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MECHANICAL BUILDING SERVICES
PERFORMANCE SPECIFICATION FOR
BATTLE RECREATION GROUND, NEW PAVILION

Battle Town Council

Project No:	2442
Reference:	MECHSPEC/IWA/PE/2442
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Contents:

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SECTION 0.0

INTRODUCTION

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Section 0.0 – Introduction – Table of Contents

0.0 INTRODUCTION

0.1 PROJECT TITLE

The Project shall be for the Mechanical Building Services Installation associated with the development of the New Pavilion at Battle Recreation Ground, North Trade Road, Battle, East Sussex, TN33 0HA.

0.2 PROJECT TEAM

Client:	Battle Town Council The Almonry High Street Battle East Sussex TN33 0EA ☎ 01424 772210
Architect:	Pump House Designs Pump House Yard The Green Sedlescombe East Sussex TN33 0QA ☎ 01424 871120
Mechanical & Electrical Consulting Engineers:	IWA Consulting Engineers Ltd Pacific House Sovereign Harbour Innovation Park Eastbourne East Sussex BN23 6FA ☎ 01323 646284
Project Manager:	Kingston Morehen 15A Hyde Gardens Eastbourne East Sussex BN21 4PR ☎ 01323 411088

All reference in this Specification to Client/Consulting Engineer etc shall infer the above.

All reference to Contract Administrator or Supervising Officer shall be the person nominated by the Employer to these roles.

0.3 LOCATION OF SITE

The Site is located at Battle Recreation Ground, North Trade Road, Battle, East Sussex, TN33 0HA.

0.4 DESCRIPTION OF WORKING AREA

The works to be carried out are within the confines of the site located at Battle Recreation Ground as detailed in the tender documentation. Existing buildings affected by the works will be demolished.

0.5 DESCRIPTION OF WORKS

The Works shall comprise the complete Mechanical Services Design, Supply and Installation associated with the new Development including:

- Existing Relocated Water Main
- Electric Heating
- Mechanical Ventilation with Heat Recovery
- Mechanical Extract Ventilation
- Domestic Hot and Cold Water
- Sanitation
- Automatic Controls
- Production of detailed Installation Drawings (see Clauses 1.50 and 1.52)
- Production of As Installed Record Drawings and Manuals (see Clauses 1.70 and 1.71)

0.6 EXTENT OF WORKS

The specification provided represents the **Consulting Engineer's performance design** for the proposed services associated with the Project and **does not constitute a full technical specification.** This specification is indicative of the scope and systems that will be required for the project and will require the Contractor to undertake their own detailed design and working drawings based on the specified criteria.

The design shall be carried out by a **competent design/consultancy** company whose staff hold appropriate membership of organisations relevant to that part of the design.

The information contained within this specification should be read in conjunction with the Main Contract Conditions, Architectural and Structural Layouts.

It is essential that Tenderers familiarise themselves with all aspects of the Works such that their Tender is a complete account of the total installation, which shall include design, supply, supervision, installation, fixing, testing and commissioning. Any subsequent claims for payment due to lack of information will not be entertained. Designs shall be submitted to the Contract Administrator for comment prior to work commencing, but it will remain the Contractor's responsibility to ensure a fully workable installation complying with all relevant regulations and British Standards.

This specification is intended to enable the Tenderer to submit a Tender and, if successful, provide their own detailed design, based on the specified criteria.

The Tenderer shall include for all detail work of every description required for the absolute completion and proper functioning of the Works and install accordingly.

The Contractor shall be wholly responsible for the design, supply, installation, testing and commissioning of all necessary equipment to complete the Works as described herein.

The Contractor shall provide a calculation package comprising heat loss calculations, ventilation calculations, fan and pump resistance calculations and also Technical Submissions for all equipment proposed. This shall be submitted for review by the Client Team 6 weeks before installations of Mechanical Services commence.

0.7 SPECIAL CONDITIONS

The Contractor shall note the following and make due allowance within his Tender for these restrictions:

(i) The works **will be carried out** in normal working hours.
(ii) The works may be carried out in phases.
(iii) Allowance shall be made for any temporary supplies that are needed.
(iv) The contractor shall note that these works shall fully comply with BS7671:2018 Requirements for Electrical Installations which came into effect on 1st January 2019.
(v) Within this specification (Section 4) is a list of Recommended Manufacturers & Suppliers, The Contractor may put forward equal and approved alternatives to all NAMED suppliers and specialists. However, this shall be stated in a covering letter with the Tender offer and shall not be deemed as accepted until approved by the CA. However, the Tender and Tender Analysis will be completed using all named "manufacturers and specialists".

For more general conditions related to working arrangements, restrictions on working methods, phasing and contract programme refer to the Clients Contract Conditions.

0.8 PRE TENDER SITE VISITS

The Contractor is **strongly recommended to visit the Site** and ascertain the working conditions and Site restrictions. The Contractor shall have no claim because of want of knowledge.

0.9 APPROVAL

All installation works proposed will be to the approval and acceptance of the Contract Administrator, who will retain authority to reject any work not acceptable to the Employer.

0.10 MAINTENANCE

The Contractor shall include for 12 months' maintenance for all Mechanical Services Installations.

0.11 PROGRAMME

Programme to be agreed with the Main Contractor.

0.12 APPROVED CONTRACTOR

Only **B&ES** approved contractors shall be permitted to install Mechanical Services.

The design works shall only be carried out by a competent design/consultancy company whose staff hold appropriate membership of organisations relevant to that part of the design.

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SECTION 1.0

PRELIMINARIES AND CONDITIONS

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Section 1.0 – Preliminaries and Conditions – Table of Contents

1.0 GENERAL CONDITIONS

All reference to Contract Administrator shall infer the officer appointed by the Employer to administer the Contract.

All reference to Electrical Contractor, Mechanical Contractor shall read, the Contractor.

The following clauses shall be read in conjunction with the Contract Conditions.

The Conditions contained within the Contract Conditions shall take precedence over any of the following clauses should there be any dispute.

1.1 FORM OF CONTRACT

The abridged inclusion here of any extract from the Conditions of the Contract in no way absolves the tenderer from their responsibility to examine the same.

The works will be carried out as a Sub Contract. The successful tenderer will become a Sub Contractor employed by the Main Contractor. They will be governed by the conditions contained in these documents and, where relative, the conditions of the Main Contract.

The Contractor shall indemnify themself against claims in respect of any negligence by the Contractor, their servants or agents, of any misuse by them of any scaffolding or any other plant, and shall insure themselves against any such liability.

1.2 LOCAL CONDITIONS

The Tenderers shall be deemed to have examined the site, the Conditions of Contract, the Specification, Schedules, Drawings and Plans, and shall satisfy themselves as to the supply and conditions of labour, carriage, carting and off-loading in the area.

The Contractor shall have no claim because of want of knowledge in any respect, and shall satisfy themself of the correctness of all deliveries.

The Contractor shall be responsible for giving reasonable prior notice of delivery of equipment to relevant authorities, such as traffic police etc.

The Contractor shall be responsible for the unloading, storage, hoisting and placing of materials in the general storage, hoisting and placing of materials in the general position of the works.

1.3 TENDERING INSTRUCTIONS

The Tenderer must complete and sign the Form of Tender and the schedules incorporated in the Tender Analysis section.

All Tender documents and drawings must be returned with the Tender in accordance with the tender return instructions.

The Employer reserves the right to appoint any of the tenderers invited to tender, and is not bound to accept the lowest or any tender. No payment will be made for the costs involved in preparation of tenders.

The Tenderers shall treat all Documents and other information relating to the Contract as strictly confidential.

The Tenderer shall return one completed copy of this document as instructed and within the time specified in the Invitation to Tender Letter.

Any tenders received after the specified time shall be declared null and void. Neither the lowest nor any tender will necessarily be accepted and the tenderer must bear in full, their cost in connection with submitting the tender.

1.4 PRIME COST AND PROVISIONAL SUMS

Where Prime Cost sums are given on the form of tender, at the time of tender the Contractor shall clearly indicate and include the percentage for profit and overheads that they require.

Provisional sums shall be included in the tender as they stand, without addition and shall be expended in whole, in part or not at all, at the direction of the Contract Administrator.

The Contractor shall not, without written consent of the Contract Administrator let any portion of the works.

The Contractor may be required to furnish a comprehensive price schedule of equipment with each item priced separately (including erection). The total of this schedule will not be binding, relative to the contract proper, but may be used to assess the value of the Contract Variations (either additions or deductions) from the original requirements.

Extra works and works to be carried out under the Provisional or P.C. Sums shall not be carried out unless instructions in writing are issued by the Contract Administrator. Provisional sums and P.C. sums (including declared profit etc.) not expended or used in the course of the Contract, shall be deducted in whole or in part from the Contract price, and there will be no compensation to the Contractor for this.

Where variation work is not of a similar character or executed under similar conditions as the general work comprising the contract, and where the variation work cannot properly be valued, work shall be charged on a time and materials or daywork basis in accordance with rates agreed.

Where items are described as 'supply only' pricing shall include for all labour, materials, goods and all costs in connection therewith, including conveyance, delivery, unloading, storing, returning packing's, handling hoisting, lowering, use of plant and equipment, establishment charges, overhead charges and profit and handing over in the place prescribed.

Where items are described as 'fix only' pricing shall include for all labour and all costs in connection therewith, taking delivery of materials and goods described, unloading, storing and returning packing's, carriage paid, and fitting and fixing materials and goods in position, including all necessary incidental materials described, use of plant and equipment, establishment charges, overhead charges and profit.

Should any doubt, obscurity or discrepancy arise as to the true meaning of any part of the specification the Contractor shall submit the same for clarification prior to submitting their tenders.

Save as aforesaid, no alteration shall be made by tenderers to the text of the tender documents and items shall be priced as described.

1.5 SCOPE OF THE CONTRACT

The scope of the contract covers the execution of all works and the supply of all materials specified or called for and, in addition, the supply and fixing of all accessories necessary for the proper completion of the Contract.

The various documents issued in connection with the Tender shall be read conjointly and, in the event of any discrepancy existing, this shall be referred to the Contract Administrator whose decision thereon shall be final.

The Drawings issued with the specification are intended to enable to Tenderer to prepare an accurate estimate and submit a tender, and are semi diagrammatic.

The Contractor shall include for all detail work of every description required for the absolute completion and proper functioning of the Works and install accordingly.

1.6 PRE CONTRACT MEETINGS

The successful Tenderer will be required to attend a pre contract meeting at the offices of the Client.

1.7 PHASING

The work included in this Contract will be undertaken in phases to suit the main programme.

1.8 PROGRAMME

The Contractor shall commence the works at such time as may reasonably be required, but not earlier than the period stated and agreed. The minimum period required from the date of written acceptance of their tender or from receipt by them of such working drawings and particulars as are sufficient for a start to be made, whichever is the later, must be stated at the time of tender. The Contractor shall complete the whole of the Contract works within the unimpeded working time to be staged by them, whether that working time is worked continuously or staged to suit the progress of other trade.

Notwithstanding the foregoing, the contractor shall place orders, arrange deliveries and execute the works in conformity with a detailed programme agreed prior to commencement of operation on site.

A copy of each order, stating the agreed delivery dates, shall be forwarded to the Main Contractor as soon as the delivery dates have been agreed.

Should the proposed delivery date of a specified item not meet the requirements of the programme, the Contractor shall immediately notify the Contract Administrator.

1.9 DEFINITIONS

The definitions for words and phrases commonly associated with the design, manufacture and site work for electrical/mechanical installations shall be those of the IET Regulations, the Mechanical and Institute of Plumbing Data Book, the CIBSE Guide, BS, CP and associated Statutory Acts.

1.10 TENDER DRAWINGS

The tender drawings are to be read in conjunction with this Specification and copies of each are issued with the tender documents.

1.11 INTERPRETATION OF TENDER DRAWINGS

This Specification and any drawings or other documents attached thereto and issued by the Contract Administrator/Engineer shall be deemed to include, whether or not specifically mentioned or shown, any materials, accessories or works as may be necessary for the satisfactory completion of the works in accordance with accepted current practice or procedure. The Tenderer shall make due allowance in their tender for such materials or works.

Where a discrepancy exists between the drawings and Specification or where the interpretation of either is in doubt, the Tenderer shall obtain written clarification on such matters before including and submitting their tender accordingly.

1.12 CLARIFICATION

Where any possible doubt exists as to the meaning of words or terms used elsewhere in this Specification, it shall be the Contractor's responsibility to ask for clarification and confirm the definition in writing.

1.13 SUB CONTRACTORS

Where Sub Contractors are to be used, they must first be approved by the Contract Administrator.

1.14 SAFETY HEALTH AND WELFARE REGULATIONS

The Contractor will provide suitable safety, health and welfare measures, all in compliance with the current Safety, Health and Welfare Regulations applicable to the works.

The Contractor will be responsible for compliance by their own staff with the Health and Safety at Work Act in the works required to be carried out. Health and Welfare measures in compliance with the latest relevant regulations will be provided but the Subcontractor will be expected to co-operate in maintaining these standards.

The Contractor shall notify the Contract Administrator in writing of their intention to use on site liquids, gases and other articles or materials which may endanger life or property, and shall ensure that any such equipment or materials are properly stored and handled at all times. They shall take all necessary precautions to safeguard against damage by fire or explosion, where the execution of the work may involve the presence of flames or sparks.

Petroleum products and other inflammable or vaporising liquids shall only be used in accordance with the regulations applicable to the storage and use of those products.

When equipment and vessels which contain flammable liquids or gases are not in use, they shall be removed to a safe place of storage.

All materials, plant and equipment, supplied, used, and installed on site, shall comply with all current health, safety and welfare legislation. Any additional cost incurred to ensure compliance shall be deducted from the Contractor's account unless otherwise agreed by the Contract Administrator.

1.15 WORK IN OCCUPIED AREAS

Where work is to take place in occupied areas or where work of noisy nature is to take place, prior arrangements must be made with the Client via the Contract Administrator with regard to accessibility and acceptable times.

1.16 INSURANCE

The Contractor must insure in respect of their liability at Common Law to their employees whilst engaged upon work in fulfilment of the Contract.

The Contractor should also hold insurance's to comply with the requirements of the Main Contract. The cover required for insurance's shall be as stated in the Appendix to Main Form of Contract.

1.17 DELIVERY AND CONSTRUCTION PROGRAMME

The Contractor shall agree a detailed programme with the Contract Administrator at the earliest possible date. The programme shall include delivery dates of all goods and materials vital to the

programme. Evidence shall be provided that the Contractor has checked with their suppliers, including nominated suppliers that such goods and materials can be made available at the required time.

Any discontinuity of the Contractor's programme arising out of compliance with client's requirements regarding the execution of the Works in such sections and such periods of time as may be required by the client will be deemed to have been taken into account by the Contractor when tendering.

Continuity of work cannot be assured in any one area, and the Contractor shall account for this in their tender.

The responsibility of preparing an accurate and practicable programme and for complying with it rests entirely with the Contractor, but two copies of the programme shall be submitted to the Contract Administrator for their information as soon as it has been agreed.

The Contractor shall arrange for a qualified representative to be present at all site meetings. They shall submit to the Contract Administrator detailed progress report covering the erection of all equipment and materials included in the Contract.

1.18 SCHEDULE OF QUANTITIES AND RATES

The Tenderer shall furnish to the Contract Administrator for approval within ten days of being requested to do so, three copies of the Schedule of Quantities and Rates upon which their tender has been based. The Schedule shall detail quantities and rates for all works in accordance with the Standard Method of Measurement, 7th edition (metric), authorised by agreement between the Royal Institute of Chartered Surveyors and the National Federation of Building.

The submission of such a schedule will not necessarily imply that the tender will be accepted.

The schedule shall be fully priced and totalled to the original Tender Price. It shall be used only for the pricing of Variation Orders.

1.19 VARIATIONS AND OMISSIONS

The Contractor shall not alter any of the Works except as directed in writing by the Contractor Administrator.

Variations shall be carried out at the discretion of the Contract Administrator, Measured Day Work rates described hereinafter, or as a supplementary quotation agreed in writing with the Contract Administrator

The Contractor's quotation shall be prepared within 14 days after the Contract Administrator's variation order being issued or 14 days after the Contractor has completed the variation works. Failure to produce a quotation in the above timescale shall deem that no extra cost variations shall apply or be approved.

The value of materials used shall be ascertained on the basis of the actual nett cost to the Contractor of the material used, after deducting all trade discounts, rebates, allowances and discounts.

Vouchers for labour engaged on, and materials used on Day Works, shall be presented for signature to the Contract Administrator or their representative at the earliest possible date, and copies distributed by the Contractor to the Contract Administrator and Architect.

The Contractor shall cost all time sheets within one week of issue and supply the Contract Administrator with three copies so that a Variation Order can be issued.

1.20 DAY WORKS

Day works shall not be undertaken without the written sanction of the Contract Administrator.

Charges in respect of Day Work shall be based on the Prime Cost of work plus percentage additions, as set out by the tender in Appendix to the form of Tender. Prime Cost shall be calculated in accordance with "Definition of Prime Cost of Day Work carried out under a Building Contract" current at the date of tender.

The Tenderer shall enter in the appropriate Appendix to the Form of Tender, the rates for labour and the percentage additions to fares and allowances, as well as the materials relating to Day Works at the time of tendering.

The rates for labour in Day Work shall be based on the Nett rates of wages plus travelling time where applicable, provision and use of all plant excluding scaffolding; tools, supervision by foreman and/or office staff; liabilities as labour employer; bonus schemes; working overtime; insurance, holidays with pay; overhead charges and profit.

(Fares and allowances shall be defined as the nett cost of such excluding travelling time).

1.21 GUARANTEE AND MAINTENANCE

The whole of the work called for in this Specification and Schedule shall be guaranteed for twelve months against defect in material or workmanship proved to be due to the negligence of the Contractor, such guarantee to date from the day of completion of the Contract. The Contractor shall reinstate at their own expense to the satisfaction of the Architect any such defective work discovered within the period of the guarantee following notification in writing, and shall commence such remedial works within 24 hours of notification. Defects or damage that are not rectified within a reasonable time will be considered as failure to comply with the Contract and retention monies will be withheld.

Materials and equipment supplied and fixed by the Contractor but not of their manufacture shall be guaranteed to the extent given by the manufacturer or supplier.

Notwithstanding the Contract Conditions, all equipment normally guaranteed for a time beyond the termination date of the defects liability period for this Contract shall be held to remain under guarantee for the maximum period.

The Contractor, in quoting for a specific piece of equipment or apparatus, whether specified herein by name, or whether a make selected by the Contractor, shall be deemed to guarantee its satisfactory performance under all working conditions which may be encountered and for the guarantee period which will extend until the end of the Defects liability Period. The Contractor shall be responsible for any defects and maintenance needs which may arise during this period.

