Building Services
Consulting Engineers

Derbyshire Fire & Rescue Service

Proposed Temporary Fire Station

Unit 3C, Boardman Industrial Estate, Swadlincote

Employer's Requirements for Mechanical Services

Tender Issue

Ref: 17.043/m

D&*d*
Building Services Consulting Engineers Ltd
Kegworth House
28 Market Place, Kegworth, Derby, DE74 2EE
Tel: 01509 670100 Fax: 01509 670110
Email: info@ddconsultingengineers.co.uk

Derbyshire Fire & Rescue Service

Proposed Temporary Fire Station

Unit 3C, Boardman Industrial Estate, Swadlincote

Employer's Requirements for Mechanical Services

Tender Issue

Contents

Revision	Description	Prepared by	Date
-	Tender Issue	P Dean	03.10.17

Derbyshire Fire & Rescue Service

Proposed Temporary Fire Station

Unit 3C, Boardman Industrial Estate, Swadlincote

Employer's Requirements for Mechanical Services

Part 1

Employer's Requirements Preamble

1.1 Definitions

The following terms appear within this Employer's Requirements document:

The Employer – Derbyshire Fire & Rescue Service

The Employer's Representative – Nigel Tate Associates

The Principal Contractor - Will be the Principal Contractor with whom the employer has contracted to complete the works. The Contractor shall be a Sub-Contractor appointed by the Principal Contractor.

Mechanical Contractor - The Contractor appointed by the Principal Contractor to design, supply and install the Works. All references to the "Contractor" will mean the Mechanical Contractor.

The Works - Shall encompass all works associated with the Principal Contractor's Contract at the site.

The Site - Shall mean the proposed temporary fire station at Unit C, Boardman Industrial Estate, Derbyshire DE11 9DL, as defined by the Principal Contractor's Contract for the works.

1.2 Scope of this Contract

This contract covers the entire design, based on information and requirements given, the detailed design, manufacture, works testing, supply and delivery to site, erection, connecting up, site testing, adjusting and setting to work of the Mechanical installation

1.3 Contractor Responsibilities

a) Contractor Design

The Contractor shall be responsible for the following:

i) Accepting copies of the scheme drawings, standards specification, performance data sheets and specific technical schedules where offered and applying himself to the resolution of the design intent in a competent, informed and diligent manner.

ii) The development and provision of design drawings, installation drawings, together with all fabrication details, manufacturers' drawings, panel layout drawings, wiring diagrams, control diagrams and schedules shall be the Contractor's responsibility.

iii) A comprehensive drawing register is to be drawn up to establish a common form of identifying areas and drawings.

iv) Symbols shown on drawings shall comply with CIBSE Standards where applicable.

v) All design and installation drawings shall be developed on Auto CAD.

b) Schedules & Calculations

The Contractor shall undertake and provide the following design information within 3 working weeks of the date of acceptance of the tender to allow full assessment, checking and approval:

- All supply and extract system load calculations
- All heating and cooling load calculations
- All pipe and ductwork sizing (velocity, pressure drop, noise)
- All pump and fan sizing (NPSH, dirty filters, commissioning tolerances)
- All expansion and contraction requirements
- All commissioning requirements (including locations of sensors for stability & accessibility)
- All performance of equipment and plant
- All diagrammatises to indicate philosophy
- All Gas Requirements
- All technical schedules of all equipment (manufacturer, type, size, construction, finish, performance data)
- All structure and airborne noise attenuation of all plant and equipment and ductwork systems

1.4 Interpretation of Documents and Drawings

a) The Specification and Tender Drawings shall be read together and the Tenderer shall, before submitting his Tender, draw attention to any discrepancies which may appear between the Document and/or Drawings and to anything which, in his opinion, may be unsuitable, undesirable or inconsistent with his guarantees and responsibilities.

b) The Tender Drawings are prepared essentially so that, in conjunction with the Specification, a correct engineering interpretation may be put on the scheme for the Works and full tender prepared.

c) The Specification shall be interpreted in accordance with good installation practice relevant to the circumstances.

1.5 Design Requirements

The Contractor's detailed design shall take full account of the Energy Conservation Act 1981, the CIBSE Energy Codes and the Building Regulations and shall include for the provision and installation of all equipment necessary to comply with their requirements and recommendations.

The Contractor's detailed designs shall take full account of the design, selection and detailed installation recommendations of the Manufacturers of all equipment selected, CIBSE Design Guides, British Standards and Codes of Practice, HVCA Standards and Air Diffusion Guide.

The Contractor shall be responsible for determining and making due allowance for the final selection of fan speeds, pump speeds, motor power requirements and the final selection of silencers, acoustic lining and enclosures etc. to meet the listed design criteria.

The capacities of plant and equipment, where shown on the Employer's Requirement Drawings have been determined by the Employer. The Contractor shall not be expected to make allowance for additional output capacity in respect of these plants but shall advise with his Tender if additional capacity is considered necessary.

1.6 Alternative Suppliers

The Contractor's attention is drawn to the named suppliers equipment detailed in the schedules.

It is necessary that the Tender offer is based upon the supply of this equipment.

Alternatives may be offered (see Volume 1, Appendix G 'Contractor's Proposal') provided the quality, design service and/or material of the substituted supplier is at least equal to that specified and/or complies with the design criteria and the supplier is approved. The Contractor is required to supply at his own cost all information including any necessary testing to decide upon acceptability of alternative products and no allowance of extension time will be made attended upon such consideration.

The Contractor shall clearly state the cost reduction that will be offered to the Client for the alternative proposal. The Client shall not be under any obligation to accept any of the alternatives offered.

1.7 Approvals and Compliance

The Contractor shall design to the following standards and shall obtain and ensure approvals and compliance with the following:

- Current Building Regulations
- Insurance Company - Test Certificates
- Gas Supplier
- Water Suppler
- Planning Officer
- Building Control Officer

- Environmental Health Officer
- Fire Officer
- Local Byelaws/Acts
- British Standards & Codes of Practice
- CIBSE Guides
- CIBSE AM10 Natural Ventilation in None Domestic Buildings
- British Gas Reports & Recommendations
- BSRIA GN7/2000 Making Natural Ventilation Work

The provision of working, fabrication co-ordination and workshop drawings having co-operated fully with all trades to ensure that co-ordination of all services and the building has been fully executed. These drawings shall have fully dimensioned positions and specific details where interface with other trades, or where exposed in critical areas to the general public's view.

Submit copies of each of the drawings, diagrams and schedules detailed in Section above in good time, to comment during the development of same.

Subject to final comments and revisions made to these drawings the Contractor shall provide copies of the said drawings, diagrams and schedules, for distribution.

The same shall apply to the working, fabrication co-ordination and workshop drawings and copies of the said drawings shall be provided after final comments have been made.

The Contractor shall appraise the duties of all plant and equipment relating to the Contract works whether specified or developed during the design (taking into account the technical and performance data sheets issued by The Employer's Advisor and shall inform The Employer's Advisor in good time of any matter with which he disagrees.

The Contractor shall draw The Employer's Advisor's attention to any discrepancy in the documents, drawings or instruction issued during or after the time of tender immediately upon receipt of same and prior to the commencement of any part of the design or works affected thereby.

1.8 Contractor's Drawings

The Contractor is required to produce design and co-ordination drawings, installation drawings, builders work drawings, shop/fabrication drawings and furnish manufacturers' drawings. In addition Record Drawings and Documentation are required.

a) Drawing Production

Prepare and submit a master plan for drawing production covering the following:

i) List of drawings to be produced.
ii) Drawing/Schedule titles and numbers.
iii) Symbols/notation/scales to be used.
iv) Cross references to other drawings.
v) Identification of drawings required for record purposes.

Prepare in conjunction with the Principal Contractor a programme for the preparation and presentation of the Contractor's drawings, samples, materials data and other information. The submission and examination dates should be programmed to meet the required dates for the placing of orders or commencements of work.

Such programme shall also include as appropriate the dates for the issue of any Design Team or Principal Contractor's drawings or information required by the Employer's Requirements.

All drawings, Schedules and other information provided by manufacturers, suppliers, or approved sub-contractors shall be reviewed by the Contractor to ensure that all requirements of the Employer's Requirements have been incorporated prior to submission. All drawings will be submitted by the Contractor to the Principal Contractor and the Design Team for review.

All submissions required by the Employer's Requirements shall be received by the Principal Contractor in sufficient time so that no delay is caused to the placing of orders or to the commencement of any part of the works.

The Contractor shall allow for the issue of 2 copies of each drawing for approval. All drawings shall be prepared on a CAD system, compatible with AutoCad software. Upon approval of drawings "for construction" the Contractor shall allow for and forward to the Principal Contractor (for D&d Building Services Consulting Engineers Ltd) a CAD disc of the relevant drawing.

The issue of drawings shall include an "overall" floor plan drawing as well as larger scale portions of the building each time drawings are issued.

b) Co-ordination Drawings

Shall mean the drawings showing the co-ordination and inter relationship of all engineering services and the integration into the structural, shop fitting, architectural, and specialist elements in detail. Such drawings should be provided to a scale of not less than 1:50 unless otherwise agreed and be prepared in detail, including low and high level plans and elevations of walls, etc, as to demonstrate that the engineering services will be properly separated from one another and can be installed and maintained in a proper workmanlike manner in the locations and spaces provided.

The Contractor shall be responsible to the Principal Contractor for the co-ordination of services in both the preparation of Shop/Working drawings and the execution of the site works.

The Contractor shall accept responsibility for coordination of his works with the work of the entire specialist Contractors to ensure that the installation as detailed does not conflict with other services or the building fabric, either during construction or within the finished building.

The Contractor shall liaise with the Principal Contractor and other Contractor's to determine restrictions imposed by others.

c) Installation Drawings

Shall mean the drawings based on the Contract Drawings and/or Co-ordination Drawings showing details of the Contractor's proposals for the execution of the Contract Works. The drawings shall be to such scales, in such detail and shall indicate all services and components for the installation and

also particular installation methods to be applied in certain instances, eg where connecting to existing services. These drawings shall also relate to builder's work drawings.
In respect of gas installations there shall be in addition a "line diagram" indicating the positions of all gas installation pipes, meters, meter controls, valves or cocks, pressure test points and electrical bonding, all in accordance with the "Gas Safety regulations".

In respect of mechanical installations shall include but not necessarily be limited to:

i) General pipework layout drawings to a scale of one fiftieth full size;

ii) Detailed pipework layout drawings for Plant Rooms to a scale of one twentieth full size;

iii) General ductwork layout drawings at a scale of one fiftieth full size;

iv) Typical detailed pipework/ductwork connection or assembly diagrams, such as 3-way valve sets, to a scale of one twentieth full size;

v) Detailed sections through ceiling voids, vertical shafts and horizontal ducts and trenches to a scale of one twentieth full size;

vi) General arrangement drawings of all mechanical plant and equipment showing the positions of the equipment, and of associated motors, starters, thermostats, humidistats, temperature and humidity control units, motorised valves, motorised dampers and the like to a scale of one twentieth full size.

d) Builder's Work Information Drawings

Shall mean the drawings and Schedules prepared to show requirements for architectural, shop fitting, or structural provisions necessary to facilitate the execution of the Contract Works and allow their integration into the project.

Such drawings should include requirements for foundations, bases, lifting and supporting structure for plant or equipment, all holes in walls, floors and ceiling elements, provision of services requirements within void above false ceilings or below false floors, the integration of the services installations into the false ceiling system, and trenches depressions, ducts, etc, in or through building and site elements.

General arrangement and floor plan drawings giving builder's work requirements shall be to a scale of 1:50.

Builder's work drawings for plant rooms shall be to a scale of 1:20.

In cases where preliminary builder's work and structural information has already been given by the Design Team, such information shall be confirmed and amplified as required above by the Contractor (including confirmation of weights of items of equipment, size of access ways, etc) and incorporated on their drawings.

The builder's work drawings shall include access details into voids, risers, shafts and other enclosures for the subsequent 'operation and maintenance of the Building Services Installations

covered by this Contract Package. The drawings of access points shall highlight those which are only likely to be used in an emergency or infrequently and those which are required regularly.

e) Shop/Fabrication Drawings

Shall mean the drawings produced for the purpose of explaining how the components of the designed works are to be fabricated and assembled.

In respect of ductwork, shall be to a scale of not less than 1:50 and 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. In addition, the location and size of all equipment, grilles, diffusers, access panels, dampers, fire dampers, test points, penetrations and associated fittings for automatic controls and instrumentation, etc, shall be shown.

f) Manufacturers' and Equipment Drawings

Shall mean the drawings of any item of plant or equipment produced by a manufacturer or equipment supplier indicating principal dimensions, fixings, connections and all other relevant details.

Where manufacturers' original drawings are used they shall be specific to the relevant Contract Works and all references to optional features, other machines of a range, etc, shall be deleted or the original drawings redrawn to comply with this clause.

Each drawing shall be stamped CERTIFIED by the Manufacturer which shall mean that:

i) The drawing represents accurately the item concerned with correct dimensions and all connections precisely located;

ii) The item conforms to the specific description given in the Employer's Requirements, quoting the reference numbers from the Employer's Requirements;

iii) The item is shown complete and entire as it will be supplied for the Contract Works and no extraneous or alternative parts are indicated.

Individual and layout drawings from mechanical component manufacturers shall include wiring both internal and external to panels and controls.

All wiring diagrams shall indicate clearly that wiring which forms part of or is connected to the equipment as delivered and shall conclude the following minimum information to enable the site connections and wiring to be completed:

i) Maximum electrical loading for each power cable.

ii) Cable termination facilities.

iii) Cable identification and all terminal numbers.

iv) Inter-connections between different items.

All manufacturers' drawings shall be prepared on a CAD system as detailed previously for trade contract drawings.

g) Switchgear, Starter and Control Instruments Panel Drawings

Shall mean the drawings showing the general arrangement of the construction, the external and internal layout of panels, and wiring diagrams comprising internal wiring, wiring types and termination references, schematics of interlocking and external wiring diagrams, internal circuitry arrangements, for the complete systems in the panels. The drawings shall also indicate all conduit connections from the panels to external equipment.

h) Progress Drawings

Shall be a full set of white prints of the Installation Drawings kept on the Site showing the progress of all work in connection with this Trade 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 by the Contractor on the drawings as they are installed.

1.9 Record Drawings

Shall mean the drawings, diagrams and Schedules produced two sets print and one set of computer discs, in AutoCAD format to provide an accurate record of the whole of the services as installed which shall:

a) Fully indicate diagrammatically each individual electrical, air, gas and fluid system, showing all plant and equipment and identifying same with type number and reference to the specified item, and showing size, flow rate, pressure drop, and velocity in each section of the pipe or duct.

b) Show major items of plant and system controls.

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

d) Indicate on individual floor plans and sections to a scale of not less than 1:20 in difficult or congested areas, all building engineering services provided under the terms of the Trade Contract, fully identifying each service and fully indicating with accurate dimensions, the sizes and positions of all plant, equipment, pipes, ductwork, conduits, trunking, under floor ducting, cable tray and cables, together with all inspection, test and maintenance points and cable joints.

e) Provide general arrangement drawings and wiring diagrams of switchgear, starter and controls panels, including, starter motor switching and interlocks.

f) Indicate the number, size, type and services supplied by every cable (circuit lists and fuses/mcb sizes for each distribution board shall be entered into relevant drawings and shall agree with lists fixed within distribution boards. Show the positions and nature of all earth electrodes installed and the route of the connecting copper tapes.

g) Show the position and reference of all luminaires, fire alarm points, speakers etc.

h) The preparation of Record Drawings shall be a rolling programme of work as the installation proceeds; it must not be left to the last moment. The Principal Contractor and D&d Building Services Consulting Engineers Ltd will regularly inspect and monitor progress on the preparation of the Record Drawings.

Two weeks before the contract completion date, the Contractor shall provide draft copies of every Record Drawing to the Principal Contractor and D&d Building Services Consulting Engineers Ltd for comment.

The drawings will be returned with comments and prior to Practical Completion full, final and approved sets will be issued by the Contractor together with CAD discs. Practical Completion will not be awarded without the receipt of final and approved Record Drawings.

1.10 Operation and Maintenance Manuals

Provide two bound copies and one electronic copy of Operating and Maintenance Manuals which shall incorporate Instruction Manuals on detail requirements covering and including the information detailed below. The manuals shall include comprehensive information on the Health and Safety and CDM regulations specific to the works.

Scope of Systems

a) A full technical description of each of the systems installed, written to ensure that the Client's staff fully understand the scope and facilities provided.

b) A technical description of the mode of operation of all systems.

Preparation of Manuals

The manuals shall be contained in A4 size, plastic covered, loose leaf, four ring binders with stiff covers, each indexed, divided and appropriately cover-titled. 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.

Prepare the Operating and Maintenance Manuals in draft as soon as the Installations Drawings are in hand.

Obligations of Manufacturers to Provide Literature

The requirements and obligations of manufacturers to provide literature as part of the installation record shall form part of the plant and equipment orders and such orders shall be considered unfulfilled until literature requirements have been met.

Information for Manuals

Where the Contractor sublets for the preparation of the Operating and Maintenance Manual to a specialist firm, he shall provide or obtain all necessary information in respect thereof.

Manufacturers' Technical Literature

Manufacturers' technical literature submitted for examination or for inclusion in the Operating and Maintenance Manual shall be prepared and assembled specifically for the Record Drawings and cross referenced to the Employer's Requirements.

Manufacturers' Guarantee and Warranties

All manufacturers' guarantee and warranties on plant, equipment etc, shall be valid up to the end of the Defects Liability Period, or for at least twelve months after Practical Completion of the total project whichever is the longer period.

All equipment normally guaranteed by the manufacturers for a period of time which goes beyond the period defined above shall be held to remain under guarantee for the maximum period.

Provide two copies of all such guarantees, one of which shall be included in the Operating and Maintenance Manual.

Installation Record

a) A photo reduction of all record Drawings to A3 size together with an index.

b) Diagrammatic drawings of each system indicating principal items of plant, equipment, valves, etc.

c) Legend for all colour coded services.

d) Schedules of plant, equipment, valves etc, by system, stating their locations within the building, duties and performance figures, together with anticipated life expectancies.

e) A unique code number for each item of plant, equipment, valves etc installed cross-referenced to the record and diagrammatic drawings and Schedules. The name, address and telephone number of the manufacturer of every item of equipment and plant shall be listed together with catalogue list numbers.

f) Manufacturers' literature including detailed drawings, electrical circuit details, and printed operating and maintenance instructions for all items of plant and equipment supplied under this Trade Contract.

g) A copy of all test certificates including those for all plant, equipment, valves, etc used in the installations, including (but not limited to) electrical circuit tests, corrosion tests, type tests, works tests, start-up and commissioning tests, including those for air and water balancing.

h) A copy of all commissioning records including control calibration.

i) A copy of all manufacturers' guarantees.

Submission of Operating and Maintenance Manual

Two complete drafts of the Operating and Maintenance Manuals shall be submitted not less than 2 weeks prior to Practical Completion.

The Operating and Maintenance Manual is an essential part of the Contract Works. The Contract Works will not be accepted as complete and payment will be withheld until the required numbers of copies of the complete final document have been received by the Principal Contractor.

Four copies of the final Operating and Maintenance Manual shall be provided by the Contractor plus two sets of discs of the complete information contained in the Manual including all manufacturers' literature are required to be issued 2 weeks prior to Practical Completion.

Systems Operation

a) Starting up, operating and shutting down instructions for all equipment and systems installed.

b) Control sequences for all systems installed.

c) Scheduled details of all equipment settings, and actual values maintained in controlled variables during commissioning.

d) Procedures for seasonal changeovers.

Maintenance

a) Detailed recommendations as to the preventive maintenance frequency and procedures, including related health and safety procedures, which should be adopted by the Client to ensure the most efficient operation of the systems.

b) Lubrication Schedules for all lubricated items of plant and equipment.

c) A list of normal consumable items.

d) A list of recommended 'running spares' required, being those items subject to wear or deterioration and which may involve the Client in extended deliveries when replacements are required at some future date

e) Procedures for fault diagnosis.

f) Emergency procedures.

