-Commissioning.

i) Pre-Commissioning

Pre-Commissioning shall generally be carried out by the MeC and their specialists as specified elsewhere and as follows:-

1. Hydraulic Pipeline Testing - All pipework installations shall be tested by the MeC. (See Clause 3.31)

2. Flushing - All pipework installations, except compressed air systems, shall be flushed by the MeC.

3. Sterilisation and Chlorination - All domestic hot and cold water systems shall be sterilised and chlorinated by the MeC. (See Clause 3.31).

4. Electrical Supplies -The EleC's controls specialist shall commission the whole controls installation.

5. Test Certificates - The MeC shall provide copies of all test certificates related to tests undertaken at manufacturers works and pre-commissioning tests.

ii) Commissioning

The MeC shall commission the whole of the Mechanical Services installations, working in conjunction with the commissioning Engineers of equipment manufacturers and systems specialists. Where manufacturers offer a commissioning service this must be used in preference to other methods. All manufacturers reports shall be included in the final documentation.

The MeC shall regulate and adjust valves, apparatus, plant and equipment such that the whole of the works shall be left in a satisfactory working order to the requirements of the Engineer.

Upon completion of all tests and balancing of the systems the whole of the works shall be operated under normal working conditions and fine tuning of controls undertaken to achieve stable operating conditions of the plant and within the building. The MeC shall be required to work closely in conjunction with the controls specialist to fine tune the systems. This operation of the installations under normal working conditions and fine tuning shall be undertaken during the commissioning period and shall not be considered as post commission proving.

iii) Commissioning Report

The MeC shall prepare a Commissioning Report for submission to the Engineer and ultimately for inclusion in the O&M Manual.

The report shall contain the following:-

- Air flow volumes for each system
- Terminal grille and diffuser volume flow records for all systems
- Central plant test data including filter and coil pressure drops, etc.
- Control settings for all plant.
- Pressure test certificates.
- Clean water/system certificates for domestic water systems.

28 Operating And Maintenance Manuals

The MeC shall prepare the operating and maintenance manuals and hand two copies to the Engineer for comment at completion of the Works. One copy will be returned with comments and one copy retained. The MeC shall correct the manual and re-submit the corrected copy of the manual together with a further copy of the corrected pages. The draft copy of the manuals shall be handed to the Engineer at Practical Completion.

Four copies of the final operating and maintenance manual shall be handed to the Engineer no later than 14 days following Practical Completion.

The contents of the manual shall be set out in a logical sequence, each section of the manual being fully indexed for quick reference and the whole contained in a ring binder format of good quality with a fully titled front cover and spine.

The manual shall include sections as follows.

- Introduction
- General Description of Systems
- Design and Performance
- Technical Data
- H & V Control System
- General Operating and Maintenance Notes
- Procedure for Operating and Maintenance
- Emergency Procedures
- Fault Tracing
- Maintenance

- Commissioning Report
- Spares
- Test Certificate
- Valve Charts
- Manufacturer's Literature

29 As Fitted Drawings

The MeC shall prepare as fitted drawings for the whole of the mechanical service works.

Progress drawings shall be submitted to the Engineer as the works proceed. The drawings shall be forwarded with each monthly application for payment and the drawings shall be updated each month to show the works completed during the previous month. Failure to submit the drawings with the monthly application for payment may lead to adjustment of the monthly certificate.

The progress drawings shall form the basis of the As Fitted drawings that shall include:-

- Plans showing all equipment, pipe runs, direction of flow etc., 1:50.
- Plant room details to scale of 1:20 showing valves numbered in accordance with charts.
- Schedule of valves numbered in accordance with valve chart.
- Ductwork drawings to same scale as those used for manufacturing purpose, showing construction.
- Controls and control panels including all equipment references and electrical wiring details.
- Any other drawings as specified elsewhere.

Provide four sets of all As Fitted drawings and valve charts. Drawings to be folded paper copies of and are to be contained within the O & M Manuals.

30 Gas Chart

The MeC shall provide a line diagram in permanent form, i.e. housed within a glazed frame, attached to the building in a readily accessible position as close as possible to the primary meter, indicating the position of all installation pipework, meters, emergency controls, valves and pressure test points of the gas service within the building. The diagram shall be submitted to the Engineer for comment before being framed.

31 User Instruction

The MeC shall allow for conducting a formal 'teach-in' session for the Client.

The instruction shall utilise the Operating and Maintenance Manuals referred to in Clause 2.28 and shall encompass a full explanation of the installations together with all aspects of usage including normal operating procedures, periodic maintenance attendances and emergency measures.

The MeC shall arrange the attendance of specialist manufacturers, suppliers, sub-contractors etc., as necessary to provide a comprehensive understanding.

Responsibility for operating and maintaining all newly installed plant and equipment shall remain with the MeC until the 'teach-in' session has been carried out.

32 Spares

The MeC shall provide and hand over to the Client on or before the date of handing over, the following:-

- A set of loose keys to fit every key operated valve, drain cock, stop cock, air valve and mixing valve in the installation, consisting of three keys of each size and type required.
- The necessary tools for normal attendance of gas burners
- One spare drive belt set for each belt driven device.
- One complete set of filter cells for each air filter.
- Six replacement fusible links for fire dampers.

All spares shall be packaged in protective coverings to facilitate storage and shall be clearly identified and referenced against the equipment to which they pertain.

33 Drying Out Of the Buildings

The drying out of the building will be the responsibility of the Main Contractor who will, subject to the approval of the Client, be allowed to use the central heating system at his own risk, but only in collaboration with the MeC who must provide the skilled supervision for the working of the plant.

The whole of the charges in connection with the fuel, supervision and the replacement of any defective, worn or damaged parts brought about by the use of the installation for drying out the building, together with any cost incurred in thoroughly cleaning down the plant immediately prior to acceptance by and to the entire satisfaction of the Engineer, shall be borne by the Main Contractor.

The use of the heating installation by the Main Contractor for the purpose of drying out the building will in no way release the Main Contractor or the MeC of any responsibility under the terms of the contract.

Section 3

Particular Mechanical Specification

Section 3

Particular Mechanical Specification

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1 Introduction

1.1 General

The Mechanical Contractor (MeC) shall be responsible for providing the design, supply, installation, commissioning and setting to work of the complete mechanical installation for this development.

The development comprises:

- 20 no. apartments
- Communal Area's to include Stairwells, Corridors, Bin Store, Cycle Store and Plant Space;
- 2 No Ground Floor Retail Unit (Shell Only);

The MeC shall comply with all aspects of this document, which shall be read in conjunction with the Standard Mechanical Specification.

The MeC shall be responsible for the full design of the complete mechanical installation. This shall also involve the production and distribution (to all relevant parties), of mechanical design and builder's works drawings and information required by other members of the project team and other interested parties. The MeC shall also provide to all interested parties, all requested information, prior to, during and after the construction phase and in due time.

The MeC shall liaise with the Employers project team for the project, which shall include the Architect, Structural Engineer, Quantity Surveyor and Consultant Engineer (Watt Energy & Consulting Engineers (WECE)) during the design and construction phases, to ensure that the proposed design is suitable and acceptable to the Employer and the project team and fit for purpose.

All mechanical drawings shall be produced in at least AutoCAD 2014 format. At project completion "as fitted" drawings shall be issued for inclusion in the Health & Safety File, together with all relevant manufacturers literature and manuals. A further copy of the "as fitted" drawings and specifications shall be issued by the MeC to the Employer, for his records. This shall be issued on CDROM.

If the MeC has reason to believe that anything described in this Specification, or shown on the indicative tender drawings is inconsistent and if the MeC has reason to believe that there are inconsistencies in respect of any specified item and its performance, he shall at the time of tender bring this to the attention of the Main Contractor, EA and the Engineer, who will notify all tenderers of his decision. Thereafter, the MeC shall not be entitled to any alteration in tender price, or the waving of any guarantee in respect of materials or workmanship.

The MeC shall at all times co-ordinate his works with those of all other Sub-Contractors and claims in respect of lack of such co-ordination will not be admissible.

The MeC shall satisfy himself as to the correctness of all connections between equipment supplied under this contract and equipment supplied under any other contract before any of the former is put into operation. Reasonable notice shall be given by the MeC to the Contract Administrator before any such connection is made.

The MeC is responsible for the storage and security of all items being supplied by him, whilst on site. The Employer will not be responsible for any payments associated with the damage or loss of equipment from site, unless fixed to the building structure. The MeC shall be responsible for ensuring all plant and materials are adequately insured for the duration of the contract.

It is critical the MeC complies fully with the requirements of the Main Contractor in relation to overall co-ordination and programme matters.

If the MeC fails to comply with the Main Contractors programme/co-ordination, then any costs associated due to delays, abortive works, additional works, etc, will be off set against the MeC's contract sum.

The MeC shall note that the life expectancy of all plant installed must be in accordance with CIBSE, ASHRAE, BS 7543, with a life expectancy of 25-30 years.

1.2 Defects Liability Period

The defects liability period for the Mechanical Services associated with the project shall be in accordance with the Main Contract documents (12 months from date of practical completion). The category of the defects shall range from High Priority to medium to low priority. The Client will contact the MeC in the event of a defect and a priority level identified. The MeC shall ensure the following criteria are achieved.

High Priority – within 3 hours

Medium Priority – within 24 hours

Low Priority – within 5 days

If the MeC fails to attend within the detailed time scales, then an alternative contractor will be engaged with all associated costs being deducted from the MeC retention monies or invoiced direct to the Main Contractor or MeC at the sole discretion of the Employer.

1.3 General Scope of Mechanical Works

This Specification of Mechanical Requirements generally relates to the design, supply and installation of all new mechanical services and associated controls required for the proposed development.

Works shall include, but not be restricted to, the design, supply, installation, commissioning and setting to work of the following:

- The design, supply, installation, commissioning and final connections of all sanitary ware and accessories.
- The design, supply, installation and commissioning of the complete above ground drainage and wastes, condensate drains, etc, (including final connection into the below ground drainage system.)
- The coordination only of the incoming water mains supply from the utility infrastructure.
- The design, supply, installation, commissioning of all hot & cold water services pipe work.
- The design, supply, installation, commissioning of all hot water generation plant;
- Chlorination of the MCWS pipework throughout.
- The design, supply and installation of all thermal insulation to all hot and cold water pipe work (and sprinkler pipework as required.)