1.22 RESPONSIBILITY

The Works shall be carried out under the direction of the Contract Administrator. The Contractor shall be responsible for the completion of the Works to the satisfaction of the Contract Administrator as regards workmanship, materials, execution and designed performance.

Up to the date of practical completion the Contractor shall supply such supervision as may be necessary to maintain the Works in good condition.

1.23 MATERIALS AND WORKMANSHIP

All materials used shall comply with the appropriate British Standards where such apply, and as detailed elsewhere in this Specification. Particular note shall be taken of the List of Prohibited Materials.

The words "equal approved" or "other approved" shall mean any make of equal quality of materials but the use of such alternative make of materials must be approved by the Contract Administrator in writing.

The whole of the work shall be carried out in a straightforward manner by competent workmen under skilled supervision.

The Contract Administrator shall retain authority to reject any work they may consider unfit and to have any portion of the work taken down, removed or undone which they may consider executed in any unworkmanlike manner or with improper materials.

The Contractor shall include for submitting for approval, samples of materials and goods when called upon to do so. All such samples shall be representative of the quality of the materials and goods intended to be used in the contract works.

Should the Contractor at the time of tendering wish to submit the names of any alternative firms or products to those specified, they may do so giving details of the effect of each on their tender. Failure to do so will prevent consideration of alternatives at any subsequent time, but in all cases tenders will be deemed to include the firms or products specified.

1.24 MATERIALS

The Contractor shall provide all materials, equipment, tools and implements, and shall on completion of the Works, remove all surplus materials and all equipment, tools and implements, and make good or reimburse the Employer for any damage caused to the building fabric or services during the execution of the Works.

Rubbish and waste materials shall be cleared to a central point for removal by the Contractor.

All materials supplied and/or work carried out shall be the best of their respective kinds, and the Contract Administrator shall be at liberty to order the removal and replacement of any faulty or inferior material supplied or work executed.

1.25 APPROVAL OF MATERIALS

The Contractor shall have the Contract Administrator's approval in writing before ordering materials specified as to be of 'approved make'. Samples shall be submitted as required by the Contract Administrator.

1.26 WORKMANSHIP

Unless stated otherwise, all areas of workmanship covered by BS or CP, whether detailed in this Specification or not, shall comply with their requirements.

All workmanship shall be subject to the approval of the Contract Administrator.

The Contract Administrator reserves the right to reject any part of the installation not complying with this Specification, and the Contractor shall carry out the necessary remedial work or replacement, free of charge, without delay to the Contract.

1.27 BRITISH STANDARDS (BS) AND CODES OF PRACTICE (CP)

All materials and items of equipment covered by the current BS, whether detailed in this Specification or not, shall comply with the material and test requirements of the particular document.

Where alternatives are permitted by the BS and this Specification does not identify the option required, the most durable materials shall be used and the most onerous set of tests shall be applied.

1.28 LABOUR, MATERIALS AND COMMISSIONING

The work shall comprise the whole of the labour and all materials necessary to form a complete installation and such tests, adjustments and commissioning as are prescribed in subsequent clauses and as may otherwise be required to give an effective working installation to the satisfaction of the Contract Administrator.

1.29 SUPPLIERS

The Tenderer shall submit with their tender a detailed list of supplier's names and addresses for materials and equipment they propose to purchase for the execution of the works.

Each supplier must be willing to admit the Contract Administrator/Engineer to their premises during normal working hours for the purpose of inspecting and testing the materials and equipment offered:

All materials and equipment shall be new.

1.30 SAMPLES

The Contractor shall, prior to placing orders, provide manufacturers' samples as requested.

1.31 COMPLETE INSTALLATION

The words 'complete installation' in the above clause shall mean not only the major items of plant and equipment conveyed by this Specification, but all the incidental sundry components necessary for the complete execution of the works and for the proper operation of the installation, with their labour charges, whether or not these sundry components are mentioned in detail in the tender documents issued in connection with the Contract.

1.32 PAYMENT

Payments will be made on an interim basis.

The Contractor shall present their application for payment to the Engineer giving full details of their claim with works executed and materials delivered to site.

The issue of a certificate of advice by the Engineer will not prejudice their subsequent approval or disapproval of any part of the Works.

The Contract Administrator will advise the Client concerning correctness of valuation of Works executed, and whether materials unfixed on site are not premature and have been adequately stored.

1.33 NEW TAXES AND DEVALUATION RECOVERY

The Contractor shall comply with all instruments contained in Clause 31 of the Main Contract, i.e. "Finance (No.2) Act 1975 Statutory Tax Deduction Scheme.

Should any extraordinary tax, levy or other charge be imposed by statute, other regulation or other Government instrument, or devaluation upon any plant appliance, cable or other materials during the contract period or any extension of the contract period resulting from the Contractors being prevented from/or delayed in progressing with the Contract works for any reason other than the Contractor's own default, all extra expenses thereby incurred shall be added to the Contract.

1.34 TEMPORARY WORKSHOPS

The Contractor shall, at their own expense, provide and erect all necessary workshops, sheds, or other buildings for their employees and workmen, at such places on site as may be appointed by the Main Contractor who will give all reasonable facilities to the Contractor for such erection.

The Contractor shall be fully responsible for the safe and dry storage of all equipment, plant and materials required for the Contract.

No equipment will be allowed to be deposited other than in the stores etc., except as may be agreed with the Main Contractor and the Contract Administrator. The Stores, Workshops etc. shall be removed as soon as the work is completed, leaving the site in an orderly condition.

1.35 ELECTRICITY/WATER

Electricity and Water should be assumed to be available on site and to be provided by the Client for the purposes of the Main Contract unless stated elsewhere.

1.36 INTERRUPTION OF SERVICES

The Contractor shall not, without the permission of the Contract Administrator interrupt or interfere with the operation of existing services such as gas, water, electricity, buried cables, sewers, drains etc., and in the case of works of Statutory Authorities or Private owners, without the permission of such Authorities or Owners.

The Contractor shall be fully responsible for any damage caused and shall make good any damage to the satisfaction of the Supervising Officer, Authorities or Owners as the case may be.

1.37 SITE ORGANISATION

The Contractor shall designate a senior member of their office staff to be the "Contractor's Representative". Such a Representative shall be an experienced and competent engineer, duly authorised to co-ordinate the Works, maintain liaison with the Contract Administrator and other parties, attend progress meetings, and generally represent the Contractor on all aspects of the Contract.

The Contractor shall, throughout the duration of the Contract, maintain an adequate Drawing Office with staff for the timely preparation of all drawings required for the Contract.

The Contractor shall, throughout the duration of the Contract, keep at least one fully competent qualified site engineer.

Any directions or instructions given by the Contract Administrator to the Contractor's Representative or the site engineer shall be deemed to have been given to the Contractor.

None of the foregoing staff shall be removed from their respective duties without the prior approval of the Contract Administrator. In the event of any of them being, in the opinion of the Contract Administrator and/or the Main Contractor, unsatisfactory or misconducting themselves, they shall be removed forthwith and be replaced by other suitably qualified to the Contract Administrator's satisfaction.

1.38 HOURS OF WORKING

The Tenderer shall include in their Tender for the difference in cost between the basic hours per week fixed by the National Agreement, and hours which they may agree with their operatives. The Tenderer shall include for such hours of working as may be necessary to comply with the programme laid down, and shall state the number of hours per week included in their Tender.

1.39 OVERTIME

Overtime shall be hours of work in excess of the basic normal working hours, as stipulated in the main contract documents and any specific amendments. Only where the Contract Administrator has specifically instructed in writing extra costs to be incurred in respect of overtime, shall the extra costs be included in the Contractor's account.

No addition of the contractor's Profit or Establishment Charges based on extra costs of overtime shall be made in the Contractor's final account.

All claims under this condition shall be recorded in triplicate and submitted weekly by the Contractor for signature by the Clerk of Works or other representative of the Contract Administrator. Such sheets shall show separately the actual hour's worked and non-productive time.

1.40 LABOUR

The Contractor shall supply all labour necessary for the proper execution of the Works.

The Tenderer shall include in their price for any extra costs of importing labour (including higher rates of wages), travelling time, fares, subsistence, lodging facilities and payments in connection with the operation of bonus schemes, as well as the cost of non-productive overtime involved in executing and completing the Works.

1.41 PARKING

It should be assumed that car parking is available on site.

1.42 TRADE CUSTOM

The Contractor shall be responsible throughout the contract for ensuring that the trade custom and local practice is followed in the employment of the appropriate grade of operatives. Not more than one apprentice or semi-skilled mate shall be employed for each full rate tradesman.

1.43 ROYALTIES

The prices quoted by the Tenderer shall include any patent royalties which may be legally expendable in respect of any articles, systems, processors or inventions included in their Tender.

The Tenderer in accepting the Contract shall accept full responsibility from all claims in respect of patent royalties.

1.44 FACILITIES BY MAIN CONTRACTOR

Welfare facilities normally provided by the main contractor shall be deemed to be included within the Contractor's Tender unless specifically specified otherwise in other Contract Documentation.

1.45 FINISHES

Where particular methods of finish and painting are not specified elsewhere, the following requirements shall be met:

(i) All metalwork shall be adequately protected against corrosion and oxidation.

(ii) All frames, cladding and the like, of mild steel construction shall be thoroughly cleaned to remove all scale, rust, oil and grease before painting, and treated with a rust inhibiting solution. One coat of metallic primer shall then be applied followed by two coats of oil bound enamel paint to BS 381C, colour to be approved.

(ii) Parts which are normally plated shall be heavily plated in hard chromium finish or parkerised, whichever is the more suitable. Cadmium or tin zinc plating will not be accepted.

1.46 FINISHES' DAMAGE

Any damage to finishes on equipment and plant after leaving the manufacturers' Work shall be made good immediately as follows:

(i) Where a metal coating is damaged, it shall be cleaned to the parent metal and coated with a zinc rich epoxy (Armour 1527), or alternative approved by the Contract Administrator.

(ii) Damaged areas of paint work shall be repaired locally by cleaning to bare metal repainted using the complete paint system previously applied.

1.47 SITE PROTECTION

Electrical equipment, or equipment with electrical component parts, shall be delivered to and stored on site with vapour-proof protection.

Equipment or component parts of equipment specifically designed to operate in normal room conditions, shall be delivered to and stored on site with a suitable waterproof protection.

Where a piece of equipment or an appliance comprises more than one part, the pieces shall be separately packed and be clearly identified on the outside with the manufacturer's name and component reference.

Particular care shall be taken to ensure that all factory applied finishes which are designed as visible finished surfaces, are adequately protected whilst stored on site.

Particular care shall be taken to protect component parts specifically designed to act as heat transfer surfaces. These surfaces all have purpose designed packing to protect them whilst in transit or stored on site.

Valve ports, pump inlets and outlets and similar equipment shall be completely covered to prevent ingress of foreign matter and flanges shall be additionally protected against damage to the flange surface.

1.48 PROTECTION

The Contractor shall be responsible for the protection of their work during and after erection.

1.49 PACKING AND DELIVERY

All packaging materials, delivery and unloading charges shall be included in the tender price.

All installation materials, component parts or complete items of equipment, shall be delivered and stored on site in boxes, crates or containers, suitably designed and constructed to give protection against transportation and handling damage. The packaging shall also be weatherproof.

All plant equipment and appliances shall be delivered with the manufacturer's name and a description of the contents on the outside of the packing.

All installation materials shall be packed and secured in a manner to avoid damage and facilitate the checking of quantities.

Materials and equipment shall be stored on site in a sequence to facilitate easy access.

All equipment and materials shall be delivered to site in accordance with the requirements of the programme.

It shall be the Contractor's responsibility to examine all materials and equipment, supplied under their Contract, on delivery to site. The Contractor shall replace, at their own cost, any such material or equipment which is damaged or faulty.

1.50 DRAWING CO-ORDINATION

The Contractor shall include for co-ordinating their own working drawings with those of the other Contractors, the major control and HVAC plant panel suppliers, the automatic controls supplier and any other suppliers drawings which are relevant to the complete system. They shall ensure that these drawings are compatible and correctly annotated and cross-referenced at the interfaces.

1.51 INSTALLATION WORKING DRAWINGS

The Contractor shall, before the relevant work proceeds, prepare and submit for the approval by the Contract Administrator/Engineer detailed installation working drawings based on the Contract Drawings. They shall take into account any modifications either to the building or the installation which may have taken place, incorporating details of the actual items of plant and equipment to be installed.

The Contractor shall similarly prepare all necessary schedules of equipment, and necessary wiring diagrams, including internal diagrams for items of electrical equipment and diagrams showing the interconnections between different items.

It shall be the responsibility of the Contractor to verify the accuracy of all dimensions abstracted from the Architect's/Engineer's drawings in the preparation of the installation working drawings.

Installation working drawings shall be prepared by the Contractor and submitted to the Contract Administrator for approval in duplicate, allowing sufficient time for the approval process without affecting the Contract Programme. Such approval shall not relieve the Contractor of the responsibility for the accuracy of installation details, discrepancies, errors or omissions. Any required amendments shall be carried out by the Contractor at their sole expense and the drawings resubmitted to the Contract Administrator/Engineer for approval.

The drawings required shall include the following:

(i) Builders Work Drawings
fully dimensioned showing plant bases, floor ducts, floor chases, sumps, drains all holes in the structure, horizontal and vertical enclosures and other information that may be required and mentioned elsewhere within the Specification.

(ii) Detailed Engineering Drawings
fully dimensioned for all Electrical Switch Rooms and Equipment Rooms, Boiler Rooms, Calorifier Rooms, Ventilation Plant Room, Tank Rooms and all other areas having engineering plant and which form part of this Contract.

(iii) Ductwork Manufacturing Drawings
fully dimensioned and detailed showing all plain and reinforced cross joints either socket and spigot or angle flanged, bend radius, tees, turning vanes, expansions, contractors, splitters, branches, dampers fire/smoke/regulation, supports etc., all designed in accordance with the relevant Section of the Specification.

(iv) Pipework Fabrication Drawings

provided where it is necessary to pre-fabricate sections of pipework off-site and shall be fully dimensional.

(v) Wiring Diagrams
provided of all control panels, starter panels and remote equipment shall detail the diagrammatic layout with cable sizes and terminal references and circuit numbers, and panel facia layouts shall provide full information upon the face mounted equipment including isolation and door arrangements.

(vi) Equipment Drawings
provided for all items of plant and equipment, giving clear indication of electrical details and duties etc.

(vii) PHE Drawings and Details
fully dimensioned showing depths and "cuts" of trenches, positions of all holes through ground beams, footings, walls, floor slabs, balconies and roofs, together with details of all air vents and rainwater outlets through roofs, location and size of all access panels and fixing details for all pipework and traps etc.

fully dimensioned drawings of all cold water mains, cold water down services, hot water secondary services, overflows, soil and waste pipes, sprinkler pipework and dry risers.

(viii) Electrical Drawings and Details
fully dimensioned showing panel layouts for LV, Switchgear, wiring diagrams of Specialist systems, fire alarms, call and communication systems, cable tray routes and layouts indicating the method of installation of cables as per Table 4A of the IET Regulations, trunking routes detailing sizes and percentages capacity of cables within trunking.

All working drawings issued by the Contractor shall take into account any modifications to the building or to the installations which may have taken place, and shall be correctly related to the detail of the actual items of equipment and plant to be installed.

1.52 DRAWINGS, MANUALS AND SAMPLES

The cost of all drawings, manuals and samples prepared and supplied by the Contractor shall be included in the tender price.

Layout, construction and installation drawings shall be drawn on A1 sheets and details may be produced on A4 sheets. In addition to the project title and the Architect's and Engineer's name and address each drawing shall include the Contractor's name and address, a unique drawing number, drawing title, scale and date.

All technical approvals and appraisals shall be in writing, and the Contractor in their programming shall allow a minimum period of twenty-one days, or an otherwise agreed period, for such approval or appraisal of drawings and samples. Equipment shall not be ordered before drawings have been approved.

Where drawings are submitted for appraisal or technical approval a minimum of three copies of each drawing will be required. Only one copy will be returned with comments.

If additional noted copies are required the Contractor shall be responsible for marking up the necessary copies.

In the event of non-approval of the original submissions, the Contractor shall allow an additional fourteen days in their programme for re-submitting the drawings.

After appraisal or technical approval has been given and before any items are despatched, complete sets of all drawings, as approved or revised to meet approval requirements, shall be distributed via the Main Contractor to the Architect/Engineer.

ALL Architects', interior designers' and structural drawings must be carefully examined before the Contractor completes their working drawings.

1.53 MANUFACTURER'S DRAWINGS

The Contractor shall, prior to the placing of orders, forward to the Architect/Engineer, manufacturer's drawings indicating the principal dimensions and operating all-up weight of the items of plant and equipment.

All installation drawings shall be provided and submitted for approval in duplicate allowing sufficient time for the approval process without affecting the Contract Programme. Upon return of the approved information, any modifications shall be made and (6) copies forwarded for distribution.

1.54 DUCTWORK DRAWINGS

The Contractor shall, prior to commencing manufacture, submit to the Architect/Engineer for technical appraisal manufacturers' shop drawings of the ductwork to be supplied and erected under the terms of the Contract to a scale of not less than 1:20.

Ductwork shop drawings shall indicate the length of each duct section, the internal dimensions of the bare sheet steel, dimensions of bends and fittings, location of stiffeners and supports and shall dimensionally locate the ducts in relation to the supporting or any adjacent structure.

1.55 AUTOMATIC CONTROLS DRAWINGS & WIRING DIAGRAMS

The Contractor shall include for producing plant schematics showing the control layout, with each item identified, and including a brief description of the controls operation and associated interlocking.

The Contractor shall include for producing logic sequence and wiring diagrams, showing the connections of all items of electric control equipment and interlocking details as defined on the plant control schematics.

Switchgear, Starter and Control/Instrumentation Panels

The Contractor shall provide mechanical drawings showing the construction, external and internal layouts of panels and widths diagrams comprising internal wiring, schematics of interlocking and external wiring diagrams, for the complete systems in the panels. The drawings shall also show all pipework and capillary connections from the panels to external equipment.

Progress Drawings

The Contractor shall arrange for a full set of white prints of installation drawings to be kept on the site showing the progress of all work in connection with the Contract. Such prints shall be kept up to date and all conduit, cable, pipe, trunking and duct runs, positions of equipment and apparatus shall be recorded on the drawings as they are installed.

The progress drawings shall be available for inspection at any time by the Contract Administrator or their appointed representative.

The Contractor shall include for their representative to keep a diary recording the progress of the works and details of all instructions received. The diary shall be at the disposal of the Contract Administrator/Engineer as and when required.

1.56 CO-OPERATION WITH OTHER TRADES

The Contractor shall acquaint themself with the general arrangements of all services and ensure that in fixing their work it will not obstruct the fixing or future maintenance of any other services. They shall fully co-operate with all other trades and take all other reasonable precautions to ensure that their progress does not impede the progress of others.