1.11 Co-ordination

The Contractor is responsible for the co-ordination and integration of the Contract Works with other works of the Project, including the production of coordination drawings, where necessary showing the works of other Contractors.

The Principal Contractor will require the attendance of' all relevant Contractor's and, where necessary their sub-contractors and suppliers, at weekly meetings to report progress with co-ordination and to resolve conflicts. Where necessary the Principal Contractor will identify "1 ad co-ordinator" Contractor for different areas of the installation to ensure co-ordination between Contractors progresses satisfactorily.

The means of achieving co-ordination will be as follows:

- Identify objectives.
- Agree priorities.
- Agree common parameters and datum.
- Identify interface details.
- Identify problem zones.
- Share responsibility between Contractors.
- Ensure available information of manufacturer's equipment details is distributed.
- Seek clarification of obscure details and design problems.
- Select most appropriate service zones.
- Identify clashes with structure/other services.
- Discuss options.
- Agree most appropriate solution.
- Review proposed solution.
- Sign off drawings.
- Submit to Design Team for comment.

The methods and process for co-ordination will include:

- Attendance at co-ordination meetings.
- The production and distribution of detail sketches.
- Queries, via RFIs, to Design Team.
- The development of proposed solutions for Design Team endorsement.
- The overlay of drawings, by exchange of CAD discs where possible.
- The adoption of clearly understood, easily verified dimensions of datum for installation staff.
- The careful programming of installation and inspection sequences.

Co-ordination drawings are to be agreed and signed by all other directly affected Contractors prior to being submitted to the Principal Contractor for Design Team review.

1.12 Materials and Protection

a) Specified Materials, Equipment and Workmanship

Unless otherwise specified all materials, plant and equipment, and the use and installation thereof, shall comply with the material, test and other requirements of the relevant British Standard Specifications and Codes of Practice, all relevant Institutional regulations statutory requirements and By-laws where applicable.

The Tender return must be based upon the named manufacturers listed in the specification. After appointment the Contractor may offer alternative manufacturers of equal specification but the acceptance of these will be solely at the discretion of the Design Team.

b) Source of Specified Materials and Equipment

All materials shall be of British manufacture wherever possible or from other member countries of the European Community.

Should the Contractor propose using any materials which are manufactured outside the European Community, they shall submit details of each alternative of non-EC origin with their tender.

c) Materials and Samples

Prior to any Contract being finalised the Contractor is to submit a comprehensive list of proposed manufacturers and suppliers of materials and equipment. This list is to be based on specified manufacturers where identified. All materials proposed are to be to the satisfaction of the Design Team and subject to submittal of details for review before placement of order.

Each manufacturer must be willing to admit the Principal Contractor to his premises during normal working hours for the purpose of examining and witnessing the testing of materials and equipment proposed for the Contract works.

All materials and equipment shall be new. Obtain and implement manufacturers' instructions on the assembly and installation of materials and equipment.

Submit all samples required by the Employer's Requirements.
The procedure for submission of samples shall be agreed prior to commencement of the Contract Works.

d) Samples and Materials

Samples of materials, workmanship, components and equipment accepted as complying with the Employer's Requirements will be retained by the Principal Contractor, and all related items included in the Contract Works shall be at least equal in all respects to these samples.

Provide or arrange to be provided by the Principal Contractor safe storage of accepted samples on site including racks for display, reference and inspection.

Materials or substances which are generally known at the time of use to be deleterious shall not be used other than as allowed by British Standards or Statutory regulations current at the time of use.

Workmanship shall be of the best quality, and shall be produced by skilled and responsible craftsman fully experienced in their respective trades.

Allow for proper packaging and safe delivery of all equipment and materials and for returning re-usable packaging to the suppliers as appropriate.

Include for obtaining materials from any source whatsoever to complete the Works within the Contract period.

Identical parts of similar equipment shall be interchangeable and any items, fittings or accessories which are used in quantity shall in each case be the produce of one manufacturer.

e) Guarantee Availability of Spares

Guarantee or provide manufacturer's written guarantees that spares will be available for a minimum period often years from the date of Practical Completion both to the Employer and to any other future building owner, occupier or Contractor having responsibility for the maintenance of the Contract works.

f) Rejection of Materials or Works not to Standard of Samples

Any material or work which is inferior to an accepted sample or is different from parts of the Contract works already constructed or which is stained or damaged after installation will be treated as defective work.

g) Protection of Materials and Equipment Prior to Fixing

All installation materials, component parts or complete items of equipment shall be delivered and stored on site in properly labelled boxes, crates or containers, suitably designed and constructed to give protection against transportation and handling damage and deterioration during storage. The packing shall be weather-proof.

Store all materials on raised boarded platforms under weather-proof cover and store pipes, conduits, trunking and the like on racking.

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

Equipment incorporating components (particularly electrical) susceptible to moisture damage shall be stored in an environment free from condensation.

Take particular care to protect component parts specifically designed to act as heat transfer surfaces. These surfaces shall have purpose-designed packing to protect them whilst in transit and storage on site.

Completely cover valve ports and ends of pipes or plug to prevent the ingress of foreign matter, and additionally protect flanges against damage to the flange surface.

Examine all materials and equipment supplied under this Contract on delivery to site and immediately prior to installation. Any materials or equipment which is damaged or faulty shall be replaced.

h) Defective Work

Replace defective work with materials, goods or work in accordance with the Employer's Requirements. Alternatively submit proposals for any treatment or making good that is considered will bring the defective work to the standard required by the Employer's Requirements. Such

proposals shall not relieve the Contractor of his responsibility to execute the Contract works to the full intent of the Employer's Requirements.

1.13 Inspection and Testing

a) General

Agree procedures for notices, witnessing, reporting and recording tests with all parties involved including Local Authorities and Statutory Undertakings, prior to the commencement of the Contract Works.

Submit copies of the formal test certificates signed by the Contractor's representative not later than seven days after completion of successful tests.

b) Additional Tests

Re-test or carry out at no extra cost any additional tests required to establish acceptability of the Contract Works following failure of any part thereof or any item therein to meet the required standard or functional performance.

c) Instruments and Equipment for Testing

Supply, check, recalibrate whenever necessary and maintain in good working order all instruments and equipment for setting out, measurements, gauging inspection, commissioning and performance testing whether they are specifically called for or implied by the Employer's Requirements.

All such instruments and equipment shall be adequate for the purpose and shall satisfy the purposes and accuracies required by the Employer's Requirements. The type of instruments proposed must be agreed with the Consulting Engineer.

d) Provision of Resources

Provide all necessary staff with the relevant skills and competence for all inspection testing, commissioning and performance testing.

e) Inspection and testing Certificates

Schedule and submit method statements and an integrated programme in respect of these elements of the Contract Works for which inspections and tests shall be carried out and for which inspection and test records shall be maintained for agreement by the Principal Contractor.

f) Certificate for Materials and Equipment

All materials shall be manufactured and tested in accordance with the appropriate British Standard or as described in this specification. Should the Contractor propose an alternative item without the appropriate certification, independent testing shall be carried out at the Contractor's expense to determine compliance with the Employer's Requirements.

Where appropriate all materials delivered to the site shall bear the manufacturer's name, brand name and any other data that may be required to verify their exact nature and relate it to the requirements of the Employer's Requirements.

Materials and components shall bear the British Standards certification Trade (Kite) Mark, British Board of Agreement Certificate mark as applicable.

g) Works Tests Certificate

Works test certificates shall include, whenever applicable, full information to enable the item tested to be identified, such as project title, Contractor's name, manufacturer's nameplate or serial numbers, the location in the Works and the delivery or batch which the sample represents.

h) Inspection and Testing Records

Maintain records of all inspections, and testing performed to substantiate conformity with the Employer's Requirements including those carried out by the Contractor and/or third party testing agencies, together with manufacturer's or suppliers certificates of test.

All records shall be retained on site and made available to the Principal Contractor on request. On completion of the Contract Works all records shall be handed over to the Principal Contractor unless otherwise directed.

These records shall include, as appropriate, but not be limited to, project title, Contractor's name, the identification of the element, item, batch or lot, the nature and number of the observations and tests, the dates of testing, the name and signature of the person responsible for the testing, the number and type of deficiencies found, and details of any corrective action taken.

Any record which indicates that any part of the Contract Works inspected or tested does not comply with the Employer's Requirements shall be submitted without delay in order that the Contractor's proposals for rectification may be assessed.

The content and format of the inspection and the test records is to be approved by the Principal Contractor.

i) Works Visits

Works visits are required to inspect final witness testing and for validation purposes. The Contractor shall allow in the Tender for all costs incurred by 3no Professional Team members, in visiting works tests, inspections and valuations including all travel, subsistence and hotel accommodation as necessary in both the UK and overseas.

1.14 Commissioning

Commissioning of the Contract Works is to be included as detailed in this Specification. The Design Team will witness and sign off every section of the testing and commissioning required. The Contractor, and their commissioning specialist, shall liaise fully with the Design Team.

a) Attendance and Co-operation

Give at least seven days' notice to the Principal Contractor of requirements for the attendance and co-operation of other Contractor's.

b) Notice to Principal Contractor

Give at least two days' notice of any commissioning or testing to be carried out to enable the Principal Contractor and the Design Team to organise the necessary witnessing.

c) Checking and Commissioning

Commissioning includes the setting to work and regulation of the installation.

Check all installations and commission in accordance with the Employer's Requirements including but not limited to the following:

i) Co-operation with the Principal Contractor and Design Team to produce method statements and a co-ordinated programme for the testing and commissioning of the complete Contract Works.

ii) Provision of all consumable materials. Check the availability of electrical power, fuel, water etc, costs for which will be met by the Employer.

iii) Provision of such temporary communication apparatus as is necessary to enable members of the commissioning team who are unable to be in visual or oral contact with each other to carry out their tasks safely and effectively. Such apparatus shall not cause interference with equipment owned or operated by other parties.

iv) Provision of proper and permanent records of relevant readings of all quantities taken during the checking, pre-commissioning, and commissioning procedures. The form of the records shall be agreed with the Principal Contractor in advance of the commissioning and the record for each complete commissioning procedure shall be dated and signed by the person whom the Contractor has appointed to be formally in charge of commissioning.

1.15 Performance Tests

When the Contractor has completed the commissioning of the whole of the Contract Works he shall give to the Principal Contractor written certification of this fact. The certificate shall be signed by the Director or Manager responsible for the Trade Contract.

Only when this written certification has been received by the Principal Contractor will performance tests be allowed to commence. These tests shall be carried out during a one week period. All systems shall be operated to ensure performance matches the design criteria scheduled in this specification. Unless otherwise agreed by the Principal Contractor in writing, where engineering systems involve the works of more than one Contractor, performance tests will only be allowed to commence when written certification from all the relevant Contractor's has been received.

Carry out during this period full tests on the compete Contract Works to demonstrate that the works meet the requirements of the Employer's Requirements.

The Principal Contractor may at his discretion waive any part of the full test procedure if he considers it has been satisfactorily demonstrated, recorded and properly certified at any earlier time but the Contractor shall however allow in his costs for carrying out all of the provisions in this clause.

1.16 Employer Instruction and Training

Prior to Practical Completion of the whole of the project, the Employer may appoint maintenance staff or a Maintenance Contractor and the Contractor shall include for providing any necessary assistance to the Employer's staff during the course of the installation and prior to Practical Completion to explain the purpose and function of the Works.

Include for a minimum period of one plant operating days prior to Practical Completion, to instruct the Employer's maintenance staff or Maintenance Contractor in the day to day running of the plant and systems. The location and function of all systems together with their control functions shall be explained and the procedures given in the Operating and Maintenance Manuals for starting up, shutting down, isolating sections, emergency procedures etc, shall be comprehensively explained and demonstrated to the Employer's satisfaction.

1.17 Spares, Tools and Charts

a) Spares

Provide at Practical Completion as part of the Contract package the following spares:-

Mechanical Services

- Sets of belts for each fan motor set.
- Set of filters for all air handling units, fan coil units and close control air conditioning units.
- 12 months' supply of water treatment, dosing chemicals.
- 4 spare fuses of each rating to be provided in each control panel.
- 4 spare air vent keys.

Electrical Services

- 10 Spare lamps of each type used.

Spares shall be handed over to an appointed representative of the Employer and a signed receipt obtained by the Contractor.

b) Tools

At Practical Completion, provide one complete set of tools and portable indicating instruments for the operation and maintenance of all plant and equipment together with suitable means of identifying, sorting and securing same. These shall include all necessary specialist tools and instruments related to plant items.

c) Plant Room Schedules and Schematics

In addition to the provision of Record Drawings, provide the following at a size to be easily readable arid frame under glass and hang in each plant room and all other appropriate locations as directed by the Principal Contractor:

i) Circuit diagrams consisting of schematic drawings of circuit layouts showing identification and duties of equipment, numbers and locations, control and circuits.

ii) Valve Schedules in the form of printed sheets showing the number, type, location, application, service and symbol, and normal operating positions of each valve installed.

iii) Control schematics and settings.

iv) Mechanical and Electrical plant items.

v) First aid instructions for treatment of persons after electric shock.

vi) All other items required under Statutory or other regulations.

vii) Location of main incoming gas valve serving gas meter and any safety shut off devices.

viii) Emergency operating procedures and telephone numbers for emergency call-out service applicable to any system or item of plant.

ix) Electrical distribution diagrams.

1.18 Construction Design and Management Regulations 2015

The tendering Mechanical Services Sub Contractors are noted to the following statements relating to the above regulations for construction and maintenance of building once built:

a) Design/Pre-Construction Stage

For design elements by the Mechanical Services Contractor, the Mechanical Services Contractor will be the appointed ‘Designer’ and will be required to develop the design proposals ensuring and identifying that risks are eliminated or foreseeable risks controlled through the design work.

The Mechanical Services Contractor shall liaise with and issue associated information to the appointed Principal Designer.

b) Construction Stage

The Mechanical Services Contractor shall be required to present risk assessments and method statements of the works; initially on overall general method statement followed by fully detailed job specific method statements for connections to live services, works within occupied public areas, large items of plant/ equipment and such like.

It shall be necessary for the Contractor to attend meetings with the Principal Designer, Principal Contractor, design team and clients representatives to determine the required method statements and a programme for the necessary shutdowns.

Method statements will be particularly important due to the nature of the works within a sensitive environment and should be presented to the Principal Contractor via the Principal Designer at least 7 days prior to each element of the works. Method statements will be assessed by the Principal Designer, design Team and the Client's representatives, amended if deemed necessary and a written statement of approval issued to the Principal Contractor when fully agreed.

The Contractor must note that requested method statements must be presented, assessed, amended if necessary and approved before each identified element of the works commences.

1.19 Schedule of Rates

The Contractor is to provide a fully quantified, prices and detailed schedule of rates showing how the tender price has been built up with a period of 7 days of being asked to do so by the Contract Administrator.

The Contract Administrators request for such information is not to be interpreted by the tenderer as an indication that his offer has been accepted or is about to be accepted.

The schedule of rates submitted is to be fully priced and moneyed out to make up the tender sum. Each item is to be priced to include the cost of the item, fixings, installation, overheads and profit.

The Contractor is responsible for the accuracy of all quantities and extensions contained in the schedule of rates.

The Contract works will be carried out in accordance with the lump sum price included on the form of tender and in the analysis of tender. The schedule of rates submitted by the successful Contractor will be used solely to establish the sums to be added to or subtracted from the contract sum should any variations be instructed to the works.

1.20 Building Log Book

The Contractor shall include producing a building energy 'Log Book' in accordance with Building Regulations.

The log book shall be produced in a format that is compliant with the CIBSE TM31 format.

The book shall be produced and submitted to the lead consultant for approval and issued at the handover meeting along with the operating and maintenance instructions.

This shall include the following information in addition to the above requirements:

a) A Suitable Index of the contents

b) Building Description and Functional Requirements. Building occupancy levels and occupancy distribution levels etc.
c) Building Services Systems Descriptions and Functional Requirements
d) A maintenance Log and Annual Review of Services including changes
e) Cross Referencing to other documents and regulations or requirements
f) Main Contacts for Essential Services, plant and equipment
g) Design Parameters including systems specifics and limitations
h) Summary of Plant and Equipment with duties and energy usage
i) Plant and Equipment Settings. Sensor positions etc (Plans required)
j) Simple Plan of Building and plant items location
k) Energy Saving Tips on use of systems.
l) Building Energy Records i.e. electric, gas, water meter readings.
m) Target values of energy uses and systems performance.
n) Building CO_2 emissions sheet based on per unit area and for the whole building.
o) Plant Maintenance Records.
p) Adjustments and alterations to plant and equipment.
q) Change of use to the systems.
r) Authorised person's sheet indicating who is responsible for the upkeep of the services with signatures indicating action taken.

1.21 Servicing

The Contractor shall include to service at the 12 months' defects period, all plant items to comply with the manufacturer's requirements with regards to maintaining warranty.

The Contractor shall include all parts and labour as required.

Derbyshire Fire & Rescue Service

Proposed Temporary Fire Station

Unit 3C, Boardman Industrial Estate, Swadlincote

Employer's Requirements for Mechanical Services

Section 2

Scope of Works

Derbyshire Fire & Rescue Service

Proposed Temporary Fire Station

Unit 3C, Boardman Industrial Estate, Swadlincote

Employer's Requirements for Mechanical Services

Section 2

Scope of Works

2.0 Introduction

This Employer's Requirements Performance Specification relates to the mechanical services works which are required at the proposed temporary Fire Station Facility at Unit C, Boardman Industrial Estate, Swadlincote, Derbyshire.

The proposed building will comprise of accommodation as shown on the architectural drawings which includes:

- Ground floor office accommodation, appliance bay and fire service specific spaces
- First floor staff areas

The tenders shall note that the facility shall be formed from partitioning half of an existing factory industrial unit.

The tenderers are advised to make themselves fully aware of the site conditions and existing services. No claims will be considered due to lack of knowledge regarding the site conditions or existing services.

The Contractor is to include for all work shown, described or apparent as being necessary for the complete and proper execution of the works.

The Contractor will be deemed to have examined the site during the tender period and fully acquaint themselves as to the local conditions, accessibility of the site, the conditions affecting Labour and materials and the execution of the contract works generally.

This specification shall be read in conjunction with all Architectural drawings and specifications, Mechanical and Electrical services Employer's Requirements.

The new building shall be a low carbon energy building and shall be designed to comply with the current L2 Building Regulation.

All areas shall be suitably zoned to allow for partial occupation and effective room environmental condition control.

The complete Mechanical Services Contractor design shall be in full accordance with the Employer's Requirements providing an energy efficient design for heating, cooling and mechanical ventilation.

2.0.1 Fire Station Brief

It is essential that the Contractor incorporates the requirements detailed within the Fire Station Brief document, room data sheets, and DFRS Technical Appendices contained within the tender documents. Should any conflict arise between the Employer's Requirements and the Fire Station Brief, this shall be brought to the attention of the Contract Administrator during the tender period.

2.0.2 Provision of Builders' Work

The Contractor shall include for providing all necessary Builders' Work information for the proposed Contractor Design to the Principal Contractor.

The Contractor shall provide necessary Builders' Work Schedules, drawings, attendances and details to the Principal Contractor in order for them to undertake necessary works.

2.0.3 Building Regulations

It shall be the responsibility for the Contractor to include within their tender for the design and installation of all services to be in compliance with all current Building Regulations including the requirements of the Building Regulation L2. This shall include for the provision of suitable calculations and documentation as necessary to demonstrate compliance.

The Contractor shall note that they shall be required to certify the entire building services installation in accordance with the Building Regulations, and provide a certificate of compliance, which shall be included in the Operation and Maintenance Manuals.

The Contractor shall also provide an energy performance certificate (L2 Regulations 2010) for the Client's Operation & Maintenance Manual.

The Contractor shall include for liaison with all relevant authorities and shall include for all calculations and related documentation as necessary for the satisfactory attainment of Building and other Regulation approval.