- The design and final sizing only of all electric underfloor heating services, towel rail and panel heaters and associated controls.
- The design, supply, installation and commissioning of all ventilation Plant and Control systems.
- The final connection of all mechanical plant (local power supply supplied by the EleC).
- The design, supply, installation and commissioning of the sprinkler system;
- The design, supply, installation and commissioning of the dry riser system;
- The design, supply, installation and commissioning of the corridor smoke ventilation system;

Other Requirements

- The inspection, testing, commissioning and certification, of all the various elements of the mechanical installation.
- The supply of all operating and maintenance instructions and manufacturer's literature. To meet the requirements of CDM legislation.
- The supply and distribution of all design, construction and as-built drawings.

The MeC shall be responsible to carry out their own chasings and builders work for all apertures with a dimension of less than 50mm. This shall cover all water, SVP's and ductwork routes throughout the properties. All other builders work over and above the 50mm shall be the responsibility of the Main Contractor. However the MeC shall be responsible for identifying, in good time, all holes, protrusions, chasings, etc. required for the passage of pipes, cables, etc.

Any and all such builders work shall be identified to the Main Contractor at the earliest possible time and positions agreed. The MeC shall also identify areas where additional reinforcement may be required, particularly with regard to roof and floor structures prior to installation of equipment.

All Works conducted under this contract shall be in full compliance with all current Statutory Regulations, Health & Safety at Works Regulations, The Construction (Design and Management) Regulations, British Standards, HVCA Standards.

The Main Contractor shall also be responsible for the supply and installation of all pattresses for the fixing of all sanitary ware and the levelling (supports).

The HVCA Standards shall be deemed the Industry Standards for the purpose of these works. Where there is doubt, the MeC shall consult with the Engineer in the first instance.

The entire Works shall comply in all respects with all relevant statutory instruments and

Regulations including the following:

a) Health and Safety at Work, etc, Act.

b) Health and Safety Executive Publications.

c) British Standards, relevant European and International Standards.

d) The Requirements for Electrical Installations, BS 7671:1992.

e) Requirements under the Electricity Acts.

f) The Clean Air Act.

g) Control of Pollution Act.

h) Energy Conservation Act.

i) Regulations under the Factories Act.

j) The Building Regulations.

k) The Gas Safety Regulations.

l) British Gas Publications.

m) Requirements of local Electricity, Gas and Water Undertakings and Fire Fighting Authorities.

n) The CIBSE Guide to Current Practice.

o) The IOP Plumbing Services Design Guide.

1.4 Ordering of Materials

Orders shall be placed for all materials, equipment etc., to ensure their arrival on-site at the earliest possible date, consistent with the limitations of storage accommodation and deterioration consequent upon long storage periods with certain types of materials, equipment etc.

1.5 Site Supervision and Co-ordination of Works

The MeC shall appoint an Engineer as Contracts Manager in supervisory charge of all work carried out under the Mechanical Engineering Contract.

This Contract Manager shall be experienced in work of a similar nature.

The Contract Manager shall be available at all times from the commencement of the Contract until the date of the final practice completion and hand-over to the Employer.

The MeC shall vest in the Contract Manager the necessary authority to discuss with, accept from, and execute for the Employer/Main Contractor all modifications and such supplementary instruction as are found necessary during the duration of the Contract.

The Contract Manager shall be supported on-site by such staff as are appropriate and necessary for the proper execution of the works in a timely and efficient manner.

1.6 Site Meetings

The MeC shall be responsible for all costs associated with attendance at all project team meetings, co-ordination meetings, and regular site meetings (fortnightly then weekly for the last eight weeks), and all other meetings organised by the project team.

At the monthly coordination meetings, the MeC must table marked up copies of all as built drawings to date for open discussion highlighting all changes. A separate set of drawings shall be provided for the consultants records.

1.7 Building Programme

The MeC shall provide labour and materials in accordance with the Main Contract Programme.

The details of this programme shall be agreed with the Main Contractor, and the MeC is required to maintain a rate of progress satisfactory, at all times, to the Main Contractor, in accordance with this programme, and carry out any particular section of the work when called upon to do so.

1.8 MeC's Design Responsibilities

The MeC shall be responsible for the design, supply, installation, commissioning and setting to work of the complete Mechanical installation for the whole of the development. There are certain exceptions which are set out within this document, therefore it is imperative that this document is read in its entirety to ensure all items required of the MeC are met and included within the tender costs.

1.9 Design Stage Responsibilities

The MeC shall be responsible for obtaining all relevant information required from the Employer team and local bodies, prior to and during the design stage. This will require liaison with the following personnel or bodies, i.e.:

1.10 Employer Team:

- Employer
- Architect
- Engineer – Watt Energy & Consulting Engineers (WECE)
- Structural Engineer
- Acoustic Consultant
- Planning Supervisor
- Any other professional consultant or adviser

Other Bodies:

- Local Fire Officer
- Local Building Control Officer or Employers Building Control Officer

- Water supply authority
- Any other involved professional body

The MeC shall also liaise with the Electrical Contractor (EleC) and provide details of all mechanical plant electrical requirements. Where information from any of the above is not forthcoming, this should be brought to the attention of the Main Contractor, Design Team and Services Consultant in particular, at the earliest opportunity.

Once all information has been collated and the mechanical design has been completed, the MeC shall issue the mechanical design drawings to the Employer's project team for comment. Comment or lack of comment from the project team members shall not indicate approval of the design and at all times the MeC shall retain responsibility for the mechanical design and its suitability to the project.

In addition, the MeC shall submit all design calculations to the Engineer for checking and comment, against the design drawings.

Design calculations shall include, but not be limited to, the following:

- Ventilation; volume flow for each room requiring ventilation under the building regulations, ductwork and system pressure drop, air velocity and fan selection.
- Fan Power; specific fan power for all fans including A/C fans (Watts/litre/second)
- Water Distribution; pipe sizing for volume flow, pump sizing for flow and head.
- Domestic Hot Water Generation; DHW demand and equipment selection.
- Anticipated demand, volume flow, incoming supply pipe sizing and minimum pressure required.
- Heating/ Cooling loads for each space (where applicable), selection of heat generation plant, cooling equipment, radiators, under floor systems etc.
- Gas pipework sizing and pressure drop calculation.

1.11 Insurance Liability Cover

The level of Professional Indemnity Insurance required from the MeC shall be set by the Employer, at the start of each project, but shall not be less than the amount detailed below.

A copy of the insurance certificates shall be lodged with the Employer prior to start of the design stage.

The MeC shall have and will maintain, professional indemnity insurance extending to his obligations under this Building Contract, for a minimum cover of £5,000,000 in respect of every claim, and such cover shall be maintained for a period of no less than 12 years from the date of the issue of the certificate of making good defects under the Building Contract.

The MeC must have Company Public, and Employers Liability insurance, set at £10,000,000 each.

1.12 Construction Stage Responsibilities

The MeC's design responsibilities during the construction stage of the project shall include, but not be limited to, the following:

- Production and issue of construction drawings.
- Liaison with the Employer team.
- Liaison/co-ordination with other contractors.
- Co-ordination and liaison with services suppliers.
- Amendment and issue of drawings as and when required.
- Production and issue of mechanical installation programme and commissioning programme at project start.
- Attendance at regular site meetings.
- Correction of defects reported at snagging.

At all times, the MeC shall liaise with other contractors on site to ensure all mechanical and electrical services can be installed in an efficient matter. For example, where services are run above corridor ceilings and within service risers, all trades shall be responsible for co-ordinating and considering both theirs and other trades. Adequate provision should be made so as not to impinge the economical installation of other services. The Main Contractor shall reserve the right to contra-charge contractors who have clearly failed to co-ordinate the works.

The MeC shall be responsible for the issue of a contract programme. The programme shall detail all works in sequence with the main contractors construction programme.

1.13 Post-Completion Responsibilities

- Attendance at post contract review meeting (2 weeks from handover).
- Attendance for breakdowns or faults during the defects liability period.
- Attendance for regular maintenance covered within this specification.
- Attendance at 6 months defects meeting.
- Attendance at 12 months defects meeting.

1.14 Designer's Risk Assessment

The MeC shall be responsible for all costs associated with the production and issue of a Designers Risk Assessment Document to the Planning Supervisor and Employer.

1.15 Plant Maintenance/Service

The MeC shall include within his tender offer for carrying out plant maintenance/servicing for a period of 12 months from Practical Completion.

The minimum plant maintenance attendance shall be:-

i) Maintain/service all plant supplied/installed under this contract. Frequency of maintenance/service visits shall be as recommended by the Manufacturers for each item of plant, including ductwork etc.

ii) All plant supplied/installed under this contract shall be serviced, inspected, re-commissioned and checked for correct operation, etc., at the end of the defects liability period. (This requirement is in addition to any specific recommendations of the individual manufacturer's specific recommendations).

1.16 Tendering Requirements

Tenderers shall make an assessment of all installation requirements to ensure that all costs are included for adjustments which could be necessary to the building fabric, building structure, external ground works etc. in order for the Works to fully meet the Specification.

Tenderers shall study all drawings, Specifications and information available at the time of Tendering to ensure the total Tender price includes for all adjustments to the building, fixtures, other services or trades to ensure that this price is based on totally integrating the Works within the building.

Exact adjustments or adaptations to the building shall be established during the Contractors preparation of co-ordinated working drawings and full details shall be produced prior to the ordering of steelwork, structural items, roof trusses and all building materials in sufficient time to meet all requirements of the main programme.

This information must be included on Builders work Drawings described elsewhere. No extra costs can be claimed for any adjustments needed to the building (or other items) in order for the specified Mechanical and Sanitary Services to be provided.