1.57 SETTING OUT

The positions of equipment etc., indicated on the drawings, are given for tendering purposes and the exact position will be decided during the Contract period. The Contractor's price shall include for any minor modifications that may be necessary.

The Contractor shall allow for setting out and shall be responsible for the correctness of the positions, levels and dimensions of the whole of their works on site.

The Contractor shall be responsible for taking all their own dimensions on site, checking runs and levels and marking out for builders work and shall allow for such in their tender.

Any unnecessary work carried out by the Main Contractor due to inaccuracy of the Contractor's drawings, dimensions, or marking out shall be paid for by the Contractor.

Where detailed drawings do not form part of this Specification, the Contractor shall ensure that the setting out of plant and equipment permits it to fit into the space allocated and allows access for maintenance and replacement purposes.

1.58 SETTING OUT SUB-CONTRACT WORKS

The Contractor will be responsible for the setting out of the sub-contract works.

All setting out and site measurement shall be carried out for the erection of all materials on site, making any modification in detail as may be found necessary during the progress of the Works, submitting any such modifications or alterations in detail to the Contract Administrator before proceeding and must allow in their Tender for all such modifications and for the provision of any drawings related thereto.

1.59 BUILDERS WORK

The Contractor will be responsible for providing all builders work in association with the installations.

Drilling and plugging of walls, floors and ceilings for the fixing of equipment shall be carried out by the Contractor, who will be held responsible for any damage to the fabric of the building. The Contractor will provide and install all necessary fixing points, i.e. 'noggins' in whatever quantity and material is required to suit the particular item of equipment to be secured, whether it be suspended from the ceiling, bolted to the wall or floor.

The methods adopted shall be agreed by all other interested parties, but in general will be applied as follows:

(a) Where builder's work is to be formed, drawings shall be provided.

(b) Where builder’s work is to be cut, it shall be marked on site.

The Contractor shall be responsible for the accuracy of the information they provide and shall be liable for the cost of correction of any errors in such information they provide.

All builders' work drawings shall be submitted to the Contract Administrator for approval before issue to site. Notwithstanding the Contract Administrator having given approval to proceed, this shall not absolve the Contractor of their responsibility in Contract to ensure that the detail given is correct.

The Contractor will be responsible for all unloading, loading, storage and craneage.

1.60 LOCAL REGULATIONS, NOTICES, FEES

The Contractor shall conform to the provisions of all relevant Acts of Parliament, Building Regulation, British Standards, IET Regulations, British Gas Regulation, the Regulations and Bye-Laws of any Local Authority, Fire officer or Insurance Office, the requirements of the Health and Safety at Work Act, and all other relevant requirements.

The Contractor shall be responsible for giving all necessary notices and for payment of all fees due to Local and Statutory Authorities.

1.61 SATISFACTION OF AUTHORITIES

All parts of the installation shall, where applicable, be to the complete satisfaction of the Architect/Contract Administrator, all Local Authorities, all Statutory Authorities and Fire and Petroleum Officers, and shall be in strict accordance with all bye-laws, rules and regulations of such authorities.

1.62 PUBLIC UNDERTAKINGS

The Contractor shall ensure that, where applicable their work and any materials used in the execution of the works in accordance with this Specification, comply with the requirements of the particular supply undertaking.

The Contractor shall, where necessary to comply with regulations, inform the supply undertakings of the proposed works and to obtain from them any written approval that may be required.

The Contractor shall make any arrangements that may be necessary to allow the connection of the new works to the undertaking's supply network. All costs shall be allowed for in their Tender.

The Contractor shall submit to the supply authority any materials for testing that the undertaking may require. The Contractor shall provide the Architect/Contract Administrator and Main Contractor with a copy of all correspondence, test certificates etc., in connection with the above.

1.63 TV INTERFERENCE

All apparatus, where the normal operation is such that interruption of low frequency or direct electric currents occurs, shall be fitted with means for suppressing the radio and TV interference frequencies so caused.

1.64 RADIO INTERFERENCE

The equipment and methods to be used in determining the level of radio interference shall be as specified in BS 727 and the limits of interference shall in all cases be those specified in BS 800: Part 1.

1.65 COMMON FITTINGS

Any items, fittings or accessories which are used in quantity, shall in each case be the product of one manufacturer and shall be used only for the service recommended by that manufacturer.

1.66 ASBESTOS

The Contractor shall ensure, prior to commencement of work, that the locations of any existing asbestos products that may be affected by the Works have been identified and that the Contract Administrator has been fully notified.

Initial inspection, however, may not reveal all asbestos materials present, so it is important that during the course of the Works the Contractor is vigilant and if any subsequent asbestos is discovered they stop work in that area immediately and the Contract Administrator is informed so that the correct action can be taken. Any effect on the Contract Programme will be taken into consideration.

The contractor must at all times be aware of their responsibilities under the Health and Safety at Work Act.

1.67 NOISE AND NUISANCE

Noise shall be reduced to a minimum, particularly when working adjacent to occupied areas.

Smoking or the playing of radios and tape machines is not permitted in any area of the site.

Compressors, percussion tools and motors shall be fitted with effective silencers as recommended by the manufacturer.

The Contractor shall fully conform to all current noise legislation restricting noise from building sites. In particular the Control of Pollution Act 1974, Sections 60 and 61.

1.68 SAFETY OF INSTALLATION

The Contractor shall fully conform to current legislation concerning safe working both during the installation, commissioning and handover. In particular The Health and Safety at Work (Etc.) Act 1974.

1.69 VARIATIONS TO SPECIFICATION

The Tenderer must include with their tender, details of all variations from the equipment, materials, installation, performance and operation as specified.

1.70 RECORD DRAWINGS

Two weeks before completion and before the final account can be agreed and any retention released, the Contractor must provide record drawings of sufficient scale and not less than the scale of Tender drawings, and produced in AutoCAD Release 2002 with a 3½" disk or CD issued to client together with hard copy and one set to the consulting engineer.

These drawings shall show in sufficient detail the precise installation installed including all amendments and variations.

These drawings shall be submitted in print form for approval, after which good quality film negatives and four sets of prints shall be handed to the Contract Administrator in addition to computer disk.

At the distribution point, a framed schematic drawing within a plastic over film will be provided by the Contractor. The "as installed drawings" shall:

(i) Fully indicate diagrammatically each individual electric air and water system, locating all plant and equipment.

(ii) Show major items of plant system controls.

(iii) Indicate plant room layouts, with sections, to a scale of not less than 1: 20

(iv) Fully indicate with accurate dimensions, the sizes and positions of all plant, equipment, cables, pipes, ductwork, etc., together with all inspection points. Each service shall be clearly identified.

(v) Provide wiring diagrams of control panels, including thermostatic control wiring, motor control and interlocking wiring

(vi) Fully indicate with accurate dimensions, the sizes and positions of all plant, equipment, pipes, ductwork, conduits, trunking, underfloor ducting, cable tray, and cable together with all inspection points and cable joints. Each service shall be clearly identified.

(vii) The complete symbol notation used for all record drawings shall be shown on a separate drawing. The symbols used for individual record drawings shall be identified on each drawing.

(viii) The preparation of the record drawings shall proceed during the installation of the works as each section is completed. The Contract Administrator shall be allowed to inspect these drawings on request during their preparation.

(ix) On completion of each drawing it shall be modified as necessary for the Contract Administrator's/Engineer approval.

(x) In addition to the provision of the above record drawings the following shall be framed under glass and hung in Plant Rooms:

(xi) Plant room record drawings showing all plant items, with numbers, locations and duties.

(xii) Control Schematics of complete installation.

1.71 MAINTENANCE AND INSTRUCTION MANUALS

At the same time as the record drawings, the Contractor shall provide the Contract Administrator with four copies of the Maintenance and Instruction Manual covering the following:

(i) Index of record drawings.

(ii) General description of systems.

(iii) Setting up and operating instructions for all equipment and systems installed.

(iv) Control sequence for all systems installed.

(v) The scheduled details of all equipment settings and actual valves maintained in controlled variables during commissioning.

(vi) Frequency and details of routine maintenance requirements

(vii) Manufacturers' literature, including detailed drawings and electrical circuit details, printed operating and maintenance instruction, for all specific items of equipment and plant supplied under this Contract.

(viii) Schedules of all equipment and plant stating their locations within the building, duties and performance figures. Each item of equipment shall have a unique code number, cross-

referenced with the record drawings. The manufacturer's name and address and telephone number for every item of equipment and plant shall be listed in the manual together with catalogue list numbers for replacement purposes.

(ix) Diagrammatic drawings of each system indicating the principal items of plant and equipment with the number code of each item indicated.

The diagrammatic drawings shall:

Fully indicate with accurate dimensions, the sizes and positions of all plant, cables, equipment, pipes, ductwork etc., together with inspection points. Each service shall be clearly identified.

The manuals shall be encased in A4 size, plastic covered loose leaf ring binders, with hard covers. Drawings larger than A4 shall be folded and accommodated in the binder so that they may be unfolded without being in any way detached from the rings.

The maintenance and instruction manuals shall be prepared in draft as soon as the working drawings are in hand.

Two temporary manuals with provisional record drawings shall be made available at least one month before practical completion to enable Client's staff to familiarise themselves with the installation. These should be of the same format as the final manuals with temporary insertions for items which cannot be finalised until the works are completed and tested.

Attention is drawn to the fact that the works will not be accepted as complete and that final payment will not be made for the works until the manuals have been accepted by the Contract Administrator as being satisfactory.

1.72 OPERATION OF PLANT PRIOR TO COMPLETION

The Main Contractor shall be at liberty to require the Contractor to operate the installation or complete portions thereof before the date of completion. Such operation shall not reduce the Contractor's responsibility for handing over the works in good condition on the date of practical completion, fair wear and tear accepted. Should the Contractor be so required to operate the installation or part thereof, they shall be entitled to reimbursement by the Main Contractor unless otherwise stated in the Specification.

The Tenderer shall allow in their tender for the attendance on and operation of, the whole plant for the purposes of performance testing after commissioning.

Prior to the practical completion of the installation the Client will be appointing an Engineer/Engineering Staff to undertake the operation and maintenance of the building services installation. The Contractor shall include for any necessary assistance to the Client's staff during the course of the installation to explain the purpose or function of the works.

The Contractor shall include for 2No. operating days prior to practical completion, to instruct the Client's Engineer/Engineering Staff in the day to day running of the plant and systems. The location and function of all items listed on the record schedules shall be explained and the procedures for starting up, shutting down, isolating sections etc., shall be comprehensively explained and demonstrated to the Client's satisfaction.

1.73 COMMISSIONING

The Contractor shall include commissioning the works so that they are in operational order before the Contractor submits in writing a request for inspection by the engineer and subsequent certification of practical completion.

The results of all commissioning, as well as manufacturers' equipment commissioning results, shall be forwarded to the Contract Administrator preferably prior to practical completion, if not, no longer than 7 working days after the said practical completion. The Contractor shall be prepared to demonstrate to the Contract Administrator or Employer, the validity of commissioning results at the Contract Administrator's reasonable request.

1.74 SETTING TO WORK

The Contractor shall arrange for a competent Engineer to attend site for a full day, 24 hours prior to the hand over of the Works to the Employer, and shall on that day rectify any faults and instruct the Employer in the operation of the plant.

The Contractor shall ensure that the aforesaid Engineer is fully conversant with the whole of the installation and competent to carry out adjustments and repairs to any part of the installation as may be necessary.

In addition to the foregoing, the Contractor shall be in attendance and a competent engineer of each specialist Sub-Contractor employed by them in connection with any section of the works.

1.75 FORM OF WARRANTY

The Tenderer will be expected to complete and sign the Standard Form of Warranty, in respect of the works, immediately following certification that the works are complete.

1.76 DATE OF PRACTICAL COMPLETION

The date of practical completion under the Contract shall be the date of practical completion agreed for the Main Contract, provided that the Contractor shall have previous to that date"

(a) Made, in the presence of the Contract Administrator, the tests specified or required by them.

(b) Received a certificate from the Contract Administrator that the Works are satisfactory.

(c) Handed to the Contract Administrator four copies of Operating and Maintenance instructions covering all plant and apparatus comprising the Works which, prior to their final submission, shall have received the Engineer's approval.

(d) Instructed the Employer's staff in the use and correct operation of the installation in accordance with the programme to be agreed with the Engineer.

1.77 FINAL ACCOUNT

On completion of the installation, the Contractor shall submit their final account based on the accepted figure with amendments as follows:

(a) Omission of the Provisional Sum and Prime Cost Sum, together with handling charges.

(b) Addition of Prime Sums incurred during the Contract, and Provisional Sums expended in whole or in part.

(c) Addition or deletion of the sums relating to Variations to the Contract.

(d) Addition of sums incurred through Day Work or non-productive overtime.

1.78 CDM REGULATIONS

The Contractor's attention is drawn to the 'Construction (Design and Management) Regulations 2015'. The Contractor shall provide complete information as required for proof of their compliance with these Regulations. In particular, record drawings shall be comprehensive and indicate to Owner/Tenant all cable, conduit, pipe and duct routes so as to ensure accidental contact with any service run is avoided.

1.79 SPARE PARTS

The Contractor shall submit a schedule of the spare parts that they recommend should be supplied, together with their individual prices. The parts list submitted shall be for component parts over and above consumable spares carried for routine maintenance, included elsewhere in this Specification.

1.80 MAINTENANCE DURING DEFECTS LIABILITY PERIOD

The tender shall include for any normal service and maintenance required during the defects liability period on all plant and equipment supplied under the Contract and submit an annual cost for service and maintenance from year 2 onwards.

1.81 RETENTION

A 5% retention will be applied to all Interim Payments, 2½ % of which will be released on completion of the Project including supply of As Installed Documentation and Manuals.

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SECTION 2.0

STANDARDS, MATERIALS AND WORKMANSHIP

IWA
M&E Consulting Engineers

Section 2.0 – Standards, Materials and Workmanship – Table of Contents

2.0 STANDARDS, MATERIALS AND WORKMANSHIP

2.1 GENERAL STANDARDS

Where not covered by the following clauses, the Standards, Regulations and Workmanship for the Contract Works shall comply with the following publications where applicable:

(a) DoE Standard Specification (M&E) No. 3
Heating Hot and Cold Water, Steam and Gas Installations for Buildings

(b) DoE Standard Specification (M & E) No. 100
Air Conditioning, Air Cooling and Mechanical Ventilation for Buildings

(c) DoE Standard Specification (M&E) No. 1 (revised 1985) Electrical Installations

(d) CIBSE Guides (All Parts) with current amendments

(e) British Standards and British Standard Codes of Practice published by the British Standards Institution

(f) CIBSE Technical Memorandum TM13
(Minimising the Risk of Legionnaires Disease)

(g) National Joint Utilities Group, Publication no. 1, no. 2 and no. 6

(h) Building Regulations

(i) The Current Water Fittings and Materials Directory (WRAS)

This standard section is to be read in conjunction with Specific Clauses, Section 3.0.

2.2 GENERAL REGULATIONS

The installation, materials and components shall comply with latest editions and amendments of the following, as applicable at the date of Tender, and shall incorporate such subsequent amendments as are practicable which take place during the period of the Contract:

- The Building Regulations
- The Health and Safety at Work Act
- Regulations under the Electricity Acts and Supply Regulations
- BS 7671: Requirements for Electrical Installations published by the IET (Latest Edition) incorporating amendments
- The Gas Safety Regulations
- The Water Supply (Water Fittings) Regulations 1999
- Special Regulations issued by Local Electricity, Gas and Water Companies, also the Byelaws of Local Authorities
- The Home Office Regulations under the Clean Air Acts

- The COSHH Regulations
- Statutory requirements, including the safety requirements laid down by HM Factory Inspectorate
- HSE documents: Approved Code of Practice (Legionella) - Legal 8 - (L8) and Legionnaire's Disease Technical Requirements - HSG274
- EU F Gas Regulations

2.3 GENERAL WORKMANSHIP

2.3.1 Electrical Supply

The electrical supply will generally be either 240V/Single Phase/50 Hz or 415V/3 Phase/50Hz and all electrical equipment required in connection with the Contract, which is the subject of this Specification, shall be suitable for this, unless otherwise stated.

2.3.2 Electrical Motors

The Maintenance Contractor shall provide electric motors, unless otherwise specified, suitable for use with a supply as described in the preceding Clause, headed Electrical Supply, and manufactured to the requirements of BS 5000 Part II, Part 99 and Part 17 with Class E insulation. Motors, unless otherwise specified, shall be continuously rated.

2.3.3 Radio and TV Interference

All electrical equipment shall be so designed or fitted with interference suppression devices to ensure that the limits of interference do not exceed the magnitude limits defined in BS 800. All components and filter units used for interference suppression shall comply with BS613.

2.3.4 Identification Principles

All pipework within Plant Rooms, on view, in ducts or in roof spaces, shall be identified by colour banding, directional flow arrows and relevant text in accordance with BS 381C and BS 1710 around the complete circumference of the pipe.

All valves, stopcocks or dampers shall be fitted with a circular, non corrosive ivorine identification disc with black lettering on a white background and shall be cross-referenced to a Valve Chart or Record Drawing on display within the Plant Room. Discs should be a minimum of 25mm diameter and secured with a brass ring and chain.

Items of Plant or equipment shall be fitted with a rectangular identification plant securely fixed and all Pumps and Fan Motors should be fitted with a manufacturer's label showing equipment type, electrical details and speed.

2.3.5 Machine Guards

All machine guards shall be in solid sheet metal or wire mesh in iron frame, all galvanised after manufacture, and shall be so designed with hinges and/or removable sections to allow for testing and maintenance. All guards shall be free from vibration.

2.3.6 Holding Down Bolts

All machinery plant and equipment shall be securely fixed by holding down bolts properly grouted in to bases or other parts of the structure.

2.3.7 Anti-Vibration

All machinery plant and equipment shall be installed such that no vibration is transmitted to the building structure which may cause disturbance or annoyance to the occupants.

2.3.8 Installation of Equipment

All equipment must be installed strictly in accordance with the manufacturer's written instructions, notwithstanding any Clauses in this Specification which may be contradictory.

2.3.9 Spares

The Contractor shall include for the provision of one complete set of all consumable spares and one set of tools required for the on-going maintenance of the Works as listed in Section 3.0.

2.4 HEATING SERVICES INSTALLATION (GENERAL)

2.4.1 Boilers

All heating boilers shall be installed strictly in accordance with the manufacturer's installation instructions and to the Regulations as set out in the relevant British Standard and Gas Regulations ruling at the time of installation.