The Contractor shall also include for the provision of a Building Log Book in accordance with Building Regulations and on completion of the project for an Energy Performance Certificate to be provided with the certification at practical completion.

2.0.4 Co-ordination

The Mechanical Contractor shall be responsible for co-ordination of all parts of the mechanical installation in terms of both design and construction with the Principal Contractor works, Electrical Services and the Client's Specialist Contractors.

2.1 Summary of Systems

The Contractor shall design, procure, supply, install, commission and set to work the complete mechanical services systems as described below, as determined by the Employer's Requirements and the Contractor design for the proposed fire station.

The scope and provision of the mechanical services is set out below:

- Provision of removal works
- Provision of LTHW heating services
- Provision of hot and cold water services
- Provision of toilet extract ventilation
- Provision of Mechanical ventilation
- Provision of internal gas services and unit heater
- Provision of internal mains cold water and H&CWS distribution
- Provision of automatic controls
- Provision of above ground drainage

It should be noted that tender drawings are indicative only and it shall be the responsibility of the Contractor to produce a fully working scheme.

The Contractor shall fully liaise with all parties concerned in the production of the building services to this premises to ensure that all design parameters and statutory requirements are met.

The design conditions are detailed in the schedules section of this document.

2.2 Incoming Mains Cold Water Services

The Contractor shall note that the existing incoming mains cold water to the industrial unit has already been separated with independently metered supply available to the Derbyshire Fire and Rescue Service in the position as indicated on the tender drawing.

The Contractor shall be required to pick up from this position and distribute as generally indicated on the tender drawings and as determined by the Contractor design.

2.2.3 Incoming Gas Services

The Contractor shall note that the existing industrial units gas meter and service is to be retained and available for use by the Derbyshire Fire and Rescue Service.

The Contractor shall distribute gas services as required by the Employers Requirements

2.3 Removal Works

The Contractor shall isolate, drain, disconnect and remove existing mechanical services as generally indicated on the tender drawings.

The Contractor shall note that the existing gas fired unit heater indicated on the tender drawings is to removed and re installed in new suitable position to provide heating to the appliance bay.

Gas services pipework shall be removed back to suitable position as determined by the Contractors design.

2.4 Provision of New LTHW Boiler Plant

The Contractor shall design, procure, supply, install and commission as determined by the Room Data Sheets and their design new LPHW heating services to serve the variable temperature heating services for the facility.

Wall mounted boiler shall be provided that meet the heating requirements of the facility as determined by the Contractor design. The new boiler shall be complete with integral time clock and automatic controls. The proposed boiler shall be installed utilising the boiler manufacturers propriety matching flue system and integral automatic controls.

The Contractor shall provide a gas fired condensing boiler in the position as generally indicated to provide heating to the facility by wall mounted radiators

The Boiler shall be installed by the Contractor and commissioned as full accordance with the manufacturers recommendations and requirements

2.5 Commissioning Valves

The Contractor shall design, procure, install and commission where necessary for the correct regulation of the heating circuits, new commissioning valve stations and isolation valves.

The commissioning valve stations shall be installed in positions to regulate the LTHW heating circuits and in such positions to enable good measurement signals to be achieved with at least 10 pipe diameters of straight pipework prior to the commissioning valve station.

2.6 LTHW Variable Temperature Heating Services

The Contractor shall design, procure, install and commission new LTHW variable temperature heating services to meet the requirements of the facility as determined by the room data sheets and the Contractor Design.

LTHW heating services shall distribute from the boiler to serve all areas via the suspended ceiling space.

Individual areas as identified on the room data sheets shall have low surface temperature radiators. The Contractor shall therefore refer to the room data sheets provided as part of the tender documents.

The Contractor shall refer to the Employer's Requirements specific schedules for further details of the LTHW heating services.

All LTHW heating services shall be insulated in accordance with this document.

2.7 Proposed Hot and Cold Water Services

The Contractor shall design, procure, install and commission new hot and cold water services to meet the requirements for the facility as determined by the room data sheets, the Employer's Requirements documents and the Contractors design.

Mains cold water distribution shall route from the provided metered position through the premises.

HWS provision shall be provided by point of use Electric Water heaters to the property as generally indicated.

Hot water services distribution shall distribute throughout the facility as determined by the Contractor Design to meet the requirements of the facility, and that of this document.

Where indicated in the room data sheets the Contractor shall provide HWS thermostatic blending valves to provide HWS to the outlets at reduced temperatures.

HWS distribution shall distribute and connect into the HWS service leaving minimum dead legs as required by the Employer's Requirements Documents.

Isolation of these services shall be provided such that individual areas of the facility can be isolated.

The Contractor shall note and include the particular requirements and recommendations of the following documents:

- The Control of Legionella Bacteria in Water Systems. Approved Code of Practice by the Health and Safety Commission.
- Design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages: BS 6700: 2006.
- Water Supply (Water Fittings) Regulations 1999.

The Contractor's design shall demonstrate as part of their proposals that the inclusion of these recommendations and requirements is included for.

The Contractor shall include for the hot and cold water services to be flushed disinfected and chlorinated in accordance with the requirements of the afore mentioned documents and this Employer's Requirements document and this Employer's Requirements document.

This shall include bacterial analysis of the hot and cold-water services. Bacterial analysis samples shall be taken for testing by approved microbiologists.

The Microbiologist shall determine the number and method of collection of samples, however a minimum of samples shall not be less than samples taken from the furthest hot and cold water service points of the distribution legs of services in each direction of the H&CWS mains throughout the building.

All results shall be provided to the Client's advisor for evaluation.

The Contractor shall refer to the specific schedules for further information.

2.7.1 Thermostatic Mixing Valve Installations

Thermostatic mixing valves shall be manufactured in accordance with:

a) BS 1415 Part 2 - Specification for Thermostatic Mixing Valves

b) BS 1224 - Specification for Electroplated coating of Nickel and Chrome

The Contractor shall design, procure, install and commissioning valves complete with the following:

a) Double check non-return valves on each service feeding the thermostatic mixing valve (TMV). The Contractor shall check that the TMV may have integral check valves fitted within the body of the unit itself. Where this is the case they are generally single check valves and the Contractor shall then include to install an additional check valve to each feed.

b) Non- return check valves shall be to BS 6268, and shall comply with the requirements of the TMV manufactures requirements.

c) Strainer on each service feeding the TMV.

d) Ball type isolation valves to enable isolation for maintenance on either the TMV itself, the Non return check valves or the strainers.

All fittings shall be currently approved by, and currently listed on, that produced by the Water Research Centre (WRC), the TMV components also being approved by the Water Fittings Byelaws scheme, listed by the WRC.

Each Thermostatic mixing valve outlet shall be set to a maximum outlet temperature of 41°C.

Set temperatures shall be checked and recorded following site commissioning. Recordings of all temperatures at the given positions shall form part of the information within the operation and maintenance manuals and/or the Health and Safety CDM regulation file for the project.

Each thermostatic mixing valve shall be capable of shutting down the supply from the TMV in the event of the cold-water service failing as required by the Health Guidance note 'Safe' Hot water and surface temperatures.

Thermostatic Mixing valves shall be suitable for a minimum maintained pressure of 0.1 bar and up to 6 bar with the inlet water temperatures between 10 and 72°C.

Refer to specific specification or schedules for particular requirement.

The Contractor shall design, supply, install and commission mixing valves to the areas indicated on the drawings.
The valves shall comply with DO8 Thermostatic Mixing Valves for Healthcare Premises. In addition, the Contractor shall install where necessary suitable flow restrictors and/or pressure reducing valves in order to ensure balanced water flow conditions and accurate control.

2.8 Proposed Mechanical Ventilation

The Contractor shall design, procure, install, commission and set to work new mechanical extract ventilation as generally indicated on the tender drawings and as requested by the Employers requirements and the Contractors design.

All mechanical extract ventilation shall be designed in accordance with CIBSE design guidelines and Building Regulations.

Toilet extract ventilation shall operate via either light switch or integral PIR.

Extract ventilation to the appliance bay shall be controlled by wall mounted controller and CO sensors positioned suitably to monitor the atmosphere.

Extract ventilation to atmosphere shall be via manufactures propriety wall mounted external grilles or louvres.

2.9 Fire Dampers and Fire Stopping

The Contractor shall procure, design, install, commission and set to work fire dampers within the proposed mechanical ventilation in full accordance with the Employer's Requirements, the Contractor design, the fire strategy of the Lead Consultant Architect, and that of Building Control.

Once installed, the Contractor shall offer all the installed positions to the Consultant and Lead Consultant for inspection and verification against the proposed fire strategy.

The positions shall be photographed and identified against the Contractor's proposed 'as installed' drawings.

2.10 Automatic Controls

The Contractor shall design, procure, supply, install, commission and set to work a new automatic controls system for the proposed Mechanical Services systems as required by the Contractor design, this Employers Requirements document and the tender drawings.

Automatic Controls shall be manufactured propriety own integral controls.

The Proposed boiler automatic controls shall incorporate time clock control.

2.11 Gas Fired Unit Heater

The Contractor shall re install the existing gas fired unit heater in the general position as indicated in order to heat the proposed appliance bay. The contractor shall include to service the unit heater in accordance with the manufacturers recommendations and requirements.

2.12 Gas Services

The Contractor shall design, procure, supply, install, commission and set to work new gas services to serve the proposed mechanical services systems as required by the Employer's Requirement document and as determined by the Contractor design.

Gas services shall serve the boiler plant and high level gas fired unit heater.

The Contractor shall re connect to existing gas distribution as determined by the Contractor design and serve the above appliances accordingly.

The Contractor shall provide gas solenoid shut-off valve at the entry point to the building and as indicated in the specific schedules of this document.

The whole of the gas distribution shall then be painted yellow oche or ID banded 'GAS' appropriately.

The whole of the gas installation shall conform to and be installed and tested in full accordance with "The Gas Safety Regulation" and British Gas Publication IM/16 Guidance notes and British Gas requirements or latest editions of the above applying at the time of tender.

All gas services pipework shall be installed in heavy grade steel to BS 1387 and painted in accordance with British Standards.

The complete gas service shall be installed in ventilated spaces. No service shall be installed in an un-ventilated space.

The Contractor shall ensure that all plant spaces are provided with adequate ventilation to comply with Gas Safety Regulations.

Suitable gas safety equipment shall be installed to serve all plant items with a "knock off button" and thermal detectors to protect the plant and property.

2.12.1 Gas Safety Valves

The Contractor shall design, procure, install and commission new gas safety to the Gas System as follows:

- Incoming main into the Building

The valve shall be line size, power failure close and interlinked to the building fire alarm system and complete with knock off buttons at the emergency exit doors.

Valves shall be auto reset but **all** equipment must have auto-ignition and flame failure protection devices.

2.12.2 Pressure Testing and Purge Points

The Contractor shall include to supply and install pressure test and purge points to be installed in accordance with British gas Publications IM/2 and IM/16.

2.12.3 Soundness Testing

The complete gas installation shall be fully tested in accordance with the British Gas document IM/5 “Soundness Testing Procedures of Industrial and Commercial Gas Installations”.

The complete gas pipework installation shall be tested using nitrogen as the test medium.

The test pressure of 1.5 x working pressure (minimum 20” WG)(50mBar) shall be checked using test gauges suitable for the test pressure for a period of time in accordance with IM/5

Any leakage shall be detected by recommended method and following rectification work the tests shall be repeated until satisfactory.

2.12.4 Purging of Pipelines

Immediately following satisfactory soundness testing, the gas pipework shall be purged fully in accordance with British Gas Document IM/2 “purging Procedures for Non-Domestic Gas Installations”

Indirect purging using Nitrogen shall be utilised in all cases.

Tests using oxygen measuring devices shall be used to ensure purging by nitrogen is complete after which the pipework shall be purged using fuel gas with the correct purging shall be tested by gas detection devices.

All fuel gas used by the Contractor shall be included for in the tender. Gas meter readings shall be taken prior to start of works and following completion of the works.

2.12.5 Safety Procedures

The Contractor shall ensure that the work area shall be kept clear and free from unauthorised personnel during all installation, testing and purging procedures and appropriate warning notices posted.

All purging shall be carried out by persons fully experienced Gas Safe registered staff and the Contractor shall take advice from British Gas with respect to purging and testing.

The Contractor shall include for the services of British Gas to assist, approve and witness all testing.

A signed receipt of approval of the installation and the testing of same shall be issued by British Gas.

2.12.6 Electrical Earth Bonding

The Contractor shall include for the pipework installation to be electrically earth bonded to other nearby services and/or to the consumer's earth terminals(s).

All such electrical earth bonding shall be undertaken by the Contractor's approved Electrical sub-contractor in accordance with the 17th Edition of the IEE Regulations latest issue, complete with all amendments and British Gas requirements.

The quality and integrity of the existing earth within the plant room is not known, therefore a provisional sum has been allowed in the tender summary to cover for the installation of a new earth bond from the incoming electrical supply to the boiler house.

2.13 Above Ground Drainage

The Contractor shall include to design, procure, supply, install and commission new above ground drainage to serve all sanitary ware items as indicated on the drawings. The installation and design shall be in accordance with BS EN 12056 Parts 1 to 5 inclusive. Please refer to the general specification for further details.

2.14 Commissioning

The Contractor shall include for the proposed mechanical services to be fully commissioned in accordance with the requirements of the plant and equipment manufacturers and that of the Contractor design.

The Contractor shall include to employ an independent commissioning engineer to undertake the commissioning of the mechanical services.

Derbyshire Fire & Rescue Service

Proposed Temporary Fire Station

Unit 3C, Boardman Industrial Estate, Swadlincote

Employer's Requirements for Mechanical Services

Section 3

Employer's Requirements Standard Mechanical Services

Derbyshire Fire & Rescue Service

Proposed Temporary Fire Station

Unit 3C, Boardman Industrial Estate, Swadlincote

Employer's Requirements for Mechanical Services

Section 3

Employer's Requirements Standard Mechanical Services

Contents

Derbyshire Fire & Rescue Service

Proposed Temporary Fire Station

Unit 3C, Boardman Industrial Estate, Swadlincote

Employer's Requirements for Mechanical Services

Section 3

Employer's Requirements Standard Mechanical Services

3.1 Pipework Services

3.1.1 General Clause

The following section details the standards of workmanship and installation practices that are reflective of a quality installed service.

Due to the type of ceiling employed in areas it shall be necessary to keep runs of water services in this ceiling to a minimum. Where pipework is installed, joints shall be kept to a minimum by using full lengths of pipework and which shall be cut to length. Generally, main runs shall be kept to above internal office spaces. Branches feeding off the mains shall have no joints if possible. Bends shall be pulled. All other areas where the pipework is exposed such as plant rooms, shall be installed in a neat and professional manner. Standard joints and fittings shall be utilised.

Pipework services shall be installed in neat and orderly appearances, arranged so that adjacent services are installed parallel to or at right angles to each other and that of the structural members of the building. Services shall be installed to give maximum headroom within spaces, not obstructing windows or doorways.

Pipework drops shall be level and true to the vertical plane. Pipework joints shall not be installed within the thickness of structural walls, floors and ceilings.

When installation programmes commence, it will be the responsibility of the installing Contractor to make due allowance for the thickness of plaster and other wall finishes, skirting heights, sill heights and floor finishes. The Contractor shall install pipework services generally around brickwork piers and columns, and shall follow the contour of the building whether so indicated on the drawing or not.

When pipework routes are being determined and in laying out the runs of services etc, the Contractor shall be responsible for obtaining information from the Principal Contractor and site professionals to ensure that full liaison is taken up so that adequate space is made available for the installation and then maintenance of the plant and systems.

Plant and system equipment shall be laid out so as to enable the pipework installations to be installed, dismantled or removed for maintenance, repair or replacement.

The correct and good use of unions and flanges shall be provided at valves, plant and equipment so as to allow such to be dismantled. No pipework shall be installed without a flange or union at a point where it passes through a wall, floor or ceiling structure. Flanges or unions shall be provided on straight horizontal runs that are unobstructed.

Where pipework expansion is considered with the use of spring or sets in the pipework, then these shall be formed on long lengths of pipework tube. These may be formed from by forging, or by cold drawn, formed to the true radius and free from deformation in the bore internal diameter that may cause thinning to the pipework tube walling. Where double sets are considered, these shall be formed in one piece, for example to pass a building obstruction. Each shall be pulled to a full 90° in the same plane.

3.1.2 Pipework Gradients

All pipework shall be installed with continuous and uniform gradients to affect the efficient natural venting or draining of the particular service. Gradients of services shall be appropriate to the services and shall follow the following rule, unless otherwise specified or stated differently within client standard specification of detailed specification.

Pipework Services	**Gradients**
LPHW Heating	1 : 500
Chilled water Mains	1 : 500
LPHW Heating branches	1 : 250
Chilled Water branches	1 : 250
Hot and Cold Water Services	1 : 500
Steam Services	1 : 250
Condensate Services	1 : 250
Compressed Air Services	1 : 250

3.1.3 Draining Points

At all system low points a drain valve shall be installed. Drain valves shall be installed so as to present the keyed way to the accessible side of the installation. Drain valve keys for the installation shall be presented to the Client at handover.

3.1.4 Air Venting Points

At all high points, suitable provision shall be included to allow realise of air entrained within the system.

3.1.5 Branch Connections

Branches from horizontal Steam mains shall be taken from the top of the main and shall be made undertaken to allow for natural expansion and contraction in the mains and branches of the service, and to allow air venting.

From Compressed Air Services, branches from horizontal mains shall be taken from the top of the service main.

3.1.6 Pipework

Pipework tubing shall conform to the following British Standard or ISO standard unless specified differently within client standard specification, Model Engineering Standard Specification*, or particular specification.

Services	Sizes	British Standard
Steam and Condensate Services	15 to 150mm	Black Heavyweight quality mild steel tubing to BS 1387
Heating Services	15 to 150mm	Black Heavyweight quality mild steel tubing to BS 1387
Chilled Water Services	15 to 150mm	Black Heavyweight quality mild Steel tubing to BS 1387
Natural Gas Services (Internal Services)	15 to 150mm	Black Heavyweight quality mild Steel tubing to BS 1387
Oil Services	15 to 150mm	Steel tubing to BS 1387
Compressed Air Services	All sizes	Galvanised Heavyweight quality Steel tubing to BS 1387
Over flow services	All sizes	Galvanised Heavyweight quality Steel tubing to BS 1387
Hot and Cold Water Services	All sizes	BSEN1057-R250 (formally BS 2871 part 1 Table X)* (NHS Model Engineering table Y)
Drainage from safety valves	All sizes	BSEN1057-R250 (formally BS 2871 part 1 Table X)* (NHS Model Engineering table Y)
Air Vents	All sizes	BSEN1057-R250 (formally BS 2871 part 1 Table X)* (NHS Model Engineering table Y)
Below ground Cold Water Services	All sizes	Medium Density Polyethylene (MDPE) Blue PE 80 to BS 6572 and BS 3284
Below ground Natural Gas Services	All sizes	Medium Density Polyethylene (MDPE) Yellow to ISO 4437

3.1.7 Pipework Jointing Methods and Materials

Pipework jointing methods and materials shall conform to the following method or material to British Standard or unless specified differently within client standard specification, Model Engineering Standard Specification *, or particular specification.

Jointing manufactures trade names have been stated to indicated quality products.

3.1.8 Jointing materials – Screwed Joints

Services	Jointing Compound
Heating Services	Boss White and Hemp, PTFE Tape
Chilled water Services	Boss White and Hemp, PTFE Tape
Compressed Air Services	Boss White and Hemp, PTFE Tape
Steam Services	Graphite Paste
Condensate Services	Graphite Paste
Natural Gas Services	Hermetic Sealant formulated for use with Natural Gas Plasticoll X10G for example PTFE tape, heavy grade formulated for use with Natural Gas, un-sintered to BS 5292 type C.
LPG Gas Services	Hermetic Sealant formulated for use with Natural Gas Plasticoll X10G for example PTFE tape, heavy grade formulated for use with Natural Gas, un-sintered to BS 5292 type C.
Oil Services	Hermetic Sealant formulated for use with oil. PTFE tape, heavy grade, un-sintered to BS 5292 type C.
Domestic Water Services	Boss Green and Hemp. PTFE tape un-sintered to BS 5292 type C.

