# Mechanical Services

# Performance Specification and Form of Tender

Project: New SEN Nursery Building

Location: Burlington Avenue, Langwith Junction, Shirebrook, Mansfield NG20 8GF

Client:

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# Contents

# 1 Preliminaries

## 1.1 Contract Preliminaries

The following preliminaries clauses are supplemental to and shall be read in conjunction with all preliminary clauses included within these tender documents and available from the Main Contractor.

## 1.2 Definition of Terms

The following definitions to this Specification are deemed to apply unless there is something in the subject or context inconsistent with such construction.

The **Client** and **Employer** shall mean:

Stubbin Wood School & Nursery
Common Lane
Langwith Junction
Shirebrook
Mansfield
Nottinghamshire NG20 8QF
Tel: 01623 742795

The **Architect** shall mean:

INCO Construction & Development Consultants
24 Green Lane
Derby DE1 1RY
Tel: 01332 315846

The **Engineer** shall mean:

EP Consulting
Alpine House
16A Alpine Street
Old Basford
Nottingham NG6 0HS
Tel: 0115 924 4433

The **Main Contractor** shall mean the successful Building Contractor nominated by the Client to carry out the construction works.

The **Mechanical Contractor** shall mean the Contractor appointed to execute the works, which are subject to this Specification and should include the Mechanical Contractors Personal Representative, Successors and Assignees.

The **Main Contract** shall mean the agreement made between the Main Contractor and the Employer for the execution of the works described in the Main Contract.

The **Sub-Contract** shall mean the agreement made between the Main Contractor and the Mechanical Contractor and shall include the Forms of Tender, Specifications, Drawings, etc.

The **Work** shall mean and include all plant and materials to be provided and the works to be carried out by the Mechanical Contractor under the Sub-Contract.

The **Site** shall mean the actual place or places to which materials, equipment, goods and other items to be used in the execution of the Contract shall be delivered or where the work shall be done by the Mechanical Contractor with so much of the areas surrounding a certain place or places as the Mechanical Contractor shall, with the consent of the Client, actually use in connection with the work, otherwise than merely for the purpose of access to the set place or places.

## 1.3 Guarantee

The whole of the works are to be guaranteed and maintained for a period of 12 months after completion and any defects that may make themselves apparent in that period shall be made good at the Mechanical Contractors expense, provided always that the fault has not arisen from causes outside the Mechanical Contractors control.

## 1.4 Acceptance of Tender

The Employers do not bind themselves to accept the lowest Tender nor to reimburse the Mechanical Contractor for any expenses incurred in Tendering. The Tender is to remain open for acceptance for a period of 3 months from the date of submission.

## 1.5 Submission of Tenders

The Tender shall be submitted in accordance with the Invitation to Tender, Preliminaries and Conditions of Contract, which together with this Specification and the appropriate Drawings form the Tender Documents.

The Tenderer shall submit a quotation of the Form of Tender and enter a breakdown of prices on a separate Tender Summary Sheet.

No Tender will be accepted unless the Tender Summary Sheet is completed, signed and returned in the return envelope provided.

The Tender shall be based upon the specified equipment. Any Tenderer wishing to submit alternatives to comply generally with the Engineering Standards required by the Specification may do so on a Schedule of Variations and include it with the Tender.

## 1.6 Inspections of Existing Conditions

Arrangements should be made to visit site by contacting the tendering Main Contractors.

The Mechanical Contractor is strongly advised to visit site to ascertain the full extent of the existing services.

Any claims out of any matter where the grounds are based on a lack of familiarity with the existing conditions will not be considered.

## 1.7 Extent of Works

The Tenderer shall include for the provision and supervision of an adequate suitably qualified labour force equipped with all necessary plant, tools, equipment and access equipment required for the execution of the works.

The works shall be the Mechanical Installation as set down in this specification, Schedules and the accompanying drawings together with all additional associated work, both temporary and permanent which may be required to ensure the correct functioning and fixing of the installation.

The Tender submitted shall also include the following:

a) All costs in respect of delivery of materials required to carry out the work together with the specialist plant and equipment.

b) All costs relating to Clients safety requirements, such as flame arrestors and total compliance with.

c) All costs relating to submission of Health & Safety Policy together with production of Method Statements for approval by the CDM Advisor.

d) All costs relating to the necessary management, supervision and maintaining records in accordance with Construction (Design & Management) Regulations 2015.

## 1.8 Discrepancies

In the event of any discrepancies between the Drawings and the Specifications, the Tenderer shall include for all items shown or described. The Tenderer shall inform the Consulting Engineer in writing at the time of Tender of any such discrepancies.

Claims for additional costs for items shown on the Drawings but not specified or vice versa will not be considered after the date of submission of the Tenders.

## 1.9 Health and Safety

The Tenderers attention is drawn to all provisions contained within the Health & Safety at Works Act 1974 and Electricity at Works Act 1989.

The Tenderer shall pay full regard to the requirements of this legislation as far as it applies to the work and include for all costs incurred in pursuance or compliance with the same.

## 1.10 Schedule of Rates

Within 14 days of receipt of notification, the successful Tenderer shall submit a detailed and Quantified Schedule of Rates to the Consulting Engineer.

The total amount of the schedule shall be the same as the original Tender and reflect the constituent parts of the work as indicated on the Tender Summary.

The costs of additions and / or omissions to the Contract shall be calculated using the Schedule of Rates wherever possible.

## 1.11 Interim Claims

Valuation of work for interim payment shall be agreed jointly by the Mechanical Contractor and the Consulting Engineer.

The Mechanical Contractor shall agree regular dates with the Consulting Engineer or give 2 days prior notice of valuation inspections.

Claims shall be submitted in the form of percentage completion with the items identified on the Tender Summary. This form shall be in addition to any other procedure required by the Contract.

Any claims for unfixed materials stored on site shall be supported by copy invoices and itemised lists of said materials.

## 1.12 Liaison

The Mechanical Contractor shall examine all available information pertaining to furniture and equipment layouts, together with prevailing site conditions in conjunction with other Mechanical Contractors as appropriate before commencing any work.

Where repositioning of equipment is required as a result of this consultation, this shall be agreed with the Consulting Engineer before installation works commence.

Claims for extra costs for repositioning arising from lack of consultation with the other Mechanical Contractors and the Consulting Engineer will not be considered.

## 1.13 Continuity of Labour

The Mechanical Contractor shall endeavour to maintain the same personnel on the works for the complete Contract.

Changes to personnel shall only be made as a result of unforeseen circumstances.

The Consulting Engineer shall be advised in writing of any proposed changes and replacement personnel shall be fully conversant with the development, nature and standards required by the works.

## 1.14 List of Drawings

The drawings listed below are those upon which the Tender is deemed to be based.

These drawings shall be read in conjunction with the specification:

| | |
|---|---|
| 25021-EPC-XX-00-DR-M-1001 | Proposed Heating Layout |
| 25021-EPC-XX-00-DR-M-1101 | Proposed Ventilation Layout |
| 25021-EPC-XX-00-DR-M-1201 | Proposed Water Services Layout |
| 25021-EPC-XX-00-DR-M-1401 | Proposed Above Ground Drainage Layout |
| 25021-EPC-XX-00-DR-M-4001 | Proposed External Mechanical Services |

The Mechanical Contractor shall take into account the Electrical Services drawings which are available electronically upon request.

## 1.15 Daywork

No daywork will be allowed unless specifically requested by the Engineer. Daywork rates shall be those as detailed in the Form of Tender.

## 1.16 Quality of Material

All materials to be used for the installation shall be of British / European manufacture except where specifically stated otherwise.

All items of plant, equipment, motors, starters and ancillary equipment, etc shall be the best of their particular type and shall be fit for the purpose intended.

All equipment shall carry the CE marking.

All materials must comply with the current British Standard specification.

The Technical Specification details the specific materials to be used.

## 1.17 Builder's Work

The Mechanical Contractor shall advise of any builder's work associated with the Contract at least 7 days prior to commencing work. A schedule of proposed builders work is also to be supplied together with any drawings.

The Mechanical Contractor should be aware that for this project the Mechanical Contractor will be responsible for carrying out his own builder's work.

## 1.18 Clearance of Site

The Mechanical Contractor shall remove at his expense, any rubbish and surplus equipment arising from his works that may have accumulated during the Contract.

Surplus materials and rubbish not removed will be disposed of by the Main Contractor, the cost of which shall be deducted from the final invoice.

## 1.19 Type of Construction

The Tenderer shall inspect the Plans and Proposals and site inspection to acquaint himself with sufficient details to carry out the installation, etc.

## 1.20 Design Calculations

Although the Mechanical Services Package is provided with sufficient detail to provide a Tender Cost, the Mechanical Services Design remains the responsibility of the Mechanical Contractor.

The Mechanical Contractor is to submit full supporting calculations for the scheme to the Consulting Engineer prior to Design Drawings being produced. Calculations should be issued two weeks prior to drawing work commencing.

## 1.21 Design and Working Drawings

The Mechanical Contractor shall be responsible for the production of fully detailed design and working drawings of each service to be installed including all purpose-made plant and equipment.

These working drawings shall be fully coordinated with other services and the structure.

The Mechanical Contractor shall work in conjunction with other sub-contractors to ensure all working drawings are fully coordinated.

Working drawings shall include detail of all containment routes.

The Mechanical Contractor shall ensure that the requirements of all contractors are fully taken into account prior to any installation commencing.

Working drawings shall be produced in accordance with a programme to suit the overall programme for the project.

Reasonable allowance shall be made for incorporating any comments made by the Consulting Engineer.

Work on site should only commence after working drawings have been issued upon which the Consulting Engineer has no further comments.

The Mechanical Contractor's drawings shall include the following:

- coordinated floor layouts, 1:50;
- coordinated services distribution layouts, 1:50;
- coordinated plant room and sections, 1:20;
- schematic diagrams of respective services, NTS;
- builders work drawings, 1:50;
- manufacturers drawings of all plant and equipment details, 1:20;
- external services, 1:200.

The Mechanical Contractor will be required to take site dimensions during the preparation of working drawings and shall be responsible for their accuracy.

Setting out of works on site shall be carried out by the Mechanical Contractor; any errors arising from inaccuracies in setting out shall be rectified at the Mechanical Contractor's expense.

The Mechanical Contractor shall be solely responsible for the accuracy of drawings and for any equipment shown being suitable for the purpose for which it is intended and in accordance with the design within this brief.