2.4.2 Boiler Mountings

All Boilers should be complete with the following mountings:

Control and High Limit Thermostat

Flow Thermometer (100 mm dial gauge) ^{o}C

Return Thermometer (100 mm dial gauge) ^{o}C

Altitude Gauge with 100 mm diameter dial, calibrated in Bar, hand set, red pointer to indicate static head, black indicating pointer and control cock.

Spring loaded NABIC type safety valve, with padlock and key, suitable for Boiler capacity, set to discharge at 0.1 Bar above the boiler operating pressure and complete with full bore discharging pipe terminating 150 mm from finished floor.

Note: Where Boilers are not connected to an open vent system (refer to BS 6644 : 1991)

Hose union drain cock and key

2.4.3 Flues (Gas Firing)

Gas Fire Boilers shall be provided with heavyweight cast iron or stainless steel flue pipe.

The flue discharge provided by the manufacturer must not be modified in any way.

2.4.4 Flues General

All Boiler flues shall be adequately supported such that the Boiler does not bear any weight with clean out doors provided and a 15mm plugged tapping for flue gas sampling

When a flue pipe enters a brick chimney, a metal sleeve, 25mm larger than the flue pipe diameter, for building in should be installed. The space between the sleeve and the flue pipe should be caulked to a depth of at least 50mm with fire proof rope.

Flue pipes must always be installed with an upward incline towards the main flue header or chimney and 90 deg. bends fitted directly to the Boiler flue outlet will not be allowed.

2.4.5 Open Vents

An open vent pipe shall be taken from each Boiler and if two or more boilers are to be installed, the individual open vents are to be linked into a common vent pipe through three way cocks to prevent operating Boilers being isolated from a free outlet.

The open vent must rise to terminate over the Feed and Expansion Tank with an open end and must rise to a sufficient height above the Tank water level to prevent water discharge.

2.4.6 Feed and Expansion Tank

The Heating Installation shall be provided with a Feed and Expansion Tank of a nominal capacity, large enough for the expansion of the Heating System, as generally indicated on the CIBSE Guide 1986, Tables B1:76. The Tank will be provided with a loose cover through which the open vent must terminate above the water line.

The Feed and Expansion Tank must be fitted with the following:

Ball valve with adjustable copper float to BS 1212 and Stopcock
Cold Feed connection without an isolating valve
Overflow pipe discharging to an approved position
Hose union drain cock
The Tank shall be fully in accordance with the latest Water Byelaws and Regulations.

2.4.7 Sealed System Expansion Vessels

Where heating systems cannot be naturally vented, a sealed system expansion vessel should be installed. The expansion vessel capacity must be sized to the total volume water content of the heating system with a direct feed mains with make up comprising pump pre-wired to a control panel, break tank with ball valve, switch fuse starter, high and low pressure switches, pressure reducing valves, pressure gauge, system isolating valve and draincock, all mounted on a baseplate and frame. The system side of the sealed expansion vessel must be fitted with a pressure safety valve air separator and air eliminators, as necessary.

2.4.8 Circulating Pumps

Each pump must be fitted with a plate indicating Manufacturer's name, motor horsepower, speed, voltage, current, FLOW RATE AND HEAD.

All pumps must be fitted with a test point on the suction and discharge port such that the head developed can be measured.

Pumps must be mounted strictly in accordance with manufacturer's instructions on suitable bases or supports. The Contractor must provide all necessary anti-vibration materials or mountings and ensure no noise or vibration is transmitted to the structure or through pipework

Each pump or pump set (where twin head pumps are used) shall be complete with suction and delivery isolating valves and a non return valve in the delivery line.

2.4.9 Radiators

Radiators shall be installed with a minimum of clearance of 150mm above floor level and 40mm clear of walls and supports, and be mounted on the manufacturer's recommended brackets.

All radiators to be fitted with a thermostatic or wheel valve on the flow, a lockshield valve on the return, and a key operated air vent plug cock.

Positions and heights of all radiators must be confirmed on site, but under no circumstances must radiators be installed to project above windowsills or abut any obstructions.

2.4.10 Fan Convectors and Unit Heaters

Fan convectors shall conform to BS 4856, Part 1 : 1972 (1983) and shall be complete with cabinet, heater element, unit motor fan assembly and thermostatic control. Additional speed and low water temperature cut off controls shall be supplied, as required.

The heating duties shall be based upon "low speed" ratings.

Unit heaters shall be complete with heat exchanger, steel casing, fan and motor, discharge louvres, guard and control gear.

The heater shall be thermostatically controlled, either individually or in groups, by a room thermostat. Additional night thermostat and time switch controls shall be supplied, as specified.

All fan convectors shall be fitted with straight pattern wheelhead and lockshield type isolating valves on the flow and return connections respectively within the unit casing.

2.4.11 Natural Convectors

Natural convectors shall be installed strictly in accordance with manufacturer's instructions and, where low level "cill-line" or "wallstrip" type is specified, will follow the contours of the building, including all necessary jointing strips, cover plates, valve boxes etc., to ensure a continuous profile.

If Finned Tube Elements are used, either with a standard or custom made cover, they must be protected from damage during installation by a rigid casing.

Each Natural Convector or section of Finned Tube Element shall be fitted with suitable wheelhead and lockshield isolating valves on the flow and return connections respectively.

Where Finned Tube Elements are served from a continuous single pipe or two pipe circulation union connections will be provided between each section.

2.4.12 Air Vents

All pipe coils, convectors and continuous convectors, shall be fitted with 1/4 inch air cocks, unless specified differently. Air bottles, where shown on the drawings, are to be formed from 152mm length of tube or equal bore to the pipe which is being vented, with 1/4 inch welded into tope and taken to low level, and fitted with 1/4 inch lockshield needle valve to Winn Fig 1650 screwed pattern.

All air vents shall be readily accessible. They shall not be concealed.

All convectors, continuous convectors, forced air heaters and concealed radiators shall have air outlet points accessible.

2.5 PUBLIC HEALTH SERVICES

2.5.1 Standards

Standards of particular relevance are:

BS 6700	Design installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages.
BBA	Information Note 33 - Unvented Hot Water Storage Systems - Hot Water Discharges from Safety Devices. BBA Requirements and Guidance.
BBS5588	Fire Precautions in the design, construction and use of buildings.
BSEN12056-2	Gravity Drainage Systems inside buildings (sanitary pipework).

BSEN12056-3	Gravity Drainage Systems inside buildings (roof drainage).
BS8301	Building Drainage.
BS 1710	Labelling of pipework.

2.5.2 External Underground Water Pipes

Shall be laid as part of this contract in a trench excavated and backfilled by others. Blue plastic marker tape with metallic insert shall be provided as part of this contract but laid by others.

2.5.3 Water Meters

If as detailed elsewhere in this specification provision of a water meter is required this shall be of the pulsed output type capable of being interrogated by the building's BMS System.

2.5.4 Trace Heating

Hot water pipework trace heating shall be provided where specified in Part 3 and/or drawings.

Anti Frost Trace Heating shall be provided to all domestic and fire water service pipes exposed to external temperatures (except where the Engineer gives written approval for its omission).

Insulation standards shall comply with the trace heating manufacturer's requirements where these are to a higher standard than those listed in 2.10 of this specification.

2.5.5 Pipe Risers

Pipe Risers shall have a load bearing bracket support on each floor.

2.5.6 Fire Sleeves

Plastic pipes which penetrate fire barriers shall be fitted with intumescent sleeves or equal to comply with Building Regulations.

2.5.7 Roof Penetrations

Shall have cravats provided as part of these works.
SVP's shall have wire or plastic guards fitted.
Rainwater outlets shall have leaf guards fitted.

2.5.8 Isolating Valves

Ballofix type valves shall be provided on each branch to individual appliances and also to each branch supplying a range of appliances. Valves shall be of the type which allow for insert of flow restrictors or other items i.e. Cottam & Preedy CP961 or approved equal. Where space permits lever operated valves shall be fitted and where not, screwdriver operated type shall be used.

2.5.9 Balancing Valves

Shall be included as required on HWSR circuits by the Contractor to achieve adequate flow.

2.5.10 Washing Machines & Dishwashers

Double non return valves as well as isolating valves shall be fitted to H&CW branches where branches are left for future connection of appliances.

2.5.11 TMV's

Where specified on drawings, etc., shall conform with TMV2 for domestic dwellings and TMV3 otherwise. Thermostatic Mixing valves shall include non return valves and screen within the body of the valve.

Deadlegs shall not exceed 3m upstream of TMVs and 2m downstream.

Thermostatic Mixing Valves shall be set to operate between 38°C and 44°C, with a maximum error on these figures of +2°C. Settings shall be: Bidet 38°C, Basin 41°C, Shower 41°C, Bath 44°C, Supervised Bath 46°C.

Where possible TMV's shall be chrome plated where exposed to view.

2.5.12 Booster Pumps

Auto Changeover between duty and other pumps shall be provided as part of the package controls. Low level cut-out sensors shall be provided in the break tanks. Pressure reducing valves shall be provided as necessary.

2.5.13 Drain Cocks, Air Relief Valves, Anti Vacuum Valves and Double Non Return Valves

Drain cocks with hose unions shall be provided on low points.

Air Relief Valves shall be provided on all high points as necessary.

Double Non Return Valves shall be provided on main branches on 1st Floor upwards.

2.5.14 Swept Bends

Swept branches and bends shall be provided on all soil and waste branch pipework (i.e. 45°), unless otherwise agreed by the Engineer. All pipe bends shall be easy bends (not short or knuckle bends), unless otherwise agreed by the Engineer.

2.5.15 Sanitaryware

Unless specifically included elsewhere in the Specification, sanitaryware shall be provided by others and delivered to a location close to the installation point for fixing and connecting up to by the Contractor. Provision of concealed WC Cisterns and Flushing Mechanisms shall be included as part of the Works unless specifically excluded elsewhere in the Specification.

Concealed WC cisterns shall be dual flush models unless specifically stated otherwise elsewhere in this Specification.

A delayed operation inlet valve which complies with BREEAM requirements shall be included unless specifically excluded by the Engineer.

2.5.16 Traps

Approved plastic waste traps shall be provided as part of the Works. Tubular traps with 75mm water seal shall generally be used.

Dish and clothes washers shall be provided with trapped stacking wastes. (Combined sink waste trap is not acceptable).

Chrome plated traps shall be specified as part of the Main Contract unless specifically stated to the contrary.

2.5.17 Rodding Access

Rodding eyes shall be provided approximately 1m above floor level on soil and rainwater stacks.

Frequency shall be every floor on soil stacks and for rainwater stacks one at top floor level, one at middle level floor and one at ground floor.

Rodding eyes at the end of branch soil and waste pipes shall wherever practical be brought up by means of an easy bend(s) above local flood level (i.e. WC pan level on soil branches).

2.5.18 Existing Pipework

Where existing pipework is to be connected into, the pipework shall be treated as new pipes with respect to testing. This shall apply to soil, waste and hot and cold water services pipework.

2.5.19 Lead

No services pipes, pump pipes or distributing pipe, or pipe fittings connected to any such pipe, shall be of lead, or contain lead.

2.5.20 Jointing Compounds

No jointing compounds shall contain lead or asbestos - e.g. Boss White. Boss Blue shall be used in preference to PTFE tape.

2.5.21 Electrical Continuity

Cast iron pipework shall have built in electrical continuity.

2.5.22 Cold Water Storage Tanks

Shall comply with the Water Regulations and have a minimum of 25mm of integral insulation.

No corrodible metal shall be used in the construction of the tank.

Chlorination shall be in accordance with Clause 13.9.4 of BS 6700.

A dial type thermometer of not less than 50mm diameter shall provide reading (degrees C) of the water temperature at approximately half depth in each compartment of the tank (where the tank is compartmentalized).

2.5.23 Pumps

The Contractor must ensure that where two or more pumps are installed e.g. for pressure boosting or HWS circulating systems, the pumps are switched over so that any standby or "back-up" pump is regularly brought into service as the main "duty" or "lead" pump, in order to minimise any danger of stagnation.

Pump impellers etc. shall be of non corrosive material suitable for use with potable, water, unless the Engineer specifically states otherwise.

Low level cut-out switches shall be provided in pump suction tanks.

2.5.24 Stagnation in Parts of Domestic Water Service Systems

The hot water system should be installed so that water is not allowed to stand undisturbed without trace heating or recirculation.

Deadlegs without insulation shall not exceed the following:-

12 m for 15mm diameter
8 m for 22mm diameter
3 m for 28mm diameter

Where existing hot or cold water pipework is removed and capped off, deadlegs/blind ends shall be of a maximum length of 1.5 times the diameter of the deadleg/blind end pipe.

2.5.25 Use of Approved Materials

Information on materials which do not support microbiological growth is found in the Water Fittings and Materials Directory. In the absence of conclusive research, it may be assumed that these materials do not provide a nutrient source for L.pneumophila.

All brass items shall be de-zincification resistant.

2.5.26 Ventilation Ductwork

Ventilation and air conditioning systems should be designed so that water, whether from the supply or from other sources such as condensation, cannot accumulate in ductwork or plant which is subjected to an air stream. Where water is discharged into a common pipe or drain, the discharge should incorporate an air break or other suitable device to prevent potentially contaminated water from being drawn back into the ventilation or air conditioning system.

2.5.27 Calorifiers (and other centralised Water Heaters)

Calorifiers shall be as described elsewhere in the Contract Documents but shall include the following unless specifically requested to be excluded:

Connections for:	Primary flow and return, cold feed, HW service flow, HW service return, drain, vent, anti vacuum valve, safety valve.
The following gauges shall be provided:	Temperature gauge, pressure gauge, temperature gauge on secondary return.

A manhole shall be provided and located on the calorifier in an accessible location.

Destratification pumps and pipework with 7 day timeswitch.

Bursting disc (where the primary LPHW is of higher pressure than the secondary)

2.5.28 Solar Water Heating Systems

Pipework and joints shall be suitable for use at the maximum operating temperatures. Ordinary soldered joints shall not be acceptable on the primary circuit.

2.5.29 Reclaimed Water

Rainwater, groundwater, greywater, blackwater and industrial water are known as reclaimed water after treatment. Pipework shall be where possible polythene appropriately marked during manufacture as set out in WRAS or where this is not possible, plastic pipework with marker tape again as set out in WRAS Information and Guidance Note No. 9-02-05.

2.6 CHLORINATION OF SERVICES ETC

The services shall be cleaned and chlorinated in accordance with the following instructions and in accordance with the Department of Health and the Welsh Office Code of practice for the Control of Legionellae in health Care Premises M&E , BS 6700 and HTM 27.

(i) The pipework shall be flushed through prior to disinfection.

(ii) The system shall be disinfected by the addition of chlorine in accordance with BS 6700 and to the satisfaction of the Engineer prior to being handed over.

(iii) During flushing out, any equipment liable to damage shall be adequately protected.

(iv) It is important to ensure that all parts of the system are disinfected, not just those which are readily accessible.

(v) Water systems should be disinfected, drained, cleaned and then disinfected again.

(a) Before being taken into use to remove contamination, which may have occurred during construction, in accordance with the British Standard BS 6700 specification for the design and installation, testing and maintenance of services supplying water for domestic use with buildings and their curtilages.

(b) If the system, or part of it, has been out of use for a significant period and has not been left dry

(c) If the system or part of it has been extensively altered, entered for maintenance or otherwise disturbed.

(d) Special Note: Where only a part of an existing building has been altered, the Contractor shall firstly obtain tests of the Main Building water to ensure that its integrity has been maintained prior to any modified connection being reinstated. All test results shall be submitted to the Main Contractor, including any shortfall of the existing system. The Main Contractor should then seek advice/clarification with regard to connection.

(vi) Hot water systems are disinfected by chlorinating the water to between 20 and 50 ppm, then allowing it to flow to all parts of the system and stand for at least 4 hours (or preferably overnight). The system is then completely and thoroughly flushed.

(vii) Cold water services should be disinfected in accordance with the British Standard BS 6700 specification for the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages.

2.7 PIPEWORK AND FITTINGS

2.7.1 Standards

Pipework and fittings shall generally comply with Section 4 of DOE Standard Specification M & E No. 3 (1986) and be in accordance with the minimum following standards.

Welded Steel Pipework
All pipework installed in accordance with this Section of the Specification shall be of heavy gauge quality mild steel and shall comply with BS 1387/1967 for sizes up to 6" and with BS 806/1975 Class "C" for sizes over 6" and all subsequent amendments.

Screwed Steel Pipework
All pipework installed in accordance with this Section of the Specification shall be of heavy or medium gauge quality mild steel, as directed, and shall comply with BS 1387/1967 and all subsequent amendments. Joints shall be screwed flanged or welded, as specified elsewhere.

Generally, all pipework installed in voids over false ceilings and in other cases where subsequent access is likely to be difficult and where ease of dismantling is not required shall have welded joints. All pipes 5" bore and over shall have welded joints and joints on small pipes may be welded instead of screwed, except where this would impede subsequent dismantling.

Galvanised Steel Pipework
All pipework installed in accordance with this Section of the Specification shall be of heavy gauge quality mild steel manufactured in accordance with the provisions of BS1387/1967 and shall be galvanised after manufacture.

Except as indicated below, joints shall be screwed throughout. All fittings shall be best quality malleable iron galvanised after manufacture.

In plant rooms or other areas where access is limited, welding may be employed but in this case such sections must be factory prefabricated from black tube and each completed prefabricated section shall be galvanised after manufacture, before delivery.

Copper Pipework
All copper pipework is to be of British manufacture to BS 2871.

Copper tubing shall be light gauge with ends prepared for capillary type fittings, specified elsewhere in this Specification of Works. Pipe ends shall be cut cleanly with purpose made cutters or hack-saw and shall be cut square. All irregularities and swarf are to be dressed off the ends to produce a smooth bore and butt end, and with an outer surface free from reeds or deep scratches.

Tubing shall be free of deformation or irregularities of bore.

Refrigerant Pipework
Pipework shall be in Refrigerant Quality Copper Tube to BS2871: PT. 2, Table 2 and shall fully comply with Section 4, PT1, of the Safety Code for Refrigerating Systems utilizing Chlorofluorocarbons published by the Institute of Refrigeration and Section 2.12 of DoE Standard Specification M & E 100.

Plastic Pipework
Plastic pipework used for Cold Water Services of polyethylene shall comply with BS 3284 or BS 1971.

2.7.2 Erection of Pipework

All pipework shall be installed in a first class manner throughout with full provision for venting and draining, expansion and contraction, and maintenance and renewal.

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 maximum headroom, not obstructing windows and doorways, and fitting in with the work of other Contractors. All pipe drops shall be plumb.

No joints shall be formed in the thickness of walls, floors or ceilings. It shall be the responsibility of the Contractor to ascertain the thickness of plaster and other wall finishes, skirting heights, cill heights and floor finishes. Pipework shall generally be set around all piers and columns and shall follow the contour of the building, whether so indicated on the drawings or not.