3.1.9 Jointing materials – Flanged Joints

Services	Jointing Compound
All Services	Composite asbestos free material graded to suit the Relevant service, for example Klingerite. Brass corrugated Taylors Ring with relevant jointing Compound to both faces.
Please Note:	Flat faced flanges to have full face jointing rings.

3.1.10 Jointing materials – Soldered Joints

Services	Jointing Compound
BSEN1057-R250 (formally BS 2871 part 1 Table X)	All fittings to have integral lead-free solder ring. Topped up by end feeding is not preferred but where necessary only lead-free solder shall be used. Self-cleaning flux shall not be permitted.

When joints are made, the Contractor shall clean all excess jointing compound and material from the joint. All excess flux shall be removed before the joint cools.

Only Water Research Council (WRC) jointing materials shall be used on Hot and Cold water services.

3.1.11 Pipework Jointing Methods

Services	Location / conditions	Method of Jointing
Heating Services	Up to 7 bar gauge working pressure and exposed to view, or in accessible positions, or In plant room or areas.	Up to and including 50mm nominal bore, screwed taper threads to BS 21. 65mm nominal bore and above Welded with flanged joints to BS 10.
Steam Services	Up to 7 bar gauge working pressure and exposed to view, or in accessible positions, or In plant room or areas.	Up to and including 50mm nominal bore, screwed taper threads to BS 21. 65mm nominal bore and above Welded with flanged joints to BS 10.
Condensate Services	Up to 7 bar gauge working pressure and exposed to view, or in accessible positions, or In plant room or areas.	Up to and including 50mm nominal bore, screwed taper threads to BS 21. 65mm nominal bore and above Welded with flanged joints to BS 10.
Natural Gas Services	Up to 7 bar gauge working pressure and exposed to view, or in accessible positions, or In plant room or areas.	Up to and including 50mm nominal bore, screwed taper threads to BS 21. 65mm nominal bore and above Welded with flanged joints to BS 10.
Oil Services	Up to 7 bar gauge working pressure and exposed to view, or in accessible positions, or In plant room or areas.	Up to and including 50mm nominal bore, screwed taper threads to BS 21. 65mm nominal bore and above Welded with flanged joints to BS 10.
Chilled Water Services	Up to 7 bar gauge working pressure and exposed to view, or in accessible positions, or In plant room or areas.	Up to and including 50mm nominal bore, screwed taper threads to BS 21. 65mm nominal bore and above Welded with flanged joints to BS 10.
Heating Services	Above 7 Bar gauge working pressure or in concealed positions or where inaccessible.	All sizes with flanged joints to BS 45504. Where equipment dictates flanges may be to BS 10.
Steam Services	Above 7 Bar gauge working pressure or in concealed positions or where inaccessible.	All sizes with flanged joints to BS 45504. Where equipment dictates flanges may be to BS 10.
Condensate Services	Above 7 Bar gauge working pressure or in concealed positions or where inaccessible.	All sizes with flanged joints to BS 45504. Where equipment dictates flanges may be to BS 10.
Natural Gas Services	Above 7 Bar gauge working pressure or in concealed positions or where inaccessible.	All sizes with flanged joints to BS 45504. Where equipment dictates flanges may be to BS 10.
Oil Services	Above 7 Bar gauge working pressure or in concealed positions or where inaccessible.	All sizes with flanged joints to BS 45504. Where equipment dictates flanges may be to BS 10.
Chilled Water Services	Above 7 Bar gauge working pressure or in concealed positions or where inaccessible.	All sizes with flanged joints to BS 45504. Where equipment dictates flanges may be to BS 10.

Pipework Jointing Methods, Continued……..

Services	Location / conditions	Method of Jointing
Compressed Air Services	In all locations / Positions	All sizes screwed to BS 21 with taper threads
Copper Services	In all locations / Positions	Capillary soldered joints on sizes Up to 108mm. **Sizes 67mm and above may alternatively be Bronze welded** to the requirements of BS 1724 connections to equipment etc to be taper threads to BS 21 or parallel threads to BS 2779 as necessary.
Medium Density Polyethylene Services	Below ground installations	Fusion welded either socket, butt or saddle as applicable. MDPE to metal pipework connections to be by purpose made compression joint BSPT threaded fusion socket or loose steel flanged adaptor. Ferrous metal shall be protected against corrosion by Denso tape wrapping.

3.1.12 Steel Tube Fittings

Wrought iron, heavy weight quality manufactured fittings manufactured to BS 1740, shall be used with mild steel tubing on Stream and Condensate Services. Screwed fittings foe all services using mild steel shall be beaded or banded, malleable iron and manufactured to BS 143.

Fittings manufactured by the following shall be used:

George Fischer
Crane Ltd

Steel tube shall be of heavy weight quality to BS 1387, and all fittings for use with Black mild steel pipework shall be heavy quality, for butt welding manufactured to BS 1965.

Where flanges are utilised with mild steel pipework then they shall be manufactured from mild steel, faced and drilled in accordance with the relevant BS table to suit the working conditions and installation.

Flanges shall be either screwed taper threads to BS 21 or be of the slip on type for welding as required by the installation.

In all cases malleable iron unions shall be of the Navy pattern, and shall incorporate bronze to bronze conical seating.

Where changes in direction take place they shall be undertaken using short sweep pattern fittings. Square fittings shall only be utilised when venting and draining is required and where approved by the Engineer.

Single reducing fittings shall only be used to reduce service installations e.g. a single reducing socket, bend or tee. Sockets shall reduce eccentrically when installed into horizontal pipework installations, and concentrically when installed into vertical pipework installations. The use of bushes will not be permitted in any circumstance.

3.1.13 Copper fittings

Fittings for use within copper pipework installations to BS 2871 shall be manufactured from copper, high quality copper alloys or gunmetal and shall be of non-dezincifiable, incorporating lead free solder rings for capillary jointing.

All such fittings shall be from the following manufacturers and range manufactured in accordance with BS 864 Part 2:

Manufacturer	**Range**
Yorkshire (IMI Yorkshire Fittings Ltd)	Potable Range

On all sizes above 108mm and where required necessary between 54mm and 108mm inc bronze welded fittings, 'Brazoweld' as manufactured by Donald Brown (Brownall) Ltd, shall be used.

Where flanges are used in copper pipework installations they shall be gunmetal or Bronze dependent upon size and jointing method as previously specified.

All flanges used shall be faced and drilled in accordance with the relevant BS table to suit the site installation and conditions. Wherever non-ferrous flanges are used on copper services then brass nuts, bolts and washers shall be utilised.

Two piece flanges on pipework sizes over 54mm may be two piece comprising of a copper alloy centre joint face and a coated mild steel backing ring.

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

Any reductions in pipework shall only be undertaken using a single fitting. Sockets shall reduce eccentrically when installed within horizontal pipework and concentrically when installed within vertical installations.

3.1.14 MDPE Pipework fittings

In installations where MDPE pipework is used the manufactures own fittings shall be used. Different colour installations such as MDPE Blue for MCW installations and MDPE Yellow for Gas service for example shall use corresponding colour fittings. Where transition installations are required between MDPE pipework and metal pipework then they shall be of non-dezincifiable brass/gunmetal.

Changes in direction shall be undertaken using the flexibility of the pipework in preference to the use of MDPE fittings to perform the bend. When utilising the natural flexibility of the MDPE pipework the minimum-bending radius shall be 15 time the nominal diameter of the pipework. Where MDPE pipework fittings are used to produce the arc in the pipework then the minimum-bending radius shall be 25 times the nominal bore of the pipework.

3.1.15 Pipework – Screwed

When screwed services are installed joints shall be in accordance with BS 21. All pipework threads shall be clean and tightly connected to the adjoining service pipework using approved jointing materials as given earlier.

All pipework shall be free of rust and deformation, and shall be free from mill scale, burrs and swarf following completion.

The Contractor shall undertake threading carefully to produce neat and accurate concentric threading that is tapered as required by the BS 21.

All exposed threads and joints on black pipework shall be painted with Red Oxide.

On galvanised pipework where exposed threads or joints are apparent the Contractor shall paint these with galvanised paint.

In all cases when galvanised pipework is used care shall be taken to ensure that the number of threads exposed ids kept to a minimum.

Any pipework that has been damaged through transit or delivery or by being held within vices etc shall not be installed. Pipework with damaged threads, fittings or bends shall not be installed.

Under no circumstance shall pipework fittings be installed within the structures of walls and ceilings.

3.1.16 Pipework – flanged

All flanges shall be machine faced and trimmed at the edges. No burrs or swarf shall be evident. All holes through flanges shall be drilled accurately and under no circumstance punched. Any flanges installed to screwed pipework shall be screwed BSPT.

Flanges on welded pipework installations shall be of ‘Welding neck’ or ‘Slip-on’ flanges.

Where flanges are installed, they should be installed to be true and square with the pipework axis. If an installed pipe was found to contain untrue flange installations, then the Contractor shall replace the relevant pipework installation or flange as required to effect a satisfactory installation.

All flanges shall be manufactured from mild steel to BS 4504 to the table as appropriate to the installation and the specified pressure.

All flange faces shall be installed true and flush with the adjoining flange, and shall include full face joint rings.

Bright steel nuts, bolts and washers shall be used, with bolts cut to the correct length. Bolt threads shall be to ISO Metric coarse, with a maximum length being so as to extend two full threads above the face of the nut. Washers shall be fitted beneath the blot head and the nut to protect the flange.

3.1.17 Pipework – Copper

Copper pipework shall be light gauge unless otherwise specified for example when undertaking work within NHS properties when the Model Engineering specifications will take preference.

Pipework ends shall be prepared for capillary type fittings. Pipe ends shall be cut square and cleaned using purpose made cutters. Pipework shall be complete with smooth bores and butt ends with outer surfaces free from deep scratches. Any irregularities and swarf are to be dressed off.

The cleaning of pipework ends and fitting sockets prior to soldering shall be carried out using wire wool, emery cloth or purpose made wire brushes. The use of self cleaning flux shall not be allowed.

All springs and sets shall be to a true radius and shall be free from deformation in the internal bore of the pipework, excessive thinning of the outer arc tube wall or kinking of the inner arc tube wall. All unsatisfactory pipework bends, sets, or springs will be rejected.

Springs and sets shall be formed on a light gauge tube bender using the correct size formers, or in small bore tubing may be made by hand using a correctly sized internal spring.

Extreme care shall be taken to ensure that no damage is caused to the pipework by vice jaws, hand tools and clamps etc. Any section of pipework or fittings that indicates major damage shall be replaced as instructed by the Consulting Engineer.

Minor scratches shall be removed by dressing them with wire wool.

3.1.18 Pipework – Medium Density Polyethylene (MDPE)

Where installations of incoming mains cold water occur for example the use of MDPE pipework is envisaged.

MDPE pipework up to nominal diameters of 63mm nominal bore shall be supplied in coil form to minimise the number of joints that are necessary during the construction process. MDPE pipework sizes over 90mm nominal bore shall be supplied in 6m straight lengths.

All open ends shall be protected and fitted with purpose made end caps or plugs to stop the ingress of dirt and debris until jointing is carried out.

Jointing shall be by socket fusion for sizes up to and including 125mm nominal bore. Sizes up to and including 63mm nominal bore may be jointed by hand, but sizes 90mm nominal bore and 125mm nominal bore shall involve the use of mechanical alignment and clamping equipment.

The use of butt fusion can be employed on sizes 63mm nominal bore and above, but must be used to joint pipework of 180mm nominal bore and larger pipework.

When large pipework installations are apparent, the use of mechanical aligning equipment shall be used to place the pipework in axial alignment, this being required for preparing the jointing surfaces and for heating and controlling the forces during fusion jointing.

To undertake services off – takes the use of branch saddles and tapping tees may be used. Where saddle fusion is employed, mechanical aids shall be used to ensure correct alignment and to control the heating and jointing forces.

To affect the joint between polyethylene valves and MDPE pipework the use of either socket or butt fusion as recommended by the pipework manufacturer shall be adhered to.

On the occasion when metal valves are incorporated into MDPE pipework installations, anchorage shall be provided to counteract the opening and closing torque of the valve.

Jointing between MDPE pipework and metal valves shall be made by compression transition couplings.

3.1.19 MDPE Pipework trenching

MDPE Pipework trenching shall be excavated to a depth of 100mm below the underside of the pipework. This 100mm gap shall be back filled with sharp sand so the pipework can be laid upon it. Once completed the pipework can be laid and tested.

Testing shall occur prior to any back filling of the trench over the pipework. If the Engineer or supervising officer has not witnessed the pipework pressure test and the back filling has occurred then the Engineers will request that the trench be excavated to expose the pipework and a retest undertaken.

Once successful testing has been undertaken the Contractor shall back fill the trench with a further 100mm of sharp sand to cover the installed pipework. The trench shall then be back filled to ground level.

At a depth of between 150mm and 250mm from ground level the Contractor shall lay continuous 150mm wide proprietary plastic warning tape, or mesh appropriate to the service beneath, i.e. with written identification of the service. The tape shall incorporate a continuous steel wire that can be detected by sensing apparatus.

Care shall be taken when back filling to ensure no bricks or large sharp objects e.g. blocks etc are included in the back fill material.

Unless specified to the contrary, the trenching and back filling works are normally undertaken by the Principal Contractor at no cost the Mechanical Contractor. The Mechanical Contractor shall however be fully responsible for ensuring that the work is undertaken correctly in accordance with these requirements and any requirements of the statutory undertakings.

3.1.20 Pipework – Brackets and Fixings

Brackets and fixings to make the installations complete shall be supplied and installed to the satisfaction of the Engineer. This shall include all pipe hooks, rollers, brackets, chains, hangers, clamps, special fixings including angle iron or steel brackets and hangers etc.

Details of brackets and fixings to be used shall be forwarded to the Engineer prior to ordering or manufacture for the Engineers approval.

Pipework supports shall be arranged as near as possible to joints in the pipework so as to give assistance to possible weaker areas of the installation. Each support must take a proportion of the installations weight and allow for expansion and contraction.

The brackets supporting main services distribution along ducts shall take the form of angle or channelled sections supporting pipework via rollers, flat iron stirrup guides or chains.

Supports shall also be situated at positions of changes in direction of the services.

Pipework shall be supported at regular intervals not greater than as indicated within the following table:

Pipework support table:

Pipework Material	Pipework Size (mm)	Maximum Interval between supports (m)
Heavy Quality Mild Steel to BS 1387	15	2.0
	20	2.0
	25	2.4
	32	2.4
	40	2.7
	50	3.0
	65	3.0
	80	3.4
	100	3.7
	150 and over	4.3
Light Gauge Copper Tube To BS 2871 Part 1, Table X	15	1.2
	22	1.2
	28	1.5
	35	1.5
	42	1.8
	54	1.8
	67	1.8
	76	1.8
	108	2.4
	159	2.7

The above table can be read and taken for both horizontal and vertical pipework installations.

Where two or more pipes are to be supported together, the supporting spacing are to be based on the centres required for the smallest nominal bore pipework.

Where vertical pipework is supported then this shall be undertaken in such a manner that no strain is imposed on the horizontal branches off the vertical main.

When undertaking fixing of the supports to a building structure the structure selected to support off shall be compatible with the strength and construction of the building fabric. Details of this shall be agreed with the Engineer prior to the installation commencing.

Under no circumstances shall pipework depend upon a wall through which it travels for its support.

Except where insulated, pipework fixed to pre-cast concrete, lightweight partitions or walls, timber or metal work shall be supported by screw fixing school board brackets. Copper pipework forming end sections of the installation to whb, sinks etc shall be secured with Hospital pattern brackets.

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

Brackets for chilled water pipework, cold water pipework and where identified for steam pipework, shall incorporate an inert structural spacer section equal to the thickness to the relative insulation and a corresponding oversize clip, the insulation being carried through the clip.

Pipework in boiler houses, plant rooms, tank rooms, ducts, ceiling voids, roof voids outside and pipework 65mm and over exposed in rooms and corridors shall be adequately guided and supported on, or suspended from rolled steel angles, tees channel or joists. These shall be suitable for building in or secured to the structure of the building.

The mechanical Contractor shall include for all necessary secondary steelwork to support the services off the building structure. All steelwork shall be hot dip galvanised after manufacture.

3.1.21 Pipework Clearances

Pipework shall be fixed to give the following minimum clearances between the pipe or insulation and the adjacent surface.

Wall	25mm
Ceiling	100mm
Adjacent services pipework - both insulated	180mm
Adjacent services pipework - both un-insulated	25mm
Adjacent services pipework - only one insulated	80mm
Insulated pipework service to adjacent electrical conduit or electrical trunking	100mm
Un-insulated pipework service To adjacent electrical conduit or electrical trunking	150mm
Ductwork	80mm
Finished floor	100mm
Light fittings	150mm

Sufficient space withstanding the above clearances shall be allowed to achieve the correct installation of thermal insulation materials of the thickness specified in the relevant section / clause of this specification.

3.1.22 Pipework Sleeving

Pipework passing through walls, ceilings, floors and partitions shall be provided with pipework sleeves of a similar material to that of the service passing through.

Pipework sleeves shall under no circumstances be used to support the pipework as it passes through the sleeve. The brackets shall be spaced equally about the wall or structure to support the pipe so that the pipe is fitted concentrically within the sleeve.

Sleeves shall be free from internal burrs and shall have an internal diameter sufficient to allow free movement of the pipework through natural expansion and contraction.

Sleeves shall not protrude through a wall or structure no more than 5mm off the outer finished surface.

The gap between the pipework and the sleeve shall be caulked with an appropriate flexible sealant to provide an effective barrier against vermin and a waterproof seal.

Where services pass through fire rated walls or smoke barriers, this gap shall be sealed with a flexible, fire – rated sealant to the appropriate requirement.

3.1.23 Painting and identification of pipework services

All exposed ferrous pipework, brackets and supports in boiler houses, plant rooms, tank rooms, shall be painted with two coats of Red Oxide paint prior to two coats of approved gloss paint as required by the Architect or client. The gloss paint shall be heat resistant where applicable. Generally the Mechanical Contractor being responsible to paint the services with the Red Oxide paint, the Principal Contractor being responsible for the finished colour.

All pipework, including services not insulated shall be identified with colour bands to BS 1710 and shall be stencilled with their description, size and direction of flow as relevant (unless otherwise directed by Architect or Client, with regard to un-insulated services).

If differing identification is found on a particular site, these should be referred to the Engineer for a decision on the standard to apply in the circumstance.

3.1.24 Pipework Expansion and Contraction

Where possible expansion of pipework shall be taken up by natural off-sets and changes in direction of the pipework runs. Where this cannot be achieved, expansion shall be accommodated by the inclusion of fabricated expansion loops or purpose made expansion bellows as shown on the relevant drawings and/or described in the particular specification.

When installing offsets at least 50% cold draw shall be applied and the Engineer shall be requested to provide details of the amount of expansion envisaged.

Cold draw on all flanged expansion devices shall be equivalent to 50% of the compensated expansion and be pulled by means of high tensile bolts through the flange. Bolts shall be pulled up evenly and diagonally to prevent distortion and uneven stressing. After flanges are butted, the bolts used to pull the system together shall be replaced one by one and to the correct length. Cold draw shall not be undertaken until such times as all anchors and guides are in place.

Expansion joints shall be installed in accordance with the manufacturer's instructions, recommendations and requirements when specified, for both the installation details and guiding.

Where expansion loops are to be used they shall be of the design and dimensions shown, constructed from the same material as the pipework they serve and be formed in long lengths of pipework without intervening joints.

Expansion loops shall be installed in the same plane with flanged end joints on the same axis.

Anchors and guides shall be supplied and installed to ensure that all movement due to expansion and contraction is taken up by the method adopted. The anchors shall be of sufficient strength to withstand the anticipated forces of expansion, and a check shall be made that the building structure, to which the anchors are attached, is adequate for the loads to be imposed.