Allowance shall be made in the Tender price for services routes or positions being varied due to the following:

i) Co-ordination with all other items.

ii) Comments from the Architect and Engineer during the course of drawing approvals for Working or Builders work Drawings.

iii) Offsetting, changes in direction or position to suit building or structural features e.g. beams, trusses, columns etc.

iv) Access for general building maintenance or access for other items.

v) Practical maintenance, subsequent removal or dismantling.

vi) Final setting-out and positions of ceilings, wall tiles and other finishes.

vii) Final positions of sanitary ware and sanitary services.

Allowance shall be made for all necessary fixings, brackets, supplementary steelwork, sleeves, plates, adaptors etc. to interface the Works with the building.

No extra costs can be claimed for any lack of detailed information in the Specification.

There shall be no qualifications to the Tender or any exclusions regarding Tendering the Works.

1.17 Maintenance Manuals and Operating Instructions and Building Manual

The MeC shall be responsible for the supply and installation of the operating and maintenance instructions and all other information required for the Health and Safety File in respect of the installations for which he is responsible. He will provide in a timely manner marked up drawings showing all deviations from the construction issue drawings marked 'As Built Drawings'.

All maintenance and operating manuals shall be copied to a CD along with all record drawings.

This information must include:

- A full description of each of the systems installed, written to ensure that the Employers staff fully understand the scope and facilities provided.
- A description of the mode of operation of all systems.
- Diagrammatic drawings of each system indicating principal items of plant, equipment, valves etc.
- A photo-reduction of all record drawings to A3 size together with an index.
- Legend for all colour-coded services.
- Schedules (system by system) of plant, equipment, valves, etc., stating their locations, duties and performance figures. Each item must have a unique number cross-referenced to the record and diagrammatic drawings and schedules.
- The name, address and telephone number of the manufacturer of every item of plant and equipment together with catalogue list numbers.
- Manufacturers technical literature for all items of plant and equipment, assembled specifically for the project, excluding irrelevant matter and including detailed drawings, electrical circuit details and operating and maintenance instructions.
- A copy of all Test Certificates (including but not limited to electrical circuit tests, corrosion tests, type tests, works tests, start and commissioning tests) for the installations and plant, equipment, valves, etc. used in the installations.
- A copy of all manufacturers guarantees, warranties and maintenance agreements offered by the mechanical contractors and manufacturers.
- Starting up, operating and shutting down instructions for all equipment and systems installed.
- Control sequences for all systems installed.
- Schedules of all fixed and variable equipment settings established during commissioning.
- Procedures for seasonal changeovers.
- Recommendations as to the preventative maintenance frequency and procedures to be adopted to ensure the most efficient operation of the systems.

- Lubrication schedules of all lubricated items.
- A list of normal consumable items.
- A list of recommended spares to be kept in stock by the Employer, being those items subject to wear or deterioration and which may involve the Employer in extended deliveries when replacements are required at some future date.
- Procedures for fault finding.
- Emergency procedures, including telephone numbers for emergency services.

The above information will be required in both electronic format and paper format.

The paper copy of the above information must be available for handing over to the Employer at the time of handover. **Practical Completion Certificates will not be issued prior to the production of these manuals and certificates.**

The MeC will be held responsible for the safe running and maintenance of the installation until the requirements of this section have been satisfactorily completed.

1.18 On Site Record Drawings

The MeC is to keep on site a set of prints of all the installation drawings bound together, and he is to mark on these prints all variations from the drawings which are made to the works whether or not such variations are the subject of official variation orders, or whether they are due to the natural process of setting out the works.

The MeC shall also mark on the prints the information stated hereunder so that the prints form a complete and accurate record of the works as installed.

- The exact position of all buried or concealed services giving the dimensions from exposed and easily observed parts of the building or site.

The drawings must be marked as described above at intervals not exceeding three days and must be kept up to date for regular inspection by the consultant engineer. They are to be kept in a good and clean condition and are to be handed over to the client's agent at such times as he shall require them.

1.19 'As Installed' Record Prints

Throughout the execution of the Sub-contract works, keep on the site a complete set of up-to-date prints and schedules marked with "As Installed" details. Make these prints available at any time to the Supervising Officer or his representative.

These on site record drawings will be used to prepare "As Installed" drawings for the Client. If, in the event, upon completion of the works, of it being discovered that, the electrical contractor shall have failed to comply with this requirement and it becomes necessary for the Supervising Officer to examine or trace through installed services in order to update the "As Installed" drawings, the cost of this work will be time charged and debited to the retention monies being held on the Contract.

1.20 "AS INSTALLED" DRAWINGS & DIAGRAMS

Unless otherwise agreed, the Sub-contract works, or any part thereof, will only be included in a Certificate of Practical Completion when the final as installed drawings have been issued to the Supervising Officer.

Include on the "As Installed" Drawings and Diagrams the following in as far as they are the subjects of the MeC works. The general content and layout of the drawing shall be as that required for the "Installation Drawings".

i) The location, including level if buried, of Public Authority supplies provided within the Sub-contract, whether carried out by the Subcontractor or by the appropriate Authority together with the points of origin and termination, size and materials of pipes, line pressure and/or other relevant information.

ii) The layout, location and extent of all air ducts, including those formed in builder's work or otherwise outside this Sub-contract but forming part of the system, showing all dampers and other equipment, acoustic attenuators, grilles, diffusers or other terminal components. Each duct and each terminal component shall be marked with its size and the air quantity flowing, as actually measured after approved regulation of the system or as computed by the addition of such measured quantities.

iii) Single line and schematic piping diagrams for the whole of the Subcontract works showing all terminal references and pipe/duct sizes.

iv) iv) The location and identity of each room or space housing plant, machinery, distribution boards draw-in boxes or apparatus.

v) The detailed general arrangements, to one-twentieth scale (minimum), of all boiler house, machinery spaces, air handling plant refrigeration plant, tank rooms, switch rooms, meter rooms and other plant spaces, including the location, identity size, colour coding and details of each piece of plant and equipment.

vi) The detailed general arrangements, to one-twentieth scale of service subways, ducts, meter rooms or other special sections of the work where, in the opinion of the Supervising Officer, the small scale drawings cannot provide an adequate record.

vii) Manufacturer's drawings showing the general arrangement and assembly of component parts of all machines and any pieces of equipment which may require servicing.

viii) Flow diagrams indicating the principles of the arrangements and operation of each the various services as related to central plant, other principal components and zoning of distribution etc.

ix) Diagrams illustrating the principles of automatic controls and of instruments, presented in combination with the foregoing or separately, as agreed with the Supervising Officer.

x) Manufacturer's internal wiring diagrams for each piece of electrical equipment supplied under the Sub-contract, together with physical arrangement drawings to locate and identify the component parts.

xi) Comprehensive diagrams showing in detail all power wiring and all control wiring and/or pneumatic of other control piping executed within the Subcontract by others in

accordance with detail provided by the Subcontractor, including size and type of conductor or piping used and identifying the terminal point.

1.21 Demonstration of System

The MeC shall make due allowance in his tender to provide a competent engineer to demonstrate the mechanical installations to the consultant engineer, client and/or his representative, the full operation and maintenance aspects of the mechanical installation at practical completion.

The persons so nominated to have made clear the following:-

i) The general layout of each system.

ii) The position, functions and method of operation of isolator, switch and controller.

iii) Full operation details and easy to use guides for all plant.

iv) The method of operation and control of every pump, fan, boiler e.t.c. so as to maintain maximum efficiency.

v) The method of cleaning component parts and the simple maintenance required to ensure proper functioning of these various items of equipment.

The MeC shall price for two number such demonstrations – initially for the client and consultant and a second demonstration for the maintenance/management company and others.

1.22 Part L1A SAP compliancy & Air testing

The townhouses shall achieve an air permeability rate of 3 m^3/m^2.hr @ 50 Pa.

Air pressure testing shall be carried out in compliance with Building regulations and in accordance with BS EN ISO 9972:2015 and ATTMA technical standard 1.

The MeC shall be responsible for the issue of all Part L1A SAP compliancy documentation & air test certificates for Building Regulations compliancy.

The SAP assessment works are to be quoted for & undertaken by **Watt Energy & Consulting Engineers Ltd**.

1.23 Tenants' Instruction/Handbooks

Notwithstanding any information, the MeC is to prepare a set of operating instructions for each dwelling. These instructions should be suitable for inclusion in a tenant's manual, and shall give adequate instructions and explanations for the tenant to understand the operation of all plant and equipment within his/her dwelling. The instructions should be provided in a format that can be expected to be understood by the tenant.

The tenants' instructions for each dwelling are to be available prior to the period of Client instruction, and handed to the Employer at the time of handover.

1.24 Users' Instructions

The MeC shall provide a concise set of user instructions for each installation, a copy of which shall be handed to the consultant.

The instructions shall be in the form of a small booklet and shall comprise of text, pictures and diagrams as necessary to convey all information needed to operate the installations in a proper and economical way. The instructions shall also include information such as location of incoming mains, electrical isolators and switches and similar.

The booklet shall be submitted to the consultant in draft form for comment, the consultant will then comment and adapt the instructions and issue to the residents and persons responsible for operating each installation.

2 Incoming Cold Water Mains

2.1 General

A New incoming water supply shall be provided to serve the apartments.

A quotation has been obtained for the new water supply and will be accepted by the client. The MeC shall include for the co-ordination only of the new incoming water supply.

The supply serving the water storage tank will be unmetered. The connection to each apartment shall be metered by an AMR meter supplied by United Utility Meters, with the tenant directly billed by United Utilities. The MeC shall be responsible for the installation of the meters and providing all adaptors as required to form a complete and working installation. The position of the new metered incoming main and meter should be coordinated with the Architect.

2No additional metered supply shall be provided to serve the Commercial Units for which the end users shall be directly billed by the Services Provider.

The supply serving the Landlord's wash down tap(s) shall also be metered via a common Landlord's meter. Each connection shall be fitted with a means of isolation.

All connections from the boosted cold water supply shall be regulated via a pressure reducing valve, before the meter to reduce the pressure to 3 bar. Each connection shall be fitted with a means of isolation.