Piping shall be erected so that there is 76mm clear below it to the finished floor level and at least 25mm to the finished wall face. Where pipework is insulated, the above clearances will be applied to the outside diameter of the insulation finish.

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.

Unions or flanges shall be provided at all connections to equipment so that they can be dismantled.

Flanges or unions shall be provided on straight horizontal unobstructed runs at not greater than 12m intervals.

Tubes shall be reamed after cutting and shall be free from burrs, rust, scale and other defects, and shall be thoroughly cleaned before erection.

Open ends left during the progress of work shall be blanked off with purpose made metal or wood plugs or blank counter flanges.

All pipes passing through walls, floors or ceilings shall be provided with sleeves cut to allow a projection of 3mm beyond the finished wall, except in lavatory blocks or kitchens where projections shall be 50 mm above finished floor level. The sleeves shall be of the same material as the tube.

Springs and sets shall be formed on long lengths of tube and may be forged drawn or cold drawn, formed to a true radius and free of deformation in bore or thinning of tube wall. Double sets made to pass an obstruction on site shall be formed in one piece, each pulled to a full 90° in the same plane. Deformation of the pipework surface will not be permitted.

All fitted pipework shall be plumbed in the vertical and levelled to the turn of a bubble in the horizontal, except where wall or floor finishes deviate from the vertical or horizontal, in which case the pipework shall be parallel to the surface to present a neat appearance consistent with the need to release air entrained in the medium.

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.

The Contractor shall make due allowance during erection or thermal insulation and this insulation shall allow complete and free movement of pipework between guides, brackets and other obstructions.

The use of bushes will not be permitted to change a pipe diameter. The Contractor must either select the correct tee or provide a nipple and appropriate reducing socket to affect the change.

All excess hemp on pipe joints must be removed after instillation, to the satisfaction of the Contract Administrator.

2.7.3 Supports, Brackets and Hangers

All pipework shall be adequately supported in accordance with such details as are given in this Specification and as required for the stable and sufficient support of the pipework.

Where allowance has been planned for subsequent expansion, settlement, vibration and other changes in the system, variable support brackets shall be used.

All supports must be adequate for the live load of the service being supported and shall be so formed and fixed that proper allowance is made for longitudinal expansion and contraction, where applicable, without lateral deviation at the level of the service, and guide points are to be sited in strategic position.

Individual pipe clips shall be formed to the perimeter of the pipe and shall be so arranged that pipework may be dismantled in the future.

Brackets on copper pipework shall either be Yorkshire 105 brass pipe brackets or Yorkshire type 107/107D or 108, as appropriate. Except where shown to the contrary in the drawings or Specification, the Contractor shall be responsible for supplying and erecting all supports, brackets and hangers.

All hangers and supporting brackets must meet fully with the Contract Administrator's approval and, if specially fabricated, the brackets and other steel work shall be painted two coats of red-oxide before dispatch from Works.

The spacing of the supports, where not specified, must not exceed the spacing given in the following Schedules.

Where one support carries more than one pipe of different sizes, the spacing shall be that specified for the smallest size of pipe.

Supports for Mild Steel Pipework

Nominal Bore	Intervals for Horizontal Runs	Intervals for Vertical Runs
15mm and 20mm	1.8m	2.4m
25mm and 32mm	2.4m	3.0m
40mm and 50mm	3.0m	3.6m
65mm and over	3.3m	4.5m

Supports for Copper, Stainless Steel

Nominal Bore	Intervals for Horizontal Runs	Intervals for Vertical Runs
15mm and 22mm	1.2m	1.2m
28mm and 35mm	1.8m	2.4m
42mm	2.4m	3.0m
54mm	2.7m	3.0m
67mm and over	3.0m	3.6m

Supports for Plastics Pipework

Nominal Diameter	Intervals for Horizontal Runs	Intervals for Vertical Runs
19mm	0.5	0.5
32mm	0.5	1.2
40mm	0.5	1.2
50mm	0.6	1.2
82mm	0.9	1.8
110mm	0.9	1.8
160mm	1.2	1.8

Where in contact with copper pipework, all brackets and clips shall be constructed from copper or brass.

All low level pipework in Rooms shall be supported at intervals not exceeding 1.5m.

In addition to the above, all vertical pipes shall be supported at the base and at least one other point. Branches from risers shall not be used to support the riser.

Pipework in trenches and ducts shall be positioned as high in the trench duct as possible and supported by means of suitable steel supports built into slots left on top of the trench with carrying rods and split pipe rings up to 65mm, above 65mm purpose made supports shall be used. Each pipe shall be supported individually.

Pipework in ceiling spaces shall be supported upon angle iron or suitable steel brackets. Retaining "U" bolts shall be provided on alternative angle iron to prevent lateral movement. Pipework shall be supported to allow free movement for expansion and contraction, particularly at the ends of long runs where a change of direction occurs.

2.7.4 Joints and Fittings

Unless otherwise indicated, joints and fittings shall be as follows:

Steel Pipework
For pipework up to and including 50mm diameter, screw joints shall be used. These shall have taper threads to BS 21:1973 and shall be made suitable jointing material to BS 5292:1980.

For pipework above 50mm diameter, joints may be either screwed or welded.

To facilitate future dismantling where pipework is connected to an appliance, valve or elsewhere, ground-in spherical seated unions shall be used for pipework up to and including 65mm diameter and flanges for pipework above 65mm diameter. Mating flanges for items of plant and equipment, excluding valves, shall be fabricated of the same material and table as the plant and equipment. All other flanges shall be wrought iron or annealed steel to BS 10 Table 'D' faced, and the joints made with joint rings and compound.

Screwed fittings, other than sockets, shall be malleable cast iron, banded or beaded pattern, screwed BSP thread. Purpose-made welded fittings shall be used on welded pipework

Headers shall be of flanged mild steel tube with flanged outlets welded on. Spare outlets shall be blanked off.

The execution of welding and the competence of the welder shall be in accordance with the current edition of "Welding of Mild Steel Pipelines Work" issued by the Heating and Ventilating Contractors Association in conjunction with the NJC for the Plumbing Industry.

The Contract Administrator shall have the right to call upon the Contractor:

To demonstrate the quality of the welder's work.

To submit welded samples for further examination and/or.

To produce the applicable Certificate of Competency.

When welding, soldering or cutting with a torch, every precaution shall be taken to prevent fire.

Copper Pipework
Fittings shall be of the capillary type for sizes up to 54mm and bronze or auto-genous welding for sizes 67mm and above. Capillary fittings must be manufactured entirely from copper. All surplus solder is to be removed after soldering. All domestic water services pipework solder shall be lead free.

PVC or Polythene Pipework
On PVCU and ABS tubes, solvent welded fittings shall be used.

On polythene tubes, compression fittings with internal ferrules shall be used.

No joints shall be allowed in underfloor heating polyethylene pipework.

Cast Iron Pipework
Shall be of an approved type with approved joints. Sanitary pipework shall be provided with electrical continuity except where specifically requested otherwise.

General
Pitcher tees, bends, twin elbows, etc. shall be of the same size as the pipework connected to them. Bushing shall NOT be used. Square tees shall be used where short sweep fittings could cause air to

be trapped in the system, on dead-leg branches or domestic hot water supply systems and on all cold water installations.

Eccentric reducing sockets shall be used to facilitate air-venting and draining and where changes of diameter are made in runs of nominally horizontal pipework.

2.7.5 Painting

All materials and brackets to be used in the installation, with the exception of those formed from copper, gunmetal or bronze, or finished galvanised, shall be given one prime coat of an approved anti-rust primer paint. All steel or cast iron goods which show signs of rust shall be carefully wire brushed down, all rust removed and the materials given a further coat of primer, before installation.

After fitting and testing of all pipework not exposed to view, black pipework and screwed joints only on galvanised pipework shall be thoroughly cleaned and painted with one further coat of rust resisting paint.

Upon completion of the thermal insulation, all unlagged pipework, cast iron valves, hangers and brackets within Boiler Rooms, Plant Rooms and Tank Rooms shall be painted with two coats of heat resisting paint to BS 4800, colour to be agreed with Contract Administrator.

Where special additional paintwork or finishes are required to be provided on particular pieces of equipment, such finishes are detailed under the relevant Clause (s) and do not obviate the obligations under this Clause.

Gas pipework in Boiler and Plant Rooms shall be finished in canary yellow.

2.7.6 Spacing of Services

Before the installation of mechanical services commences, it is essential that arrangements are made with other trades to ensure a minimum clearance of 150mm from other services.

Where underground services (gas, water, electrical, telephone and television cables etc.) are to be accommodated in a common trench, the spacing, separation and depth of the services shall not be less than the minimum requirements of the Public Utility providing the serving, and the accepted standard of good practice.

2.7.7 Use of Dissimilar Metals

The Contractor will ensure that in no part of the system does he include, either in contact or at a distance, dissimilar metals which will promote chemical or electro-chemical action, causing a weakening or failure of the service. This applies not only to the internal surfaces but also to the external surfaces of all pipes, fittings, valves, plant, vessels, pump and any other items of equipment in the installation.

2.7.8 Purging of System

Upon completion of a service, the Contractor shall purge the system to expel all foreign matter, constructional debris and swarf. Full bore through all sections of the system shall be established to the satisfaction of the Contract Administrator.

In wet systems, the purging shall be carried out by washing through with clean water. In gas and air systems, the purging shall be carried out with high pressure nitrogen.

Any blockage which is indicated shall be properly investigated and cleared by the Contractor at his own expense.

2.7.9 Venting

Pipework for systems carrying water at a temperature less than 100°C shall be run, wherever possible, to give natural venting.

All points shown on the drawings and in all positions in the pipework system where a high point is formed and venting is required, automatic air vents shall be provided. These shall be standard pattern type "B", manufactured by Charles Winn & Co. Limited and shall be fitted with 1/4 inch diameter outlet, extended to a suitable position.

2.8 VALVES AND COCKS

2.8.1 General

All valves and cocks for heating, hot and cold water services, cold feeds, mains water and natural gas service shall comply with the requirements of the appropriate Water and Gas Authority and the Contractor shall include for any testing and stamping which the Authorities require.

Isolating and/or Regulating Valves shall be installed by the Contractor in all of the following positions, whether shown on the Tender Drawings or not:

With the exception of open vent pipes and overflows, which shall not be valved, isolating valves shall be installed on all items of plant or equipment, with a suitably sized drain cock, to allow shut down and drainage independently from the system. This is deemed to include Heater Batteries. Isolating valves will normally be Gate type operation with Wheelheads or Lockshields, as directed below.

Regulating valves comprising a Metering Station connected to a Double Regulating Valve shall be installed:

- In the return water connection on the normally open circuit of any three way control valve.
- on each main branch return in heating and hot water service circulation systems, as directed.

Double regulating valves shall always be provided on the bypass connection from any three way control valve or as directed by the manufacturer

All radiators shall be valved on the flow and return connections as directed below

All pumps shall be installed with suction and discharge port isolating valves

Hot and cold water services serving sanitary ware fittings, either individually or in ranges, shall be fitted with a stop cock.

Cold feed connections to tanks or to items of equipment shall be fitted with Lockshield Gate Valves.

Where a water main enters the building or connects to any equipment, including storage tank ball (float) valves, or serves drinking or mains water outlet points, a stopcock shall be installed.

At all positions where allowance is made to provide a future service to other buildings or future works or extension to the Contract Works.

2.8.2 Valves and Cocks

Valves for the various services are as follows:

Low temperature hot water, hot water service, cold water service (isolation)

Up to and including 2" nb steel and 54mm od copper shall be Crane D171 (Bronze) or equal and approved.

2.5" nb steel and over shall be Crane F52 or equal and approved.

Mains water (isolation)
To BS 5433 (Underground), BS 5163 or BS 1010 (Above Ground).

Gas service
All equipment served with Gas shall be fitted with a gas cock of a type approved by British Gas

Radiator and Fan Convector Valves
All radiators shall be fitted with straight or angle pattern thermostatic radiator valves, wheel or lockshield valves, as appropriate. All radiator valves will generally be matt bronze finish, except where lockshield valves are fitted to a radiator with a thermostatic radiator valve where they will be chrome or nickel plate finish. Angle pattern valves must always be installed with the spindle in the vertical plane.

Drain Cocks
Drain cocks shall be Crane D344 or equal and approved, or Crane D340 where used to drain drops to radiators.

Regulating Valves
All regulating and/or balancing valves shall be as indicated in Section 3 of this Specification and installed strictly in accordance with manufacturer's instructions and requirements.

Non return Valves
Non return valves shall be Crane D136 or FM 468 or equal and approved.

Ball (Float) Valves
Each water storage tank and system feed or feed and expansion tank shall be fitted with Equilibrium Ball Valves, complete with 150mm Copper Ball (100mm for feed and expansion tanks).

2.8.3 Valve Chart and Labels

All valves shall be labelled and recorded on a Valve Chart indicating the purpose of the valve and, where the valve is performing a regulating function, the setting and flow rate through the valve. Labels and Valve Chart shall be as detailed in Clause 2.3.4.

2.8.4 Valve Keys

The Contractor shall mount, on a board fixed in a position to be agreed, a key or wrench to fit each size of lockshield valve air plug, plug cock etc. A spare key or wrench of each size shall also be handed to the Contract Administrator.

2.8.5 Painting

Where pipework abutting valves is painted, whether with primer, rust inhibitor or finishing paint, the valves shall be masked to prevent paint being transferred to the body of the valve or to its union or other connections to the pipe.

2.9 VENTILATION & AIR CONDITIONING DUCTWORK

2.9.1 General

Ductwork shall be:

in accordance with HVCA Specification DW144 (1998) DW/TM2 and TR/17 (1998).

as indicated upon the Contract Drawings and run generally parallel with walls and ceilings, allowing a 100mm space between walls, ceilings and the face of the duct or the insulation.

kept clean during fabrication and as installation proceeds and free of debris, rodents, etc., with all openings sealed with strong plastic sheet or other suitable materials at all times when work is not in progress.

cleaned down both inside and outside on completion by brushing, vacuum cleaning, use of grease and oil remover, etc., before commissioning of the system.

constructed using sealants, gaskets, flexible joints, acoustic linings, adhesives, etc., which will not support bacterial growth and which will not produce fire or smoke hazards if involved in a fire, including grille and diffuser attachments.

constructed with integrally sealed seams and cross joints selected from DW144 to provide air tight joints sufficiently leak proof to meet the leakage limits and without the use of edge sealants, sealing tapes, welded seams, self tapping screws or pop rivets, or the use of slip joints unless essential.

arranged to provide smooth internal surfaces where slip joints are used. Assembled correctly relative to flow of air and with flanged joints provided with gaskets.

protected on all cut edges by a layer of paint or protective coating to minimise corrosion.

fire stopped around perimeter where it penetrates fire compartment external walls, floors and enclosures and cavity barriers and sub-compartment walls or enclosures.

provided with weather proof collars where it passes through roofs or external walls.

drained adjacent to duct mounted humidifiers or de-humidifiers and adjacent to the air intake when there is a risk of water formation within the duct.

to the nominal cross section sizes shown on the Contract Drawings based upon DW144 standard sizes and thickness, and the minimum thickness shall be 0.8mm and 1.6mm for internal and external ducts respectively.
manufactured from either of the following materials in accordance with Section 3.0.

i. Hot dipped galvanised MS to BS 2989i

ii. Stainless Steel to BS 2989

iii. Aluminium to BS 1470

of flanged cross joint construction in Plant Rooms

stiffened and braced to prevent drumming

provided with access doors at all positions as recommended in DW144 for cleaning purposes and for maintenance to all dampers and heat exchangers, filters and humidifiers.

incorporate 22mm dia test holes after each item of plant and at all main branches and before all balancing dampers and in accordance with Section 3.0.

incorporate flexible ducts for final connections to grilles and diffusers if indicated upon the Contract Drawings.

2.9.2 Ductwork Supports

Shall comprise:

supports, hangers and stands in accordance with the HVCA Specification DW144 except that supports bolted through the ductwork or spring clips shall not be used.

thermally insulated and vapour sealed supports.

fixing for attaching supports or hangers to the building structure or fabric by methods to DW144.

flanged supports to the floor slab for vertical ductwork passing through floors, with additional intermediate supports if necessary.

of materials equivalent to the ductwork which they are supporting.

independent supports to each grille and diffuser installed in suspended ceilings, the ceiling tile and/or ceiling support frame shall not be used.

an anti-vibration insert between each duct and support bracket.

2.9.3 Volume Control Dampers

Shall be:-

installed in each branch duct of the ventilating system to ensure that design air volumes can be achieved at each grille or diffuser and be positioned so that the damper controls are easily accessible.

either of the 'opposed blade' or 'iris' type.

i Dampers for:
Rectangular, Circular (or) Flat Oval Ducts
Shall:-

be constructed from stainless steel and be of the aerofoil opposed blade design with external blade position indicator and locking screw.

be provided with spigot connections to suit the ductwork or flanged connections accordingly to the DW144 Ductwork Specification.

ii Dampers for:
Circular Spigot connections to Plenum Boxes
Shall:-

be constructed from hot dipped galvanised MS and be of the Iris design with an external adjustment lever and position indicator.

be mounted in rigid ductwork with a minimum straight length of (6 x dia.) upstream and (3 x dia) downstream, failure to comply with this requirement will create inaccurate air volume readings.

2.9.4 Fire and Smoke Dampers

Shall be:

fire rated dampers fully complying with BS5588:Part9:1999 and DW/TM3 held in the open position by means of a Thermally Actuated device set to operate at 72-74°C.

provided where ductwork passes through fire compartment walls, floors and enclosures and cavity/barriers, generally as indicated upon the Contract Drawings and of sizes to suit the ductwork without causing additional resistances to air flow.

provided with an access door located within the ductwork to provide access to the internal damper for maintenance and inspection.

(i) Fire Dampers
Shall be:

Stainless Steel Folding Curtain type with unbroken movable joints, stainless steel constant tension closure springs for positive closure, and stainless steel peripheral gasketing, all housed in a galvanised steel fully welded spigotted type casing suitable for mounting in square, rectangular, circular, or flat oval ductwork

fitted with self re-settable latching removable release mechanism cassette which shall ensure the closure of the curtain under full fire conditions.

provided with HEVAC/HVCA installation frames incorporating tabs for building into the structure.

All fire dampers shall have spring fail safe closed operation.

(ii) Combined Smoke and Fire Dampers
Shall be:-

Proportional Torque Control Automatic Smoke & Fire Dampers with 75mm x 0.5mm thick stainless steel aerodynamic interlocking blades incorporating synthetic seal, with steel blade end bearings and peripheral gasketting, housed in a galvanised steel fully welded 1.2mm spigotted casing suitable for square, rectangular, circular or flat oval connections.

supplied with the blades in the closed position to prevent ingress of dirt and dust. The totally enclosed opposed blade drive shall be positioned out of the airstream for protection against damage and be hard wearing and fee running.

complete with Control Mode/Damper connection by means of a patented snap lock drive interface mechanism, totally independent of the ductwork.

provided with HEVAC/HVCA installation frames incorporating tabs for building into the structure.