Pipework guides shall be fitted as necessary to constrain the sideways movement of the pipework. Where an expansion device is installed adjacent to an anchor point, at least two guide brackets shall be installed; one fitted two pipework diameters and one fifteen pipework diameters on the free side. Where the expansion device is installed midway between two anchors, a minimum of four guide brackets shall be installed, two either side spaced as previously described.

Branch connections from mains are, whether shown on the drawings or not, to incorporate double sets to provide swinging joints such that mains expansion movement shall not be impeded by or transmitted to the branch pipework.

3.1.25 Pipework Electrolytic Action

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

3.1.26 Dezincification

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

3.1.27 Air Eliminators

Air bottles and automatic air eliminators shall be supplied, installed and commissioned where indicated on the drawings and at all high points of the heating and domestic hot water service

installations where self venting through the mains or taps cannot take place or would not prove satisfactory.
Generally air bottles shall be used on heating installations and automatic air eliminators on Domestic Hot Water installations unless otherwise directed, or stated on the drawings.

Where air bottles are installed that is difficult to access or reach, then an extension bleed pipe shall be neatly installed from the top of the air bottle to a position agreed on site that is convenient, and not obstructive, at 1.4m from the finished floor level and terminate with a air valve to vent the air.

Where the air vent position is exposed to view in rooms and corridors it shall be installed at high level. Copper 8mm copper tube may be used to BS 2871 table Y. In boiler houses, plant rooms and tank rooms, the bleed pipework shall be in 8mm Heavy quality mild steel tube to BS 1387 with malleable iron fittings neatly run on the surface of walls and structures.

Air bottles shall be constructed from 50mm square branch, connected to an air bottle that is formed from 50mm tube and not less than 300mm in length. The top of the air bottle being fitted with a cap and loose key operate 8mm brass needle seat air vent valve.

Where air eliminators are used they shall be of manufactured type ‘C2’, complete with double check valve and lockshield valve.

Air eliminators shall be installed off mains with the eliminators branch the same size of the pipework; unless pipework is over 50mm then the branch may be 500mm. This shall be complete with concentric reducing socket to the air eliminator fitting. Run from the automatic eliminator shall be a 8mm copper pipe to BS 2871 table Y, to discharge externally to the building in a suitable position. This shall be run neatly and shall discharge directly over a rain gutter, gully drain or onto the roof. The extent of pipework running outside shall be limited to prevent freezing during winter conditions, should water droplets remain in the service.

3.1.28 Pipework Flushing and Cleaning – (relevant to all water systems)

Following completion of sections of the installation and following the completion of the complete system final pressure test, the systems shall be thoroughly flushed out so that all foreign matter is removed from the system.

Water systems shall be thoroughly flushed using clean water.

The flushing medium wherever possible shall be fed into the systems at high level positions and flushed out at low points. Suitably sized flushing plugs with valves shall be used. Flushing through 15mm drain valves is not considered good practice to flush a system out by.

Prior to flushing taking place the Contractor shall remove all filters, meters, circulating pumps, traps, valves, controllers non – return valves, and equipment / plant that may become damaged as part of a flushing process.

Sufficient time shall be given to ensure that all foreign matter is removed from the system. Flushing should also be undertaken under pressure at a pressure that is deemed suitable to the installed system. Care must be taken with regard to flushing old and existing systems at pressure.

The Clerk of works, Engineers or site Engineer shall witness Flushing procedures. The length of time to flush shall be recorded.

Once flushing has been deemed to be complete, the Contractor's appointed specialist water treatment provider or company shall take samples of water from each service, at the furthest point in each direction of the building. These samples shall be taken away for analysis to indicate whether flushing has been successful.

If samples indicate that further flushing is required then this shall be undertaken until agreeable analyses are obtained indicating that all foreign matter, suspended solids and impurities have been removed.

Following the completion of the flushing process the Contractor shall undertake to remove all strainers, dirt pockets etc and thoroughly clean them out of any residual debris that may be held within them as a result of the disturbance caused be the flushing processes.

The Contractor shall employ a specialist company of Water Treatment Engineers to advise on a suitable corrosion inhibitor which shall be added to the heating or cooling system to prevent corrosion or contamination of the pipework services.

The correct corrosion inhibitor shall be added to the final system fill. Determination of the system water content shall be undertaken by the Contractor, who shall then inform the specialist. The water treatment specialist then will then advise the Contractor of the correct dosage for the system(s).

The Engineer will be fully informed of these findings and undertake to give their approval prior to work taking place on the system.

Water treatment shall be added to a system via dosing pot, either presently installed within the existing system, or temporarily installed in a position agreed by the Engineer.

The Contractor shall include for all associated costs with regard to the water treatment, and specialist advice.

Following the addition of the water treatment, a period of 1 week will lapse and then the specialist water treatment engineers shall test the system(s) at four separate locations to check the level of inhibitor within the system.

If these tests indicate an inadequate or unsuccessful water treatment exercise then the Contractor shall at their expense undertake to repeat the water treatment until such time that successful tests are achieved to the satisfaction of the Engineer.

3.1.29 Sterilisation of Systems

Prior to hand over (however giving sufficient time period to receive test results back, prior to hand over) all water mains, fire, boosted and tank cold water and domestic hot water service flow and return services, storage tanks, vessels and water heaters within and forming part the contract, shall be thoroughly and efficiently sterilised.

Sterilisation shall be carried out by Specialist Contractor or Water Authority.

The sterilisation shall be carried out in full accordance with BS CP 6700, Section 3, Clause 13.

On all projects and schemes, once works have been completed and successful pressure tests witnessed then the Hot and Cold Water services have been filled with water, the Contractor shall be required to chlorinate these systems in full accordance with BS CP 6700, Section 3, Clause 13. The Contractor shall then maintain these systems in safe working condition until such time as practical completion is given.

Prior to practical completion all hot and cold water services systems shall again be chlorinated to BS CP 6700, Section 3 Clause 13.

Once completed the Contractor shall provide certification indicating the areas where chlorination has occurred, this information shall also include information on the levels of chlorination used, and the results of the final microbiological tests.

During chlorination the Contractor shall frequently check the system, to ensure that the residual levels do not increase more than 10% of the required levels.

Once the system has been chlorinated the systems shall be flushed of all chemicals and refilled with fresh water.

The Contractor shall include taking samples for Microbiological tests from three different positions, where possible these samples shall be taken from the furthest positions within the systems. Microbiological tests shall be carried out by specialist, Public Health Authority, or local Water Undertaking in whose area the project is situated.

The Microbiological tests shall confirm that the Water from the installation is suitable for human consumption and free from harmful bacteria or chemicals.

It therefore must be noted that until such time as successful Microbiological tests are achieved that the systems cannot be given back to the client or any practical completion recommended to the Lead Consultant or Contract Administrator.

It may be noted that the Microbiological tests take 7 to 10 days normally to complete.

The original copies of these tests shall along with two copies be given over for inclusion within the Health and Safety manuals or Operation and Maintenance manuals.

The methods used to test the samples shall be in accordance with given in ‘Analysis of raw water, potable and waste waters’ published by the Department of the Environment or method approved and employed by the Public Health Authority at the time of the tests.

The above tests shall be strictly adhered to and shall include ‘E Coli tests, chemical analysis to indicate the copper and lead content of the water in mg/l (ppm) and legionella test and analysis.

The Contractor shall allow adequate provision within their contract for the full and correct completion of these procedures as indicated.

Prior to hand over, practical completion the Contractor shall include to flush the system twice weekly with fresh water in order to not allow the stagnation of water within the system. The Clerk of Works or site engineer shall undertake the witnessing of these flushing procedures.

3.2 Valves

Valves shall be installed where indicated on the drawings, in accordance with the following schedules.

The Contractor shall supply, install and commission all valves called for in the specification and/or indicated on the tender drawings. If in any location the Contractor considers that a valve is required they shall bring this to the attention of the Engineer for instruction during the installation period.

Valves shall be installed in positions, which permit easy access for maintenance and operation.

The Contractor shall not install valves over electrical services, where the gland may leak and cause damage to the electrical installation or cause unsafe situations.

On screwed valves union couplings shall installed directly adjacent on the downstream side.

All items of plant shall be isolated individually from the relevant service serving the plant.

All distribution services shall be isolated at their source, for example at plant room positions, low loss headers etc. At distribution legs off distributing mains the flow service shall be isolated, with the corresponding return leg isolated using the regulating valve that shall be installed to regulate the flow through that particular leg.

Isolation valve shall be complete with wheel heads, regulation valves with lockshield covers.

As indicated on the drawings regulation valves shall be of the commissioning type to achieve correct balancing of the system, these shall have characterised plugs and proportional flow adjustment with pressure tapings.

On installations with three port diverting or mixing situations, the diverting/mixing leg shall be installed with characterised plug regulating valve for balancing the leg pressures to the appropriate circuits. Double regulating valves may be used to give the added capability to also isolate the service.

All valves shall be suitable for the pressure and medium of the relevant service.

3.2.1 Valve Schedule

Service	Duty	Size	Type	Joints
LPHW Heating	Flow Isolation	Up to 50mm	Copper alloy gate valves BS5154 Hattersley: Fig 33X Crane: D151	Screwed

LPHW Heating	Flow Isolation	65mm and above	Cast Iron gate valve BS5150 Hattersley: M540 PN6 Crane: FM 52	Flanged to BS4504 Table 10

Service	**Duty**	**Size**	**Type**	**Joints**
LPHW Heating Chilled Water	Flow Regulation and measurement	Up to 50mm	Orifice valves – Copper Alloy pressure tapped variable orifice double regulating valves to BS7350 Hattersley: Fig 1700 Fig 1700L (low Flow) Crane: D930 D930 (low Flow)	Screwed
LPHW Heating	Flow Regulation and measurement	Above 65mm	Orifice valves – Copper Alloy pressure tapped variable orifice double regulating valves to BS7350 Hattersley: Fig M737 Crane: DM930	Flanged to BS4505 Table 10
LPHW Heating	Flow Regulation and Measurement	Up to 50mm	Commissioning stations – copper alloy double regulating and orifice plate close coupled Hattersley: Fig:2432 Fig:2472L (Low Flow) Crane: D941 D942 (Low Flow)	Screwed
LPHW Heating	Flow Regulation and Measurement	65mm and above	Commissioning stations – Cast iron double regulating and orifice plate close coupled Hattersley: Fig:M2733 Crane: DM941 Copper alloy double regulating valve	Flanged to BS4504 table 10 Screwed
LPHW Heating	Flow regulation	Up to 50mm	Hattersley: Fig 1432 1473 (Low flow)	

			Crane: D920 D921 (Low Flow)	
Service	**Duty**	**Size**	**Type**	**Joints**
LPHW Heating	Flow regulation	65mm and above	Cast Iron double regulating valve Hattersley: Fig M733DR1432 Crane: D920	Flanged to BS 4504 table 10
Tank Cold Water Mains Cold Water Hot Water Service	Isolation	Up to 50mm	Copper alloy gate valve Hattersley: Fig 33X Crane: D151	Screwed
Strainers		Up to 50mm	Copper alloy pipeline type oblique Hattersley: Fig810 Crane: D297	
Draw off connections H&CWS	Isolation	15mm, 22mm	Ballofix Patent valves	Chromium plated with compression end fittings
Natural Gas Non MDPE		15mm to 65mm	Crane D195	Saunders Type 'A' cast malleable iron Body, Grade C Diaphragm or as Bryan Donkin Each valve shall be fitted with a union adjacent to facilitate future maintenance.
Non-return Valves				
Heating and Chilled water		80mm and above	Bryan Donkin soft seal 555	Each valve shall be fitted with a union adjacent to facilitate future maintenance.
Hot and Cold water Services				
Hot Water Service in flow pipework minimum pressure drop		15mm to 50mm 65mm to 200mm 15mm to 54mm	Hattersley 3048, Crane D141 Hattersley M651 PN16 or Crane F479 Hattersley 3048, Crane D141	

		67mm to 203mm	Hattersley M651 PN16 or Crane F479	
		28mm to 54mm	Hattersley 47	
		67mm to 203mm	Gunmetal Screwed Holden and Brooke Ltd Senflex Super-Sensitive	
Service	**Duty**	**Size**	**Type**	**Joints**
All non-return valves installed on hot and cold water services shall be treated internally to prevent corrosion in accordance with the Local Authority requirements and shall be complete with non metallic parts.				Each valve shall be fitted with a union adjacent to facilitate future maintenance.
				Lockshield type with hose connection, and renewable 'O' ring gland type.
Drain Valves		15mm	Hattersley 47	
			Cast Iron Gunmetal Trim Holden and Brooke Ltd Senflex Super-Sensitive	Where fitted to chromium plated or stainless steel services shall be chromium plated finish.
			Hattersley 370/371	

Notes to accompany valve specifications:

Valves to be full line size unless specifically indicated and noted on the drawings.

Orifice valves and commissioning stations to be selected at line size for tender purposes. However, the final size to be installed shall be confirmed prior to the order to be placed by the Contractor.

3.2.2 Commissioning valves and balancing valves

To promote reliable and accurate balancing of the water systems, the Contractor shall supply, install and commission commissioning valve sets, wherever indicated on the drawings.

The Contractor my install combined commissioning valve sets ie orifice plate/DRV close coupled units, or separate orifice plate on flow and Double Regulation valve on the return in the positions as generally shown on the drawings.

Valves shall be as indicated in the aforementioned schedule.

Commissioning valves shall be installed at the following positions or as deemed necessary to achieve correct balancing of the systems.

Were a position not indicated on the drawings or schedules and the Contractor deemed it necessary to achieve correct balancing, then the Contractor shall bring this to the attention of the Engineer during the construction period for suitable contract instruction.

a) All mains and sub mains leaving plant room and boiler house installations

b) Heating and Chilled water Coils

c) All pump assemblies with the exception of Domestic Hot Water Services return services.

d) Across all refrigeration machine chilled water evaporators
e) Across all refrigeration machine chilled condensers

3.2.3 Thermostatic Mixing valve installations

Thermostatic mixing valves shall be manufactured in accordance with:

BS 1415 Part 2	Specification for Thermostatic Mixing Valves
BS 1224	Specification for Electroplated coating of Nickel and Chrome

The Contractor shall supply, install and commissioning valves complete with the following:

a) Double check non-return valves on each service feeding the Thermostatic Mixing valve (TMV). The Contractor shall check that the TMV may have integral check valves fitted within the body of the unit itself. Where this is the case they are generally single check valves and the Contractor shall then include to install an additional check valve to each feed.

   Non-return check valves shall be to BS 6268, and shall comply with the requirements of the TMV manufactures requirements.

b) Strainer on each service feeding the TMV.

c) Ballofix isolation valves to enable isolation for maintenance on either the TMV itself, the non-return check valves or the strainers.

All fittings shall be currently approved by and currently listed on that produced by the Water Research Centre (WRC). The TMV components also being approved by the Water Fittings Byelaws scheme listed by the Water Research Centres (WRC).

Each thermostatic mixing valve outlet shall be set to a maximum outlet temperature of 41ºC, except where fitted to bidets where this temperature setting shall be 37ºC.

Set temperatures shall be checked and recorded following site commissioning. Recordings of all temperatures at the given positions shall form part of the Information within the operation and maintenance manuals and / or the Health and Safety CDM regulation file for the project.

Each TMV shall be capable of shutting down the supply from the TMV in the event of the cold water service failing. As required by the Health Guidance note ‘Safe’ Hot water and surface temperatures.

TMVs shall be suitable for a minimum maintained pressure of 0.1 bar and up to 6 bar with the inlet water temperatures between 10°C and 72°C.

Where shower thermostatic mixing valves with hand held shower hose they shall be installed at suitable heights for the application, however shall not be allowed to have shower hoses of length that may allow the shower head to be immersed within the shower tray.

The flexible hoses shall be copper alloy chromium plated with a plastic inner tube together with a plastic showerhead. The showerhead shall be one that can be dismantled for cleaning / disinfection. The shower head shall be clipped to purpose made matching vertical sliding bar which shall allow positioning at varying heights or hand held showering when removed.

TMVs shall be as manufactured by:

Manufacturer	**Model Range**
Caradon / Mira ltd	Rada / Mira
Horne Engineering Ltd	Horne 15, Horne 20 or Horne 25
A J Gummers Ltd	Sirrus
Meynell Ltd	Safemix

Refer to specific specification or schedules for particular requirement.

3.3 Mechanical Ventilation

3.3.1 Fans

Fans shall be of the make, type and size described in the particular specification and/or shown on the drawings.

All fans shall be supplied complete with an electrical drive motor either direct coupled or with belted drive train as specified. With belt driven fans the motor and the fan shall be mounted on a common base frame and adequate provision shall be made for accurate belt tensioning adjustment. A spare drive belt set shall be supplied with each belt driven fan.

Standby motors either coupled or loose shall be provided where specified in specific specification.

All fans shall be of substantial construction using materials compatible with the service air conditions. All rotating parts shall be accurately balanced to eliminate vibration.

Fans shall be fully isolated from the ductwork system and the building fabric by means of properly selected anti-vibration mountings, flexible ductwork couplings, anti-vibration hanger brackets etc.

The Contractor shall allow for one pulley/drive train chance on constant speed belt driven fan sets during final commissioning.

3.3.2 Galvanised Steel ductwork

Unless specified otherwise in the specific specification all sheet metal ductwork s hall be manufactured and installed in accordance with HVCA Specification DW 144 and as amended by this specification. Ductwork shall be manufactured from best quality cold reduced continuously hot dipped galvanised sheet steel.

Rectangular low velocity/pressure ductwork shall be constructed in accordance with table 5 of the HVCA specification DW 144.

The exception being that ductwork shall be manufactured from minimal nominal thickness of 0.8mm and not 0.6mm as given in the table, and 1.0mm for outdoor applications.

Medium velocity/pressure rectangular ductwork shall be constructed in accordance with Table 6 of DW 144.

High velocity/pressure rectangular ductwork shall be constructed in accordance with Table 7 of DW 144. The classification of ductwork shall be as table 1 of DW 144.

Ductwork shall be manufactured using hot dipped galvanized sheeting to BS EN 10142 grade P02G, 275 mass coating, M finish, B surface with C surface treatment, to the nominal cross sectional sizes shown on the drawings, based on the standard sizes and thickness' described in DW 144 with the exceptions as given above.

Where circular ductwork is specified, this shall be constructed in accordance with Table 13, 14 and 16–19 of DW 144. This shall be spirally wound where indicated on the drawings.

Minimal thickness shall be 0.8mm and not 0.6mm at stated in the tables.

The Contractor shall note that minimal throat radius of bends shall be at least equal to the ductwork width.

The use of self tapping screws shall not be allowed.

Rectangular ductwork shall be provided with additional stiffening as necessary to obviate vibration and drumming by either cross breaking or beading, or closer spacing of cross joints.

Cross-joints in circular ductwork shall be plain socket and spigot, with or without connectors, with integral sealant and mechanical rivet fixings. Flanged joints, with gaskets, shall be used in strategic positions to facilitate future removal.

Prior to final commissioning, and before the internal decorations commence, the ductwork shall be thoroughly blown through and cleaned out. This operation shall be carried out with the minimal volume flow rate of air obtainable from the system, within the capacity of the fan. Particular care must be given to ensure no over loading of the fan motors occurs at this time because of low system pressure resistance.

Filtration shall be removed from the systems during this operation.

3.3.3 Changes in Ductwork Section

Changes in direction in rectangular ductwork shall be by square pattern fittings with integral air turns. Ductwork changes in section shall be required for connections to items of plant and equipment. Angles of transition shall be kept to a minimum.

On low pressure systems the angle of transition shall be limited to 30° on the upstream side and 45° on the downstream side (typically velocity systems less than 10m/s).

High velocity systems, conveying air at greater velocities than 10m/s these transition angles shall be limited to 20° and 30° respectively.

Angles exceeding these shall only be allowed following written consent of the Engineer.