The MeC shall be responsible for the supply and installation of all fire collars, to the mains cold water distribution pipe work deemed to penetrate a fire break. The MeC shall be responsible for requesting from the Main Contractor or Designer; any drawings required detailing the proposed fire barriers.

The MeC shall also be responsible for sealing all holes installed for the pipe work runs to ensure compliance with the air permeability test.

All MCWS pipe work shall be fully insulated in accordance with this Specification and where routed through unheated areas of the main building supply install and commission a thermostatically controlled electrical trace heating system to maintain the MCWS above freezing at all times.

3 Public Health Services

Domestic hot water for each apartment shall be generated via an unvented, direct electric hot water cylinder, as detailed on the tender drawings.

The hot water cylinder shall be supplied and installed complete with expansion vessel, cylinderstat, temperature and pressure relief valve, multi-channel timeclock control, two heating elements and all other associated ancillaries to form a complete and working installation.

The MeC shall be responsible for the sizing, design, supply and installation of the proposed systems in accordance with the manufacturer's instructions. The water heaters/ cylinders shall be located as shown on the Tender drawings, ensuring the manufacturer's minimum maintenance clearances are met.

In addition, the water velocities and pressure drops used for the design shall not exceed the recommendations as below:

i) Maximum Pipe Velocity (40 dia and below) 0.75 m/s

ii) Maximum Pipe Velocity (above 40 dia) 1.5 m/s

iii) Maximum Pressure Drop 300 Pa/m

The hot water cylinders shall be installed and commissioned in strict accordance with the manufacturer's recommendations and a commissioning certificate issued by the MeC for inclusion in the Health and Safety File.

3.1 Hot and Cold Water Distribution

The MeC shall include for the piping of all hot and cold water services to all proposed points of use. Full details of pipe work routes are detailed on the tender drawings. In addition, at each **easily accessible** point of use, ball-o-fix isolating valves shall be installed for maintenance and isolation purposes.

The MeC shall also be responsible for the final connection and testing of all supplied or direct supplied mechanical equipment, kitchen equipment, white goods and sanitary ware, washing machines and dishwashers and sinks etc as detailed on the tender drawings.

The MeC shall allow for making all final connections and the installation of service valves to all toilets, whb's, all points of use within the kitchen and to all other items of water consuming equipment as detailed on the tender drawings.

Where supplies are required to the aforementioned equipment and any other equipment installed by others, the MeC must ensure that the requirements of the Water Regulations and that of the local Water Bylaws Officer are met. The MeC shall liaise with the local Water Authority Bylaws Officer during design stage to ascertain whether additional measures are required to meet these requirements. All such measures shall be included and accounted for within the tender.

Upon completion of the installation, the system shall be chlorinated in accordance with BS EN 806. The MeC shall provide all necessary equipment and connections for this operation.

The domestic hot and cold water services shall be installed in accordance with the requirements of BS EN 806, BS 8558:2011, Building Regulations and Local Water Byelaws.

All water service pipe work (DHWS & MCWS) shall be pressure tested to a minimum 1.5 times the working pressure, flushed and cleaned in accordance with BSRIA Application Guide AG1/2001, and commissioned in accordance with CIBSE Commissioning Code W.

3.2 Prevention Against Legionellosis

All water services supplies in addition to complying with the above stated British Standards shall be installed to comply with the latest publications for prevention against Legionellosis including Legionnaires Disease, as detailed below;

i) CIBSE TM13: 2013 - Technical Memoranda 'Minimising the Risk of Legionnaires Disease.'

ii) Health and Safety Executive - Legionnaires Disease – technical guidance series Booklet HS(G)274.

iii) Health and Safety Executive - Legionnaires' disease. The control of legionella bacteria in water systems Approved Code of Practice and guidance

3.3 Pipe Work and Fittings

i) Pipework shall be copper to BS EN 12449:2016 or a WRAS approved plastic pipework system to BS EN 12201 installed fully in accordance with the manufacturer's recommendations. All pipework shall be copper where exposed. The MeC shall submit proposals to the consultant at tender stage.

ii) The installation shall comply with HVCA standard for installation work TR10.

iii) No joints shall be installed in inaccessible locations.

iv) Isolating valves shall be installed to enable isolation of all items of sanitary equipment or plant for maintenance.

v) Every heat generator shall have no less than one temperature gauge and one pressure gauge for efficient control and running. Each main branch circuit leaving a heat generator plant room shall be fitted with a temperature gauge and pressure gauge on the flow and a test plug on the flow and return.

vi) Isolation valves shall be provided to permit a single point isolation of water services for items of plant or equipment. The final connection to each WC shall be provided with its own isolating valve.

vii) Drain points shall be incorporated at all system low points and on all sub-circuits to permit drain down.

viii) Thermostatic mixing valves (TMVs) shall be provided to all showers and baths, such that the maximum hot water delivery temperature does not exceed 48^0C.

ix) The MeC shall include for cleaning of all fittings and valve strainers as required in order to provide satisfactory operation of the water systems.

x) All ball cocks shall be quiet in operation so as not to disturb occupants.

xi) All pipework penetrating the structure shall be sleeved to allow for movement. All sleeves shall be packed with a non-setting compound to prevent noise or cross talk transmission.

xii) Pipe spacing shall allow for 25mm between lagged surfaces and 50mm between bare pipes or bare pipe and lagged surface.

3.4 Sterilization of Domestic Hot Water & Cold Water Services

Prior to handover, all new domestic hot water services and cold water distribution services (including the incoming supply), shall be sterilized and flushed in accordance with the following:

In pipe work under pressure, chlorination shall be carried out through an installed injection point at the beginning of the pipeline, using a chemical pump, until the measured free residual chlorine at the end of the pipeline is not less that 20 mg/L (20ppm). The chlorinated solution shall be left for not less than 24 hours and then the whole thoroughly flushed out with clean water until free residual chlorine in water at the end of the pipeline cannot be detected at a level above that in the clean water entering the pipeline from the water suppliers main.

All visible dirt and debris shall be removed from the cistern. The cistern and distribution pipes shall be filled with clean water and then drained until empty of all water. The cistern shall then be filled with water again and the supply closed. A measured quantity of sodium hypochlorite solution of known strength shall be added to the water in the cistern to give a free residual chlorine concentration of 50 mg/L (50ppm) in water. The cistern shall be left to stand for 1 hour then each draw-off fitting shall be successively opened working progressively away from the cistern. Each tap and draw-off fitting shall be closed when the water discharged begins to smell of chlorine.

The cistern shall not be allowed to become empty during this operation; if necessary it shall be refilled and chlorinated as above. The cistern and pipes shall then remain charged for a further 1-hour. The tap furthest from the cistern shall be opened and the level of free residual chlorine in the water discharged from the tap shall be measured. If the concentration of free residual chlorine is less than 30 mg/L (30ppm) the disinfecting process shall be repeated.

Finally, the cistern and pipes shall remain charged with chlorinated water for at least 16 hours e.g. overnight, and then thoroughly flushed out with clean water until the free residual chlorinate concentration at the taps is not greater than that present in the clean water from the water supplier's main as determined by the testing of samples by the relevant Authority. Further tests shall be carried out to ensure that water is within EEC recommended limits. A satisfactory test certificate shall be obtained by the MeC and this, together with the MeC's own certificate verifying that sterilization to the correct concentration and procedure has been carried out, shall be included within the handover documentation.

The MeC shall include for all charges associated with water sample testing and certification.

Where chlorinated water that has been used to disinfect an installation is to be discharged into a sewer, the Authority responsible for land drainage and pollution control shall be informed.

3.5 Sanitary Ware, Wastes & Drainage

3.5.1 Sanitary Ware

The MeC shall be responsible for the supply, management, installation and fixing, of all sanitary ware.

A full sanitary ware schedule is available from the architect and must be included within the MeC tender package.

The MeC shall be responsible for the final connection and testing of all items of sanitary ware and shall also design, supply, install and test, the complete plumbing and above ground drainage systems for the development.

Details of designed drainage flow rates shall be passed to the Project team, so that the underground drainage systems can be correctly designed.

The MeC shall be responsible for the final connection, testing, commissioning and complete installation (including all materials) of all sanitary ware.

Rodding eyes shall be installed as required to ensure that the complete system can be cleared of blockages.

The drainage pipework shall be suitably vented to atmosphere or by an AAV. Ventilation of drainage pipework shall be in accordance with building regulations approved document part H.

The MeC shall be responsible for the supply and installation of all sanitary ware to the following:

- Sinks
- All Taps (H&C)
- Dishwashers (where client Supplied)
- Washing Machines (where client Supplied)
- All Toilets/ Bathrooms
- Kitchens

3.5.2 Soil Pipes

The MeC shall refer to the indicative tender drawings and Architects drawings for indicative runs and positions for the main soil pipes. The MeC shall be responsible for the design, supply and installation of the complete above ground drainage installation through to the final connection into the below ground drainage system).

Soil, waste and drainage systems are detailed below, specifying Marley as the preferred manufacturer. The MeC may consider alternative systems and manufacturers, but must obtain prior written approval from the Engineer.

All soil pipes and fittings to be Marley, PVC-U System with solvent welded joints except where seal ring joints are required for thermal/building movement. All pipes and fittings to comply in all respects with British Standard 4514: 2001 and shall, where appropriate, bear the BSI kitemark.

All drainage pipework serving the apartments and routed through the retail units shall be HDPE with solvent welded joints.

All internal pipe work to be supported using holder bats made of mild steel protected from corrosion by galvanising or plastic coating. The holder bats shall be positioned around fitting sockets, to provide

both anchor points, for support and as a fixed point to control thermal movement, or locate around pipe to act as a pipe steady permitting free longitudinal thermal movement of the pipe work. Holder bats made of PVC-U may be used to support external pipe work.

Access shall be provided where necessary either by means of an integrally moulded door on access branch, access bend, access pipes, or alternatively by a two-piece door, with integral clamp, fitted directly into the pipe.

The method of jointing to be employed shall be that of solvent welding using Liquid Weld cement manufactured to BS 6902. Pre-assembled Seal ring joints shall be used where necessary to accommodate thermal/building movement or the upstream sockets of solvent type fittings may be converted to seal ring joints by the addition of a seal ring adaptor.