Drawings shall be produced on AutoCAD LT 2025 or any prior agreed CAD system with the Consulting Engineer.

The Consulting Engineer requires a minimum period of 10 working days to comment on drawings from receipt.

## 1.22 Staff Instructions

The Mechanical Contractor shall include within his tender sum an adequate allowance to brief the end user personnel upon the installations and the complete system operating parameters.

The brief is to take the form of two separate seminars given by the Mechanical Contractor at the premises.

## 1.23 Compliance

Unless the Consulting Engineer is informed in writing at the time of tender, the Mechanical Contractor will be deemed to fully comply with this specification using the suppliers and materials detailed.

Alternative suppliers and materials will not be considered after this time.

## 1.24 Coordination of Services

The Mechanical Contractor shall allow within his tender for full site coordination of the electrical installation with the Electrical Contractor and all other trades. Prior to any works

starting on site, he shall make due allowance for meeting with the Electrical Sub-Mechanical Contractor, Builder and all other trades to ensure full coordination of the mechanical and electrical services takes place.

Any clashes between services should be brought to the attention of the Consulting Engineer prior to the installation works commencing.

# 2 General Technical Clauses

## 2.1 Extent of Works

The Mechanical Services Mechanical Contractor hereinafter referred to as the Mechanical Contractor, must include in his Tender for the supply, delivery, storage and installation of all materials and equipment necessary to complete the installation in accordance with his Standard Specification, Drawings and any other supplementary information issued by the Engineer.

The term Mechanical Contractor shall also be taken to mean Sub-Mechanical Contractor where this term applies. The expression Engineer will be taken to mean the Consulting Engineer responsible for the design installation.

## 2.2 Visiting Sites

The Mechanical Contractor must visit the site to ensure his being conversant with all local conditions, as on no account will any extras be permitted due to his failure to do so.

Where systems are to be installed within existing buildings, the Mechanical Contractor shall, before tendering, examine the scheme as shown on the Drawings and as specified in relation to the building, or buildings and shall then be deemed to have good knowledge of the scheme or schemes and claims for costs for extra labour and / or materials will not be allowed when it can be shown that this examination has not been closely carried out.

## 2.3 Plans and Specifications

The Mechanical Contractor shall allow for all works to be carried out in accordance with the scheme Drawings, this Standard Technical Specification and the Particular Specification for the Project. Any discrepancies between the relevant elements of the documentation shall be identified to the Engineer.

## 2.4 Samples

Any materials which are offered as an alternative to those specified may involve the Mechanical Contractor in having to furnish samples of the proposed materials to the Engineer for his approval.

## 2.5 Workmanship and Measurement of Work

All materials and workmanship throughout the entire Contract is to be new and to the best of the respective kinds and to the complete satisfaction of the Engineer (acting for the owner) under whose supervision the work will be carried out. Any pipework delivered to site in a rusty or defective condition will be rejected.

The Mechanical Contractor is to take his own measurements on site and is to be entirely responsible for the quantities required.

## 2.6 Local Bylaws and Regulations

The Mechanical Contractor shall ascertain and act in accordance with any local bylaws and regulations which may affect the work under this Contract. Any cost for the stamping of valves, fittings and the like must be covered by the Mechanical Contractor in his Tender.

## 2.7 Reception and Storage of Materials

The Mechanical Contractor shall provide a proper storage area for materials, tubes, fittings, etc delivered to site which must be received at the site by the Mechanical Contractor.

Tubes and fittings stored on the ground at the site will not be approved for use. The Mechanical Contractor will be fully responsible for reception and storage.

Where tubes, radiators, boiler sections, etc are stored outside, proper sheeted racks and other supports must be provided.

## 2.8 Liability for Defects

The Mechanical Contractor is to make good any defects in his work due to faulty workmanship or materials provided by him which arises in 12 months from the date of acceptance of the completed installation by the owner. This applies to all materials, equipment and completed work.

## 2.9 Testing and Regulations

The Mechanical Contractor shall include for testing as specified in Clause 2.38 and below at all various sections of the installation.

All labour and equipment required for carrying out the tests shall be provided by the Mechanical Contractor.

Seven days' notice of all tests shall be given to the Engineer to enable him or his authorised representative to be present.

For water pipes, the Water Undertaking's Plumbing Inspector shall also be given at least seven days' notice before the test is applied.

If any portion of the works fails to pass the test, tests of the said portions shall be repeated within a reasonable time upon the same terms and conditions, save that all reasonable expenses to which the Main Contractor may be put to the repetition of the tests shall be deducted from the Contract price.

The repeat of any test required shall be at no additional cost to the Employer.

The Mechanical Contractor shall include in his Tender for the proper filling, venting and draining of all installations or sections of installations and make due provision for suitable disposal of the testing media and shall make good all defects arising out of, or caused by tests.

If the test pressure is not maintained for the specified period, the Mechanical Contractor shall make good any weak joints, defective fittings, etc and repeat the test in the presence of the Engineer or his appointed representative until the specified test conditions are maintained at no additional cost to the Employer.

All pipework concealed in the building structure, fixed behind partitions or false ceilings, roof spaces, in trenches or buried shall, in addition to the following applicable tests, be pressure tested and passed as satisfactory before concealment.

The Mechanical Contractor shall give due notice in writing to the Engineer and Main Contractor when the said concealed or buried work is ready for inspection and the Engineer shall, without unreasonable delay, carry out his inspection and / or witness the tests unless he informs the Main Contractor and the Mechanical Contractor in writing from time to time that he considers such inspection unnecessary, but in no instance shall concealed work or

buried work be covered without being tested by the Mechanical Contractor in the manner described in the Specification.

All tests shall be carried out and approved before any paint, thermal insulation or similar cladding is applied to the installation.

The accuracy of the Mechanical Contractor's testing instruments shall be demonstrated to the satisfaction of the Engineer, as required.

Due allowance shall be made by the Mechanical Contractor for testing in such sections as necessary due to the programming of the work.

The standard precautions shall be taken to protect spring loaded valves, pressure gauges and any other fittings or plant which could be damaged due to excess pressure above the normal operating range.

### 2.9.1 Hot Water Installation

The whole of the hot water heating system shall be subjected to a hydraulic test pressure of twice the working pressure of 3.5 bars g. (50 p.s.i.g.) whichever is the greater. The test shall be maintained for a period of not less than one hour, or as long as is necessary to inspect the whole of the installation, if the time required for this is greater than one hour.

Welded pipework shall be separately subjected to a hydraulic test of twice the working pressure or 7.0 bar g. (100 p.s.i.g.) whichever is the greater for a period of not less than one hour or as long as is necessary to inspect the whole of the pipework involved.

### 2.9.2 Hot and Cold Water Services

The whole of the hot water and cold water supply systems shall be subjected to a hydraulic test pressure of twice the working pressure of 7.0 bar g. (100 p.s.i.g.) whichever is the greater, for a period of one hour or as long as is necessary to inspect the whole installation.

### 2.9.3 Gas Pipework

All pipework shall be tested in accordance with The Gas Safety (Installation and Use) Regulations (GSIUR) and British and European Standards.

### 2.9.4 Existing Services

The Mechanical Contractor shall note that existing services shall not be subjected to any pressure tests

All new services shall be hydraulically tested before connecting to any existing service.

Should the Mechanical Contractor fail to observe the above before any pressure test is applied to existing pipework, the Mechanical Contractor will be held responsible for the complete removal and replacement of any sections of the existing system which the Engineer considers necessary at no additional cost to the Contract.

### 2.9.5 Equipment

No equipment shall be subjected to a pressure test with the associated services except where stated to the contrary.

### 2.9.6 Heating Installation

The main flow and return temperature shall be observed by reference to test thermometers. When a steady flow temperature has been reached, the return temperature shall be noted.

The circulations shall be balanced as follows:

All main circuits have been designed for an equal drop and therefore, the main return temperatures should all be the same. The first step is balancing, therefore, compare the main return temperature.

The circuit with the lowest temperature (ie the largest drop) shall be taken as the index, and the control valve in each of the other circuits adjusted as necessary until all return temperatures do not vary by more than 1.5 Deg. C.

On completion of the above, the control valve on each radiator, unit heater and convector shall be adjusted to give equal temperature drop within the following limits.

| Radiators, Convectors Flow Temperature or Coils | Max Variation in Temperature Drop Across Individual |
|---|---|
| 82°C + | 1.5 |
| 71°C + | 1.0 |
| 60°C + | 0.5 |

The Mechanical Contractor shall establish the frictional resistance of coils and the respective control valves from the manufacturer's data.

The Mechanical Contractor shall first ensure that the by-pass and control valves are hydraulically balanced with the respective coils.

The Mechanical Contractor shall then regulate the branch circuit valves to ensure that the correct quantity of water is passing.

The Mechanical Contractor shall include for carrying out approved tests during the heating season at a time agreed with the Engineer which shall not be outside the 12 months Defects Liability Period.

These tests shall include the recording of external and room temperatures and the records shall be submitted to the Engineer.

The Mechanical Contractor shall note that the tests shall be carried out during the heating season and this may entail returning to the site after completion. The Mechanical Contractor shall make due allowance for all such costs in his Tender.

### 2.9.7 Hot and Cold Water Outlets

Cold water connections shall be on the RIGHT HAND side of the fittings when facing the actual fittings. This shall be confirmed with the Main Contractor prior to installation.

The Mechanical Contractor shall demonstrate to the Site Engineer that an acceptable pressure flow rate can be maintained on the outlet fittings.

### 2.9.8 Heat Test

On completion of the installation and before insulation is applied, the separate heated systems installed by the Mechanical Contractor shall be heat tested for a period of not less than 8 hours during which time, all circuits are to be regulated.

If any leaks occur during the period of the test, the Engineer shall require the Mechanical Contractor to rectify the leaks and re-test all systems until they are satisfactory.

The Mechanical Contractor shall note that HEAT TESTS shall be carried out during the heating season or at any time selected by the Engineer. This may entail returning to the site after completion. The Mechanical Contractor shall make due allowance for all such costs in his Tender.

The provision of all fuel and energy used during the testing and until such times as the plant is accepted shall be provided free of charge to the Mechanical Contractor.

### 2.9.9 General

Normally, the Mechanical Contractor will ensure that the installation is operating in accordance with the specification before inviting the Site Engineer to witness a test. By mutual agreement between the Mechanical Contractor and the Site Engineer, the latter may be present during the balancing. In this case, the operation will be a combined balancing and witness test.