3.3.4 Turning Vanes

Air turning vanes shall be of the correct profile to ensure complete changes of direction of the airflow, with extended leading and trailing edges and with the radius and spacing selected to achieve uniform velocity through the bend.

Air turns shall be rigidly fixed to the ductwork such that drumming and vibration or blade oscillation occurs.

Turning shall not be achieved by means of unequal square elbows and all turning vanes should be installed with an angle incidence between 40 and 50°. No air turns in excess of these angles of incidence shall be allowed and the Contractor shall be requested to remove these and replace them at their own expense.

At square take off branches on air supply systems and on all square take off branches to supply air diffusers the use of ‘Deflectrol’ insert air turns. The Deflectrol shall be of the 15° type, as manufactured by Senior Coleman Ltd or equal and approved.’

Branch connections on supply air systems shall not normally require ‘Deflectrol’ fittings when the leading edge of the ductwork shoe is installed to the branch.

3.3.5 Ductwork Drawings/Allowances

The tender drawings are intended as a diagrammatic representation of the design intent and do not necessarily show all bends, sets and precise positional locations.

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

3.3.6 Ductwork Supports

All ductwork shall be provided with suitable supports which shall be supplied and fixed under this project.

The method of support may differ for different building structures; therefore the method of support shall be agreed with the Engineer after assessing the suitability of the various alternative methods to suit the building in question.

Horizontal rectangular ductwork shall generally be supported on mild steel bearers passing beneath the duct suspended by a hanger drop rod at either end from the building structure.

Steel bearers shall be either of angle iron square cut with all sharp burrs removed and painted with two coats of red-oxide rust prevention paint or proprietary channel (e.g. 'Unistrut') self-galvanized finish with ends treated after cutting and fitted with plastic blanking caps.

All bearers shall be of sufficient length to ensure a clearance of 25mm is maintained between the drop rod hangers and the sides of the duct or duct insulation where applicable.
Any support system used shall comply with the tables and sub-clauses of HVCA DW 144, Clause 19, with the following amendments:

a) Minimum drop rod diameter shall be 10mm

b) Minimum bearer member strut shall be 25mm x 3mm flat

c) Maximum spacing between support struts shall be 2.5m

In all cases ductwork supports shall be thermally insulated and vibration isolated from the ductwork itself. Cold ductwork systems such as incoming fresh sir, and ductwork following cooling coils that is vapour sealed, shall be provided with support insulants as detailed in clause DW 144/19.6.

Specialist anti-vibration mountings shall be provided to offer vibration isolation from all items of rotating machinery, such as fans, pump sets and refrigeration appliances.

Specialist anti-vibration mountings shall be as manufactured by Sound Attenuators Ltd.

These shall be the lateral spring type or, in the case of small axial fans of the neoprene type.

When selecting vibration isolators the selection shall take into account the structure that the support is being achieved from, the weight of equipment supported, and whether reciprocating or centrifugal and size of drive.

Vibration isolation shall provide maximum protection to the building fabric and shall not produce further noise from their installation by re-radiated airborne noise generation.

On insulated ductwork a high-density load bearing phenolic foam strip isolator of equivalent dimensions to the thickness of the insulation and the bearer length between drop rods, shall be fitted between the bearer and the duct.

Vertical rectangular ductwork shall generally be supported from purpose made mild steel angle cantilever brackets located one either side of the rising/dropping duct, secured back to the building fabric.

This ductwork supports shall bear on the cantilever brackets with a neoprene isolator, as specified before, interposed. Clearance between the cantilever brackets and the duct or duct insulation sides shall be maintained as for drop rods on horizontal ducts.

Supports for circular ducts shall be by full circumferential mild steel split bands, with splits on the horizontal centre line and two-drop rod hangers. Single point vertical centre line hangers will not be accepted.

On un-insulated ductwork the neoprene isolator, as specified before, shall be fitted around the whole circumference of the duct.

On insulated ductwork, a pre-formed high-density phenolic foam insert of insulation thickness shall be incorporated between the split band and the duct.

3.3.7 Test Holes

22mm diameter test holes are to be provided in all ductwork before and after each item of plant and at all main branches and before all balancing dampers whether shown on the drawings or not. Test holes shall be arranged in accordance with CIBSE Commissioning Code, Series A, Air Distribution and BSRIA Application Guides 1/75 and 1/77. All test holes shall be sealed with 'top-hat' type grommets.

3.3.8 Volume Control Dampers

Volume control dampers shall be provided in accordance with DW 144 or wherever necessary in all ducted ventilation systems to enable efficient control and regulation of air movement in accordance with the design intent.

Dampers shall be of rigid manufacture and damper blades shall have an aero-dynamic cross section. Flat plate or Butterfly dampers shall not be permitted.

Multi blade dampers shall be employed ion all ductwork and shall be of the Stainless Steel or mild steel opposed blade type where used for balancing with a robust linkage system external to the ductwork housing.

Blade bearings shall be self lubricating nylon type and a locking device shall be present on each damper. Dampers shall be free from vibration in any position and shall be reasonably air tight when closed.

Following final commissioning and balancing, all dampers shall be locked in position and stops shall be fitted.

Not all dampers will be shown on the tender drawings but as guidance to minimum requirements they should be positioned as follows:-

a) At all main duct divisions, to each leg

b) At all branch connections off main ducts

c) At all minor branches where they serve three or more outlets

d) At all duct terminations to grilles, diffusers, etc. (These dampers may be integral with the terminal).

It should be noted that dampers on air handling unit mixing boxes shall be of the parallel blade type to provide correct control characteristics.

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

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

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

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

Multiple assemblers shall include all necessary mullion-joining plate's seals and fixings.

Supply diffuser and extract grille plenum boxes shall have integral spigot positioned volume control damper for final trimming of the air volume. Within the construction of diffusers and grilles shall be Multi opposed blade dampers.

All volume Control Dampers shall be by: Actionaire their Air Shield type.

Grille and diffuser dampers shall be supplied with the grilles and diffusers specified elsewhere in this specification.

3.3.9 Fire dampers

Where fire dampers only are denoted the ductwork shall be provided with a fire damper together with proprietary manufacturers building frame.

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

Dampers shall be tested to BS 476, part 8 Time and temperature Curve and shall maintain their integrity for a minimum period of 2 hours.

Unless specified to the contrary, fire dampers shall be of the spring- loaded curtain type with blades packed out of the air stream activated to close at an in duct air temperature of 72°C.

The release mechanism cassette shall be two thermal actuators in the form of a helical coil memory metal close coil bound compression springs. External indication of blade status shall be provided. Damper sizes shall be to suit duct sizes and shall have galvanized steel casings and stainless steel shutters with side seals.

The damper blades shall be manufactured from Stainless steel with stainless steel bearings. The damper case being manufactured from a welded air tight construction formed from a minimum thickness to 18 gauge galvanised steel with spigot connections for ease of ductwork connection.

Fire Dampers shall be by Actionaire Fire Shield series

It shall be appreciated that the damper forms part of the fire barrier and as such must be rigidly fixed and fire sealed to the building fabric. Wherever the building construction allows, dampers must be mounted in a HEVAC installation frame positioned centrally in the wall or floor thickness. Building in ties shall be incorporated for the Principal Contractor's benefit.

The Contractor shall allow for full liaison and co-ordination with the Principal Contractor to install the dampers within the wall structures, although others will carry out the attendant builders work, the Contractor shall be responsible for ensuring the correctness of the work.

Where it is proposed to utilise other methods of fixing, drawn details shall be submitted to the Engineer for comment prior to the work being undertaken.

Access doors shall be provided on the upstream and downstream sides of the fire damper to allow inspection and cleaning of the blade system. All fire dampers shall be tested to show correct operation after installation and reset prior to hand-over.

During construction the Contractor shall supply the dampers shut and install them into the installation in this position until the commission stage. Prior to commissioning the Contractor shall include to vacuum out the linkages and blades so that they are free from dust and debris. The Contractor shall finally lubricate the dampers in accordance with the manufacturer's requirements.

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

3.3.10 Fire and Smoke Combination Dampers

Where fire dampers are also designated as smoke control dampers they shall be constructed from similar materials but shall be of the parallel multi-blade type and incorporate fail-safe closing and motorized re-setting. Precise details of mode control shall be as described the particular specification or schedules.

Suitable combination fire and smoke dampers are manufactured by Actionaire Ltd, being their Smoke shield combination fir smoke damper. Other equal and approved manufacturers may be considered providing they meet the following detailed specification.

All such dampers are to be combination fire and smoke dampers and will be noted on the drawings as such for referencing. If no reference is given then the Contractor shall include for such in the positions indicated.

The Combination Fire Smoke dampers shall be tested to BS 476 Part 8 Time and Temperature Curve and shall maintain their integrity for a minimum period of two hours.

They shall provide positive smoke control by means of gasketing and seal arrangements and the leakage rate shall not exceed 0.06m3/sec of air when the damper is closed against a differential pressure of 100mm water gauge.

The dampers shall be held open by a replaceable link rated to close the damper at 72°C induct temperature and this fusible link shall be removable from the outside.

Manual damper re-setting device shall be incorporated.

Damper blades shall be manufactured from stainless steel with stainless steel bearings. The damper case shall be welded airtight construction, manufactured from 18 gauge galvanised steel with spigot connections for ease of ductwork connection.

Specific details regarding the control of the dampers shall be found within the specific specification or schedules. The Contractor shall note that these particular dampers are often wired and linked into the fire alarm system.

If no indication is given in the specific specification or schedules then the Contractor shall include in there tender for all Combination Fire and Smoke dampers to be Mode 5, these being the Electrical reset mode at 24 volt (As Actionaire Ltd type reference)

It shall be appreciated that the damper forms part of the fire barrier and as such must be rigidly fixed and fire sealed to the building fabric. Wherever the building construction allows, dampers must be mounted in a HEVAC installation frame positioned centrally in the wall or floor thickness. Building in ties shall be incorporated for the Principal Contractor's benefit.

The Contractor shall allow for full liaison and co-ordination with the Principal Contractor to install the dampers within the wall structures, although others will carry out the attendant builders work, the Contractor shall be responsible for ensuring the correctness of the work.

Where it is proposed to utilise other methods of fixing, drawn details shall be submitted to the Engineer for comment prior to the work being undertaken.

Access doors shall be provided on the upstream and downstream sides of the fire damper to allow inspection and cleaning of the blade system. All fire dampers shall be tested to show correct operation after installation and reset prior to hand-over.

During construction the Contractor shall supply the dampers shut and install them into the installation in this position until the commission stage. Prior to commissioning the Contractor shall include to vacuum out the linkages and blades so that they are free from dust and debris. The Contractor shall finally lubricate the dampers in accordance with the manufacturer's requirements.

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

3.3.11 Access Doors

Access doors shall be provided in accordance with DW 144.

Access doors shall be provided in all ventilation ductwork adjacent to volume control dampers, fire dampers smoke control dampers, heater/cooler batteries and elsewhere where access for maintenance and/or inspection is required.

Doors shall also be provided throughout the ductwork systems to enable sufficient access for internal cleaning as required by DW 144 and TM2 Internal Cleanliness of New ductwork installations.

Each section of ductwork between internal obstructions shall be accessible with door fitted at a maximum of 6m centres (3m for kitchen ventilation systems).

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

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

All access doors shall have a minimum clear opening of 450mm x 350mm unless duct sizes dictate otherwise, where final details must be approved by the Engineer.

Access openings shall be rigidly framed with airtight covers designed so that they can be speedily removed and replaced. Sealing gaskets, suitable for the ductwork pressure classification, shall be provided, together with sufficient clamping type latches to ensure an airtight and watertight seal between door and ductwork.

Where ducts are thermally insulated the frame of the access door shall be extended beyond the face of the duct equal to the thickness of the insulation. Any Vapour seal present shall be maintained across the face of the frame.

The access doors on insulated ductwork shall be double skin construction containing insulation properties equal to that of the ductwork insulation.

Access doors shall not protrude into the air stream and where installed at high level shall be complete with either hinges or chains to give protection to operatives below.

Internal finishes of the access doors shall be smooth so as to ensure no build up of dust and debris against the finish.

3.3.12 Flexible Ductwork

Purpose made flexible ductwork connections shall be provided to ensure vibration isolation to rotating machinery and may also be used following written consent of the Engineer in the following locations.

Flexible ducting shall be used in positions shown on the drawings and for final connections to false ceiling mounted grilles and diffusers.

Flexible ducts shall be supported at lm intervals and unless specified to the contrary, shall not exceed 1.0m in length to make final connections to grilles and diffusers.

Maximum misalignment between the rigid ductwork and the diffuse/grille shall be 50mm.

Where specified to be fire rated, flexible ducting shall provide a resistance to penetration of fire of at least 30mins when tested to BS 476, Part 8. In addition, they shall provide a class 1 resistance to surface spread of flame when tested to BS 476, Part 7.

Where used in general positions including un-fire rated above ceiling locations, flexible ducting shall be manufactured from an aluminium / polyester / aluminium laminate enclosing a high tensile steel continuous wire helix.

Where specified to be thermally insulated, flexible ductwork shall be manufactured as described for general use with an additional external layer of fibre-glass insulation having an outer jacket of reinforced aluminium laminate to provide a vapour barrier and a class 1 resistance to fire spread.

Joints between flexible and rigid ducting shall be secured by worm drive metal clips.

Flexible ductwork shall not be installed through fire compartment walls, floors or partitions. All flexible ductwork, both on grilles, diffusers and fans, shall not contain asbestos materials and shall not give off excessive smoke or toxic fumes if involved in a fire. Connections using flexible ductwork shall not be undertaken in areas of high risk, where deposits of flammable equipment and substances are likely to be stored
The Contractor shall make reference to Specification DW 144 regarding such issues.

Flexible ductwork to suit each application shall be as manufactured by DEC International.

3.3.13 Ductwork Flexible Connections

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

Unless specified as requiring special qualities, e.g. fireproof, noise break-out attenuation etc., flexible connectors shall be purpose made from machine stitched heavy weight canvas trapped to the adjacent rigid duct and plant by mild steel angle and/or flat iron continuous girth clamps.

The canvas shall not be fitted unduly tight but not over slack, and shall be air sealed to the rigid duct and plant with non hard setting sealant mastic. The free gap between rigid items shall be not less than 50mm or more than 100mm.

Flexible ductwork to suit each application shall be as manufactured by DEC International

3.3.14 Grilles and Diffusers

Grilles and diffusers shall be of the make, type and size as described in the specific specification or schedules, or as shown on the drawings.

Unless specified to the contrary all terminals shall be fitted square and level with the building fabric and finishes. Grilles and diffusers fitted to suspended false ceilings and served from the main distribution by flexible ducting to a maximum length of 1m, and shall be mounted to purpose made plenum boxes with circular spigot connection.

The whole assembly shall be independently supported from the building structure and not reliant upon the suspended ceiling.

Unless specified to the contrary, grilles and diffusers shall have integral opposed blade volume control dampers operated by key through the face of the terminal. They shall be complete with matching ductwork plenum, itself including a spigot connection complete with volume control damper.

Ductwork plenum shall be manufactured from 0.8mm ductwork and shall be of air tight construction.

Independent connection brackets shall be used to connect between the grille/diffuser and the plenum box. Only in difficult circumstances is screw fixing through the grille/diffuser spigot allowed, then written permission shall be sought from the Engineer.

Screw fixing through the flange front face shall not be allowed.

3.4 Above Ground Waste Sanitary Pipework

The Mechanical Contractor shall include for all above ground drainage as indicated on drawings and/or as detailed within this specification.

3.4.1 Waste Drainage Installations

Include to provide and install new waste drainage installation to all new sanitary ware as indicated on the drawings.

3.4.2 Statutory Regulations

All above ground sanitation installations shall be in accordance with Parts 1 to 5 of BS EN 12056 ‘Gravity Drainage System Inside Buildings’ and Part H of the current Building Regulations

Particular notice shall be taken of any further Local Authority building control requirements.

3.4.3 Sanitation Systems

All connecting pipework shall be of minimum falls and inclination, all in accordance with details shown upon the drawings and relevant regulations.

All anti-syphon pipework from the traps of sanitary appliances, shall be connected above the flood level of adjoining fittings and pipework.

3.4.4 Pipework

a) All horizontal 100, 80, 50, 40 and 35mm diameter pipework connecting waste branches and anti-syphon pipes throughout, shall be PVC to BS 4514 and 5255 solvent welded as ‘Terrain’ systems, with BS 3943 traps. All as indicated upon the drawings. Only “Terrain” pipework systems shall be installed.

b) All 100, 80 and 50mm diameter vertical stacks, together with connecting pipework and branches, shall be PVC to BS 45 BS 4514 14/5255, solvent welded as ‘Caradon Terrain’

Systems **only**. Mixtures of PVC pipe and fitting systems from different manufacturers are not allowed.

3.4.5 Pipework Fittings

'Terrain' PVC Pipework

a) All vertical and suspended 100mm and 80mm diameter main pipework shall have Terrain No. 140 plastic coated steel Holderbats, and No. 191 intermediate brackets for pipe fixing.

b) All vertical 100mm and 80mm pipework shall be fixed at maximum 2.0 metre centres, with suspended pipes fixed at maximum 900mm centres.

c) All vertical, horizontal and suspended 50mm, 40mm and 35mm diameter, waste and anti-syphon, vent pipework shall be Terrain No 243 zinc plated steel brackets for pipe fixings at 500mm centres for 35 and 40mm pipe, and 900mm centres for 50mm pipe. In all cases, the manufacturers written 'Sitework Instructions' giving maximum support and expansion spacing requirements shall be adhered to, for reference see pages 7, 8 and 9, "Sitework Instructions" etc. by Terrain (1989 publication).

3.4.6 Branch Waste Pipes

All branch waste pipes shall fall at minimum 1¼° gradient to point of discharge, with means of cleaning access at changes in direction.

Where PVC waste pipes connect to PVC soil or waste branches on main 80mm and 100mm diameter stacks or floats, all such connections shall be made via Terrain No 117/121. Pre-formed boss branches. No stick-on boss fittings shall be allowed except for urinals.

3.4.7 Bends

The use of sharp 90° short radius elbows is not permitted. Only swept, medium or large radius bends, preferably 135° shall be used for changes in direction.

For 90° large radius bends, 2 no. 135° fittings can be combined to form bend.

3.4.8 Branches

All shall be swept, in the direction of flow, for horizontal pipework.

Where vertical branches join suspended pipework, 135° swept tees shall combine with 135° bends to form long radius square or connecting branches.

All vertical soil stacks connecting to horizontal pipework shall include above described long radius arrangement and terminate with a rodding access branch.

3.4.9 Offsets

All offsets in main vertical stacks shall consist of 2 no. 135° bends and cut length of pipe, to form offset.

Any offsets shall be avoided in wet portion of vertical stacks. Similarly, any such offset in pipework shall have means of rodding access local to, and above the offset.

3.4.10 Access Fittings

In all cases, specific care shall be taken to ensure that all cleaning doors and rodding eyes are positioned for easy accessibility and maintenance.

a) All main 100mm, 75mm and 50mm vertical cast iron stacks pipework shall have access pipes located:-

   i) Ground Floor - above stack connection to drain
   ii) Basement - at ends of suspended branches

b) All stub waste pipes shall have top access rodding eyes inserted into the highest connecting branch, for direct cleaning of vertical stub and connection drainage pipework.

c) All main 100mm, and 80mm vertical PVC pipework stacks shall have Terrain No. 138/139 access pipes with screwed seal cover located above floor level of adjoining appliances.

d) All access caps on 50mm/40mm and 35mm diameter PVC waste pipework shall be Terrain No. 237 plug access in branches, as located upon the drawings.

3.4.11 Drain Connections

a) <u>Vitrified Clayware Drainage</u>

   All stacks shall connect to vitrified clayware underground drainage systems via an adaption joint for 'Supersleeve' systems.

   (i) All PVC waste pipework shall connect to 100mm diameter drain socket via approximately sized 'Supersleeve' adapter No's AD125 - AD300 series.