All A.A.V's from 32mm to 110mm in size to be supplied by Marley approved by the British Board of Agreement and covered by certificate No. 92/2811. Installation of all valves to comply with the guide lines set out in the above mentioned document.

Generally, the pipes and fittings shall be colour grey, to British Standard 5252:10.A.07.

Each system shall be insulated in order to achieve the required sound attenuation of Building Regulations Part E, and to avoid condensation in accordance with Building Regulations Part F. Generally the insulations shall comprise rigid fibre glass sections (80-110kg/m^3), split for fixing, attached using galvanised steel wire, or similar. Additional acoustic insulation shall be installed to all branches as they penetrate through to the ground floor areas to ensure the acoustic sound levels detailed within this specification are adhered too.

The MeC shall determine the exact number of vent pipes that shall terminate at roof level, ensuring the vent stacks are 900mm vertically and 3m horizontally from the nearest opening into the building or fresh air intake.

All vent terminations shall incorporate a vent cowl or balloon guard. Where vent pipes are required below terrace areas it should be necessary to route these to a suitable location.

Fire dampers shall be installed to all fire breaks within service riser walls, and all other fire compartment walls detailed on the tender drawings and Designers drawings.

The MeC shall be responsible for the connection into the nearest stack of all floor gulleys and condensate/ drainage pipe work.

3.3.3 Waste & Drainage Pipes

The Main Contractor shall be responsible for the supply, installation and testing of the following:

- All above ground drainage soil and vent stacks.
- Final connections of soil and wastes into the underground drainage system.

All waste pipes and fittings to be Marley PVC-U system with solvent welded joints except where seal ring joints are required for thermal movement.

All pipes and fittings to comply in all respects with the requirements of British Standard 5255.

3.5.3 Inspection and Testing

The work shall be inspected and tested during installation at agreed stages. ALL WORK WHICH WILL BE CONCEALED SHALL BE TESTED BEFORE IT IS FINALLY ENCLOSED.

A final test shall be made upon completion for soundness and performance in accordance with British Standard 5572:1994 Code of Practice for Sanitary Pipe work. The final test shall be witnessed by Building Control and all results logged and certified.

3.5.4 Testing of Drainage

The MeC shall be responsible for the air tightness testing of all above ground drainage systems to satisfy the Building Regulations. The Building Regulations require an air or smoke test, producing a pressure of at least 38mm water gauge, be applied to completed sanitary pipe work. Smoke testing is not recommended for use with PVC-u systems and is less easily conducted than an air test.

All traps shall be charged with water, the stack top sealed with an expanding plug and at the base of the stack, a second expanding plug complete with air hose attachment shall be fitted. If this is inconvenient, access is possible at the highest inspection chamber or by plugging the inspection chamber and passing the test flexible tube through the water seal of a WC pan.

The pressure must be retained for a minimum of 3 minutes and during this time every trap must maintain at least 25mm of water seal.

A drainage test certificate shall be issued by the MeC upon completion of testing and this shall be entered in the House Health and Safety File.

4 Heating System & Controls

The MeC shall be responsible for the design, supply and installation of the proposed heating system as detailed on the tender drawings.

4.1 Electric Underfloor Heating System

The MeC shall be responsible for the design and final sizing only of the electric underfloor heating system as indicated on the Tender drawings. The system shall be the deviflex DTIP-10 system or equal and approved.

The EleC shall be responsible for the supply, management, storage, security, wiring, installation and setting to work of the Electric Underfloor Heating System to the apartments including all power supplies as indicated on the tender drawings.

The final sizes of the electric underfloor heating shall be determined by the MeC with procurement of the electric underfloor heating by the EleC.

The electric under-floor heating system shall be installed within the floor screed or within the joists with suitable reflector plates complete with insulation; the MeC shall ensure that the builders work requirements to accommodate the under floor heating installation are agreed with the architect and incorporated into the design.

The under floor heating installation shall include the following:-

1. Floor insulation;

2. Perimeter edge insulation;

3. Polythene membrane;

Each area served by the under floor heating system shall be installed in separate zones as indicated on the tender drawings.

The under floor heating system shall be designed to BS EN 50559:2013 and use floor surface temperature limits specified by that norm.

The under floor heating system shall carry full BBA approval, with respect to the whole system.

4.2 Temperatures – External/internal

The internal spaces temperatures shall be as detailed below and on the tender drawings.

Space	Temperature (Heating)
External Temperature (For heat loss)	-5°C
All spaces	21°C

4.3 Towel Rails

The EleC shall be responsible for the supply, management, storage, security, wiring, installation and setting to work of all Electric Towel Rails in wet rooms as indicated on the tender drawings.

The electric towel rails shall be from the Adax The Bray range, Straight, in chrome finish or equal and approved. A sample must be provided for the Employer for approval, prior to the ordering of any electric panel heaters. Equal and approved manufacturers will be considered if identified by the EleC at tender stage.

The final sizes of the electric towel rails shall be determined by the MeC with procurement of the electric towel rails by the EleC.

4.4 Panel heaters

Electric panel heaters shall be provided in the communal areas as detailed on the tender drawings. The electric panel heaters shall be from the Adax Neo Range, in black finish.

Electric panel heaters within the communal spaces shall be controlled via an integral timeclock and thermostat.

The EleC shall be responsible for the supply, management, storage, security, wiring, installation and setting to work of all Electric Panel Heaters & electric towel rails to the communal spaces and apartments on each floor including all power supplies as indicated on the tender drawings.

The final sizes of the electric panel heaters shall be determined by the MeC with procurement of the heaters by the EleC.

A sample must be provided for the Employer for approval, prior to the ordering of any electric panel heaters.

Equal or approved manufacturers will be considered if identified by the EleC at tender stage.

4.4.1 Controls

The MeC shall be responsible for the design supply and installation of all required controls for the proposed electric underfloor heating system.

Within the apartments, a smart thermostat heating shall be provided in each heating zone in the location detailed on the tender drawings. Thermostats serving wet rooms shall be provided c/w floor sensors. The programmer shall have WiFi connectivity for control via a Smart Phone App. The programmer shall be the Danfoss DEVIreg smart thermostat, in black finish or equal and approved.

Any alternative control system shall be submitted by the MeC at tender stage for approval by the consultant.

5 Thermal Insulation

All internal pipework running throughout the building (incoming mains cold water and hot and cold pipework) shall be thermally insulated. All pipework shall be insulated to reduce heat losses/gains and to reduce condensation build-up. The insulation shall be Class O fire rated flexible foam material in all areas.

All pipework services shall be insulated throughout their entirety (i.e. plant room, service risers, ceilings, corridors, floor voids, etc.). The MeC shall also be responsible for ensuring the mains cold water supplies are adequately protected from mechanical damage, vandalism (fixed on tray) and most important, FROST PROTECTION. The MeC shall supply and install all required thermal insulation for the protection of the water supplies against frost.

All CWS distribution pipe work within roof voids, duct spaces, or any other exposed areas, shall be thermally insulated with pre-formed ISOVER pipe insulation.

Manufacturers details will be required confirming all insulation materials avoids the use of substances with Global Warming Potential (GWP) of 5 or more in either manufacture or composition.

All external pipework shall be insulated as detailed above and protected by a weather-proof and shatterproof finish coating. The finish coating shall comprise a layer of open weave glass cloth impregnated with polymeric weather-proof and waterproof emulsion or equivalent.

All valves, strainers, flanges, unions etc, shall be insulated by one of the following three methods with weatherproof finish coating:-

a) Mineral wool lamella mat having a density of not less than 40-50kg/m^3 with a factory applied class '0' bright reinforced aluminium foil laminate facing and secured to the adjoining insulation by means of 75/100mm wide soft aluminium foil tape or equivalent to maintain the integrity and continuity of the vapour barrier.

b) Oversize pre-formed mineral wool pipe sections having a density of not less than 100kg/m^3 with a factory applied class '0' bright reinforced aluminium foil laminate facing and secured to the adjoining insulation by means of plain soft aluminium foil tape or equivalent to maintain the integrity and continuity of the vapour barrier.
c) Tie socks.

On all external pipework etc, the vapour barrier must be maintained and the insulation and finish shown to be weatherproof and waterproof.

6 Mechanical Ventilation

6.1 General

The MeC shall be responsible for the design, supply, installation and commissioning of the complete ventilation systems as detailed on the tender drawings. All ventilation rates shall comply with current building regulations and be agreed prior to installation.

The MeC shall be responsible for the design, supply and installation of all fans, grilles, fire dampers, supports, fixing brackets, anti-vibration mounts, attenuators, cross talk attenuators (between adjoining spaces), ducting, external louvers and controls etc to form a complete and working installation

The MeC shall reference the indicative ventilation drawings issued with this tender, for details of ventilation requirements and routes. The MeC shall be responsible for adopting the indicative layouts to form part of their design criteria.

6.2 MVHR System

A continuous mechanical supply and extract with heat recovery (MVHR) system shall be provided to the apartments detailed on the tender drawings.

Ventilation shall be controlled via a three speed central fan complete with humidity detection to vary the fan speed. The central heat recovery fan shall be the Vent Axia Lo Carbon Sentinel Kinetic High Flow or equal and approved.

The units shall have a bypass mode to bypass the heat exchanger in summer months and humidity sensor to automatically boost the ventilation rate. A switch shall also be provided as detailed on the tender drawings to enable occupants to manually boost the ventilation rate.

Ventilation shall be provided at a suitable rate to satisfy Building Control and Meet Building Regulations Approved Document F.

Extract from the wet rooms and kitchens shall be supplied via the combined ventilation system as indicated on the Tender Drawings.

The toilet/ shower/ bath areas shall be provided with makeup air utilising undercut doors if applicable, air shall be provided from the living areas.

Heat recovered supply ventilation shall be provided to the habitable rooms, including bedrooms and living areas.

The MeC shall reference the indicative ventilation drawings issued with this tender, for details of ventilation requirements and routes. The MeC shall be responsible for adopting the indicative layouts to form part of their design criteria.