The Mechanical Contractor shall note that he will be required to provide suitable charts to record all test results. Two copies of the suggested format for the charts shall be submitted to the Engineer for comment in good time for any comments to be incorporated prior to testing.

A copy of all test results shall be included in each of the Instruction Manuals or alternatively, separate books may be made. A preliminary copy of all results shall be made available 10 days after testing from site.

## 2.10 Drawings sent for Approval

Drawings shall be sent to the Engineer for general approval, but approval of such Drawings will not exempt the Mechanical Contractor from his liabilities under the Specification.

These Drawings shall show any special bracket, anchor or guide arrangements. The Mechanical Contractor shall not use the Tender Drawings for installation purposes unless the Engineers agreement is granted and on provision that these Drawings are supplemented with the necessary notes and working details. The Mechanical Contractor will still hold full responsibility for such Drawings and their subsequent revisions.

## 2.11 Record Drawings

On completion of the works, the Mechanical Contractor must supply one complete set of polyester Drawings showing all the services covered by the Contract, all equipment, panels, radiators, pipes, taps, valves, etc to be shown in their correct positions together with one set of 1 / 20th detailed Drawings of the boiler room plant, including automatic stokers, oil burners, gas burners and thermostatic controls, catering, ventilation and all plant included in the Sub Contract or Contract plus a valve chart to be positioned in the boiler house.

In addition, a hardwood framed and glazed valve chart shall be mounted in the boiler house(s) or plant room(s).

## 2.12 Builder's Work

Where the Engineering Mechanical Contractor is the Main Contractor, the Engineering Mechanical Contractor must include in his Tender and be responsible for carrying out all builder's work necessary to complete the installation to the complete satisfaction of the Engineer.

## 2.13 Delivery Forecast

When submitting his Tender, the Mechanical Contractor shall give the manufacturers delivery forecasts for materials.

## 2.14 Pipework Sleeves and Covers

All pipes passing through walls, floors, and ceilings, partitions, etc shall be inserted through sleeves of similar materials to the pipe.

Sleeves shall be free from internal burrs and shall have an internal diameter sufficient to allow free movement of the pipes. In order to reduce fire risk, the distance between the pipe and sleeve shall not exceed 6mm.

Sleeves passing through floors and fire walls shall be packed with an approved material, ie leadwool. Sleeves shall not be used as supports for the pipes and pipes shall be fixed clear of sleeves at all points.

Pipes passing through sleeves in external walls of buildings, duct subways, etc shall be caulked between pipe and sleeve with an approved material ie leadwool, to form an effective and permanent vermin-proof and weatherproof seal.

Sleeves passing through kitchen floors or other areas where water is present shall have an upstand of 100mm.

All sleeves required to be built into the structure shall be handed to the Main Contractor for building in before the concrete, etc is placed and proper steps must be taken by the Mechanical Contractor to ensure that sleeves remain in the correct position whilst concrete, etc is set and that the sleeves allow free movement of the pipes.

The Mechanical Contractor will be held responsible for ensuring that no pipes are "bedded in" by any making good carried out by the Main Building Mechanical Contractor or by any other cause.

Cover plates shall be fitted on all pipes passing through walls, floors, ceilings, partitions, etc and shall be flamco plastic plates. The installation of the pipes must be such that the plates may be accommodated without cutting away either the plate or floor / wall. Cover plates shall have white finish and shall be securely fixed.

## 2.15 Open Ends

During the progress of the work, open ends of pipes, tees, fittings, etc must be closed with metal or plastic plugs. Plugs made from paper or other material will not be allowed.

Work not protected in accordance with this clause will not be accepted.

## 2.16 Pipe Burr

Suitable reamers must be provided for completely removing the inside burr from steel and copper pipes.

The Mechanical Contractor should understand that if evidence of unremoved burr is found on one small portion of the work during the installation, the Engineer will require the remaining work to be dismantled for his inspection. This will be carried out at the expense of the Mechanical Contractor.

## 2.17 Tubes

All tubes shall be of British manufacture and shall comply in all respects with British Standard Specification.

### 2.17.1 Heating

The whole of the system shall be in heavy weight or medium weight tube as laid down in the Particular Specification.

### 2.17.2 Hot Water

If carried out in steel, this shall be galvanised medium weight tube.

If pipework is carried out in copper, this shall comply with EN1057 R250 Half Hard.

In separate hot water service installations, the pipework used for the primary circulation shall be similar to that used for the secondary pipework.

### 2.17.3 Cold Water

This shall be as previously specified for the hot water.

### 2.17.4 Gas

This shall be heavy weight steel tubing.

Where dissimilar metals are used, the Mechanical Contractor must provide and fit approved insulating joints to prevent corrosion due to electrolytic action.

## 2.18 Pipe Fittings and Joints

Fittings shall be screwed malleable for all sizes up to and including 50mm (2") and should be flanged for 65mm (2-1 / 2") work and over. Should copper be chosen for pipework systems, the type of fitting required will be indicated in the supplementary Specification or on the Drawing.

During the progress of work, sections of pipework will, after erection, be partially dismantled to enable the Engineer to examine the joints, and where any fault is found, the section of work affected will not be accepted.

Threads must be cut to engage fully with the fitting and must not be too long or too short.

Threads must be correctly and cleanly cut and must be of the right length for each pipe size.

Screwed joints on domestic water services shall be made with Boss Blue, Permanite GT Tape, Silicon Tape Spray or PTFE Tape. Screwed joints on closed heating systems may be made using Boss white or equivalent jointing compound in addition to the above list. Any jointing material used must first be checked with the local Water Authority approved list for compliance. Flanged joints must be machined, faced and ground, or made with graphited non-asbestos jointing gaskets or rings.

All capillary joints shall be made using flux and solder to Water Authority approval.

Some welding joints on heating mains in trenches and in boiler rooms, pump rooms or other accessible positions will be allowed, where this method will benefit the installation without jeopardizing the easy renewal of sections of the pipework during future maintenance work.

Welded joints will not be allowed in exposed positions in rooms with the exception of plant areas. Bends must be used wherever possible.

Elbows will not be allowed in positions where bends can be used.

Sweep tees on tongue tees will be used in preference to ordinary square tees.

Pipe runs must follow the line of the building and sets must be made around all piers and other projections.

Pipes must also be set to follow the lines of all recesses unless specifically agreed otherwise for aesthetic reasons.

Where details have not been approved, the Mechanical Contractor must discuss all pipe runs with the Engineer and obtain permission before proceeding with the installation.

Provision for proper drainage for all runs must be made.

Special attention must be made to the installation of vertical pipes. Careful arranging of pipework, especially where more than one service occurs or occupies the same trench or chase will be insisted upon to achieve the neatest appearance possible.

Clean joints will be insisted upon and tool marks or imprints on valves and fittings will not be tolerated.

## 2.19 Valves

Valves for heating and hot water shall be approved manufacture and shall be fullway gate pattern of gunmetal throughout, up to and including 80mm (3"), and cast iron for 100mm (4") diameter and over; with screwed ends up to and including 50mm (2") diameter and flanged for pipes 65mm (2 1 / 2") diameter and over.

Cast iron fullway valves shall be fitted with renewable gunmetal seating rings.

Valves fixed in rooms shall be easy clean pattern.

Radiator valves shall be of approved British manufacture and a polished brass finish unless specified otherwise in the Particular Specification.

Keys and dust caps must be provided for lockshield valves.

For steam, condensate and for cold water unless otherwise specified, gunmetal globe pattern valves shall be used.

On the hot, tanked, cold water and gas services, where draw offs or pipes serving a fitting or series of fittings occurs, an approved screw down stop cock with pinned jumper shall be used.

On mains cold water service, where draw offs or pipes serving a fitting or series of fittings occurs, an approved screw down stop cock with a loose jumper shall be used.

## 2.20 Hangers and Supports

The Mechanical Contractor shall supply and fix all the necessary brackets, clips, hangers, rollers and chairs and the like, to adequately support all mains, branch pipes and the like installed by him within the scope of this Contract.

The Mechanical Contractor shall allow for supporting all pipework at centres not exceeding those stipulated in the following table, and at closer intervals if warranted by the arrangement of pipework, fittings or valves. Additional brackets shall be provided as necessary at the beginning and ends of runs, and at junctions and bends and at the base of vertical shafts and risers.

All brackets and hangers shall be installed with special attention to freedom for lengthwise expansion either in horizontal or vertical plant and to levels for air elimination and drainage.

Valves 50mm and above shall be individually supported.

Supports for rise and drop pipes shall be arranged to allow freedom for expansion movement of horizontal runs.

All pipelines shall be separately supported - Pipes slung from other pipes will not be allowed.

Where School Board pattern pipe brackets are used to support copper pipes, they shall be cast brass and when copper pipes are supported by wrought iron or purpose made brackets, a chafing sleeve of suitable material ie lead shall be fitted to prevent damage to the copper and in such a manner that it cannot be displaced by repeated expansion and contraction of the pipework.

All necessary metal supports, tees, angle or channel sections, screws, bolts, etc shall be provided and fixed by the Mechanical Contractor except where stated otherwise. The Mechanical Contractor shall also be responsible for the accurate setting out of same.

Gunmetal saddles shall not be used unless special permission has been obtained from the Engineer. This permission will only be given if other suitable types of fittings are not available.

The Mechanical Contractor shall provide all necessary brackets and supports at all heavy items of plant such as valves, traps, vertical pipework, reducing valves, etc to ensure that no strain is transmitted to the pipework.

Anchors and guides shall be independent and shall not form part of the main pipework support system.

Except where otherwise stated on the Drawing, the spacings between pipe supports shall not exceed the values in the following table:

All hanger rings and pipe clips (except with the exception of School Board pattern) for copper pipelines may be of ferrous metal. Suitable liners shall be used to protect the pipes. The width of the liner shall be enough to allow for expansion of an internal dimension to suit the pipe.

Bronze rollers shall be used in conjunction with non-ferrous pipelines.

All supports shall be arranged in such a manner that the required gradient can be obtained.

Drawings of all purpose made supports shall be submitted to the Engineer for comment prior to fabrication.

With the exception of non-ferrous supports, all brackets and parts of bracket assemblies shall be delivered to site with a protective coat of paint or similar.