All Smoke/Fire dampers shall have spring fail safe closed operation.

2.9.5 Flexible Joints

Shall be:

provided at fan inlet and outlet connections and any other positions shown on the drawings.
equal in cross section to the points of connection and not longer than 200mm or less than 100mm.

of "Neoprene" Coated Glass Fibre or other materials excluding asbestos and have fire resistance properties of 30 minutes integrity to BS 476 : Part 8 : Class 1 Surface spread of flame to BS 476 : Part 7 and not produce smoke or toxic fume hazards if involved in a fire.

complete with galvanised mild steel backing flats drilled to suit flanges.

installed without undue deflection or slackness between correctly aligned ductwork and fan flanges or spigotted connections.

2.9.6 Flexible Ductwork

Shall be:-

used for final connections to grilles and diffusers if shown on the drawings.

of steel strip construction compatible with that used for the ductwork and generally to DW144 with standard or air tightness to equal that of the ductwork constructed to meet the fire precautions recommended in BS 5588 and BS 8313 which comprise:-

i Length of flexible ductwork branches not to be longer than 3.7 metres, or pass through fire compartment walls, floors or enclosures of sub compartment walls or enclosures or cavity barriers.

ii Fire resistance to meet BS 476 : Part 6 with indices of performance not more than 1 = 12 and i = 6.

iii Materials which will not produce smoke or toxic fume hazards if involved in fire.

2.9.7 Leakage Test of ductwork Sections

Shall be:

applied to erected sections of the ductwork complete with access doors at the test pressure and flow rates, prior to insulation being applied.

carried out generally in accordance with DW143 and DW144 using portable fan and test equipment.

recorded on test sheets based on DW143 and DW144 examples and compared to acceptable leakage rate.

interpreted as requiring that sections which need excessive remedial work on seams or joints are to be replaced by new sections, this requirement to be identified during the preliminary test to DW143 paragraphs 4.9 and 4.10.

2.9.8 Leakage Checks on Completed System

Shall be:

carried out when the fan has been first set to work and before thermal insulation is fitted and an inspection made on all connections from plant to ductwork including any untested joints between tested sections and all joints and seams not previously subjected to leakage pressure tests, including plant casings, grille joints, dampers etc.

2.9.9 Service Identification

Shall comprise:

colour coding and identification generally to DW144 Appendix B at sufficient positions to ensure no confusion of services, at all servicing access points, at each side of walls and floors and where duct size changes.

Additional triangular black and yellow hazard symbols to BS 3510 and BS 5378, on all extract systems carrying radio active, infectious, toxic, chemical or explosive substances.

2.10 THERMAL INSULATION

2.10.1 Thermal Insulation

Thermal insulation shall be applied to all pipework and ductwork specified herein. Where pipework is to be covered, this shall be carried over all bends, pipe clips, expansion loops and anchors. All valves shall be insulated with removable valve muffs.

All of the installation or sections of the installation shall be hydraulically tested as specified before the application of lagging. All pipework shall be painted with primer coat in accordance with Clause 2.7.5 of this specification and allowed to thoroughly dry before the application of any insulation. Insulation shall be in accordance with Building Regulations (Second Amendment) 1981 Part P and any subsequent amendments or additions and to the following British Standards unless otherwise stated.

BS 3533 - 1981
BS 5422 - 1990
BS 3927 - 1986
BS 5970 - 1992

Insulation materials, adhesives and finishes shall be inherently proof against rotting, mould, fungal growth and attack by vermin, be non-hydroscopic and in all respects be suitable for continuous use throughout the range of operational temperatures and within the environment used. Generally, mineral fibre or CFC free phenolic foam shall be used. All thermal insulation materials used shall be classified non combustible in accordance with BS 476, Part 4, or shall be rated Class 'O' to the Building Regulations when tested to BS 476 parts 6 and 7.

N.B. Phenolic foam insulation is not to be installed on services operating at temperatures above 120°C.

Man made mineral fibre (MMMF) insulation or calcium silicate containing MMMF shall not be used in kitchen/food areas or on/in air conditioned services or spaces.

2.10.2 Standard of Work

All insulation work shall be carried out by a reputable specialist Contractor such as a member of the Thermal Insulation Contractors Association

All materials delivered to site shall be new and dry and be maintained in good condition throughout the progress of the work.

The Contract Administrator or his appointed authority shall not accept poor quality, badly finished work, or irregularities in the thickness of insulation or in the protective finish. To ensure that the correct thickness has been applied, one piece from each run of insulation shall be cut out at the discretion of the Contract Administrator. If the inspection reveals any defects, the insulation Contractor shall cut out a further two pieces for inspection. If these also prove defective then the insulation shall be removed and new insulation and finishes as specified be applied at the Contractor's expense.

All pipework shall be insulated separately and adjacent parallel runs of pipework shall not be married together in one insulation covering.

All insulating materials and associated products shall be applied strictly in accordance with the manufacturer's recommendation and instructions, and work failing to comply with these will not be accepted by the Contract Administrator.

All joints, surfaces, edges and overlaps shall be neatly finished and where possible overlaps shall be arranged to be on the blind side or on the water shedding side.

Where allowance has to be made for pipe/duct expansion or contraction, the insulation shall be finished in a neat and approved manner permitting easy access and disconnection of removable items without disturbing the insulation.

On surfaces operating below ambient temperature a complete moisture vapour seal shall be provided over the insulation by a continuous unpunctured vapour barrier jacket or coating.

All insulation situated out of doors and exposed to the weather shall have a weatherproof finish, suitable for the anticipated environmental conditions to which it will be subjected.

No insulation shall be applied to any part of the work until that particular part has undergone successful inspection and pressure testing.

2.10.3 Services to be Insulated

Unless otherwise directed in Part 3 of this section of the Specification the following services will always be insulated:

Heating and Hot Water Services

(i) Pipework beneath or in structural floors.

(ii) Pipework at high level or in roof spaces (except pipe coils).

(iii) Risers and drops and any pipework to be boxed in or enclosed in any way in Builders Works ducts and timber or preformed housings.

(iv) All pipework in Plant Rooms, Boiler Houses, Tank Rooms, Calorifier Rooms etc. with the exception of Open Vents above the water level of the feed tank.

(v) All external pipework.

(vi) Any area where environment is controlled by other services.

Cold Water Services including Down Service, Cold Feeds, Mains Water and Chilled Water Circulation

(i) All pipework where surface condensation may occur.

(ii) All pipework where freezing may occur.

Ventilation and Air Conditioning Ductwork

(i) All supply and extract ductwork within plantrooms.

(ii) All supply ductwork in external locations.

iii) All supply ductwork in false ceilings, service voids and other untreated spaces.

(iv) All extract ductwork on heat reclaim systems.

Refrigerant Pipework

(i) Liquid and suction pipes up to 80mm.

Rainwater Pipework

(i) All horizontal runs of rainwater pipework within the heated building. Minimum thickness 15mm low emissivity outer finish (e.g. bright class O foil).

2.10.4 Thickness of Insulation

The thickness of insulation shall be as shown for the relevant services in the tables in Clause 2.10.17.

2.10.5 Hot Pipework

Temperature up to 120°C maximum including:

Domestic Hot Water	up to 80°C
Low Pressure Hot Water	up to 95°C

Boiler House and Plant Rooms

Pipework shall be insulated with plain, standard density preformed sections. All sections shall be close butted and secured with three self adhesive tape bands per metre section. The finish shall be plain or hammerclad aluminium sheet jacketing applied in accordance with the instructions on the manufacturer's technical data sheet. All joints in the facing are to be sealed with self-adhesive matching Class 'O' tape, 100mm wide.

Internal other than Boiler House or Plant Rooms

Concealed or high level pipework shall be insulated with Class 'O' aluminium foil faced preformed sections. All sections shall be close butted together and secured with three aluminium bands per metre section. All joints in the facing are to be sealed with self-adhesive matching Class 'O' tape, 100mm wide.

External, Exposed to Weather Conditions

All insulation shall be weatherproofed with waterproof, vapour permeable plastic coating or bitumen impregnated fabric systems applied in accordance with the instructions on the manufacturer's technical data sheet.

2.10.6 Pipework situated in External Service Ducts subject to occasional Temporary Flooding

All insulation to be finished with 0.8mm polyisobutylene (PIB) sheeting fully sealed from ingress of water by solvent welding all overlap seams with manufacturer's recommended solvent.

2.10.7 Pipework buried in Trenches and covered with Selected Backfill (e.g. Sand or Fine Gravel)

Heavy density (60kg/m3) pipe insulation to be used in place of standard density. Finished with a protective covering of 50mm wide pipe wrap tape spirally wrapped over the insulation with a 50% overlap or equal and approved finish.

2.10.8 Hot and Cold Cylinders or Calorifiers

When not supplied with insulation by the manufacturer, cylinders and calorifiers shall be insulated with slotted glass tissue faced laminate or preformed radius and bevelled lags adhered to the vessel with general purpose adhesive. The insulation shall be finished with a heavy duty polymeric mastic

breather coating, applied in accordance with the instructions on the manufacturer's technical data sheet.

2.10.9 Cold Pipework

Temperature Range	0°C to +20°C
Chilled Water	up to 5°C
Cold Water Mains	up to 20°C

All cold pipework irrespective of location is to be insulated with Class 'O' aluminium foil faced preformed sections. All joints in the facing are to be sealed with self-adhesive matching Class 'O' Tape, 100mm wide. Support of the insulation shall comprise three aluminium bands per metre section.

In areas where the insulation is to be overclad the jacketing is to be secured with stainless steel or aluminium banding. Screws and Pop Rivets are not to be used.

General installation of cold pipework shall be in accordance with Clause 2.7, but with due care and attention to ensure there is a continuous vapour barrier.

2.10.10 Ventilation and Air Conditioning Ductworks

Rectangular Ductwork
Shall be insulated with Class 'O' foil faced, rigid slabs bonded to all faces with a general purpose adhesive. Insulation to inverted surfaces or sides of ducts which exceed 500mm in depth shall be additionally supported with pre-bonded insulation hangers and washers. All joints in the facing are to be sealed with self-adhesive matching Class 'O' tape, 100mm wide.

Circular or Flat Oval Ductwork
Shall be insulated with Class 'O' foil faced phenolic foam laminate (back slotted) or Class 'O' foil faced mineral wool lamella mat, fully bonded to the duct surface with a general purpose adhesive. All joints in the facing are to be sealed with self-adhesive matching Class 'O' tape, 100mm wide. Support to the insulation shall comprise 25mm wide strapping applied as circumferential bands at 300mm centres.

Additional finishes over the foil facing will be as described within Clause 2.10 for the respective areas.

2.10.11 Pipe Supports

Insulated pipework is to be separated from clips by fitting purpose made high density phenolic foam blocks complete with bonded spreader plate and full wrap round foil facing.

Blocks shall overhang the clip by a minimum of 30mm each side and are to match the thickness of adjacent insulation.

2.10.12 Ductwork Supports

Insulated ductwork is to be isolated from support beams by fitting foil faced heavy density phenolic foam strip, 150mm wide by the full width of the duct. Strip is to match the thickness of adjacent insulation.

2.10.13 Heating Feed and Expansion Tanks and Cold Water Storage Tanks

Shall be insulated with Class 'O' foil faced, standard density slabs secured to the tank with general purpose adhesive and Fastfix insulation pins and washers spaced at 450mm x 450mm centres. All corner and straight butt joints sealed with self-adhesive matching Class 'O' tape, 100mm wide.

All exposed edges of the insulation shall be weatherproofed with a polymeric emulsion coating applied in accordance with the instructions on the manufacturer's technical data sheet.

New Cold Water Storage Tanks shall be insulated with 25 mm of integral insulation at manufacturing stage.

On rectangular tanks in areas where the insulation is exposed to mechanical damage or at the discretion of the Contract Administrator, the four vertical corner joints of the insulation shall be protected with 22 swg. galvanised mild steel or aluminium angle 75mm x 75mm and firmly held in place with horizontal bands spaced at 450mm centres or other approved means of support.

Areas behind fixed access ladders shall be protected with aluminium cladding.

2.10.14 Finishes

Internal, Concealed or Exposed to view at High Level

The insulation shall be supplied with a factory applied Class 'O' foil finish. All overlap joints in the foil jacket shall be sealed with contact adhesive. All other joints between sections of insulation shall be sealed with 100mm wide self adhesive matching Class 'O' tape.

All exposed edges of the insulation and where the jacket is penetrated by insulation pins or other protrusions shall be sealed with butyl sealant or self adhesive tape.

Internal in Plantrooms, Boilerhouse or where an extra Heavy Duty Finish is required

The insulation shall be finished with a plain or hammerclad aluminium sheet jacketing applied in accordance with the instructions on the manufacturer's technical data sheet. All exposed ends shall be provided with segmented aluminium end stops.

External, exposed to Weather Conditions

The insulation shall be finished with a suitable weatherproof mastic applied in two coats with a fibreglass reinforcing membrane between coats as recommended by the manufacturer.

In cold, damp working conditions, a quick drying solvent based mastic coating may be used in place of polymeric emulsion. The surface of the insulation must be dry when the coating is applied.

2.10.15 Use of Self-Adhesive Foil Tapes

Where self-adhesive tape is specified to seal the joints in vapour barrier jackets, it is essential, in order to obtain good adhesion, that the surface to which it is to adhere is clean, dust free and perfectly dry. As most insulation is applied on sites where it is difficult to guarantee such conditions, it is recommended that the surface to be sealed is primed with a thin brush coat of

contact adhesive and allowed to dry (approximately 5 minutes) before the tape is applied. This guarantees a strong permanent seal.

2.10.16 Identification of Services

The Contractor shall include for colour identification bands to BS 1710 : 1975 appropriate to the service carried by the pipework or ductwork. Bands shall be applied at regular intervals but each pipe or duct passing through a room or area must have at least one identifying band. Also all insulation, whether enclosed in pipe ducts or exposed to view, will have identifying bands and directional flow arrows.

2.10.17 Thickness of Thermal Insulation

Required thicknesses of thermal insulation for the various services are indicated in the following Tables 1 - 9 inclusive.

THICKNESS TABLES
In accordance with BS 5422 REV 2001

Thicknesses shown in the tables are based on manufacturer's typical declared thermal conductivity values at the appropriate mean temperature of insulation as follows:

Insulating material	Mean temperature of insulation (°C)				
	0	+10	+50	+75	+100
	Thermal conductivity (W/m·K)				
Phenolic foam (PF)	0.018	0.018	0.023	0.025	*
Mineral wool (MW)	0.032	0.034	0.037	0.040	0.044
Nitrile rubber (NR)	0.035	0.037	0.040	0.043	*
Calcium silicate (CS)	*	*	0.050	0.053	0.055

* Not recommended for use at these mean temperatures where,

Mean temperature of insulation = $\frac{\text{Hot face temperature + Cold face temperature}}{2}$

TABLE 1 **Thickness of insulation for chilled and cold water supplies to prevent condensation on a low emissivity outer finish (e.g. Bright Class O Foil) in an ambient still air temperature of 25°C and relative humidity of 80%.** (Draft BS 5422:2001 - Table 8)

Steel pipe size (mm)		Temperature of water (°C)					
		+10		+5		0	
		Thickness of insulation (mm)					
NB	OD	Phenolic foam	Mineral wool	Phenolic Foam	Mineral wool	Phenolic foam	Mineral wool
15	21	15	20	15	25	20	30
20	27	15	25	15	30	20	40
25	34	15	25	20	30	25	40
32	42	15	25	20	30	25	50
40	48	15	30	20	30	25	50
50	60	15	30	20	40	25	50
65	76	20	30	25	40	30	50
80	89	20	30	25	40	30	50
100	114	20	30	25	40	30	50
150	168	20	40	30	50	35	60
200	219	20	40	30	50	40	60
250	273	25	40	30	50	40	65
300	324	25	40	35	60	40	65
Vessels and flat surfaces		30	50	40	65	50	80

TABLE 2 **Environmental thickness of insulation for non domestic heating installations to control heat loss.** (Draft BS 5422:2001 - Table 12)

Steel pipe size (mm)		Hot face temperature of installation (°C)					
		+75		+100		+150	
		Thickness of insulation (mm)					
NB	OD	Phenolic foam	Mineral wool	Phenolic foam	Mineral wool	Phenolic foam	Mineral wool
15	21	15	30	15	40	50	80
20	27	15	40	20	40	60	80
25	34	20	40	20	40	60	100
32	42	20	40	20	50	65	100
40	48	20	40	25	50	65	100
50	60	20	40	25	50	65	100
65	76	25	40	25	50	75	100
80	89	25	50	30	60	75	100
100	114	25	50	30	60	75	105
150	168	25	50	35	60	75	105
200	219	30	50	35	60	80	110
250	273	30	50	35	60	80	110
300	324	30	50	35	60	80	110
Vessels and flat surfaces		35	50	40	65	90	115

TABLE 3 **Environmental thickness of insulation for non domestic hot water services.** (Draft BS 5422:2001 - Table 13)

Steel pipe size (mm)		Water Temperature of 60°C	
		Thickness of insulation (mm)	
NB	OD	Phenolic foam	Mineral wool
15	21	15	25
20	27	15	30
25	34	20	30
32	42	20	30
40	48	20	35
50	60	20	35
65	76	25	35
80	89	25	40
100	114	25	40
150	168	30	50
200	219	30	50
250	273	30	50
300	324	30	50
Vessels and flat surfaces		35	50

TABLE 4 **Environmental thickness of insulation for domestic central heating installations (+75°C) and hot water supply systems (60°C) to control heat loss in potentially unheated indoor areas with ambient air temperature of -1°C.**
(Reference Draft BS 5422:2001 - Table 14)

Outside diameter of copper pipe (mm)	Water temperature of 60°C/75°C	
	Thickness of insulation (mm)	
	Phenolic foam	Mineral wool
10	15	25
12	15	25
15	15	30
22	20	40
28	20	40
35	25	40
42	25	40
54	25	50
Cylinders	35	50

TABLE 5 **Environmental thickness of insulation for ductwork carrying warm air.**
(Reference Draft BS 5422:2001 - Table 11)

Temperature difference between air inside ductwork and ambient air (°C)					
10		25		50	
Environmental thickness of insulation (mm)					
Phenolic foam	Mineral wool	Phenolic foam	Mineral wool	Phenolic foam	Mineral wool
20	40	25	50	35	65

TABLE 6 **Thickness of insulation for condensation control on ductwork carrying chilled air in ambient conditions 25°C, 80% rh.**
(Reference Draft BS 5422:2001 - Table 10 - low emissivity finish 0.05)

Minimum air temperature inside the ductwork (°C)							
15		10		5		0	
Thickness of insulation (mm)							
Phenolic foam	Mineral wool	Phenolic foam	Mineral wool	Phenolic foam	Mineral wool	Phenolic foam	Mineral wool
20	30	25	50	40	75	50	100

TABLE 7 **Minimum thickness of insulation required to give protection against freezing under specified commercial and institutional conditions.**
(Reference Draft BS 5422:2001 - Table 23)

Initial water temperature		+ 2°C		+ 2°C	
Minimum ambient temperature		-6°C (Indoor unheated areas)		-6° C (Outdoor)	
Evaluation period		12 h		12 h	
Permitted ice formation Permi		50%		50%	
Pipe size (mm)		Thickness of insulation (mm)			
0.Dia.	Bore	Phenolic foam	Mineral wool	Phenolic foam	Mineral wool wool
Copper Pipes					
15.0	13.6	23 (25)	78 (80)	68 (70)	413 (420)
22.0	20.2	10 (15)	23 (25)	21 (25)	58 (60)
28.0	26.2	7 (15)	13 (20)	13 (15)	28 (30)
35.0	32.6	5 (15)	10 (20)	9 (15)	18 (20)
42.0	39,6	4 (15)	7 (20)	7 (15)	13 (20)
54.0	51.6	3 (15)	5 (20)	5 (15)	9 (20)
76.1	73.1	2 (15)	4 (20)	4 (15)	6 (20)
108.0	105.0	2 (15)	3 (20)	3 (15)	4 (20)
Steel Pipes					
21.3	16.0	18 (20)	48 (50)	44 (45)	173 (175)
26.9	21.6	10 (15)	21 (25)	20 (20)	52 (60)
33.7	27.2	7 (15)	14 (20)	13 (15)	29 (30)
42.4	35.9	5 (15)	9 (20)	9 (15)	17 (20)
48.3	41.8	4 (15)	7 (20)	7 (15)	13 (20)
60.3	53.0	3 (15)	6 (20)	5 (15)	10 (20)
76.1	68.8	3 (15)	4 (20)	4 (15)	7 (20)
88.9	80.8	2 (15)	4 (20)	3 (15)	6 (20)

NOTES: Thickness given are minimum calculated specifically against the criteria noted in the table. Adopting these thicknesses may not satisfy other design requirements. Thicknesses shown in brackets are nearest standard thicknesses normally available from manufacturers.