At the earliest opportunity, all builders' works related to the installation of extract fans and ducting shall be identified to the building contractor.

All ventilation systems shall be sized to meet the design criteria detailed within this specification and on the tender drawings. Any deviations from these details must be highlighted for approval prior to installation.

The MeC shall include for a volume control damper to be installed at every grille/ diffuser and main branches, within the serving ductwork where applicable. The fans shall be installed in accordance with the manufacturers recommendations and use their controllers/ sensors.

Fresh air and discharge louvres shall be adequately separated to eliminate recirculation of air discharged from the system.

6.3 Centralised MEV System

A continuous mechanical extract ventilation (CMEV) system shall be provided to the apartments, as detailed on the tender drawings.

Ventilation shall be controlled via a two speed central fan systems complete with humidity detection to vary the fan speed. The central fan serving the apartment shall be a Vent Axia Multi-Vent MCDC-MSH or equal and approved.

Extract from the areas shown on the Tender Drawings shall be supplied via the combined ventilation system.

The kitchen, toilet and shower/ bath areas shall be provided with makeup air utilising undercut doors if applicable, air shall be provided from common areas and via trickle ventilators.

The fan shall be of a continuous mechanical extract ventilation type and provide simultaneous ventilation of the separate areas, as indicated on the Tender Drawings.

The fan shall also provide humidity control utilising a second speed, under normal operation the unit shall operate at the continuous trickle setting and shall provide the boost (automatically) at the dictates of the inbuilt humidistat, located within the fan unit.

A switch shall also be provided as detailed on the tender drawings to enable occupants to manually boost the ventilation rate.

At the earliest opportunity, all builders' works related to the installation of extract fans and ducting shall be identified to the building contractor.

All ventilation systems shall be sized to meet the design criteria detailed within this specification and on the tender drawings. Any deviations from these details must be highlighted for approval prior to installation.

The MeC shall include for a volume control damper to be installed at every grille/ diffuser and main branches, within the serving ductwork where applicable.

The fans shall be installed in accordance with the manufacturers recommendations and use their controllers/ sensors.

6.4 Kitchen Ventilation

An extract grille from the ventilation system shall be positioned within 1m from the oven/ hob, within the ceiling.

Direct over hob recirculation shall be supplied complete with carbon filtration & variable speed control.

The kitchen areas shall be provided with makeup air utilising undercut doors if applicable, air shall be provided from living areas via the whole house ventilation system.

6.5 Ductwork

All ventilation ductwork shall be manufactured and installed by a competent specialist ductwork Sub Contractor who should take all site dimensions necessary for its installation. Fully dimensioned double line drawings of all ductwork services shall be forwarded for approval by the Architect and Engineer.

Ductwork shall be flat channel PVC type, from the Vent Axia range or equal and approved.

Intake and exhaust ductwork shall be insulated along its entire length with equivalent of at least 25mm of a material having a thermal conductivity of ≤0.04W/(m.K) to reduce the possibility of condensation forming. All ductwork passes through unheated spaces shall be insulated in the same manner.

Intake and exhaust terminal shall be adequately separated to prevent re-circulation, as per guidance in the building regulations part F and NHBC guidance, chapter 8.3. All ductwork passing through fire compartment floor slabs or walls, shall incorporate fire dampers, having a minimum rating of one hour.

Unless specifically indicated on the drawings, the use of flexible ductwork shall not be permitted, other than final connections to grilles/ diffusers, max length 300mm.

All ductwork within the service spaces shall be mounted on anti-vibration mounts to minimise noise/vibration and ensure the noise criteria are met.

6.6 Fire Dampers

The MeC shall be responsible for the supply and installation of all Fire/ Smoke dampers as detailed on the tender drawings (or as required by the design to comply with building and fire regulations) and within all service risers, entering and leaving the service risers, all fire compartmentation breaks, etc. Refer to the Architects fire compartmentation drawings for final positions.

The MeC shall note the fire compartments along the run of the ductwork and allow the relevant costs for all fire dampers. Fire strategy drawings are available from the project architect.

6.7 Grilles, Diffusers and Louvres

The MeC shall be responsible for the design, supply and installation of all grilles/louvers as identified on the tender drawings. The MeC shall provide a sample of each grille to the Consultant for written approval prior to installation.

All spigot connections to the grilles shall be minimum 125mm diameter.

All grilles etc shall be finished to a BS or RAL colour to be selected by the Architect.

A commissioning report shall be handed to the Project Co-ordinator for inclusion in the House Health and Safety File.

The MeC shall ensure that all manufacturers' minimum access requirements for maintenance are met and shall consider all safety issues related to access for maintenance.

6.8 Pre-Commissioning

The MeC shall provide a fully detailed method statement to include the pressure testing, cleaning, preparation for balancing and witnessing and reporting of all testing and commissioning information.

Include for all necessary works prior to commissioning as detailed below:

i) Ensure that all the facilities necessary for the various systems, in accordance with the CIBSE and BSRIA Codes have been included and are correctly located and sized.

ii) Ensure that all ventilation systems are completely clear of any obstructions, debris and superfluous matter. Secure all fire dampers in the open positions and ensure that all access covers are secured in position.

iii) Carry out pre-Commissioning on each system against specific check sheets in order to bring the plant and equipment to the stage of static completion where it is ready and safe to be set to work. Submit completed static check sheets to the Employer's Agent as each system is pre-commissioned.

iv) Ensure that all components are correctly installed. Cleanliness of air distribution systems is essential.

v) Undertake checks in accordance with the relevant CIBSE and BSRIA Commissioning codes to ensure that the appropriate system is in a satisfactory and safe condition before starting up.

vi) Rectify all installation defects prior to commissioning, where the defect has any bearing on the commissioning of a system or systems.

vii) Test and certify all ventilation installations prior to commencement of commissioning. Include the following tests:-

- Works test of plant items
- Air leakage tests of ductwork to Eurovent 2/2 1981 Class A

Commissioning and Commissioning Records

i) Commission all of the systems installed and agree a commissioning programme, prior to commencement of the work. Update and amend commissioning programme as and when necessary.

ii) Submit a fully detailed commissioning method statement for each type of system to be commissioned.

iii) Balance all air systems to within the tolerances detailed in Commissioning Code "A" and BSRIA Code 3/89, 2/82 and 1/91.

iv) Ensure that all distribution systems are balanced with due regard to noise generation.

v) Record and submit as commissioning records all measurements and operational details as commissioning work proceeds.

vi) Clearly mark all air distribution system dampers with their balanced setting position when the individual system has been balanced. Lock all dampers in their final regulated positions in a secure manner.

vii) Demonstrate the final balance of all air systems to the Employer's Agent.

viii) Submit the Commissioning Records and certify that the results are within the allowed tolerances. Do not precede with system performance tests until the certified records have been submitted and accepted in writing.

7 Sprinkler Services

The sprinkler system shall be designed to provide coverage to all apartments and shall be installed in accordance with UL 1626 & BS9251:2014 .

The sprinkler shall be category 2 to BS 9251 with a minimum discharge density of 4mm/min and minimum supply duration of 30 minutes.

All sprinkler heads shall be concealed.

A dedicated sprinkler riser shall be provided, with a connection made to the boosted cold water supply in the plant room. An interface shall be provided between the sprinkler flow switch and priority demand valve in the plant room to ensure the supply to the potable water outlets is shut-off in the event of sprinkler activation. The sprinkler service shall be provided by Hall & Kay, contact Thomas Palmer:

- Telephone: 0161 872 7316
- Mobile: 07711 764 913
- Email: thomas.palmer@hkfire.co.uk

A residential zone valve assembly shall be provided on each floor, comprising an isolating valve, flow switch and drain and test valve.

All sprinkler pipework within apartments shall be CPVC blazemaster type or equal and approved. All pipework within risers shall be medium grade steel to BS EN10255.

All sprinkler services pipework routed through unheated spaces shall be adequately protected against frost damage by installing thermal insulation and providing trace heating.

8 Dry Riser Services

The dry riser shall be designed and installed in accordance with BS9990: Code of practice for non-automatic fire-fighting systems in buildings:2006 and BS 5041-2:1987.

Approved Document B (Fire Safety) of the Building Regulations (England & Wales) requires that any building more than 18m high, measured from the fire brigade access level to the top floor, or which has floors more than 10m below ground must be provided with 'fire fighting shafts' and a fire fighting rising main.

The water feed from the fire service pump into the Dry Riser is routed through an inlet breaching connection and should installed at the fire brigade access level on an external wall. The breeching connections should be contained in a red glass fronted box with the wording 'Dry Rise Inlet'. The inlet breeching unit for a 100mm diameter dry riser has two 65mm male instantaneous hose connections which must comply with BS 336 Specification for fire hose couplings and ancillary equipment 1989.

Inlet boxes and breeching inlets should be manufactured to comply with BS 5041. The lower edge of the inlet box must be located between 400mm and 600mm above the ground. The inlet should be fitted with a drain valve to drain water from the dry fire main at the end of operations.

Landing valves should be constructed of gunmetal with a flanged inlet and should be designed to BS 5041 Part 1 Fire hydrant systems equipment. Specification for landing valves for wet risers 1987. The valves should be fitted with a wheeled valve connected directly to one (or in the case of larger risers, two) 65 mm instantaneous female coupling to BS 336, with removable blank cap and retaining chain. They should be installed at each floor level, except the ground floor. The landing valve should preferably be located inside an easily recognisable red metal box with a glass panel, labelled Dry Riser. The boxes should be locked and have a glass panel that can be broken to gain access to connect the fire hose. The most commonly installed landing valves are either horizontal instantaneous hose connection or 'bib nosed' with a downwards angle each with a 64mm instantaneous hose connection.

An air release valve should be fitted at the top of the dry riser to expel air when filling the main and allow ingress when draining the system.

Fire mains should have a nominal bore of 100 mm and the system should be designed to withstand a pressure of one and half times its predicted maximum operating pressure.

The pipes should be manufactured to BS EN 10255: Non-alloy steel tubes suitable for welding and threading 2004.

Pipes for wet risers must be heavy quality and when it is installed in locations where it is susceptible to corrosion it must be galvanized. Dry risers pipes are usually heavy quality galvanized.