   (ii) All WC pans connecting straight to drain, shall have 'Multikwik' flexible connections, so as to facilitate disconnection and removal of appliance from drainage system.

3.4.12 WC Connections

a) Where WC pans connect to 100 diameter PVC, sanitation pipework, a Terrain No. 128/129 flexible connector shall provide a demountable joint.

b) Where WC pans connect to 100 diameter PVC soil floats, a range of Terrain No. 155 manifold branches shall be used, with Terrain No. 134 Access caps on ends of horizontal float.

c) Where WC pans, to BS 5503, connect to 100mm diameter cast iron, sanitation pipework. A 'Multikwik' flexible connector shall provide a demountable joint between the WC pan and plain ended cast iron pipework.

3.4.13 Expansion Fittings

All pipework shall be installed, in accordance with Messrs Terrain's stated recommendations for fixing and allowances for expansion.

a) All 100mm, 80mm main stack, pipework shall have Terrain No 109 seal ring adapters for solvent welded fittings, where required throughout vertical running length.

b) All suspended 100mm and 800mm main pipework shall include Terrain No. 190 thermal movement limiter fittings inserted with 34mm spacing. All in accordance with the manufacturers published "Site work Instructions".

c) All 50, 40 and 35mm branch waste pipework shall incorporate Terrain No. 225 expansion connectors on **every** waste branch connection to main stacks and stub wastes, at maximum 2.0 metres spacings. These shall be **fixed and anchored** in position to prohibit ancillary expansion and movement.

   All as detailed on page 22, and fig. 86 in Terrain's 'Site work Instructions'.

3.4.14 Vent Terminations

All stacks shall terminate a minimum of 400mm above roofs or adjoining surfaces, all in accordance with the requirements of the current Building Regulations.

Under no circumstances shall 'Durgo' type AAV's be used without written consent by the Supervising Officer.

3.4.15 Fire Stopping

All sections of sanitation system shall be fire stopped in accordance with the Building Regulations requirements (by Main Contractor).

Specific provision shall be provided where PVC vent or waste pipes penetrate compartment floors and walls. The Mechanical Services Contractor shall supply and fit all pipes, where required, with Terrain No. 125 intumescent fire brake sleeve to BS 476, built in to adjoining surfaces, and edge sealed with intumescent mastic around the flange. Where PVC and cast iron pipework systems interconnect, it shall be acceptable to carry the cast iron pipe through the adjoining wall or floor, so as to extend the fire protection zone.

3.4.16 Testing and Sanitation Systems

All pipework shall be inspected internally for debris and checked free of defects prior to commissioning of the installation.

All pipework that shall be ultimately enclosed within main ducts or bulkheads, false ceilings etc. shall be air tested to 38mm before closing in.

Finally, all completed pipework shall be air tested in accordance with BS 5572 and to the satisfaction of the Supervising Engineer, and Test Certificates supplied.

Any defects shall be replaced with new pipework and fittings, and then re-tested to original standard of approval.

Random performance testing of pipework and trap seals shall be carried out to the satisfaction of the Supervising Engineer.

Before handover a complete commissioning test of all drainage and sanitation pipework shall be carried out.

Derbyshire Fire & Rescue Service

Proposed Temporary Fire Station

Unit 3C, Boardman Industrial Estate, Swadlincote

Employer's Requirements for Mechanical Services

Section 4

Specific Schedules for the Mechanical Services

Derbyshire Fire & Rescue Service

Proposed Temporary Fire Station

Unit 3C, Boardman Industrial Estate, Swadlincote

Employer's Requirements for Mechanical Services

Section 4

Specific Schedules for the Mechanical Services

Contents

Appendix

Schedule No 1

Tender Drawings

The Contractor is to also refer to the Architectural, Structural and Mechanical Services drawings produced for this project.

Drawing No	Drawing Title
17.043/M/01 Rev T0	Existing Mechanical Services
17.043/M/02 Rev T0	Proposed Mechanical Services Ground Floor
17.043/M/03 Rev T0	Proposed Mechanical Services First Floor

Schedule No 2

Manufacturers/Suppliers

The manufacturers and suppliers that are named in this specification reflect the level of quality that is to be achieved within the installation.

Where names are given the tendering Contractor must base their tender on one of the names indicated in order to ensure fair trading.

Alternatives may be considered separately and any alternatives, which the tendering Contractor's wish to put forward for consideration, shall be indicated in the returning summary of tender.

Cost differences, any technical variation from the specification must be reported in detail by the tenderer.

Schedule No 3

General Design and Installation Standards

The complete Mechanical Services provision as required by the Employer's Requirements Specification and as provided by the Contractor Design shall be in accordance with and comply with all relevant British Standards, Codes of Practice, Building Regulations and the requirements of the Statutory Authorities.

All standards referred to or applicable shall be the edition, revision or appendix that is applicable at the current time of tender unless otherwise stated.

The complete Mechanical Services provision as required by the Specification and as provided by the Contractor Design shall be designed in accordance with accepted good practice and shall, unless otherwise stated within this document be designed to the design recommendations of the CIBSE (Chartered Institution of Building Services Engineers) Design Guide together with those of the HVCA (Heating and Ventilation Contractor's Association).

The mechanical materials and workmanship specification defines the quality of materials and workmanship expected and forms an integral part of the tender documentation.

Calculations

The Contractor shall calculate heating loads by use of a suitable software tool. This may be either HevaComp or CyMap. Copies of the calculations shall be submitted to the Client's advisor for inspection.

Pipework sizing and Hot and Cold Water services shall also be sized using suitable software.

Design Principals

Internal Conditions

Air temperatures, fresh air requirements and environmental noise criteria for each space or plant requirement shall be in accordance with the CIBSE Design Guidelines and L2/F1 Building Regulations.

External Conditions

As CIBSE Design Guidelines for Swadlincote, Derbyshire UK.

Room Design Temperatures

Room design temperatures shall be as follows and generally as per the CIBSE design guide where not stated or as per the following table.

Summer time temperatures need only be met where air-conditioning is required by the Employer or as required to comply with building regulations.

Air change rates are for guidance only however where the Contractor feels that values other than those stated are appropriate, then these may be utilised provided that the value can be justified.

Note: All temperatures are to be **DRY RESULTANT**.

Outside design conditions shall be normally taken as -4°C. 100 % humidity for winter heat loss calculations and 29°C. 55% humidity for summer heat gains.

These conditions apply to none exposed Sites at sea level and in temperate climates. Where other conditions prevail then suitable allowances must be made.

Noise levels shall be limited to CIBSE recommendations. External noise levels shall not exceed existing valves and shall comply with local authority requirements.

Thermal Comfort

The Contractor shall at their design stage provide design evidence that demonstrates that the thermal comfort levels in the occupied spaces of the building are assessed to ensure that appropriate thermal comfort levels are achieved and to enable user control where required.

Mechanical Ventilation Rates

The Contractor shall include in addition to the natural infiltration rates the following provisions for mechanical ventilation. Rates shall generally follow the guidelines of those recommended by the CIBSE, HSE documentation and Building regulations requirements.

Natural Ventilation

Where suitable openings are provided, ventilation may be catered for by natural ventilation. Where however large occupancies occur and there is a possibility of noise pollution (due to opened windows), then provision shall be made to install a suitable ventilation system.

Make Up Air

Care shall be taken in designing the services to ensure that sufficient and make up air is provided to the building and its occupants. Systems should be designed to avoid drawing either cold or contaminated air into occupied spaces. Where make up air is provided, it should also be designed in compliance with the building regulations with respect to specific fan power, energy efficiency etc.

When selecting ventilation equipment such as recuperate units, then care shall be taken to ensure that under winter conditions, supply air temperatures are maintained to such a level that drafts are avoided. Where necessary, re-heater units shall be included.

Grille, Diffuser and Supply Device Selection

Any device supply air shall be selected and sized to prevent draughts. Also, the Contractor shall ensure that discomfort does not arise from air movement, temperature gradients of hot spots.

Environmental Room Data Sheets

General

Room	Space Temperature	Ventilation	Heating
Ground Floor			
Entrance	18°C Winter Ambient summer	To meet Building Regulations for occupancy	Radiator
WC/Showers	21°C Winter Ambient summer	Extract vent to meet Building Regulations for occupancy	Radiator
Corridor adjacent WC's	18°C Winter Ambient summer	Supply air to meet Building Regulations	Radiator
Locker Areas	21°C Winter Ambient summer	To meet Building Regulations for occupancy	Radiator
Stores	Unheated	Unventilated	None
Gym	21°C Winter Ambient Summer	To meet Building Regulations for occupancy	Radiator
Corridor between Gym & Fire Kit Space	21°C Winter Ambient summer	To meet Building Regulations for occupancy	Radiator
Compressor Room	5°C Winter frost protection Ambient summer	Naturally ventilated via louvre in door	Radiator
Drying Room	25°C All year round	To meet Building Regulations, intermittent occupation 6 people	Radiator

Room	Space Temperature	Ventilation	Heating
BA Maintenance Room	20°C Winter Ambient summer	6AC/hr positive pressure	Radiator
Appliance Bay	18°C Winter Ambient summer	General extract ventilation	Unit heater
Stairs	18°C Winter Ambient summer	N/R	Radiator
First Floor			
Female Locker Room	21°C Winter Ambient summer	To meet Building Regulations for occupancy and extract ventilation rate	Radiator
Female WC/Shower Room	21°C Winter Ambient summer	To meet Building Regulations for occupancy and extract ventilation rate	Radiator
Male Locker Room	21°C Winter Ambient summer	To meet Building Regulations for occupancy and extract ventilation rate	Radiator
Multi-use Office	21°C Winter	To meet Building Regulations for occupancy	Radiator
Kitchen/Mess Room	21°C Winter	To meet Building Regulations for occupancy	Radiator

Specific Noise Criteria

External Environment

Where the Contractor Design may impact upon the adjacent areas, the Contractor Design for Mechanical Services systems shall be such that sound reduction and vibration isolation in the existing noise criteria found in the plant room area.

Any Building Services Plant shall be designed to limited environmental external noise limited of noise levels outside the building to NR55 at 2m or to no greater than existing levels. Where existing natural ventilation louvres or openings exist the Contractor's Design shall ensure no increase in present noise levels.

Internal Environment

Noise levels to occupied spaces shall be in accordance with CIBSE requirements and recommendations, and in any event shall not exceed NR38-40. Where plant items are positioned above office ceilings, particular care shall be taken in minimizing and controlling break out noise. This may be achieved by a combination of careful unit selection, acoustic “jackets” and inlet and exhaust silencers.

Internal Heat Gains

The Contractor Design shall take into account all casual, occupational, infiltration and associated Electrical Services lighting heat gains, all as CIBSE Design Guides.

Where specialist equipment items are used, the heat load of that item shall be obtained from the suppliers for accuracy of gains calculations. This shall apply to items such as photo-copiers, printers, computers etc.

Heat Losses

Heat losses shall be carried out using dry resultant indices in accordance with CIBSE methodology. External wall heights shall be taken as the full floor to floor height and not floor to suspended ceiling in accordance with CIBSE recommendations.

Infiltration losses shall be based on either 1 air change per hour or as per the infiltration rate achieved by the air permeability rate of $5m^3/hr$ per m^2@50Pa (whichever is the worst case). Additional air change allowance may be required in rooms having external doors. Where this occurs suitable allowances shall be made.

Emitter Selection

Suitable allowances for fast heat/intermittent operation and an additional margin of 10% for errors shall be included in accordance with good practice.

Temperature Gradient within Spaces

The Contractor Design shall ensure that no more than a 2°C temperature gradient shall apply between the head and ankle height of an occupant.

Air Movement

Air movement guidelines shall be as recommended by the CIBSE Design Guides other than in the immediate vicinity of particular air distribution diffusers etc in occupied areas.

Care shall be taken in selecting grilles and diffusers in ensuring suitable space coverage without creating discomfort due to draughts. Swirl type diffusers should be used in preference to louvred face diffusers.

Maximum Surface Temperatures

The surface temperature of any Contractor's proposal for emitters touched by occupants within Public toilet areas together with the maximum discharge temperature from hot water service taps within disabled areas shall be in full accordance with the Health Guidance Note "Safe Hot Water and Surface Temperature" document/

These being 41°C to touch at emitters and 41°C at TMV3 thermostatic blending valve fed hot water service outlets.

Duct Velocities

Duct velocities shall be designed for a maximum of 6m/sec in main duct runs and 2.5-3m/sec in branch ducts. Velocities in grille box connections shall not exceed 2.5m/sec.

Where the Contractor wishes to use low loss 'self-balancing' headers, these shall be sized on such a velocity and pressure drop that provides an even flow rate.

It should be noted that proprietary equipment such as heat recover 'VAM' units may have very low external static pressure capabilities which may result in the requirement for even lower velocities.

Pipework Criteria

Pipework velocities shall not exceed 1m/sec and system pressure drops shall not exceed 220Pa/m.

The Contractor shall also ensure that the sub-circuit system pressure drop is limited to the available system pressure allowance where appropriate i.e. as supplied with packaged chiller plant etc.

Schedule No 4

Boiler

The Contractor shall design, procure, install and commission as determined by their design new LTHW Boiler in the positions generally indicated on the Employer's Requirements drawings and as detailed below:

Proposed boiler solution shall have low nox emissions that comply with the BREEAM assessment document issued as part of the tender documents. The lowest achievable nox level emitting boilers shall be considered in order to achieve greater BREEAM rating for the building.

Manufacturer:	Worcester Bosch
Model:	Greenstar i System
Quantity:	1 No.
Ratings:	As required and determined by the Contractor Design.
Fuel:	Natural Gas
Flue Connection:	As required and determined by the Contractor Design
Connections:	As required and determined by the Contractor Design
Operating Temps:	To suit energy efficient design
Rated Flow (Kg/s):	As required and determined by the Contractor Design
Requirements:	High efficiency low Nox boiler

Manufacturer:

Worcester Bosch Group
Warndon
Cotswold Way
Worcester
WR4 9SW

Tel: 0330 1239 339

Schedule No 5

General Extract Fans

The Contractor shall design, procure, install and commission as determined by their design new general area extract fans.

Fans shall be selected based on optimum performance, ease of use, noise and low energy requirements. Manufacturers own controls may be utilised where suitable.

Ventilation equipment shall where possible be kept within the building envelope to facilitate maintenance.

Fan types listed are preferred options, however where options are available, these shall be of the same quality or of higher standard.

General Extract Fans shall be of the following type:

Toilet, Male & Female Changing Areas:	Vent Axia, low carbon silhoulette 100, BAS Range or equal and approved.
General Extract Fans:	Vent Axia 'T' Series or equal and approved Local control where applicable

All extract fans in accommodation rooms, toilets, cleaner's rooms; bathrooms shall be of low voltage type where appropriate.

Larger plant items shall be connected to independent wall mounted controller.

Address:

Vent Axia
Narrowboat Way
Dudley
DY2 0XQ
Tel: 01384 418800

Schedule No 6

Thermostatic Blending Valves

The Contractor shall install new Thermostatic Blending Valves as required by the Contractor Design. These shall be fitted to all areas accessible by the public and also to areas such as disabled WC's.

These shall be located on all water fittings accessible to the patients.

Manufacturer:	Horne Engineering Co Ltd
Position:	Alongside or beneath outlet positions
Model:	TMV3 as determined by the Contractor Design
Finish:	Bronze, Complete with Integral non-return valves, strainers and swivel inlet connections.
General Requirements:	Temperature setting to 41°C
Connection sizes:	As determined by the Contractor Design
Accessories:	White Plastic Cover and wall mounting kit
Dead Legs:	Maximum 1m on pre-mix side and 3m on mixed outlet side and in accordance with Legionella requirements

Refer to Employer's Requirements for additional details.

Or equal and approved

The Horne Engineering Co Ltd
Rankine Street
Johnstone
Renfrewshire,
PA5 8BD

Tel: 01505 321455
Fax: 01505 336287

Schedule No 7

Thermostatic Showers

The Contractor shall design, procure, install and commission new TMV3 thermostatic shower blending valves in accordance with the room data sheets and the Employer's Requirements.

Manufacturer:	Mira
Position	As required by the room data sheets and positioned as indicated on Employer's Requirements tender drawings
Model:	Sport
	As determined by the Contractor Design
Connection sizes:	As determined by the Contractor Design

Address:

Kohler Mira Ltd
Cromwell Road
Cheltenham
Gloucestershire
GL52 5EP

Tel 0844 571 1777

Schedule No 8

Commissioning Valves

The Contractor shall design, procure, supply, install and commission the following commissioning valves in the positions as indicated on the tender drawings.

Commissioning stations shall generally be Hattersley type 1432 double regulating and 1000 orifice metering device for sizes up to 50mm. For sizes over 50mm, then the valves shall be M733 double regulating valve and M2000 orifice metering device or 953G double regulating valves and M5000 orifice plates.

Commissioning stations are to be installed in the LTHW water services.

Commissioning valves on each hot water services return connection position to HWSF shall be the Danfoss MTCV thermostatic circulation valve on the HWS return pipework.

Model Ref: DN15 Code 003Z051500
DN20 Code 003Z052000

Danfoss Randall Ltd
Ampthill Road
Bedford
MK42 9ER

Tel: 0845 1217 400
Fax: 0845 1217 515

All values are to be verified at installation stage prior to final commissioning

Address:

Hatterley Newman Hender Ltd
Burscough Road
Ormskirk
Lancs

Tel: 01695 577199
Fax: 01695 578775

Schedule No 9

Pipework Flushing and Cleaning – (relevant to all water systems)

Following completion of sections of the installation and following the completion of the complete system final pressure test, the systems shall be thoroughly flushed out so that all foreign matter is removed from the system.

Water systems shall be thoroughly flushed using clean water.

The flushing medium wherever possible shall be fed into the systems at high-level positions and flushed out at low points. Suitably sized flushing plugs with valves shall be used. Flushing through 15mm drain valves is not considered good practice to flush a system out by.

Prior to flushing taking place the Contractor shall remove all filters, meters, circulating pumps, traps, valves, controllers non – return valves, and equipment / plant that may become damaged as part of a flushing process.

Sufficient time shall be given to ensure that all foreign matter is removed from the system. Flushing should also be undertaken under pressure at a pressure that is deemed suitable to the installed system. Care must be taken with regard to flushing old and existing systems at pressure.

The Clerk of works, or Client's advisor shall witness Flushing procedures. The length of time to flush shall be recorded.

Once flushing has been deemed to be complete, the Contractors appointed specialist water treatment provider or company shall take samples of water from each service, at the furthest point in each direction of the building. These samples shall be taken away for analysis to indicate whether flushing has been successful.

If samples indicate that further flushing is required then this shall be undertaken until agreeable analyses are obtained indicating that all foreign matter, suspended solids and impurities have been removed.

Following the completion of the flushing process the Mechanical Services Contractor shall undertake to remove all strainers, dirt pockets etc and thoroughly clean them out of any residual debris that may be held within them as a result of the disturbance caused be the flushing processes.

The Contractor shall employ a specialist company of Water Treatment Engineers to advise on a suitable corrosion inhibitor which shall be added to the heating or cooling system to prevent corrosion or contamination of the pipework services.

The correct corrosion inhibitor shall be added to the final system fill. Determination of the system water content shall be undertaken by the Contractor, who shall then inform the specialist. The water treatment specialist then will then advise the Contractor of the correct dosage for the system(s).

The Client's advisor will be fully informed of these findings and undertake to give their approval prior to work taking place on the system.

Water treatment shall be added to a system via dosing pot, either presently installed within the existing system, or temporarily installed in a position agreed by the Engineer.

The Contractor shall include for all associated costs with regard to the water treatment, and specialist advice.

Following the addition of the water treatment, a period of 1 week will lapse and then the specialist water treatment engineers shall test the system(s) at four separate locations to check the level of inhibitor within the system.

If these tests indicate an inadequate or unsuccessful water treatment exercise then the Contractor shall at their expense undertake to repeat the water treatment until such time that successful tests are achieved to the satisfaction of the Clients Representatives.