Where proprietary items are shown, these shall have the manufacturers standard finish. All other brackets and the like shall be given one coat of red oxide before delivery to site. Brackets fabricated in site shall be painted immediately after making.

Supports fixed external to the building where exposed to atmosphere shall be galvanised after fabrication prior to fixing. All associated steelwork, fixings, etc shall be similarly treated.

The Mechanical Contractor shall ensure that no dangerous edges are exposed. Any that could be harmful or could injure the maintenance staff should be removed and rounded off prior to painting / galvanising.

All fixing bolts, rawbolts, etc shall be provided by the Mechanical Contractor.

The Mechanical Contractor shall be responsible for marking the positions for all supports by the provision of Drawings issued by the Mechanical Contractor to the Main Contractor.

Retention hoops shall be fitted over pipes and rollers at every fourth bracket, changes of direction and elsewhere as required to ensure the pipe remains on the roller.

Retention hoops shall be fitted with a gap approximately 3mm between the pipes and retention hoop to ensure free movement of the pipe.

Supports shall be generally as detailed below as applicable.

a) Ceiling Voids

Pipework shall be supported by means of a swinging type support which permits the movement of the pipes. The supports shall be generally supported by means of drop rods from angle cross members attached to the roof beams of joists, through a hemispherical washer.

b) Internal Ducts

Pipework in the new ducts shall be supported by means of rollers and chairs.

The Mechanical Contractor shall be responsible for correctly setting out all supports and for ensuring that same are correctly installed.

Chairs shall be securely fixed to ensure no movement.

c) In Builders Casings

Pipework shall be supported by means of screwed School Board pattern brackets.

d) Exposed to View in Rooms

The Mechanical Contractor shall supply and fix all clips of the School Board pattern where pipes are adjacent to walls. These shall be of the screw on type for screwing to woodwork and screwing into the blockwork walls (Crane Ltd fig. No. 501 or Yorkshire fig. No. 108 or 100).

Where pipes are suspended from the ceiling or support from the floor, brackets as above could be used if and where practical. As an alternative, single or double hanger rings (Crane Ltd fig. No. 529 or Yorkshire fig. No. 107) shall be provided with back plate (Crane Ltd fig. No. 515 or Yorkshire fig. No. 116), with locknuts.

In all cases, brackets shall not be of the stamped pattern or formed with straps. Saddle straps will not be accepted except where specifically instructed by the Engineers.

When erecting supports, the Mechanical Contractor shall ensure that any equipment or pipework adjacent to the support can be easily maintained and that no obstruction or withdrawal space is made by the installation of the supports.

The Mechanical Contractor shall give full dimensions to the Main Contractor regarding the fixings for all supports and shall be responsible for the correct positioning and installation of same.

All brackets and supports shall be to BS 3974 Part 3 1980.

The Mechanical Contractor shall note the requirement for applications where thermal insulation is to be continuous. (See THERMAL INSULATIONS) when designing pipe supports for such application.

| PIPE BORE (mm) Nominal | MAXIMUM SUPPORT SPACING (M) | | | | | |
|---|---|---|---|---|---|---|
| | STEEL PIPE | | COPPER PIPE | | IRON PIPE | |
| | Horizontal | Vertical | Horizontal | Vertical | Horizontal | vertical |
| Up to 15 | 1.8 | 2.4 | 1.2 | 1.8 | | |
| 20 | 2.4 | 3.0 | 1.4 | 2.1 | | |
| 25 | 2.4 | 3.0 | 1.8 | 2.4 | | |
| 32 | 2.7 | 3.0 | 2.4 | 3.0 | | |
| 40 | 3.0 | 3.6 | 2.4 | 3.0 | | |
| 50 | 3.0 | 3.6 | 2.7 | 3.0 | 1.8 | 1.8 |
| 65 | 3.7 | 4.6 | 3.0 | 3.6 | | |
| 80 | 3.7 | 4.6 | 3.0 | 3.6 | 2.7 | 2.7 |
| 100 | 3.7 | 4.6 | 3.0 | 3.6 | 2.7 | 2.7 |
| 125 | 3.7 | 5.4 | 3.0 | 3.6 | | |
| 150 | 4.5 | 5.4 | 3.6 | 4.2 | 3.7 | 3.7 |
| 200 | 5.6 | 6.0 | | | 3.7 | 3.7 |
| 250 | 5.0 | 6.0 | | | 4.5 | 5.4 |
| 300 | 6.1 | 10.0 | | | 8.0 | 10.0 |
| 350 | 10.0 | 12.0 | | | | |
| 400 | 10.5 | 12.6 | | | | |
| 450 | 11.0 | 13.2 | | | | |
| 500 | 12.0 | 14.4 | | | | |
| 600 | 14.0 | 16.8 | | | | |

| PIPE BORE (mm) Nominal | MAXIMUM SUPPORT SPACING (M) | | | | | |
|---|---|---|---|---|---|---|
| | UPVC PIPE | | POLYETHYLENE PIPE | | GLASS PIPE | |
| | Class OBC | Class D,E,6,7 | Type 32 | Type 50 | | |
| | horizontal | horizontal | horizontal | horizontal | horizontal | vertical |
| Up to 10 | | 0.6 | 0.3 | 0.45 | | |
| 15 | | 0.6 | 0.4 | 0.6 | | |
| 20 | | 0.65 | 0.4 | 0.6 | | |
| 25 | | 0.75 | 0.4 | 0.6 | | |
| 32 | | 0.8 | 0.45 | 0.7 | | |
| 40 | | 0.9 | 0.45 | 0.7 | 0.9 | 1.7 |
| 50 | 1.1 | 1.2 | 0.55 | 0.85 | 1.2 | 1.7 |
| 65 | 1.2 | 1.4 | 0.55 | 0.85 | | |
| 80 | 1.4 | 1.5 | 0.6 | 0.9 | 1.2 | 1.7 |
| 100 | 1.5 | 1.7 | 0.7 | 1.1 | 1.2 | 1.7 |
| 125 | 1.7 | 1.9 | | | | |
| 150 | 1.8 | 2.1 | | 1.3 | 1.2 | 1.7 |
| 175 | 2.0 | 2.3 | | | | |
| 200 | 2.1 | 2.5 | | | | |
| 225 | 2.3 | 2.7 | | | | |
| 250 | 2.4 | 2.9 | | | | |
| 300 | 2.6 | 3.1 | | | | |
| 350 | 2.9 | 3.4 | | | | |
| 400 | 3.1 | 3.7 | | | | |
| 450 | 3.4 | 3.7 | | | | |
| Above 450 | 3.7 | 3.7 | | | | |

## 2.21 Spacings

Space pipe runs in relation to one another, other service runs and building structure, allow for specified thickness of thermal insulation and ensure adequate space for access to pipe joints, etc.

The following are recommended as minimum clearances in spacing of pipe runs:

| Between | And | Clearance (mm) |
|---|---|---|
| Pipeline – insulated or uninsulated | Wall finish | 25 |
| | Ceiling finish or soffit | 50 |
| | Floor finish | 150 |
| Insulated pipeline | Adjacent service runs | 25 |
| Uninsulated pipeline | Adjacent service runs | 50 |
| Adjacent pipelines | Both uninsulated | 150 |
| | One uninsulated | 75 |
| | Both insulated | 25 |

## 2.22 Air Venting

The Mechanical Contractor must allow in his Tender for the proper air venting of all steam, condensate, heating, hot and cold water pipes and appliances whether provision for this is shown on the Drawings or not.

Open vents, automatic air vents, air bottles and wheel operated air vents will be allowed as approved by the Engineer. Loose key air cocks or valves will not be allowed on pipes, radiators or other equipment unless specified.

## 2.23 Draw Offs

The Mechanical Contractor will provide and fix all hot water and cold water taps to draw offs, except those actually secured to or serving a sanitary fitting when he shall run his pipes to within a distance of 500mm from the actual connection to each fitting and the Builders Plumber will connect to the fitting.

All drinking water points shall be so labelled with an ivorine label marked "DRINKING WATER".

## 2.24 Draining

The Mechanical Contractor must allow in his Tender for the proper drainage of all mains and branches, storage and pressure vessels, boilers, steam, condensate, heating, hot water, cold water and gas installations whether provision for this is shown on the Drawings or not.

Provision for drainage shall consist of gland cocks or other approved valves as detailed in the Particular Specification. Every cock or valve shall be fitted with a hose connection.

## 2.25 Painting, Polishing and Cleaning

The decorative painting of all unlagged pipes and radiators etc supplied and installed by the Mechanical Contractor in the 'user' areas, except where stated in the previous Clauses, will be carried out by the Mechanical Contractor.

Pipework in all other areas, if after installation the pipework condition is found to be unsatisfactory, will be painted two coats of red oxide at the Engineers request.

This shall also include user areas and shall be done prior to any decorative painting.

All steelwork supports, hangers etc shall also be painted together with all pipework except galvanised and copper in plant rooms.

This painting is to consist of thorough wire brushing and painting two coats red oxide.

Pipework which is to be insulated shall be painted by the Mechanical Contractor as above prior to thermal insulation being applied.

Thermal insulation shall be further painted as specified under the appropriate Clause.

The Mechanical Contractor shall provide a chart giving the colour identification for the various services which shall be mounted in a glazed frame and fixed in an approved position on site.

All welds shall be painted with two coats of a red lead based paint immediately upon completion and before application of the heat insulation.

In the case of control panels and similar items for which special finish is provided, great care is taken that these are not damaged during erection. Any damage is to be made good to the satisfaction of the Engineer.

The Mechanical Contractor shall, before handover of the Contract Works, clean all items of plant and equipment. Bright parts and polished parts shall be burnished and any adhesive protection removed.

The fact that certain items of plant and pipework etc are painted to manufacturers standard prior to delivery, does not release the Mechanical Contractor from final painting on completion of the works, to colour schemes as laid down by the Engineer.

Any painting of unlagged pipework shall be to BS 1710:1984 to the same colour code as the Thermal Insulation.

The final painting shall not be commenced until the entire installation or agreed sections of the installation have been completed, tested and approved by the Engineer.

During the thermal insulation, the Mechanical Contractor will be required to attend on the Thermal Insulating Sub Mechanical Contractor for the purpose of pipework identification.

The Mechanical Contractor shall include for the identification of all pipework painted by the Mechanical Contractor. The identification and identification marks, generally as Thermal Insulation. The Mechanical Contractors attention is also drawn to Clause "WITNESS OF PAINTING".