9 Associated Mechanical Wiring

The EleC shall be responsible for providing all electrical supplies and isolators to all mechanical equipment proposed. The MeC shall be responsible for all field wiring, interconnecting cabling and all final connections to ensure the correct operation of the mechanical plant. The MeC shall be responsible for highlighting to the EleC, the electrical supplies required for the equipment listed below:

- Hot Water Cylinder (controls wiring by MeC);
- Category 5 Break tank(s) (controls wiring by MeC);
- Instantaneous electric hot water heater(s) (controls wiring by MeC);
- Potable water and sprinkler booster set(s) (controls wiring by MeC);
- Electric Underfloor heating thermostat(s), temperature sensor(s), heating programmer(s) (controls wiring by MeC);
- Electric Towel Rail(s) and Electric Panel Heater(s)
- All ventilation Fans & Controllers (controls wiring by MeC);
- Smoke Ventilation Control(s) and battery backup (controls wiring by MeC);
- All other systems associated with the mechanical design, not listed above

The MeC shall be responsible for ensuring all final circuit wiring complies with the system of wiring requirements detailed within the Electrical specification.

10 Testing, Commissioning, Manuals and Drawings

10.1 General

The MeC shall carry out the testing and commissioning of the plant installed, all in accordance with the various manufacturers instructions. All test results shall be recorded and tabulated and documentation in the form of commissioning certificates shall be issued to the Engineer for checking. Further copies of all certification shall be included in the house Health & Safety File and Employer's handover pack.

The MeC shall liaise with the Consultant Engineer and demonstrate to him that the system operates and is controlled in accordance with the design intent. Operation of all plant controls shall be further demonstrated to the Employer at a time to be arranged, following handover.

The MeC shall be responsible for the programming of all plant control systems and time clocks. Time clocks shall be set to the operating times required by the Employer. Under no circumstances are time clocks or programmers to be left on constant.

10.2 Ventilation Systems

Pre-Commissioning

The MeC shall provide a fully detailed method statement to include the pressure testing, cleaning, preparation for balancing and witnessing and reporting of all testing and commissioning information.

The MeC shall allow for all necessary works prior to commissioning as detailed below:

- Ensure that all the facilities necessary for the various systems, in accordance with the CIBSE and BSRIA Codes have been included and are correctly located and sized.

- Ensure that all ventilation systems are completely clear of any obstructions, debris and superfluous matter. Secure all fire dampers in the open positions and ensure that all access covers are secured in position.

- Carry out pre-Commissioning on each system against specific check sheets in order to bring the plant and equipment to the stage of static completion where it is ready and safe to be set to work. Submit completed static check sheets to the Employer's Agent as each system is pre-commissioned.

- Ensure that all components are correctly installed. Cleanliness of air distribution systems is essential.

- Undertake checks in accordance with the relevant CIBSE and BSRIA Commissioning codes to ensure that the appropriate system is in a satisfactory and safe condition before starting up.

- Rectify all installation defects prior to commissioning, where the defect has any bearing on the commissioning of a system or systems.
- Test and certify all ventilation installations prior to commencement of commissioning. Include the following tests:-

1) Works test of plant items
2) Air leakage tests of ductwork to Eurovent 2/2 1981 Class A

10.3 Commissioning and Commissioning Records

- Commission all of the systems installed and agree a commissioning programme, prior to commencement of the work. Update and amend commissioning programme as and when necessary.

- Submit a fully detailed commissioning method statement for each type of system to be commissioned.

- Balance all air systems to within the tolerances detailed in Commissioning Code “A” and BSRIA Code 3/89, 2/82 and 1/91.

- Ensure that all distribution systems are balanced with due regard to noise generation.

- Record and submit as commissioning records all measurements and operational details as commissioning work proceeds.

- Clearly mark all air distribution system dampers with their balanced setting position when the individual system has been balanced. Lock all dampers in their final regulated positions in a secure manner.

- Demonstrate the final balance of all air systems to the Employer's Agent.

- Submit the Commissioning Records and certify that the results are within the allowed tolerances. Do not proceed with system performance tests until the certified records have been submitted and accepted in writing.

10.4 Pipework Systems

General

- Include for all necessary works prior to commissioning as detailed below.

- Allow for the presentation of a fully detailed method statement for all pre-commissioning, flushing, testing, cleaning and sterilisation of all pipework systems.

Pre-Commissioning

- Carry out pre-Commissioning on each system against specific check sheets in order to bring the plant and equipment to the stage of static completion where it is ready and safe to be set to work. Submit completed static check sheets to the Consulting Engineer as each system is pre-commissioned.

- Ensure that all components are correctly installed. Cleanliness of water distribution systems is essential, and reference should be made to the requirement for prevention of the introduction of pseudonomas in section 10.2.5 (chemical cleaning).

- Ensure that statically complete installations are correct with regard to all details required by the specification and are clean and safe to operate.

- Undertake checks in accordance with the relevant CIBSE and BSRIA Commissioning codes to ensure that appropriate system is in a satisfactory and safe condition before starting up.

- Rectify all installation defects prior to commissioning, where the defect has any bearing on the commissioning of a system or systems.

Tests

- Test and certify all services installations prior to commencement of commissioning; including associated electrical and automatic control systems. Include the following tests.

i) Hydraulic pressure tests of pipework

ii) Works test of plant items

Pressure Testing of Pipework

- All pipework shall be hydraulically pressure tested either in sections or as complete circuits prior to insulation being applied and prior to concealment.

- No water shall be introduced to any system before consultation with a specialist water treatment sub-contractor, to ensure the prevention of the introduction of pseudonomas.

- The execution of hydraulic pressure testing of pipework, shall be in accordance with the "Guide to good practice for Site Pressure Testing of Pipework", as issued by the Heating and Ventilating Contractor's Association.

- Pipework shall be tested to one and a half times the normal working pressure which, when attained, shall hold for 2 hours.

- Where items of equipment form part of a system, they shall be connected to that system during testing.

- Any instrument or item of equipment not capable of withstanding the test pressure or procedure specified shall be temporarily removed or bypassed.

- Upon completion of each whole installation and before any insulation is applied or encasing or burying of any section of pipework, subject each system to an hydraulic test as per the schedule and demonstrate to the satisfaction of the Employer's Agent that the system or section is sound and watertight. Pipework encased or buried shall be subject to a similar test at a time to suit the progress of the work.

- Allow for site testing of the works to be carried out in sections as the work progresses, to suit the requirements of the works programme. Allow for all isolation and other temporary work, including the provision of all plugs, caps, tees, drain fittings etc. to facilitate such tests, and for the treatment of test water, should this be requested by the specialist water treatment sub contractor.

- Maintain a schedule of all tests. Upon completion of each test, the Contractor shall issue a test certificate, duly signed by the Employer's Agent, which shall verify that the test has been satisfactorily carried out.

- All pressurised pipework shall be tested by filling the pipework section to be tested with water and raising its pressure to the pressure specified below. The pipework section shall then be left without further strokes of the pressurisation pump and with the test pump disconnected. All joints must remain tight for a period of at least two hours. The Employer's Agent's decision as to whether the section is sound being governed by the rate at which the pressure falls.

- All drain piping shall be tested by running water through to waste. Air vents shall be tested at such time as the heating installation is put into operation, with air vents and piping examined for signs of leakage and malfunction.

- On completion of each hydraulic test, the water shall be released or retained as recommended by the specialist water treatment sub contractor. If necessary the water shall be drained then thoroughly flushed through to ensure the removal of as much dirt and dross as possible, before being refilled and put into service.

- After refilling, all strainers shall be checked and cleaned as necessary.

- The test pressures to be applied to the various services are to be 1.5 times the maximum pressure imposed in the system under working conditions.

- Natural gas systems shall be pressure tested to meet the recommendations of British Gas, Publications DM/5, Soundness Testing Procedure for Industrial and Commercial Gas Installations.

- Any fault discovered during such tests detailed above shall be remedied at once and the test reapplied until the Employer's Agent is satisfied that the section under test is sound.

Chemical Cleaning

- The services of a specialist water treatment sub contractor shall be employed, to ensure the proper control of every introduction of water into pipework systems, either for pressure testing, flushing, and cleaning or for the final fill and commissioning of the systems in part of whole.

- The Contractor shall ensure that the method statement for chemical cleaning is formulated in collaboration with the specialist sub contractor.

- Following the completion of installation of any individual system or major section of a system, thoroughly flush that system to remove all dirt, debris and millscale, etc, to the method statement, and with the full knowledge of the specialist sub contractor.

- Chemically clean (in the manner stated) and flush domestic water systems including incoming mains and storage tanks, drinking water mains and hot and cold water mains. These shall be chlorinated, sterilised and flushed prior to handover. The requirement of CIBSE technical memorandum TM13 and the procedures agreed in the method statement shall be strictly adhered to.

- Allow the provision of suitable tapping points for chemical introduction and all necessary drain/flushing connections, particularly at the bottom of all risers.

Thermal Test (After Insulation and Painting)

- A series of tests shall be performed on the hot water supply installation to Code of Practice CP 342. Records shall include normal temperature, flow and pressure head available at fittings and equipment served.

Commissioning and Commissioning Records

- Commission all of the systems installed and agree a commissioning programme, prior to commencement of the work. Update and amend commissioning programme as and when necessary.

- Submit a commissioning method statement for each type of system to be commissioned.

- Balance all hydraulic systems to within the tolerances detailed in Commissioning Code "W" and BSRIA Guides 2/89 and 8/91.

- Ensure that all distribution systems are balanced with due regard to noise generation.

- Record and submit as commissioning records all measurements and operational details as commissioning work proceeds.

- Lock all hydraulic regulating devices in their final regulated positions in a secure manner.

- Record the final regulated position of all hydraulic regulating devices and submit as part of the Commissioning Records.

- Demonstrate the final balance of all hydraulic systems to the Employer's Agent.

- Submit the Commissioning Records and certify that the results are within the allowed tolerances. Do not proceed with system performance tests until the certified records have been submitted and accepted in writing.