Some of the insulation thicknesses calculated are too large to be applied in practice but are included to highlight the difficulty in protecting small diameter pipes against freezing under extreme conditions. In these cases, to provide the appropriate level of frost protection to certain sizes of pipes, it may be necessary to provide additional heat to the system, for example by controlled periodic circulation of the water or by heat tracing.

Thickness calculations ignore the specific heat capacity and surface resistance of the insulation in order allow for a common situation where the temperature of the insulation is lower than the initial temperature of the water.

TABLE 8 Minimum thickness of insulation to protect against freezing for domestic cold water systems.
(In accordance with BS 5422:REV 2001, Table 24)

Initial water temperature		+ 2°C (Indoors and inside the envelope of building insulation)		+ 2°C (Outdoors or Indoors but outside the envelope of building insulation)	
Minimum ambient temperature		-6°C		-6°C	
Evaluation period		12 h		12 h	
Permitted ice formation		50%		50%	
Pipe size (mm)		Thickness of insulation (mm)			
0.Dia.	Bore	Phenolic foam foam	Mineral wool	Phenolic foam	Mineral wool wool
Copper Pipes					
15.0	13.6	20 (20)	62 (65)	23 (25)	78 (80)
22.0	20.2	9 (15)	20 (20)	10 (15)	23 (25)
28.0	26.2	6 (15)	12 (20)	7 (15)	13 (20)
35.0	32.6	5 (15)	9 (20)	5 (15)	10 (20)
42.0	39,6	4 (15)	7 (20)	4 (15)	7 (20)
54.0	51.6	3 (15)	5 (20)	3 (15)	5 (20)
76.1	73.1	2 (15)	4 (20)	2 (15)	4 (20)
Steel Pipes					
21.3	16.0	15 (15)	38 (40)	18 (20)	48 (50)
26.9	21.6	9 (15)	18 (20)	10 (15)	21 (25)
33.7	27.2	7 (15)	12 (20)	7 (15)	14 (20)
42.4	35.9	5 (15)	8 (20)	5 (15)	9 (20)
48.3	41.8	4 (15)	7 (20)	4 (15)	7 (20)
60.3	53.0	3 (15)	6 (20)	3 (15)	6 (20)
76.1	68.8	2 (15)	4 (20)	3 (15)	4 (20)

NOTES: Thicknesses given are calculated specifically against the criteria noted in the table. Thicknesses shown in brackets are next higher standard thicknesses normally available from manufacturers.

Some of the calculated insulation thicknesses are too large to be applied in practice but are included to highlight the difficulty in protecting small diameter pipes against freezing under extreme conditions. To provide the appropriate level of frost protection to certain sizes of pipes, it may be necessary to provide additional heat to the system, for example by heat tracing or periodic circulation of the water.

The above thickness calculations ignore the specific heat capacity and surface resistance of the insulation.

TABLE 9 Environmental thickness of insulation for process pipework and equipment to control heat loss.
(Based on BS 5422:2001 - Table 15)

Steel pipe size (mm)		Hot face temperature of installation (°C)					
		+100		+200		+300	
NB	OD	Phenolic foam	Mineral wool	Mineral wool	Calcium silicate	Mineral wool	Calcium silicate
15	21	20	50	70	90	105	130
20	27	25	50	70	90	110	135
25	34	25	50	75	95	115	140
32	42	25	50	80	100	120	145
40	48	30	60	85	105	125	150
50	60	30	60	90	110	130	160
65	76	35	60	95	115	140	165
80	89	35	65	100	120	145	170
100	114	40	70	105	125	150	175
125	140	40	70	110	130	160	185
150	168	45	80	120	140	165	190
200	219	45	80	125	145	175	200
250	273	50	85	130	150	185	210
300	324	50	90	140	155	190	215
Vessels and flat surfaces		65	110	165	185	220	245

2.11 FLUSHING PRECOMMISSIONING CLEANING & WATER TREATMENT

Flushing shall be:

undertaken on all systems before pressure tests are conducted and carried out using water or air as appropriate with parts that will restrict flow or sustain damage removed.

witnessed to demonstrate that there are no blockages and that no foreign matter remains.

undertaken again when water is drained off or air released after pressure testing to establish that the systems are still clean.

arranged so that water systems are left dry after testing until setting to work and air systems left charged with reduced pressure air monitored by a gauge to show any damage by other trades up to the hand-over.

Filling shall be:

by means of quick-fill connection supplied and fitted by the contractor.

carefully controlled in the case of hydraulically tested systems to ensure that water hammer does not occur and demonstrated to show that all air has been vented off and the system is full and ready for testing.
similarly controlled when systems are re-filled for regulation balancing and setting to work etc.

Pre-Commissioning cleaning shall be:

carried out on all water systems strictly in accordance with BSRIA Application Guide AG1/2001 "Pre-Commissioning Cleaning of Pipework Systems" and BS 7593 "A Code of Practice for Treatment of Water in Domestic Hot Water Central Heating Systems."

The Contractor shall include for the chemical treatment of all water systems installed to prevent corrosion and the build up of sludge and scale in heating circulation systems and sterilisation of hot and cold water services as follows:

LPHW Circulation Systems:- shall be provided with suitable dosing equipment to facilitate initial dosing and ongoing water treatment of the systems.

A Water Treatment Specialist shall be engaged to advise on system dosing requirements based on Manufacturers Recommendations for all the Installed Plant and Systems.

The Contractor shall allow for the provision of all such recommendations to the satisfaction of the Contract Administrator.

HWS Secondary Service, Cold Water Down Service, Cold Feed and Mains Water Systems:-

After thoroughly flushing the system with fresh water to remove all swarf deposits and debris, the tanks, storage heaters and all distribution pipework shall be sterilised in accordance with BS 6700.

2.12 TESTING AND COMMISSIONING

2.12.1 General

The Contractor shall carry out the testing, commissioning and setting to work of all plant equipment and systems forming this contract generally in accordance with current CIBSE Commissioning Codes and BSRIA Commissioning Guides with fully logged results as required under The Building Regulations Part L2 (A) 2006 edition.

2.12.2 Method of Testing (Not Gas Service)

The whole of the heating installation, hot and cold water, oil services and ventilation systems shall be subjected to pressure and performance tests. Before any tests are carried out, 48 hours notice of such tests shall be given, in writing, to the Contract Administrator in order that he or his representative may be present.

Should any section of the works be tested without any notice having been given to the Contract Administrator, such tests shall be carried out in his presence and if the work has been covered up it shall be uncovered without expense to the Employer.

Pressure tests shall be carried out as required and before any non-conducting composition or paint is applied.

Pressure tests shall be of 30 minutes duration and the pressure shall be equal to one and a half times the head of water on the apparatus or 350 kPa (3.5 bar), whichever is the greater, except for

pipework in floor or external ducts which shall be tested to twice the working pressure or 700 kPa.

Oil and air pipework or plant shall be pressure tested pneumatically and water pipework and plant hydraulically.

Immediately each boiler is erected and before connecting to pipework, it shall be hydraulically tested to the pressure detailed above.

The Contractor shall Provide the necessary water or air pressure pumps and also all necessary plugs, blank flanges and temporary filling connections etc. for sealing off open ends in order that the installation may be tested in sections, if required, by the progress of the building operations.

Any faulty materials revealed during such tests shall be removed and replaced without expense to the Employer.

All heating and water systems shall be flushed out with clean water until all scale, rust and dirt are removed. During the flushing out, provision shall be made to exclude filters, pumps, mixing valves and other items of plant which could be damaged by the cleaning operations.

Before the above flushing out is carried out, 48 hours notice shall be given, in writing, to the Contract Administrator in order that he or his representative may be present.

2.12.3 Method of Testing (Gas Installations)

The whole of the gas services shall be subjected to pressure and performance tests. Before any tests are carried out, 48 hours notice of such tests shall be given, in writing, to the Contract Administrator in order that he or his representative may be present.

Should any section of the works be tested without notice having been given to the Contract Administrator, such tests shall again be carried out, in his presence, and if the work has been covered up, it shall be uncovered without expense to the Employer.

On completion of the pipework - or section(s) of same - if required by the progress of the building operations - AND PRIOR TO CONNECTIONS TO APPLIANCES AND GAS METERS, the whole shall be tested pneumatically to a pressure of 1 bar (15 psi) for a minimum period of 15 minutes.

On completion of all connections to gas appliances and meter, the valve on the inlet side of the meter shall be closed and the whole installation tested pneumatically to a pressure of 50 mbar(20 in wg) for a minimum period of 15 minutes.

NOTE: This pressure may have to be increased if the service pipe is connected to a medium pressure main - Contract Administrator to advise, if applicable.

The Contractor shall carry out performance test by checking that flow at outlets, pressure settings of governors and input consumption of all equipment included in this Contract conforms to Manufacturers' Specifications.

If service pipe exceeds 2" diameter, a line diagram shall be provided adjacent to meter position as called for in Gas Safety Regulations 42B. This is to be photo printed on to a white laminate board. Certificate No. 4 - Gas Safety Regulations - shall be submitted, in duplicate, to the Contract Administrator on forms provided.

The Completion Certificate will not be issued until this Clause has been complied with completely.

2.12.4 Equipment Tests

The Contractor will carry out Equipment Tests in strict accordance with manufacturer's instruction and commissioning, as generally detailed in the following CIBSE Commissioning Codes:

Series A - Air Circulation Systems

Series B - Boiler Plant

Series C - Automatic Control Systems

Series R - Refrigerating Systems

Series W - Water Distribution Systems

The Contractor will record the following information, while carrying out Performance Tests to be included in the Operating and Maintenance Manual.

Boiler Plant
Pressure test in accordance with 5J:02 (d) measured in kPa

Output test giving flow and return temperatures and time taken from cold to achieve design temperature when fully operational.

Efficiency tests giving CO2 content, smoke number, flue gas temperature at boiler smoke outlet and burner oil or gas pressures.

Flue Dilution System
Demonstrate that the products of combustion are 1% CO2 or less.

Record air volume flow rates in (m3/sec) and air temperatures in (Deg C) at both inlet and outlet.

Water Circulation Systems
Flow rate (in Litres/sec) at each balancing or regulating valve and setting of valve to achieve design.

Flow and return temperatures at each circuit measuring point.

Room temperature at a minimum of three positions on each floor or each area served by the system.

The external temperature at 09:00, 12:00 and 15:00 hours on the day or days of the testing.

Record setting of all thermostatic and automatic control equipment.

Demonstrate to the Contract Administrator the operation of each piece of control equipment with simulated conditions, as necessary. Where automatic control equipment, with or without mixing/diverter valve, is installed, the control equipment manufacturer shall carry out the commissioning and testing.

Water Supply System
Flow checks of all draw-off points and ball valves shall be made.

Circulation tests on HWS systems are as for heating system with all draw offs closed.

Circulating Pumps
Measure pressure difference across each pump suction and discharge to determine the actual flow rate. A copy of the Pump Operating characteristic, with the test pressure marked, must be included in the Operating and Maintenance Manual.

Record speed of rotation of impeller and motor shaft.

Record start and running currents on each phase.

2.12.5 Commissioning

All plant items shall be commissioned by the manufacturer or a specialist commissioning engineer and all commissioning results recorded are to be included with the Operating and Maintenance Instruction Manuals that form part of these contract works.

Certified copies of all test results are to be submitted, in duplicate, to the Contract Administrator for acceptance before inclusion in the Operating and Maintenance Instruction Manuals.

2.13 ASSOCIATED ELECTRICAL INSTALLATION

This section specifies the requirements for the electrical systems associated with the Mechanical Services that are to be provided to affect the complete system. Work can only be undertaken by NICEIC or ECA approved Contractors.

2.13.1 References

The following shall apply:-

Health and Safety at Work Act

The Statutory at Work Regulation

Electricity Supply Regulations : 1988

IET Wiring Regulations : Latest Edition including all relevant British Standards, references and amendments. (BS 7671)

2.13.2 Conduits

Shall be to BS 4568 : Part 1 : 1970, BS 6099 : Part 1 : 1981 (1986) and BS 31 : 1940 (1988). Minimum diameter 22mm. Fully re-wirable and installed horizontally or vertically. Shall not be concealed before inspection or approval. Non-screwed conduits fittings shall not be used.

2.13.3 Trunking

Shall be to BS 4678 : Part 1 : 1971 (1988) with appropriate class used to suit ambient conditions.

Sized to comply with BS 7671 IET Wiring Regulations

Suitably fixed to structure including all necessary fire barriers and precautions.

2.13.4 Cable Trays

Shall be to BS 1449 and of the galvanised type. Minimum width 100mm and sized to suit BS 7671 IET Wiring Regulations

Supported to provide rigid fixing using cross sections of unistruts and steel drop rods.

Cables to be fixed using approved ties.

2.13.5 Single Core and Flexible Cables

Minimum size of 1.5mm² and enclosed in conduit and/or trunking

Copper conductors stranded with equal c.s. as phase conductor.

Sized in accordance with I.E.E. Regulations and to BS 6004 : 1990

Flexible cables shall be a minimum of 0.7mm² and heat resistant type to suit the ambient temperatures.

2.13.6 Mineral Insulated Cables

Shall be to BS 6207 : 1987 and of heavy duty.

Sized to BS 7671 IET Wiring Regulations and fixed to structure or to cable tray (more than one run).

Looped in a complete turn at motors or other equipment liable to vibrate.

2.13.7 Steel Wired Armoured Cables

Shall be of PVC/SWA/PVC or XLPE type to BS 6346 : 1989 or BS 5467 : 1989.
Cable joints shall not be allowed.

Minimum size shall be 4mm² and all sized to the BS 7671 IET Wiring Regulations.

2.13.8 Control and Extra LV Wiring

Shall be to BS 6231 : 1990, BS 6701, BS 6360 : 1981 and IEC : 92 : Part 3.
All cables shall be enclosed in trunking or conduit.

Cables with sheath, armour and protection may be installed in free air but fixed on to cable tray.

Maximum length of free cable for final termination shall not exceed 500mm.

2.13.9 Luminaires

Shall be BS 4533.

Fixed to ceiling/wall structure using conduit suspension, chain suspension or unistrut sections.

Final connections from ceiling roses to suspended/recessed luminaires shall be in 3 core heat resistant flexible cable.

2.13.10 Power Outlets

Shall be to BS 1363 : 1984 surface pattern type. All socket outlets shall be supplied with plugs (13 amps).

Final connections from the connection unit shall be in flexible conduit unless stated otherwise in Section.

2.13.11 Motors

Shall comply with BS 2757 : 1986 : Insulation, BS 5000 : Part 10, 11 and 99 and BS 4999 : Part 72 and of maximum continuous rated.

2.13.12 Starters

Shall comply with BS 4941 : Part 1, 2, 3 and 4 and comply with the rating and duties as the associated motor.

Shall incorporate mechanical and electrical interlocking on contactors for reversing and/or reduced voltage starting.

Every starter shall have a separate isolating switch of same make and rating.

2.13.13 Panels

Shall be rated at 415/240 volts, manufactured in approved metals for switchgears and by reputable manufacturer.

Provided with proper entries for conduits, trunking termination and MICC cables.

The panel shall have full height and width access door adequately hinged with cables laid and fixed in suitable pattern to allow frequent opening and closing of panels. The panels shall have interlocked isolating switch in addition to external switch.

Internal wiring shall be to BS 6231 : 1990, colour coded, bunched and run in harness type system.

A detailed scaled down schematic of the wiring details of the panel shall be provided in the panel.

2.13.14 Testing

Shall be carried out in accordance with the Latest Edition of BS 7671 IET Wiring Regulations.

All equipment (motors, starts, etc.) shall be tested in accordance with the BS 7671 IET Wiring Regulations, relevant to British Standards and the manufacturer's recommendations.

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SECTION 3.0

SPECIFIC MECHANICAL CLAUSES

Section 3.0 – Specific Mechanical Clauses – Table of Contents

3.0 SPECIFIC MECHANICAL CLAUSES

The Contractor shall note the following comprises the Consulting Engineer's Performance Specification for the Mechanical Services works associated with the development of the New Pavilion at Battle Recreation Ground, North Trade Road, Battle, East Sussex, TN33 0HA.