All paint, red oxide etc shall be of a high quality as manufactured by British Paint Ltd or equal approved.

The type of paint and red oxide to be used by the Mechanical Contractor shall be approved by the Engineer before any painting is undertaken. It is the Mechanical Contractors responsibility to clean out the floor ducts prior to the duct covers being fitted.

It should be noted that it is the Mechanical Contractors responsibility to ensure that all filters, including those in fan convectors, etc are clean and if throwaway type filters are used in the air handling units, then these shall be replaced if found necessary.

## 2.26 Welded Joints for Mild Steel Pipework

All flanges, branches, bosses, drain pockets, butt joints, etc shall be welded by the oxy-acetylene or electric arc process.

For joints in straight lengths of pipe, butt welds shall be used in which the pipe has been cut using a tube cutter or a machine controlled oxy-acetylene torch, burrs removed by rammer and ends trimmed and bevelled to make a fair faced joint.

For welds to seamless butt welded fittings and butt welded pipe joints, the joint shall be fused by a penetration weld and finally finished off with a fillet weld of ample dimensions. All welds shall be hammered finally and finished smooth. Care shall be taken to ensure that no weld is located within 1.00M of any anchor joint.

Each joint shall be of sufficient strength to withstand the stresses imposed by internal pressure and thermal expansion, the weight of the pipe fitting and thermal insulation. Metal-arc welding shall be in accordance with requirements of BS 2971.

All butt, branch and mitre welds for use with pipes of below 50mm nominal bore shall be made using the oxy-acetylene process in accordance with the requirements of BS 2640 with the use of mild steel filler rods which shall be in accordance with the requirements of BS 1453 type A2.

Branch mitre connections shall be made by the use of approved forged welding fittings.

Only qualified welders shall be employed and they shall have passed 12 months before the start of the works, the tests set out in Clause 4 and 10 of BS 2645 Part 2.

Operators with current certificates for welding from the authorities following will be accepted:

- Lloyds
- The Association of Heating and Ventilating and Domestic Engineering Employers
- British Oxygen Company Ltd
- Insurance Companies - Associated Officers Technical Committee

Particular attention is drawn to the following:

a) The name of each welder to be employed on the Contract shall be given to the Engineer in writing before the welder commences work.

b) Each welder on the Contract shall be provided with a steel marker die and after he has completed a weld joint, he shall mark the same with an identifying symbol.

c) Where necessary, staging and protection from the weather shall be provided to enable the welding operation to be performed correctly; and screened from view in the case of arc welding.

d) Segmented and cut-and-shut bends will not be allowed.

e) Immediately welded joints have been made, cleaned and inspected, they shall be protected by two coats of red lead paint.

f) Welded pipe assemblies shall be such that welded joints do not affect each other.

g) Every precaution must be taken to prevent damage by scorching or fire. Suitable heat resistant mats must be used and two portable fire extinguishers shall be provided by the Mechanical Contractor for use by the welders in an emergency.

Brazed and silver soldered joints on copper pipelines shall be carried out to BS 1723 / 63 and BS 1845 / 66 and filler rod and flux (if necessary) shall comply in all respects to BS 1845 / 66, type CP2, except that type CP1 rod shall be used where specifically called for in any subsequent Clause.

A similar proprietary equivalent may be used providing that it will produce a joint at least equal to those using the filler rod specified including immunity to the effects of dezincification.

Proof of composition of filler rod proposed shall be submitted to the Engineer prior to commencing work on site.

Test specimens will also be required for copper joints as previously specified in this Clause, for steel pipework joints.

All brazed seams in calorifiers to BS 853:1996 Part 2, shall be fabricated using a filler rod specified as being free from the risk of dezincification.

See also the paragraph concerning the provision of welding plants, under a separate Clause 2.03.

## 2.27 Ductwork

The Mechanical Contractor shall include for the manufacture, supply and installation of the ventilation ductwork and the installation of ventilation plant by a Specialist Sub Mechanical Contractor. The Mechanical Contractor shall give the name of this Sub Mechanical Contractor in the sub-letting section of the Tender Documents.

The supply and installation of the ductwork and installation of the associated Ventilation Plant shall be by a specialist Sub Mechanical Contractor under the terms and conditions of the JCT Form of Sub-Contract and the Standard Form of Tender for Nominated Sub Mechanical Contractors.

The Mechanical Contractor shall obtain from his Specialist Sub Mechanical Contractor, a priced schedule of rates for the Works. The schedule shall include manufacturer, supply and erection rates of the various sizes of ductwork, bends, offsets, dampers and all other work included as part of the Sub-Contract.

The prices shown in the schedule shall include all profits, overheads and Main Contractors discount and shall be used as a basis for pricing any variation to the Sub-Contract Works.

Acceptance of the schedule of prices shall not absolve the Mechanical Contractor of his responsibility for the accuracy of the contents of the document.

(i) Ductwork materials and general Specification applicable to either form of sheet metal ductwork construction specified.

The ductwork shall be adequately supported by purpose made hangers and supports and shall be installed truly horizontal and vertical. All duct sections shall be truly square, rectangular and circular as specified and any twisted, deformed or unsatisfactory ductwork shall be replaced as directed by the Engineer at no additional cost to the Contract.

All sheet metal ductwork shall be manufactured from strip mill cold reduced mild steel / coil continuously hot dip galvanised to BS 2989:1967:Group 2:Class 2A.

For black steel ductwork the material shall be cold rolled close-annealed or strip mill cold reduced black mild steel sheet.

All mild steel section components of all duct systems such as angle flanges, stiffeners, brackets and supports shall be painted two coats red oxide or zinc chromate paint before fixing to ductwork.

The Specialist Sub Mechanical Contractor shall note that whilst erecting the ducting on site, it is his responsibility to ensure that his workmen thoroughly seal all joints before the fixing screws are inserted and that screw heads and the external surfaces of the joints are also given a coat of sealer. After 24 hours, a second coat of sealer shall be applied to all joints and allowed to dry at least 24 hours before carrying out any test.

The Mechanical Contractor shall ensure that during all stages of erection, any open ends of ductwork or grilles and diffusers are protected from the ingress of dirt by the application to those ends of a suitably reinforced paper covering, securely held in place with adhesive tape or other approved means. The Engineer reserves the right to have any length of ductwork removed and cleaned should these precautions not be observed.

Where ducts run together, a 6mm (1 / 4") felt insertion piece shall be placed between the ducts to avoid vibration being conveyed from one duct to the other.

Where ductwork is located in corners of rooms, the Specialist Sub Mechanical Contractor shall fit as close to the wall as possible, preferable flush, to prevent traps.

All the ductwork dimensions, as indicated on the Drawings, are internal dimensions and hence clean edges shall be maintained at all joints so that at no time should there be any ductwork material projecting into the air stream. The use of self-tapping screws for fixing ductwork where the screws projects into the air stream will not be accepted.

The runs of the ducting are shown as accurately as possible on the Drawings, but the Specialist Mechanical Contractor shall be responsible for taking his own site dimensions and preparing all necessary working Drawings.

The Specialist Sub Mechanical Contractor shall take into full consideration, all problems concerned with the installation of this ductwork and adequate allowance must be made to take up all expansion or contraction during working conditions.
Test holes 25mm (1") diameter shall be provided downstream of all fans, supply junctions and dampers and upstream of all extract junctions and dampers.

Test holes shall also be provided on each side of all items of plant. Covers fitted with spring clips as supplied by FT Products Ltd, or equal and approved shall be fitted to all test holes.

Test hole spacings shall generally be in accordance with BS 848 and shall be indicated on the ductwork Sub Mechanical Contractors Drawings and approved by the Engineer.

Any mild steel sheet ducts exposed to outside weather conditions shall be galvanised after manufacture and shall be of 18 gauge thickness up to 1067mm (42") across the longer side, and 16 gauge thickness over 1067mm (42") across the longer side.

Ductwork between inlet louvres and the first item of plant shall be protected by painting one coat of Calcium Plumbate Primer and two coats of bituminous paint.

A suitable jointing compound as manufactured by the Minesota Mining and Manufacturing Company Ltd or equal and approved shall be used on all slip joints, the sealer being applied before the joint is made and, after rivetting, any excess sealer shall be wiped off to leave a clean and neat finish.

Flanges shall be sealed with 6mm (1 / 4") thick strip such as "Prestik" or other equal approved. The flanges shall be sealed to the duct with the sealer used for slip joints.

Plastic sealing tape shall only be allowed at the discretion of the Engineer.

All joints shall be completely airtight.

All ductwork connection to plant or equipment shall be sealed with a suitable jointing material and the angle size used for mating flanges shall be the same size and thickness as that provided on the plant to which connection is being made.

Any part of the ductwork where galvanised protection is damaged during manufacture or erection shall be retouched with two coats of aluminium or other corrosion resisting paint.

The Mechanical Contractor shall supply and fix a 20mm (3 / 4") BS P tapped and plugged boss without internal lip to ensure water is not retained in any duct systems where water may collect.

Where bends in the ducting are indicated, they shall be of the type shown. Where square bends are installed, they shall incorporate correctly design aerofoil vanes or airturns as manufactured by Barber-Colman Ltd, Sale, Cheshire or equal and approved.

In positions where round bends are shown, the centre line radius shall be as large as possible. R / D = 1 shall be the minimum for low velocity ductwork.

All tapers shall be so formed that they have a maximum reduction ratio of 1 in 7 unless site conditions do not allow. If the reduction ratio is greater than 20° then the taper shall be fitted with guiding vanes.

Airtight access doors shall be provided on both sides of all fans, filters and heater batteries for inspection, cleaning and maintenance purposes. At any fire damper, an

access door shall be provided large enough for the blade to pass through and in such a position that the maintenance staff will be able, without undue trouble, replace the fusible link.

Access doors shall also be provided adjacent to each regulating and isolating damper to allow inspection of the blade. In these cases, the size of the opening shall be sufficient to allow the blade to pass through.

Access doors up to 457mm (18") on the longest side shall be constructed from 18 swg galvanised sheet with edges folded through 90° to suit a 25mm (1") x 5mm (3 / 16") flat iron frame rivetted to the duct. The door shall be hinged on one side with "Camlock" fasteners or equal and approved. A foam rubber gasket shall be stuck to the inside face of the door to seat onto the 25mm (1") x 5mm (3 / 16") frame.