10.5 Public Health Systems

Tests at Manufacturer's Works

- Tests of all specified materials and equipment shall be arranged at manufacturer's works, tests shall conform to the appropriate British Standard and, as subsequently specified herein, shall at the Employer's Agents discretion be carried out in the presence to their representative.

10.5.1 Tests Carried Out At Site

- Ensure that the tests carried out meet the standard requirements of the Local Authority and all the tests contained within this specification whichever is most severe, to the satisfaction of the Local Authority and the Employer's Agent.

- The Contractor shall be solely responsible for verifying the Local Authority requirements for testing these installations.

- Where it is necessary to test portions of the piping systems before the system is complete, successive tests must overlap so that no joint or section of pipe is missed in the testing.

- Access covers, cleaning eyes and rodding eyes shall be removed, cleaned, greased, replaced and suitably sealed prior to testing.

- All soil, waste, ventilation and rainwater pipes shall be subjected to an air pressure or not less then 40mm water gauge. The gauge shall remain steady for a period of five minutes. Where applicable, such tests shall be applied before ducts or duct casings are built of false ceilings are erected.

- All works shall be further tested on completion of installation prior to handing over.

- The air pressure tests briefly mentioned above shall be carried out strictly in accordance with the recommendations contained within the British Standards Code of Practice 5572.

Plant & Equipment

The complete installation shall be maintained and run for as long as required to ensure that all plant, equipment and controls, etc., are working correctly as designed. This period shall commence after the completion of all the necessary adjustments. The correct operation of all plant, services, controls and instruments and each item of equipment shall be proved by demonstration to the Main Contractor and Services Engineer, prior to the works being handed over to the Client.

Should the completion of the witnessed demonstrations be prevented during the period agreed for witnesses attendance and have to be postponed to a later date, by reason of the Contractor/ Sub-Contractor failing to ensure that all of the installation has been prepared for functioning in a correct, safe and proper manner, and in accordance with the specified requirements, then the Contract/Sub-Contract Sum may be reduced by an amount equal to the expenses incurred by the Witnesses having to return to site at a later date for resumption of the Testing.

Further attendance shall be provided for supervising and instructing the Client's Engineer on the correct operation and maintenance procedure of all plant, equipment, controls etc.

A full report shall be provided of all tests and results upon completion.

10.6 Heat Test

After satisfactory completion of pressure test and prior to the application of insulation, all heating and domestic hot water systems are to be put into operation and maintained at working pressure and temperature for a minimum period of one hour, after which the systems shall be allowed to cool down. The systems shall then be examined for any defects.

10.7 Regulation and Circulation Test

The whole of the installation shall be regulated to ensure an even circulation through every branch in accordance with the commissioning and circulation test procedure laid down in the appropriate CIBSE commissioning codes.

All necessary instruments and equipment for the above tests shall be provided by the MeC.

10.8 Test Certificates

Each test/commissioning certificate shall contain the following information:

- Building location
- Identification of equipment and description of installation
- Test carried out
- Results and observations
- Name of commissioning engineer who conducted the test & date.

11 Identification & Painting

11.1 Pipework

Pipework shall be identified in accordance with Section 2 of this specification. Pipework within the plant room shall be further identified with an arrow marking the direction of flow and lettering to denote function (i.e. DHW, DHWR, COLD FEED, etc.). Identification lettering shall be approximately 50mm high and shall be placed on pipework at regular intervals.

11.2 Painting

All unprotected mild steel pipework and all supporting steelwork and brackets shall be thoroughly cleaned and painted with an approved chromate primer or red oxide paint immediately after erection to prevent oxidisation.

Un-galvanised ferrous sheet metal, or other ferrous materials, shall have a protective coat of paint or other acceptable material before dispatch from works.

12 Smoke Ventilation Services

12.1 Corridor Smoke Ventilation System

A smoke ventilation system is required to corridors and landings to fulfil the requirement for safe means of escape.

The corridors and landings shall be provided with ADB shaft as necessary to comply with the requirements of Approved Document B: 2006 Volume 2 to the Building Regulations.

The ADB shaft shall have a minimum cross section of 1.5m^2, and minimum internal dimensions no less than 0.85m. The shaft shall be nominally straight and vertical and open to the atmosphere at the top. Weatherproof termination shall be provided by either the Colt EN Seefire louvred natural smoke ventilator or the COLT AXS 140 Combined Ventilator and Roof Access Hatch (as shown on the tender drawings.) The ventilators shall comply with BS EN 12101-2:2003.

The shafts shall be of fire resistant construction and at each storey an automatically controlled Colt Damper & Grille providing an air flow path from the corridor to the shaft.

The Colt Damper & Grille system shall be supplied to provide a safe and reliable actuation system for use in smoke ventilation of commercial and residential properties. The system has been designed to be applied to allow passage of smoke and fumes from corridors into smoke shafts.

The system shall be designed to provide individually addressable and controllable door actuation systems which communicate back to a central control panel and communicates to the main fire system.

In automatic mode, the system shall be activated by a dedicated fire detection system incorporating smoke detectors in the ventilated spaces and supplied as part of the AOV system or by operation of a manual break glass switch. Only the Colt Damper & Grille in the space where smoke is detected and the shaft termination ventilators shall open. All other Colt Damper & Grilles shall remain closed.

Control shall be by the Colt OPV system / an intelligent fully addressable control system.

The control system shall:

- Be specifically designed and optimised for fire protection use;
- Use manufacturer's fully tested and proven standard control panels, not custom designed and manufactured items;
- Incorporate a mimic panel for fire service use;
- Be fully flexible and user friendly;
- Be user re-configurable for basic operating parameters;
- Be fully configurable and re-configurable using a Windows (or similar) based tool, requiring no programming knowledge;
- Be capable of operating all equipment simultaneously, without need of cascade control;
- Provide full battery backup so that a maintained supply is not required;

- Provide local battery backup providing at least 70 operations and intelligent control at each OPV / enabled ventilator;
- Provide battery capacity monitoring for all batteries (not just voltage monitoring);
- Provide visible and audible fault and fire condition warning at the control panel;
- Incorporate a watchdog to all microprocessors to check system and force appropriate reset if necessary;
- Allow interrogation of operating status of equipment direct from the control panel and via a plug in computer connection;
- Provide diagnostics for the controls, wiring and OPV / enabled ventilators;
- Have the option to relay diagnostic information to a remote service company via the telephone network;
- Be capable of controlling dampers / door actuators and ventilators and connecting directly to dedicated detectors and break glass switches;

The design, manufacture, installation, wiring and commissioning of the complete system shall be carried out by one specialist company and their approved sub-contractors. The specialist company shall be responsible for gaining Building Control approval for the AOV system.

The specialist company shall be a BSI registered firm for the design, manufacture, installation and commissioning of smoke control systems in accordance with ISO 9000. Proof of certification shall be provided with tender submission.

The system will require annual maintenance and testing. The supplier shall include in the tender for a service visit and system test to be carried out one year after the system hand over.

Section 4

Summary of Tender

Section 4 – Mechanical Summary of Tender

Please note that the summary must be completed in full. Any returned tender summaries not completed fully will be discounted.

For any clarifications during the tender period please contact Daniel Watt at WE&CE Ltd on 0161 434 3 103.

Section	Description	Cost (£)
1	Introduction	
1.1	General	
1.2	Defects Liability Period	
1.3	General Scope of Mechanical Works	
1.4	Ordering of Materials	
1.5	Site Supervision and Co-ordination of Works	
1.6	Site Meetings	
1.7	Building Programme	
1.8	MeC's Design Responsibilities	
1.9	Design Stage Responsibilities	
1.10	Employer Team	
1.11	Insurance Liability Cover	
1.12	Construction Stage Responsibilities	
1.13	Post-Completion Responsibilities	
1.14	Designer's Risk Assessment	
1.14	Noise Levels	
1.16	Plant Maintenance/Service	

1.17	Tendering Requirements	
1.18	Maintenance Manuals and Operating Instructions and Building Manual	
1.19	On Site Record Drawings	
1.20	'As Installed' Record Prints	
1.21	Demonstration of System	
1.22	Part L1A SAP compliancy & Air testing	
1.23	Tenants' Instruction/Handbooks	
1.24	Users' Instructions	
	Sub Total £	
2	**Incoming Mains**	
2.1	General	
	Sub Total £	
3	**Public health services**	
3.1	Hot & Cold Water Distribution	
3.2	Prevention Against Legionellosis	
3.3	Pipework & Fittings	
3.4	Sterilization of Domestic Hot Water & Cold Water Services	
3.5	Sanitary Ware, Wastes and Drainage	
3.5.1	Sanitary Ware	
3.5.2	Soil Pipes	
3.5.3	Inspection and Testing	

3.5.4	Testing of Drainage	
	Sub Total £	
4	Heating System	
	Sub Total £	
5	Thermal Insulation	
	Sub Total £	
6	Mechanical Ventilation	
	Sub Total £	
7	Sprinkler Services	
	Sub Total £	
8	Dry Riser Services	
	Sub Total £	
9	Associated Mechanical Wiring	
	Sub Total £	
10	Testing, Commissioning, Manuals and Drawings	
	Sub Total £	

11	Identification & Painting	
	Sub Total £	
12	Smoke ventilation	
	Sub Total £	
Any other works not itemised (please detail)		
1		
2		
	Sub Total £	
	Total to form Tender	

Signed:
Position Held:
For And On Behalf Of:

Authorised Extra Work

Should any extra work or variation be required at day work rates, we undertake to carry out the work at net cost plus the following percentage additions to cover supervision, establishment charges and profit for work performed during normal hours.

Materials..... %

Sub-contract work..... %

Plant..... %

Labour rates for dayworks are also to be submitted, to be priced as fully inclusive hourly rates for the various standards of labour.

Labour rates: -

Schedule of Rates

Upon the client's request, the Contractor shall provide **within 7 days** a 'Quantified Schedule of Rates' covering the entire installation. **Lump sum** rates of any form will not be acceptable.

This schedule shall be based on the same prices as those used to comprise his Tender and shall be used to value any omissions or additions to the Contract.