3.1 DESCRIPTION OF WORKS

The Works covered by this Contract comprise the design, supply and installation of the following:

- Existing Relocated Water Main
- Electric Heating
- Mechanical Ventilation with Heat Recovery
- Mechanical Extract Ventilation
- Domestic Hot and Cold Water
- Sanitation
- Automatic Controls

The Contractor shall also be responsible for providing:

- Fully detailed Design drawings
- Detailed Installation Drawings (see Clauses 1.50 and 1.52)
- As Installed Record Drawings and Manuals (see Clauses 1.70 and 1.71)
- Calculation Package and Technical Submittals

3.2 SPECIAL CONDITIONS

The Contractor shall note the following and make due allowance within his Tender for these restrictions:

(i) The works will be carried out in normal working hours.
(ii) The works may be carried out in phases.
(iii) Allowance shall be made for any temporary mechanical supplies that are needed.
(iv) The contractor shall note that these works shall fully comply with BS7671:2018 Requirements for Electrical Installations which came into effect on 1st January 2019.
(v) Within this specification (Section 4) is a list of Recommended Manufacturers & Suppliers. The Contractor may put forward equal and approved alternatives to all NAMED suppliers and specialists. However, this shall be stated in a covering letter with the Tender offer and shall not be deemed as accepted until approved by the Contract Administrator. However, the Tender and Tender Analysis will be completed using all named "manufacturers and specialists".

For more general conditions related to working arrangements, restrictions on working methods, phasing and contract programme refer to the Client's Contract Conditions.

3.3 QUOTATIONS / 3RD PARTY SPECIFICATIONS

When reference is made in this Specification to quotations or 3rd party specifications, the Contractor shall check with the quotation originator and satisfy themselves that the quotation / 3rd party specifications fully covers the requirement as set out in this Specification and the Contract Drawings, as no claim will be entertained after Tender for any omission which may have been made. It should be noted the Specialist quotations / 3rd party specifications may not have been based on the latest drawings. All final measurement, quantities and spec requirements are the responsibility of the Mechanical Contractor.

3.4 BUILDING REGULATIONS PART L: VOLUME 2 REQUIREMENTS

The new building shall meet the requirements of Building Regulations Part L: Volume 2, 2021 Edition.

3.5 MECHANICAL SERVICES DESIGN CRITERIA

3.5.1 Space Heating

Outside (Winter):	-4°C Saturated

Inside (Winter):

Circulation, Cleaners, Stores, Kitchen	19°C
Club Room, Community Area, Officials Room	21°C
WC's, Changing Rooms, Showers	19°C
Undercroft	Unheated except to avoid pipework freezing

3.5.2 Mechanical Ventilation

10 l/s per occupant Outdoor Air

Function Room	1 person per 2m²
Café	1 person per 2m²
Kitchen	60 l/s Extract or if commercial equipment to suit BESA document DW172
WC's, Changing Rooms, Showers & Officials Room	6 Air Changes per Hour Extract
Cleaners	4 Air Changes per Hour Extract

3.5.3 Noise Levels (from Mechanical Services)

Club Room, Community Area, Officials Room	NR35
Circulation, Cleaners, Stores, WC's, Changing Rooms, Showers	NR40
Kitchen	NR45

3.6 INCOMING WATER MAINS

The existing water mains connection to the demolished building shall be relocated to suit the new building, running pipework in to the undercroft area.

As the new building is off of the highway, it is expected that this work may be carried out directly by the Contractor. Should the existing meter position be changed, then the Contractor shall contact South East Water who shall then carry out this work.

Should South East Water become involved, the Contractor shall be responsible for the application, liaison, supervision and co-ordination of South East Water in undertaking these works. The Client will pay for the works directly.

Underground and ducted pipework shall be in Blue MDPE barrier pipe and the internal pipework shall be in copper.

A connection from the incoming water main shall be run directly to an outdoor water fountain/bottle refill station.

3.7 HEATING

Electric Panel Heaters shall be provided in the following areas:

- Hallways
- Lobbies
- Clubroom
- Refreshments Area
- Individual WC Cubicles off of Hallway

These are areas that will be continually or intermittently used at any time while the building is in use.

The electric panel heaters shall be wall mounted at low level, be appropriate in type for the individual areas, and be rated to suit the requirements.

Each heater shall have an integral thermostat and an individual controller, which will allow 5+2 day timeclock setting and be able to be operated remotely with Wi-Fi connectivity. Controllers shall be tamperproof.

Low level electric bar or skirting heaters shall be provided below benches in the following areas:

- Changing Rooms
- Officials Room

These are areas that will be used by groups of people to a known schedule.

The heaters shall be provided with a caged cover, so that the heaters are not able to be covered, which may become a fire risk.

Each heater shall have an integral thermostat and an individual controller, which will allow 5+2 day timeclock setting and be able to be operated remotely with Wi-Fi connectivity. Controllers shall be tamperproof.

3.8 VENTILATION

Individual Mechanical Extract Ventilation Fans will be provided to the following area:

- Individual WC's off of Hallways
- Kitchen and Kitchenette

These are areas that will be continually or intermittently used at any time while the building is in use.

Ventilation Fans shall be through wall or ceiling mounted versions with ducted discharge via a roof cowl or soffit vent.

The fans shall be controlled by individual ceiling mounted PIR sensors, which shall have an adjustable 0-20 minute run on timer. The fans shall also have humidistat control to operate on high humidity levels.

Make up air shall be provided by infiltration into the building, gaps and cracks around doorways and where necessary undercuts to doors.

Heat Recovery Ventilation Fan Units shall be provided to the following areas:

- Changing Rooms with connected WC and shower areas
- Officials Room with connected WC and shower
- Wet Room.

These are areas that will be used by groups of people to a known schedule.

Individual units shall be provided for each changing rom, with a separate unit serving the Officials Room and Wet Room.

Heat Recovery Ventilation Units shall be of the horizontal type, with integral filters and electric heater battery for tempering of incoming air, and mounted in the ceiling void of the building. Intake and discharge terminals may be roof cowls or louvres, ducted from the units. Extract grilles shall be of the egg crate type and be located in the ceiling of the WC and shower areas. Supply grilles shall be of the air valve or louvre diffuser type and located in the ceiling of the changing zone of each area. Supply and extract connections shall be ducted from the units.

The heat recovery ventilation units shall be controlled by individual controllers located in an area accessible to staff only. The controllers shall be on/off, speed controllable and have timeclock control with 5+2 day settings and suitable remote control via Wi-Fi.

Where needed the path for air to travel between supply and extract grilles shall be by gaps and cracks around doorways, and where necessary undercuts to doors.

Natural Ventilation by trickle ventilators, openable windows, doors and air infiltration will provide necessary ventilation to the following areas:

- Refreshment Room
- Clubroom

3.9 HOT AND COLD WATER SERVICES

The relocated cold water main shall be run into the undercroft of the building, where a cold water packaged booster set shall be located.

The tank shall have a minimum capacity of 1600 litres, which may be reduced subject to suitable top up rate proven by a flow/pressure test on the existing mains. The booster set shall comprise a minimum of 2 pumps (duty/assist) and be suitable for delivering a pressure of 3 bar at each outlet.

A heat pump water heater shall also be provided in the undercroft area, as the Lochinvar Amicus Aquatar fitted with a 12kW immersion heater. The water heater shall be matched with a buffer vessel to increase the minimum quantity of stored hot water to a total of 950 litres. Suitable natural ventilation shall be provided into the undercroft to suit the needs of the heat pump water heater. The manufacturer's requirements shall be followed in terms of pumping between water heater and buffer, unvented system requirements, system pumped return, etc.

The limited height of the undercroft area shall be considered for installation, maintenance and replacement of any plant installed in this area.

All sanitaryware draw-offs are to be provided with an inline water flow limiter to minimise the water consumption to the building. Flow limiting devices may be integral to the sanitaryware fitted.

Flow limiters shall be set to the following:

Basin	3 l/min
WC	4 l/min
Shower	8 l/min
Kitchen Sink	5 l/min

All pipework shall be in copper.

Electronic water conditioners shall be fitted to the incoming water main and hot water flow pipework.

Each shower shall be provided with a thermostatic mixing valve which shall be specified by others.

A 22mm diameter boosted cold water supply shall be provided to the kitchen area for fit out by the company that will operate this unit. This connection shall be provided with a check meter, so that the operator can be billed by the Client for their water use.

Chlorination of Services, Cleaning & Precautions against Legionella Contamination

All domestic water services shall be cleaned and chlorinated in accordance with the following.

The pipework shall be flushed through prior to sterilisation.

The system shall be sterilised by the addition of chlorine in accordance with BS 6700 and to the satisfaction of the Engineer prior to being handed over.

During flushing out, any equipment liable to damage shall be adequately protected.

All parts of the system shall be disinfected, not just those which are readily accessible. Any parts of the existing system upstream requiring disinfection shall be included.

Water systems should be disinfected, drained, cleaned and then disinfected again:

a) before being taken into use to remove contamination which may have occurred during construction, in accordance with BS 6700.

b) If the system, or part of it, has been out of use for a significant period and have not been left dry.

c) If the system, or part of it, has been extensively altered, entered for maintenance or otherwise disturbed.

Hot water systems shall be disinfected by chlorinating the water to between 20 and 50 ppm, then allowing it to flow to all parts of the system and stand for at least 4 hours (or preferably overnight). The system shall then be completely and thoroughly flushed.

Cold water services shall be disinfected in accordance with BS 6700.

3.10 SANITATION

Sanitary and waste pipework shall be provided and installed as indicated by the Contractor.

Adequate flow-capacity, falls and ventilation shall be provided throughout.

Rodding access shall be provided 1m above floor level.

Where this cannot be achieved rodding eyes are to be placed in an area where the use of them is possible and all must be provided with suitable access panels where applicable.

3.11 ACOUSTICS AND ANTI VIBRATION

3.11.1 General

Acoustic and anti-vibration treatments shall be applied to all ventilation plants and systems, all pumps and booster set so as to comply with Part 2 of this specification to achieve the minimum criteria specified listed in Clause 3.5.3.

The Contractor shall appoint a specialist Acoustic Supplier to check all acoustic treatments indicated and advise on any additional treatments required to meet the criteria.

The Contractor shall supply and install all such equipment and incorporate all recommendations under the direction of the Contract Administrator.

3.11.2 Responsibilities

The responsibilities of the Contractor:

1. The achievement of air borne noise levels as specified in ventilated areas due to noise transmitted or created by ventilation plant or equipment or created directly by any specialist equipment mounted in ventilated space.

2. Providing adequate anti-vibration treatments or isolation for all plant, equipment, and machines including pipes, ducts, grilles and diffusers so that –

   a) no excessive vibration is transmitted to the floors and walls of the building

   b) the mechanically induced vibration levels in floors, walls and ceilings of occupied areas is sufficiently small to avoid the radiation of sound power to the areas at such a level as to compromise the relevant criteria.

   c) all such treatments are to be satisfaction of the Contract Administrator.

3. Providing flexible connections and/or supports in pipes and ducts where these reconnected to resiliently mounted machines.

4. Providing all relevant information of necessary builders work for the prevention of sound transmission from Plant Rooms or Areas to adjacent occupied spaces.

5. Control of Plant Room noise levels to the criteria specified.

3.11.3 Liabilities

In the event that the stated criteria are exceed due to the supply or installation of equipment which does not meet the specification the Contractor shall undertake such remedial action at no extra cost to achieve the criteria.

3.12 TESTING AND COMMISSIONING

The testing and commissioning shall be carried out in accordance with the following recommendations and as set out in CIBSE Commissioning Codes and BSRIA Commissioning Guides with fully logged results as required under The Building Regulations 2000 Part L1B (2010).

3.12.1 General

a) The Contract Administrator shall have powers to test all or any of the materials and equipment used in the work in any manner they may deem necessary to ensure that they conform to the specification.
b) The testing of systems under the various sections of the Specification may be required to be carried out in parts, or as a whole.
c) All tests shall be carried out in the presence of the Contract Administrator or their chosen representative to their complete satisfaction.

d) The Contractor shall demonstrate to the satisfaction of the Contract Administrator or their chosen representative that the installation or any portion thereof, which has been set to work, complies with the requirements of the specification.
e) Any defects of workmanship, material performance, maladjustment's, non-compliance with the specification, or other irregularities which become apparent during the tests shall be rectified by the Contractor, at no cost to the Contract, and test repeated at the Contractor's expense until the whole is proved free from defects and in complete working order to the satisfaction of the Contract Administrator.
f) All systems shall be left sound and perfect.
g) For the commission of specialised items of plant or equipment the works shall be carried out by the Manufacturers personnel.
h) The Contractor's commissioning Engineer shall ensure that any commission work carried out by specialist manufacturers/contractors, is carried out to their satisfaction and in such a way that it does not prevent him from proceeding with the overall commissioning.

3.12.2 Pipework Systems

a) Pressure testing of piped services systems, or any section of a completed system, shall be completed prior to the application of any thermal insulation to the piped surfaces.
b) Tests on lengths of pipe or portions of systems shall be applied by filling the section to be tested with water and raising its pressure to the figure quoted in this Specification.
c) The section shall then be left fully isolated without further strokes of the pump and all joints must remain watertight for a period of at least two hours, the Supervising Officer's decision as to whether or not the section is sound being governed by the rate at which the pressure falls.
d) Any fault discovered during such tests shall be at once remedied by the Contractor at their own cost and expense, and the test reapplied until the Contract Administrator is satisfied that the section under test is sound. Remedial work shall conform with all the requirements of the Specification for material and standards of workmanship.
e) On completion of the test, the water shall be released and drained away as rapidly as possible, the section being then thoroughly sluiced through to ensure the removal of as much dirt and dross as possible before refilled and put into service.
f) Pressure tests shall be carried out at 1.5 times highest working pressure and held to test for not less than 30 minutes for LTHW heating, DHWs and CWDS, MWS and FM Services to 90m head or 1.5 times maximum working pressure, whichever is the greater. After isolation of equipment liable to be damaged, the gas service pipework shall be air pressure tested to 2 times the maximum working pressure or to 50 mb whichever is greater. Installation pipework tested to 30 mb. Test applied for 3 minutes with no fall in pressure over the last two minutes of the test period. A normal working test under design conditions shall then be carried out for not less than 6 hours.
g) The Contractor shall ensure that the systems are completely clear of any obstructions, debris and superfluous matter, prior to any test being applied and upon completion.
h) The complete distribution system shall be balanced to ensure that the required flow rates are present at each point.
i) Air tests for leaks and performance tests shall be carried out as set out in BS5572 for Sanitation/Waste Pipework.

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SECTION 4.0

RECOMMENDED MANUFACTURERS & SUPPLIERS

RECOMMENDED MANUFACTURERS & SUPPLIERS

Copper Pipe & Fittings	IMI Yorkshire Fittings ☎: 01132 701 104
Valves & Cocks	Crane ☎: 01473 277 300
TMV's	Horne ☎: 01505 321 455
Non Return Valves	Herz Valves UK Ltd (or approved equal) ☎: 01483 502 211 or Bergin Limited ☎: 0208 202 3737
Isolating Valves (Ball)	Cottam & Preedy ☎: 0121 552 5281
Soil, Waste & Rainwater Pipes	Saint Gobain ☎: 0115 930 5000
Electronic Water Conditioners	Hydrotec ☎: 01494 796040
Plastic Waste Pipe	OSMA ☎: 01249 766 600
Mechanical Extract Ventilation Fans and Heat Recovery Ventilation Units	Nuaire ☎: 02920 858500
Heat Pump Water Heater	Lochinvar ☎: 01295 271640737 387 170
Packaged Boosted Water Set	Direct Pumps & Tanks ☎: 01159 444474
Electric Heaters	Dimplex ☎: 0344 879 3586

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SECTION 5.0

TENDER ANALYSIS & DAYWORKS

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Section 5.0 – Tender Analysis & Dayworks – Table of Contents

5.0 TENDER ANALYSIS

5.1 TENDER ANALYSIS & DAYWORKS

This Tender Analysis is required to be completed by the Contractor "IN FULL".
Non compliance with this requirement will make the Tender "**NULL AND VOID**".

5.2 EQUAL & APPROVED

The Contractor may put forward equal and approved alternatives to all **NAMED** suppliers and specialists. However, this shall be stated in a covering letter with the Tender offer.

The Tender and Tender Analysis will be completed using all named **"MANUFACTURERS AND SPECIALISTS".**

5.3 QUOTATION

When reference is made in this Specification to quotations, the Contractor shall check and satisfy themselves that the quotation fully covers the requirement as set out in this Specification and the Contract Drawings, as **no** claim will be entertained after Tender for any omission which may have been made. All final measurement and quantities are the responsibility of the Mechanical Contractor.

5.4 PROVISIONAL & CONTINGENCY SUMS

Provisional and contingency sums are to be included and used as directed by the Contract Administrator.

5.5 MECHANICAL SERVICES TENDER ANALYSIS (FIXED PRICE)

This Tender Analysis is to be completed in full by the Contractor.
Non compliance with this requirement will make the Tender null and void.

No	Item	£
1.	Design, Supply and Installation of Existing Relocated Water Main	
2.	Design, Supply and Installation of Electric Heating	
3.	Design, Supply and Installation of Mechanical Ventilation with Heat Recovery	
4.	Design, Supply and Installation of Mechanical Extract Ventilation	
5.	Design, Supply and Installation of Domestic Hot and Cold Water System	
6.	Design, Supply and Installation of Sanitation System	
7.	Design, Supply and Installation of Automatic Controls	
8.	Production of fully detailed Design drawings	
9.	Production of detailed Installation Drawings (see Clauses 1.50 and 1.52)	
10.	Production of As Installed Record Drawings and Manuals (see Clauses 1.70 and 1.71)	
11.	Production of Calculation Package and Technical Submittals	
12.	12 months' Maintenance	
	Sub Total £	

	Additional Items not covered in the above for consideration:	
	1.	
	2.	
	3.	

Grand Total £ _____

The above Fixed Price Tender shall be open for acceptance for the period of three months from date of Tender Return. This priced Specification must be returned in accordance with Invitation to Tender Letter.

Signature: (Director or Agent) _____

Name of Firm: _____

Address: _____

_____

Date: _____

B & ES No: _____

5.6 DAYWORKS

For the valuation of variations which cannot be measured and valued, the Contractor shall be allowed to charge daywork in accordance with the conditions of the Contract.

The basis of charging in respect of labour will be the rates inserted by the Contractor below. Such rates will be deemed to include all on costs, statutory contributions, levies, overheads and profit, builders discount and shall not be subject to any percentage or other addition.

The basis of charging in respect of materials and plant will be the cost of the items properly incurred plus percentages for overheads and profit inserted by the Contractor below:

Labour in Dayworks	Normal Working Hours (per hr)	Outside Normal Working Hours (per hr)
Fitter	£	£
Fitter's Mate	£	£
Plumber	£	£
Plumber's Mate	£	£

Materials in Dayworks:

Percentage for overheads and profit

Plant in Dayworks:

Percentage for overheads and profit

Signature: (Director or Agent) _____

Name of Firm: _____

Address: _____

_____

Date: _____

B & ES No: _____