Doors with the longest side over 457mm (18") shall be manufactured from 18 swg galvanised sheet with edges folded and flattened over a 32mm (1 1 / 4") x 5mm (3 / 16") angle iron frame. A sealing frame constructed from 25mm (1") x 5mm (3 / 16") angle shall be rivetted to the duct.

The doors shall be hinged along one side with a heavy quality continuous hinge and secured on the other side with "Camlock" fasteners or equal and approved. A foam rubber gasket shall be stuck to the inside edge of the door to seat against the angle frame. All MS framing shall be galvanised after manufacture.

No site welding shall be permitted on galvanised components except at the discretion of the Engineer and all approved welds on any part of the sheet metal ductwork shall be wire brushed on both sides to remove zinc oxides and the burnt areas shall be treated with two coats of zinc base paint.

All cut edges of galvanised sheets and deep scratches such as caused by scribers shall be painted two coats of zinc based paint as each length or item of duct be finished manufacture.

Bolts, nuts and washers shall be manufactured from bright mild steel and shall be cadmium plated or electro galvanised.

(ii) Sheet Metal Ductwork Construction

Sheet metal ductwork shall be manufactured in accordance with the latest editions of the HVCA Publications or the Nov 82 CIBS E Guide recommendations.

The form of ductwork construction proposed shall be indicated where applicable on the Tender Documents.

All ductwork shall be low velocity.

a) Sheet Metal Ductwork Construction - CIBS E Nov 82 Guide

Where this Specification deviates from the recommendations of the Guide, this Specification shall be deemed the correct instruction.

Longitudinal seams shall be staggered on each succeeding section and shall be of Pittsburg lock formed type and arranged wherever practicable on the top side of the duct.

Where rivetted seams are necessary, the pitch of the rivets shall in no case be greater than 50mm spacings.

Solid rivets where used shall be neatly finished with a button snap tool. Any cut rivets

shall be replaced with new.

During the course of the manufacture, in the Specialist Sub Mechanical Contractors works, a sealer shall be applied to rivets, grooved seams, etc on the internal side of the metal whilst the pocket formed during the folding of the "Pittsburg" lock shall be flooded with sealer. The sealer shall also be brushed into all lap and corner joints.

Joints between duct sections in ducts up to longest side 584mm (23") shall be made with a correctly formed socket and pigot slip joint, joggled to ensure a smooth internal finish and made to suit the direction of the airflow.
Joints whereby the area of the duct is reduced shall not be acceptable. All joints between sections shall be rivetted. Joints in ducts over 584mm (23") to have angle mating flanges of the sizes and at the centre shown above.

Joints in ducts up to longest side 584mm (23") shall be rivetted at 50mm (2") pitches as shown above, sealing compound having applied between spigot and socket.

Intermediate lateral joints between flanges on ducts with longest side over 584mm (23") shall have a stiffener fixed over the slip joint and secured with nuts and bolts or hickbolts at 64mm (2 1 / 2") pitches.

Stiffeners are to be provided as shown above and where else necessary to ensure adequate rigidity and to prevent sagging or drumming by the sides.

Angle mating flanges shall have a 9.5mm (3 / 8") of the sheet metal duct returned over the flange face to ensure no leakage occurs.

b) Sheet Metal Ductwork Construction - HVCA Publications

Where this Specification deviates from the HVCA Publications, this Specification shall be deemed the correct instruction.

## 2.28 Calorifiers

New hot water storage calorifiers, tanks or other vessels for direct or indirect hot water supply must be provided and fixed as indicated in the Supplementary Specification, or as shown on the Drawing. Pressure test certificates from the manufacturers must be sent by letter to the Engineer before any pressure vessel of this type is fixed.

Where more than one cylinder or other hot water storage vessel is to be fixed to serve the same system, stop valves must be fitted to enable any vessel to be emptied completely and isolated from its neighbours without interrupting the hot water supply to the building or buildings.

These valves must be fitted whether shown on the Drawings or included in the Supplementary Specification or not, unless their omission is specifically called for on the Drawings or in the Supplementary Specification.

The Mechanical Contractor must arrange gravity systems to the calorifier fixing height to ensure the greatest possible circulating head. The calorifier being fixed as high as possible; or the horizontal centre line of the boiler or other heater, as low as possible.

The Mechanical Contractor shall supply all fixings, supports or brackets other than brickwork or concrete. Where vessels are supported upon steel or iron cradles or other supports, the soft metal liner must be rigidly fitted between all bearing surfaces on the vessel and the cradle or other support.

Actual building in of supports will be done by the Builder. Where a builder is not employed on the Project, the fixing must be included by the Mechanical Contractor.

All vessels shall have fitted to sizes detailed in the Particular Specification and Drawings, the following tappings / connections and equipment:

- Primary flow and return

- Secondary flow and return
  Cold feed (if required)
  1 No. 25 gland cock draining
  1 No. open vent
  1 No. safety valve
  1 No. 100mm dial altitude / pressure gauge with syphon
  1 No. 100mm dial thermometer and ancillary control or thermostat bosses

Where the primary medium is steam, a further pressure gauge shall be fitted to the steam chest.

Should the Particular Specification call for steel vessels, they must be galvanised after manufacture.

## 2.29 Circulators and Pumps

The Mechanical Contractor shall provide and fix in the positions shown on the Drawings, electrically driven pumps or circulators of an approved make.

The pump capacity must be as stated in the Supplementary Specification. Where two or more pumps or circulators are to be installed, the Mechanical Contractor must make full arrangements for valving to ensure the complete isolation and removal of any machine without interruption to the services, whether shown on the plans or not.

Every machine must be designed for super silent running.

Machines for hot water supply must be designed with a suitable overload characteristic to enable sudden heavy water draw off to take place without damage to pump or motor.

Each machine must be provided with motor, stop valves, drain valves, counter flanges, lubricators, spanners and sufficient packing for one complete repacking of the glands.

The Mechanical Contractor shall also include for the fixing of machines and for connecting to the piping system as shown on the Drawings or as instructed on site.

Electrical wiring will normally be carried out under a separate Contract, except where indicated otherwise in the Supplementary Specification and or on the Drawing.

## 2.30 Anti-Vibration

The Mechanical Contractor shall provide under all pumps, circulators and machines, an approved anti-vibration pad or other approved anti-vibration mountings.

## 2.31 Expansion

The Mechanical Contractor shall make all the necessary arrangements and provide the necessary fittings to take up expansion of all heated pipes under working conditions, as generally indicated on the Drawings.

Wherever possible, expansion of pipework shall be taken up by natural offsets and changes of direction of pipe runs.

Branch connections on high temperature (above LPHW) main pipelines generally shall be made such that the branch main will run at the side of the mains for a distance of 2 metres and consequently transfer any stress due to expansion and contraction off the connection and on to the bend.

All expanding pipes shall be allowed to move in a free, proper and pre-determined manner and direction.

The joints to all expansion bends or bellows shall not be drawn up until the anchorages have been rigidly fixed and the Engineer, or his representative has checked and "unsprung" position in each case and authorised work to proceed.

All pipes shall be fixed with sufficient clearance from walls, joists, floors and other obstructions capable of resisting lengthwise expansion and special care shall be taken to avoid pipe fixings preventing free movement of branches near junctions with main pipe runs.

## 2.32 Electrical Work

The electrical work or plant items must comply in all respects with the current edition of the Institute of Electrical Engineers Regulations for electrical equipment in buildings.

## 2.33 Removal of Old Materials and Debris

Unless specified otherwise or indicated on Drawings, the Mechanical Contractor must dismantle and remove all old equipment, pipework, fittings and materials which will become redundant when the installation as shown and specified is completed. Where equipment is to be retained by the Client, then the Mechanical Contractor will allow for removal and delivery to a designated location.

The Mechanical Contractor shall remove all debris caused by his work as it accumulates and on completion, leave all parts clean.

Where the works require complete removal of existing, then this shall be done in a neat and orderly fashion with due regard for the Main Contractors building programme.

Items of plant shall be stored on site for inspection by the Client, large items of equipment being inspected prior to removal, unless the Particular Specification deems otherwise.

Where the works require part removal of existing then the Mechanical Contractor shall inspect all relevant existing valves and equipment being retained and allow in his Tender for replacing such items, if in his opinion, progress of work would be hindered by their continued use. Such replacement items shall be included in item 'U' of the Tender Summary and separately scheduled by the Mechanical Contractor for form part of the Tender documentation.

## 2.34 Overtime

When submitting his Tender, the Mechanical Contractor must allow for all payments to the workmen and staff necessary to complete the installation as shown on the Drawings and specified.

This applies particularly to the existing building where it becomes necessary to execute certain work without interrupting the routine and services to the occupants.

Extra costs will not be allowed for overtime where it can be shown that the Mechanical Contractor should, by his experience, have allowed for the cost in his Tender.

Should the Mechanical Contractor require guidance on this point when preparing his Tender, he should make early communication with the Engineer who will be glad to advise him.

## 2.35 Commissioning Manuals and as Fitted Drawings

The Mechanical Contractor shall always include for specialist equipment such as boilers, controls, etc to be commissioned by the manufacturer when complete.

1. A schedule shall be produced showing the room temperature obtained in each separate area of the building. In the case of large areas, a grid system of measurement shall be employed.

   These readings shall be logged against the prevailing ambient conditions and submitted to the Engineer.

2. Noise levels shall be taken in any area served by fan assisted or ducted heating and schedules with (1).

3. Where regulating valves are employed then a diagrammatic drawing of the system shall be produced showing the valve setting, pressure drop and resultant flow rate.

4. Ductwork systems shall be dealt with in a similar manner by use of the balancing dampers.

5. Heater batteries shall be logged with their respective flow and return and air on and off temperatures.

6. All fans shall have a total volume check carried out.

7. All pumps shall have a volume check carried out using the altitude gauges and the pumps curve to determine total flow rate.

8. Temperature readings taken during mild or summer conditions shall be repeated under cold conditions during the defect liability period.

9. Labels shall be fitted to each valve and shown on a valve chart which shall also indicate the valves purpose.

   Labels shall be fitted to each item of equipment which shall show the plants identification, eg "HWS Boiler No. 1" and in the case of pumps or other like equipment, the relevant duty, eg "Htg Pump No. 2, 2.3 kgs at 20.0 kn / msq."

   Valve labels shall be minimum 25mm diameter with 6mm lettering.

   Plant labels shall be minimum 80mm x 40mm with lettering of 6mm.