Corrosion Inhibitor

The Contractor shall include supplying and applying the correct amount of corrosion inhibitor to the proposed LPHW Heating system.

The Contractor shall include for liaison with the manufacturer of the inhibitor to establish the exact quantity and grade of inhibitor to add to the system.

The Contractor shall also include within their operating and maintenance manuals for the requirement of annual water quality checks and replacement after a maximum of seven years use.

A test certificate shall be issued with the O&M Manual to confirm water treatment levels

Manufacturer: Fry Technology Ltd (Fernox)

Inhibitor: As required by the system components

Address:

Fry Technology Ltd
Tandem House
Marlowe Way
Beddington Farm Road
Croydon
CR0 4XS

Tel: 0870 601 5000

Schedule No 10

Hot and Cold Water Services Chlorination

Sterilisation of Systems

Prior to hand over (however giving sufficient time period to receive test results back, prior to hand over) all water mains, fire, boosted and tank cold water and domestic hot water service flow and return services, storage tanks, vessels and water heaters within and forming part the contract, shall be thoroughly and efficiently sterilised.

Sterilisation shall be carried out by Specialist or Water Authority.

The sterilisation shall be carried out in full accordance with BS CP 6700, Section 3, Clause 13.

On all projects and schemes, once works have been completed and successful pressure tests witnessed then the Hot and Cold Water services have been filled with water, the Contractor shall be required to Chlorinate these systems in full accordance with BS CP 6700, Section 3, Clause 13.

The Contractor shall then maintain these systems in safe working condition until such time as practical completion is given.

Prior to practical completion all hot and cold-water services systems shall again be chlorinated to BS CP 6700, Section 3, Clause 13.

Once completed the Contractor shall provide certification indicating the areas where chlorination has occurred, this information shall also include information on the levels of chlorination used, and the results of the final microbiological tests.

During chlorination the Contractor shall frequently check the system, to ensure that the residual levels do not increase more than 10% of the required levels.

Once the system has been chlorinated the systems shall be flushed of all chemicals and refilled with fresh water.

The Contractor shall include taking samples for Microbiological test positions, from the furthest positions within the systems in each direction, and or each distribution leg. Microbiological tests shall be carried out by specialist, Public Health Authority, or local Water Undertaking in whose area the project is situated**.**

The Microbiological tests shall confirm that the Water from the installation is suitable for human consumption and free from harmful bacteria or chemicals.

It therefore must be noted that until such time as successful Microbiological tests are achieved that the systems cannot be given practical completion.

It may be noted that the Microbiological tests take 7 to 10 days normally to complete.

The original copies of these tests shall along with two copies be given over for inclusion within the Health and Safety manuals or Operation and Maintenance manuals.

The methods used to test the samples shall be in accordance with given in 'Analysis of raw water, potable and waste waters' published by the Department of the Environment or method approved and employed by the Public Health Authority at the time of the tests.

The above tests shall be strictly adhered to and shall include 'E Coli tests, chemical analysis to indicate the copper and lead content of the water in mg/l (ppm) and Legionella test and analysis.

The Contractor shall allow adequate provision within their contract for the full and correct completion of these procedures as indicated.

Prior to hand over, practical completion the Contractor shall include to flush the system twice weekly with fresh water in order to not allow the stagnation of water within the system. The Clerk of Works or Client's advisor shall undertake the witnessing of these flushing procedures.

Schedule No 11

Thermal Insulation

General

The Contractor shall design, procure and install thermal insulation systems to pipework and ductwork systems in full accordance with the Employer's Requirements and, where applicable, any client specific standard specifications for thermal insulation.

The Contractor shall also adhere to specific requirements of BREEAM with regard to thermal insulation standards and performances where BREEAM is applicable to the project.

All thermal insulation shall be installed and applied by specialist contractors on behalf of the Contractor.

All thermal insulation shall be in full accordance with the following British Standards:

- BS 5422: 2009 – methods for specifying thermal insulation materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range of -40°C to +700°C
- BS 476 – Fire tests on building materials, including all parts and amendments.
- BS 1710 – Specification for identification of pipelines and services.
- BS 5970 – Code of Practice for Thermal Insulation of Pipework and Equipment.
- BS 3533 – Glossary of Thermal Insulation Terms
- BS 3937 – Specification for Rigid Phenolic Foam for Thermal Insulation in the form of slabs and profiled sections.

No materials containing CFC components shall be acceptable.

Thermal insulation shall be applied to pipework systems in accordance with BS 5422: 2009 to control heat loss, control condensation and prevent against freezing.

Materials and finishes of thermal insulation shall be such that they are mould- and fungal growth-proof and proof against deterioration.

Finishes shall be as follows:

Pipework Systems

Area	**Finish**
Service Duct	Factory applied Class 'O' foil finish, all joints between sections to be sealed by 50-75mm wide foil adhesive.
Ceiling Voids	Factory applied Class 'O' foil finish, all joints between sections to be sealed by 50-75mm wide foil adhesive.

Internal and Exposed to View	Canvas membrane (typically Chilseal CP50 type). Insulation stretched tight to ensure free from creases etc., overlapped by 50-75mm along all joints.
External	Insulated to ambient conditions. Waterproof polyisobutylene applied to insulated materials and banded overlaps.
Plant rooms etc.	Factory applied Class 'O' foil finish. All joints between sections to be sealed by 50-75mm wide foil adhesive then covered by fabricated aluminium casing for protection.

Ductwork Services

Area	**Finish**
Internal, exposed ductwork on view	Insulated to ambient conditions complete with waterproof polyisobutylene adhered to the insulation material and bonded between sections.
Service ducts and voids	Class 'O' finish. Joints 50-75mm foil seal, wide self-adhesive match Class 'O' tape.
Internal plant room	Class 'O' finish. Joints 50-75mm foil seal, wide self-adhesive match Class 'O' tape with additional fabricated sheet, aluminium casing for protection.
Valves, Tees, Bends etc.	All to be insulated with the same materials as above, oversized sections of preformed sectional insulation. Concentric and matching for thickness, surface matching. Bends ad fittings formed and mitred. End caps to pump casings, flanges, valves etc. Pipe insulation not to be wrapped around small sections of pipe.
Pipework – Chilled Water	Continuous vapour sealed Inserts with some insulation properties to be between pipework and brackets. Outside diameter matching pipework alongside. Insulation finish shall carry on over insulation inserts. Ensure care of the vapour seal is maintained on all cold water service and chilled water service pipework insulation.
Pipework – HWS	All ways insulated and concealed from view. Insulated as detailed above.

External pipework	Insulated to meet the ambient external conditions and weatherproofed with polyisobutylene sheets, adhere to the insulation finish, complete with 50mm end and edge caps. Flanges etc oversized segments of insulation – polyisobutylene to continue running through the support structure to provide continuous waterproof finish.
Area	**Finish**
Insulation Thickness – Pipework	Where insulation thermal and ductwork W/m°C of the insulation material is closed cell phenolic foam 0.02W/m°C at 20°C

Pipe Size (mm)	Chilled Services Water	LTHW Htg		HWS CWS	MWS
Minimum Thickness of Insulation (mm)					
15	20	20	20	20	20
20	25	20	20	20	20
25	25	20	20	20	20
32	25	25	25	20	20
40	25	25	25	20	20
50	25	25	25	20	20
65	30	25	30	20	20
80	30	25	30	20	30
100	30	30	30	20	20
125	30	30	30	20	20
150	35	30	30	20	20
200	35	35	35		
250	35	35	35		
300	35	35	35		
Flat Surfaces + Vessels	40	35	35	25	25

NB: Phenolic foam shall not be used in services operation above 120°C

Insulation Thickness – Ductwork	Where thickness of insulation thermal sections comply with K value of 0.018W/m°C at an average of 10°C temperature difference between duct and ambient air/thickness of insulation.

10°C	25°C	50°C
25mm	30mm	40mm

Valve Jackets

Contractor to design, procure and install thermal insulation jackets to all flanges and valve sets.

Jackets shall be purpose made to suit size of flange/valve and shall be complete with drawstrings to allow for suitable fixing.

Schedule No 12

Commissioning

All pre-commissioning and post commissioning shall be carried out by an approved independent Commissioning Specialist.

The commissioning shall include but not be limited to the following:

Post Commissioning

All new plant and systems shall be commissioned in accordance with the CIBSE codes of practice.

The Contractor shall ensure independent commissioning of the following Mechanical Services systems:-

- LTHW Heating Systems and Radiators
- Gas Fired Unit Heaters
- H&CWS Distribution

Where commissioning of boiler plant, and gas fired unit heaters is being undertaken by the manufacturer, the Contractor shall include for the commissioning specialist to be in attendance during this commissioning.

Schedule No 13

Gas Solenoid Valves

The Contractor shall design, procure, supply, install, commission and set to work new gas solenoid valves to the gas services as required by the Employer's Requirements and the Contractor's design.

Gas solenoid valves shall be fitted to complete with Gas Safety Regulations and the Building Fire Plan in the following positions:

- Incoming position

Manufacturer:	Black Teknigas Ltd or equal
Type:	Powerseat
Model:	BC 6 series
Size:	As determined by the Contractor Design
Nominal Flow Rate:	As determined by the Contractor Design
Ancillaries:	BC66MRF manually resettable thermal fuse (One per plant item) 1 x BC66ESB emergency cut out switch located adjacent to the exit door 1 x BC66RS240 manual reset switch

Black Teknigas
Unit 3
Bydand Lane
Little Paxton
Huntingdon
Cambridgeshire
PE19 4ES

Tel: 01480 407074
Fax: 01480 407076

Schedule No 14

Fire Sleeves

Traditional Pipework

Traditional pipework shall be fire sleeved when penetrating a fire barrier. Sleeving shall be carried out utilizing Industrial Hangers Ltd Pacifyre Mk II fire stopping sleeves. These shall be suitable for the diameter and type of pipework.

Where wall depths vary with the length of sleeve, the Pacifyre device shall be adjusted to suit the wall thickness as recommended by the manufacturer.

Fire stopping shall be carried out in accordance with Building Regulations Approved Document 'B' and relevant British Standards including BS 476.

Seals shall allow the full and proper movement of pipework for expansion without creating undue noise.

Building in of the sleeves shall be by the Main Contractor.

Plastic Pipework

Where plastic pipework is proposed, fire sleeves shall be suitable for the application.

Fire sleeves should be used where single PB pipes of 32mm outside diameter and above or multiple banks of pipes penetrate fire barriers. They should generally comply with the requirements of the local fire authority.

Pacifyre Fire Stopping Sleeve Characteristics

a) They shall be constructed with an intumescent lining.

b) Casings should accommodate the expansion of intumescent linings during fire conditions.

c) Intumescent linings should expand inwards at a temperature of about 150°C and completely seal the openings against the passage of flames, fumes and smoke. Such linings should also be in accord with the pipe manufacturer's requirements.

d) Note: The pressure of the expanding intumescent lining may crush PB pipes.

e) Individual sleeves mounted on vertical pipework should:

- Be of construction suitable for surface mounting
- Be installed on the pipe immediately below the barrier (the collar should be securely fixed to the sleeves, the sleeve and the flanged collar butted up against the fire barrier and the flange bolted into position) or similar.

Manufacturer:

IHL Walraven
Industrial Hangers Ltd
Thorpe Close
Thorpe Way Industrial Estate
Banbury
Oxon
OX16 4UU

Tel: 01295 753400

Schedule No 15

Pipework Supports and Sleeving

Supports

The Contractor shall supply, install and commission a support system designed to safely carry the building services.

Supports shall be suitable for the installation and shall not create excessive loads or stress on the building structure. Any loads created shall be designed to give minimal effect and shall be notified and agreed with the structural engineers.

Support systems shall be appropriate for the type of pipework and where necessary, the following items shall be provided:

1. Swivel Support Joints (Appropriate to the pipework movement)

2. Insulating blocks (Appropriate to the service temperature and pipe loading)

3. Rubber Linings (Appropriate to the pipework type)

4. Nylon Coatings within Slide Guides (To reduce loads due to pipework expansion)

5. Anchors (Positions to be agreed)

Support Systems

The Contractor may adopt support systems that are appropriate for the installation.

Systems may include Flamco Railing, Unistrut or Walraven Rapid-Rail. Systems shall be designed, installed and commissioned in accordance with good practice and the manufacturer's recommendations.

Pipework Support Distances

Pipework shall be supported in accordance with M&E 3 Spacing. Support system main support frame distances shall be designed to accommodate the smallest pipe or the pipe with the minimum spacing distance.

Manufacturer/Supplier:

IHL Walraven
Industrial Hangers Ltd
Thorpe Close
Thorpe Way Industrial Estate
Banbury
Oxon
OX16 4UU

Tel: 01295 753400

Schedule No 16

Pipework Fittings Systems

The Contractor shall as an option, provide a cost saving for utilising ‘rapid fix’ fittings and installation methods.

The systems shall include:

1. Mapress Steel Pipework Systems by Mannessmann
2. Press-Fit / Xpress Copper pipework by Yorkshire Ltd

Operatives shall be fully trained and competent in the use of these systems.

Mapress type systems shall be used on any LTHW Services and Press Fit/Xpress shall be used on the copper services.

Pipe size comparisons are given on the attached sheet. All drawing dimensions are based on traditional sizes. Equivalent sizes shall be taken as the nearest internal dimension that is the equivalent to the traditional pipe.

Schedule No 17

Corrosion Inhibitor Water Treatment

The Contractor shall include for the following procedures to be undertaken.

Once the existing heating system is drained, the Contractor shall include flushing the system prior to reconnection of the proposed services to the existing system.

The heating system is to be flushed out and treated with a mild de-sludging agent. (Fernox reference IC20). The Contractor shall ensure that the cleansing agent is suitable for systems of this age and type.

Once the installation is complete, the Contractor shall operate heating system at full duty for 3 days and then drained. The sludge shall be removed by continuous flushing with at least three re-fills and water discharges.

The Contractor shall make application to Local Authority for permission to discharge flushing agent and system water to drain and waste removal shall comply with the requirements of the Environmental Protection Act.

Following the flushing process, the system shall be filled with an inhibitor suitable for the types of metal present in the system.

The inhibitors shall be:

1. Fernox CH3 for steel, copper and cast iron systems
or
2. Fernox COPAL for systems with copper and aluminium.

In any case, it shall be suitable for the system in question.

All chemicals must be used in accordance with manufacturer's instructions and recommendations. The Contractor shall perform a system surveys in order to determine which de-sludging agent and inhibitor is most appropriate.

Details of the system water content are to be given to the water treatment supplier in order to ascertain the system dosing requirements and concentrations.

The bulk of the water dosing shall be carried out by adding the chemicals to the cold feed tank or feed system. A temporary hose filler point may be connected to the system to facilitate this, however all necessary precautions necessary must be taken in order to comply with water board regulations.

In addition the Contractor shall include to supply, install and commission a 5 litre capacity dosing pot in the boiler house complete with valves and interconnecting pipework. This shall be installed across the flow and return connections or similar suitable position to be agreed with the Consulting Engineers. The dosing pot shall be a Flowmech Ltd. CDP-5.

The Mechanical Contractor shall include to supply and apply the correct amount of corrosion inhibitor to the proposed LPHW Heating system.

The Mechanical Contractor shall include for liaison with the manufacturer of the inhibitor to establish the exact quantity and grade of inhibitor to add to the system.

The Mechanical Contractor shall also include within their operating and maintenance manuals for the requirement of annual water quality checks and replacement after a maximum of seven years use.

Manufacturer:	Fry Technology Ltd (Fernox)
Inhibitor:	MB-1
System Estimated Volume:	As determined by the Mechanical Contractor Design

Water system content is to be verified at tender stage and incorporated within the Mechanical Contractor's installation and commissioning figure.

Address:

Fry Technology Ltd
Tandem House
Marlowe Way
Beddington Farm Road
Croydon
CR0 4XS

Tel: 0870 601 5000
Fax: 0870 601 5005

Schedule No 18

Radiators

The Contractor shall procure, design, supply, install, commission and set to work, new LTHW Heating Radiators in the positions as generally indicated on the tender drawings, as required by the Employers Requirements and the Contractors Design.

In circumstances where internal wall space is restrictive, for example disabled toilet area, the Contractor shall include to take into account the heat loss from that space and add this to a radiator positioned for example in the corridor adjacent the space to provide heating to the disabled toilet.

Contractor shall provide suitable proposals to the lead consultant architect to suit each area

Main Areas

Manufacturer:	Stelrad or equal and approved
Model:	Elite Range
Connections:	2×1⁄2" side connections for flow, return, air vent
Valves:	Danfoss TRV c/w matching LSV
Colour:	Powder-coated, available in white (RAL 9016) or as required by the Architect
Heat Output:	As determined by the Contractor Design
Flow & Return Temperatures:	As Determined by the Contractor Design

Stelrad Radiators
Stelrad House
Marriott Road
Mexborough
Rotherham
S64 8BN

Tel: 01709 578950

Schedule No 19

Identification

The Contractor shall include for all items of plant, valves, pipework, local electrical isolators, controllers, sensors etc to be labelled and identified.

The labelling of valves, plant labels etc shall be based upon the following:

White/Black/White traffolyte secured by chains or screws, 3mm or 5mm high capital lettering.

Pipework banding shall be in accordance with BS

Colour banding continuous with the flow direction, name of service together with the size of the service.

Water Service Outlets:

All outlet points shall be identified by white/black/white traffolyte label fixed to the wall behind the appliance as follows:

Tank Cold Water	Not Drinking Water
Mains water	Drinking water
Hot Water	Hot water

Schedule No 20

Water Heaters

The Contractor shall design, procure, install and commission new point of use electric storage water heaters to the positions as generally indicated on the Employers Requirements tender drawings and as required and determined by the Contractor Design**.**

Manufacturer:	Heatrae Sadia
Model / Type:	Multipoint, Horizontal or Vertical to suit application
Storage Volume:	As determined by the Contractor design
Ancillaries:	As determined by the Contractor design to meet the requirements of site pressure and water regulations

Manufacturer:

Heatrae Sadia
Hurricane Way
Norwich
Norfolk
NR6 6EA

Tel: 01603 420220

Schedule No 21

Water Boilers

The Contractor shall design, procure, supply and install drinking water boilers to serve the mess room. The units shall be served from the mains cold water distribution.

The boilers shall be complete with remote or integral water conditioners.

Model: Eco-boil

Manufacturer: Zip Water Heaters

Manufacturer

Zip Water Heaters

Contact: 08456 005 005

Schedule No 22

Miscellaneous Items

The Contractor shall note:

Final Hot and cold water services connections to all sanitary appliances and equipment are to be included within the contract. All sanitary ware and taps etc shall be supplied by others.

Derbyshire Fire & Rescue Service

Proposed Temporary Fire Station

Unit 3C, Boardman Industrial Estate, Swadlincote

Employer's Requirements for Mechanical Services

Appendices

Contents:

Derbyshire Fire & Rescue Service

Proposed Temporary Fire Station

Unit 3C, Boardman Industrial Estate, Swadlincote

Employer's Requirements for Mechanical Services

Analysis of Tender

1.0	Preambles	£
2.0	Preliminaries	£
3.0	Removal Works	£
4.0	MCW Distribution and Thermal Insulation	£
5.0	Gas Service Distribution	£
5.1	Gas Solenoid Valves Etc.	£
6.0	Unit Heater Installation and Servicing	£
7.0	LTHW Heating Services	£
7.1	Thermal Insulation of Above	£
8.0	Hot and Cold Water Services	£
8.1	Thermal Insulation of the above	£
9.0	Mechanical Ventilation	£
10.0	Above Ground Drainage	£
11.0	Testing and Commissioning	£
11.1	Manufacturer's Commissioning Services	£
12.0	Pipework Flushing	£
13.0	Chlorination and Bacterial Analysis Testing	£
14.0	Operation & Maintenance Manuals	£
15.0	12 Months Maintenance of all Plant	£
16.0	Part L and EPC	£
17.0	**Total**	**£** _____

Signed ……..……Dated……

For and on behalf of……..…….

Address……..……..

…….....

End of document