   Valve charts shall be Traffolyte fixed with brass "S" hooks and chain.

   Plant labels shall also be Traffolyte fixed with "S" hooks and chain or other means suitable for the equipment. Adhesive will not generally be used.

10. A commissioning manual for approval of test figures by the Engineer shall be produced enclosing the relevant information detailed in items 1 to 8.

    Three copies of the manual are required in a black plastic A4 size ring binder, containing clear plastic A4 size sleeves for each document.

11. The Mechanical Contractor shall allow for attendance and supervision for commissioning of all specialist items relating to the system or systems whether or not the equipment or controls form part of the Mechanical Contractors supply or Contract.

### 2.35.1 As Fitted Drawings

The Mechanical Contractor shall include within his Tender, for the production of suitable As Fitted Drawings. These shall be available in CAD format based on AutoCAD LT latest version.

The Mechanical Contractor will provide one CAD disk containing the As Fitted Drawings and shall provide a minimum of two sets of paper prints of the As Fitted Drawings and these shall be contained within the Manuals for future reference.

## 2.36 Thermal Insulation

The materials and complete installations shall conform as applicable with the following Standard References:

British Standards

BS 5422:2009 Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40oC to +700oC

*Note: BS 5422:2009 tables for refrigeration, chilled water and process pipework are specified as the minimum thickness of insulation required to qualify for the DECC Enhanced Capital Allowance scheme. New guidance for the insulation of hot water and heating pipework has been published in the revised Energy Technology Criteria List – July 2013 https: / / etl.decc.gov.uk / etl / site / criteria.html. Thickness tables for phenolic foam insulation are included in Tables 8 & 9 of this specification.*

BS 5970:2012 Thermal insulation of pipework, ductwork, associated equipment and other industrial installations in the temperature range of -100oC to +870oC – Code of Practice

BS EN 14303 Thermal insulation products for building equipment and industrial installations – Factory made mineral wool (MW) products – Specification

BS EN 14304 Thermal insulation products for building equipment and industrial installations – Factory made flexible elastomeric foam (FEF) products – Specification

BS EN 14306 Thermal insulation products for building equipment and industrial installations – Factory made calcium silicate (CS) products – Specification

BS EN 14314 Thermal insulation products for building equipment and industrial installations – Factory made phenolic foam (PF) products – Specification

BS 476 Fire tests on building materials and structure
Part 6 1989 Fire propagation test for materials
Part 7 1997 Surface spread of flame tests for materials

Approved Document B (Fire Safety) Appendix A12 - Definition of Class 0 Fire Resistance

Heating and Ventilating Mechanical Contractors Association

DW 144 Specification for sheet metal ductwork materials

All pipework, ducting, vessels and equipment operating up to 100ºC, including refrigeration, chilled water, cold water, domestic hot water, heating installations and air conditioning shall be insulated with Foil Faced, CFC-free, Class O Phenolic Foam having a declared thermal conductivity of 0.025 W / m·K at 10ºC mean temperature aged in accordance with BS EN 14314. Kooltherm Pipe Insulation or Kooltherm Duct Insulation as manufactured by Kingspan Industrial Insulation or equal and approved.

All pipework, vessels and equipment operating above 100ºC, including medium and high pressure hot water and steam installations shall be insulated with Foil Faced Mineral Wool having a thermal conductivity of 0.040 W / m·K at 75ºC mean temperature. Rockwool H&V Pipe Insulation as manufactured by Rockwool UK Ltd or Crown SA Pipe Insulation as manufactured by Owens Corning-Alcopor Ltd or equal and approved.

New materials shall be:

- Completely free of CFC's / HCFS's.
- Completely free of asbestos in both insulation and surface finish.
- Of the specified material, thickness, quality and thermal conductivity.
- Free of chemicals which may contribute to corrosion of the insulated surface.
- CE Marked in accordance BS EN 14314:2009 as required by the Construction Products Regulation (EU) No 305 / 2011 (CPR) for Phenolic Insulation.
- Of a thermal conductivity of 0.025 W / mK at 10ºC mean temperature in accordance with BS EN 14314 and based on the time averaged value over 25 years, plus a safety increment for phenolic insulation
- Where mineral fibre materials are referred to, resin bonded glass or rock based fibres.

Fire performance of new materials shall be:

- Class 'O' as specified in the Building Regulations, Approved Document B (fire safety), Appendix A12 as follows:
  - A material that is non-combustible in accordance with BS 476 Part 4.
    or;
  - A material having a combined Class 1 Spread of Flame Rating in accordance with BS 476 Part 7 and Fire Propagation Indices, main-index I<12 and sub-index i < 6 in accordance with BS 476 Part 6.
- Less than 5% Smoke Obscuration Rating in accordance with BS 5111:Part 1.
- Not capable of producing large quantities of toxic fumes or dripping burning particles when involved in a fire.
- Pipe insulation shall have a European fire classification of BL-s1,d0 or better to BS EN 13501-1:2007+A1:2009.

Existing materials shall be:

- Removed or disturbed taking the necessary precautions in accordance with the Health & Safety at Work, etc Act with particular reference to the Asbestos Regulations of asbestos is confirmed as being present in the insulation or finish.

Factory applied reinforced aluminium foil finishes shall be:

- Factory applied 'Bright Class O' type glass reinforced aluminium foil laminate with lacquered finish fully bonded to the insulation. Note the term 'Bright Class O' foil is generally used by manufacturers of all types of insulation materials to describe their factory applied vapour barrier facing.

- Where provided, overlapped joints shall be sealed with the insulation manufacturers approved adhesive or self-adhesive overlap strip. Otherwise, longitudinal and circumferential joints shall be sealed with matching Class O dead soft aluminium foil tape not less than 100mm on mineral fibre and 50mm wide on phenolic foam insulation.

- Not punctured by fixing devices particularly where finish is a vapour or moisture barrier.

Metal clad finishes shall be:

- Of aluminium sheet, plain, reeded or hammered finish applied to all insulated pipework in plant rooms and to calorifiers and hot wells.

- Secured by aluminium rivets, stainless steel self-tapping screws or aluminium bands. On cold insulation services, care shall be taken to avoid puncturing the moisture vapour barrier. Banding shall be used where possible on cold services.

- Fabricated into removable covers secured by self-tapping aluminium screws and rivets on calorifiers and hot wells.

  Of the following gauge sheet:

  - 0.75mm thick minimum on pipes 125mm dia. and under.
  - 0.9mm thick minimum on pipes 150mm dia. and above.
  - 1.2mm thick minimum on calorifiers, hot wells, cisterns, etc or 0.9mm if ribbed sheet suitable.
  - 1.6mm thick minimum for removable covers.

- Neatly finished at service connection points with cut-outs reinforced by aluminium rings.

- Provided with additional support brackets as may be necessary on larger vessels.

- Kept clear of direct contact with dissimilar metals to avoid electrolytic action.

- Installed with allowance for expansion and contraction to take place.

- Where installed as a weather-proof finish, all overlapped joints, cut-outs and protrusions through the cladding shall be sealed and made water-tight with Fosters 95-44 flexible mastic sealant. The overlaps shall be positioned to shed water where possible.

Valve and flange boxes shall be:

- Fabricated from plain flat aluminium sheet equal to thickness on pipework; made in two halves hinged at the centre; secured by easy-release catches and with space inside for access to bolts.

- Insulated inside with the same insulation and thickness as on the pipework, except on vapour sealed services where the insulation is to be applied and sealed to the adjacent insulation. Provided on services as indicated on the tables.

- Alternatively, if specified in Part D, flanges may be insulated with oversize "removable" sections to cover the flange and bolts and finished as on the pipework, with removable securing bands. This shall apply only to foil covered insulation on CWS, HWS and LTHW and is the method to be used for unions on vapour sealed services.

- Materials in Food Preparation and Storage Areas, Clean Rooms, Pharmaceutical and Medical aseptic areas shall be:

- Free from fine mineral fibres and use made of alternative materials as indicated in the tables.

### 2.36.1 Alternative Fibre Reinforced Plastic Finish

Fibaroll fibre reinforced plastic shall be used in locations where a seamless waterproof, chemical resistant finish with high mechanical strength is required.

Fibaroll finish is particularly suitable where plant is exposed to chemical and hose down cleaning, weather conditions and for buried pipelines. As manufactured by:

Fibaroll UK Ltd
Unit F Anglo Industrial Trading Estate
Shepton Mallet
Somerset BA4 5BY

Materials on potable water cisterns shall be:

- As Clause 02 / 07.

Protective coatings, vapour barriers and adhesives shall be:

- To the manufacturers recommendations suitable for the service conditions and compatible with the insulation materials and / or metal surfaces.

- Non-toxic and non-flammable when being applied and when dry.

- Class 'O' fire rated indoors and Class 'I' to BS 476 Part 7 outdoors.

- When required as a vapour barrier, have permeance values of not more than; 0.05 g / (s.MN) for cold water supplies at 10ºC; 0.015 g(s.MN) for chilled water at 0ºC to 5ºC and to BS 5422:2009 Table 1 for refrigeration services to suit working temperatures.

### 2.36.2 Installation Practice

Insulation and Finishes shall be:

- Carefully applied in accordance with good practice as outlined in BS 5422:2009 and BS 5970:2012 and without disturbing or damaging pipework and equipment.

- Installed only after the service if it requires pressure testing first has satisfactorily passed the tests.

- Installed only after the surfaces to be insulated have been cleaned and are free from moisture, oil, grease, surplus soldering flux and building materials debris or dust.

- Under no circumstances, shall overlaps of the aluminium foil jacket be tucked inside the insulation joints where they may make contact with the underlying insulated surface.

- Arranged to allow access to all removable parts without need to damage insulation.
- Matched and sealed as necessary to insulated load bearing supports installed by the mechanical services engineers for specified services.
- On hot services terminate at each side of fire compartment or sub compartment walls and floors. On cold services, to avoid condensation damage to the building fabric the vapour sealed phenolic foam insulation shall be carried through the wall with an additional intumescent fire protection sleeve covering.
- Arranged as mitred sections or moulded shapes at bends and fittings and finishes as on the pipes.
- With non-corrodible metal bands where necessary to secure heavy insulation sections in addition to sealed seams and joints, generally 3 bands per metre section. Phenolic foam pipe insulation shall be secured by additional bands of 50mm self-adhesive foil joint sealing tape, generally 3 bands per metre section.

Cisterns, calorifiers, hot wells and feed tanks shall be:

- Insulated all over including top, also underside as practicable except feed and expansion cisterns.
- Arranged with removable insulation to manhole covers, heater batteries, etc with insulation heating finished at cut outs and sealed.
- Provided with any necessary cleats, brackets, pins, etc as required to support the insulation with those requiring attachment during vessel fabrication by others to be as specified in Part D.

Vapour sealed insulation shall be:

- Arranged with the insulation sealed over its full length and sealed to insulated supports and to valves, flanges and unions. Vapour sealed insulation carried through the walls and ceiling of cold rooms without a break with the hole in the wall or ceiling sealed to the insulation vapour seal.
- Where passing through fire compartment or sub compartment walls and floors it shall be covered with an intumescent sleeve to maintain the integrity of the specified fire resistance of the structure.

### 2.36.3 Pipe Supports

Pipework supports shall be insulated from the pipework on all HVAC services. On cold and chilled applications Kooltherm Insulated Pipe Support Inserts shall be used to minimise the risk of thermal bridging, limit the formation of condensation and facilitate the installation of a continuous vapour barrier. On hot water and LTHW services Kooltherm Insulated Pipe Support Inserts shall be used to limit overall system heat loss, and to minimise the risk of heat transfer through supporting structures.

### 2.36.4 Final Inspection of Insulation

All insulation work shall be inspected by the Engineer in conjunction with the Mechanical Contractor as areas are completed and before any areas are covered or hidden by subsequent building operations.

The arrangements for the inspection will be made by the Mechanical Contractor allowing sufficient notice for the Engineers visit. During such inspections, the work will either by accepted, rejected or accepted with remedial work to be carried out.

Particular attention will be paid to the standard and quality of aluminium cladding and patches and ill-fitting sheets will not be allowed for example.

Once accepted, the Mechanical Contractor will advise the Main Contractor of such areas as finally complete.

Subsequent damage will be made good by the Mechanical Contractor within two weeks of a final inspection which will be carried out prior to handover. Such remedial works shall be carried out at no expense to the Contract.

Mechanical Contractor should note that damage to lagging or insulation by other trades should, where practical, be logged and reported to the Main Contractor from whom reimbursement should be sought. Delays in repairs to lagging will not be accepted because of reimbursement problems.

### 2.36.5 Removal of Asbestos Insulation

#### 2.36.5.1 General

The Mechanical Contractor shall include for all the removal of existing insulation whether asbestos or not. The removal of asbestos insulation shall comply with all the latest regulations and the Mechanical Contractors attention is drawn to the Asbestos Regulations and the Health and Safety at Work Act.

The Insulation Mechanical Contractor shall be allowed to erect site and shower facilities for execution of the Contract. The siting of these huts, etc shall be near to the contaminated area but the exact location shall be confirmed.

#### 2.36.5.2 Site Hygiene

The Mechanical Contractor shall be required to clean-up adjoining walls, floors, scaffolding and equipment.

Clean-ups shall be carried out daily, after work has ceased, with additional clean-ups as necessary.

#### 2.36.5.3 Protective Equipment

Respiratory protection and protective clothing shall be required where stripping of thermal insulation is taking place. Unless dust can be reduced by wetting or controlled by dust extraction equipment, all stripping operations shall require respiratory protective equipment of the new sophisticated type such as positive pressure respirators or airline breathing apparatus.

#### 2.36.5.4 Respiratory Protection

The Mechanical Contractor shall provide respirators of a type approved by the Factory Inspectorate for use in asbestos containing atmospheres and must be issued on a personal basis. These respirators shall be kept in a dustproof container when not in use, eg a plastic bag sealed with tape.

Respirators shall be cleaned, checked and maintained at regular intervals by a designated person. Before reissue to another person, respirators are to be disinfected.

The Regulations require that all persons required to wear respirators shall be fully instructed in the proper use of the equipment.

### 2.36.5.5 Protective Clothing

The Mechanical Contractors shall provide overalls and head gear which must be worn during the working period, but not during "walking time" to and from the workplace if, during this time, the asbestos worker will be in contact with other people or will pass through "clear" areas.

Before being removed, overalls, caps and shoes shall be cleaned by a vacuum cleaner - not blown clean - and after removal, stored in a dust tight container such as a tape sealed plastic bag.

Due to the extent of the Contract, the Mechanical Contractor shall make provision for segregation of insulation workers by providing separate changing rooms and accommodation for clothing together with shower facilities. Other clothing shall be stored in a clean building where asbestos dust cannot penetrate.

The Mechanical Contractor shall be responsible for the maintenance and laundering of the protective clothing. For laundering, the clothing should be packed in plastic bags and marked "Asbestos Contaminated Clothing" in bold letters.

The Mechanical Contractor shall remove from site immediately, any employee found not complying with the Regulations with regard to correct protective clothing including respirators, overalls, etc.

### 2.36.5.6 Protective Screens

The Mechanical Contractor shall supply screens made from plastic sheeting which shall be erected to isolate the area being worked and prevent unnecessary spread of contaminated dust.

The Mechanical Contractor shall seal off the area being worked and "DANGER ASBESTOS" notices shall be positioned at all entrances to the working area. Under no circumstances shall notices be removed before air borne concentrations are below the recommended levels.

### 2.36.5.7 Removal of Insulation from Site

Due to limited space, safety, etc the Mechanical Contractor shall remove from site all waste material as it accumulates at regular intervals (ie at the end of each working day).

The Mechanical Contractor shall be responsible for advising the Local Authority and making arrangements for disposal of the asbestos contaminated insulation removed under the Toxic Waste Disposal Act.

The Regulations require all loose asbestos or asbestos waste to be carried in closed receptacles which prevent the escape of dust.

The Regulations require that the Mechanical Contractor shall use containers clearly and boldly marked with 'Asbestos - do not inhale dust'. Suitable polythene bags printed with this legend shall be used.

### 2.36.5.8 General Codes of Practice and Recommendations

The Mechanical Contractor shall be required to carry out the Contract as laid down in the Asbestos Research Council Recommended Codes of Practice for the handling and disposal of

Asbestos Waste Materials (revised March 1975). These are all in accordance with the Asbestos Regulations.

Recommended Codes of Practice
The Asbestos Research Council
Environmental Control Committee Secretary
P O Box 18
Cleckeaton BD19 3JU

***No young person under eighteen years of age may be employed where the Regulations call for use of protective equipment.***

## 2.36.6 Handing Over Insulation

Before handover certificates are issued, the Mechanical Contractor shall have passed over to the engineer, all of the following as provided in the Contract:

a) Makers instruction manuals of servicing and maintenance.

b) Makers operating instructions.

c) Schedules of plant and equipment lubrication.

d) Test and Guarantee Certificates.

e) Insurance and inspection authority reports.

f) Local or other Authority Certificates.

g) List of tools, keys and special equipment of any sort handed over.

h) Completion certificate prescribed in the current issue of the IEE Regulations for the Electrical Equipment of Buildings.

Three copies of this manual are required and each shall comprise of a black A4 size ring binder suitably indexed containing clear plastic A4 size sleeves for each document.

## 2.36.7 Insulation Thickness Tables - In Accordance with BS 5422:2009

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

| Insulating material | Mean temperature of insulation (ºC) | | | | |
|---|---|---|---|---|---|
| | 0 | +10 | +50 | +75 | +100 |
| | Thermal conductivity (W / m·K) | | | | |
| Phenolic foam (PF) | 0.025 | 0.025 | 0.025 | X | X |
| Mineral wool (MW) | 0.032 | 0.034 | 0.037 | 0.040 | 0.044 |
| Calcium silicate (CS) | X | X | 0.050 | 0.053 | 0.055 |

X = Not recommended for use at these mean temperatures.

Calcium Silicate to be used as alternative to mineral fibre on services above 100ºC in non-fibrous areas.

TABLE 1

Thickness of insulation for chilled and cold water supplies to prevent condensation on a low emissivity outer finish (eg Bright Class O Foil) in an ambient still air temperature of 25ºC and relative humidity of 80%.
(Reference BS 5422:2009- Table 8)

| Steel pipe size (mm) | | Temperature of water (ºC) | | | | | |
|---|---|---|---|---|---|---|---|
| | | +10 | | +5 | | 0 | |
| | | Thickness of insulation (mm) | | | | | |
| NB | OD | Phenolic foam | Mineral wool | Phenolic foam | Mineral wool | Phenolic foam | Mineral wool |
| 15 | 21 | 15 | 20 | 20 | 25 | 25 | 30 |
| 20 | 27 | 15 | 25 | 20 | 30 | 25 | 40 |
| 25 | 34 | 20 | 25 | 25 | 30 | 30 | 40 |
| 32 | 42 | 20 | 25 | 25 | 30 | 30 | 50 |
| 40 | 48 | 20 | 30 | 25 | 40 | 30 | 50 |
| 50 | 60 | 20 | 30 | 25 | 40 | 35 | 50 |
| 65 | 76 | 20 | 30 | 30 | 40 | 35 | 50 |
| 80 | 89 | 20 | 30 | 30 | 40 | 40 | 50 |
| 100 | 114 | 25 | 30 | 35 | 40 | 40 | 50 |
| 150 | 168 | 25 | 40 | 35 | 50 | 45 | 60 |
| 200 | 219 | 30 | 40 | 40 | 50 | 50 | 60 |
| 250 | 273 | 30 | 40 | 40 | 50 | 50 | 70 |
| 300 | 324 | 30 | 40 | 40 | 60 | 55 | 70 |
| Vessels and flat surfaces | | 35 | 50 | 50 | 65 | 65 | 80 |

TABLE 2

Minimum thickness of insulation for non-domestic heating installations to control heat loss.
(Reference BS 5422:2009 - Table 15)

| Steel pipe size (mm) | | Hot face temperature of installation (ºC) | | | | |
|---|---|---|---|---|---|---|
| | | +75 | | +100 | +150 | |
| | | Thickness of insulation (mm) | | | | |
| NB | OD | Phenolic foam | Mineral wool | Mineral wool | Mineral wool | Calcium silicate |
| 15 | 21 | 15 | 30 | 40 | 50 | 80 |
| 20 | 27 | 20 | 40 | 40 | 60 | 80 |
| 25 | 34 | 20 | 40 | 50 | 60 | 100 |
| 32 | 42 | 20 | 40 | 50 | 65 | 100 |
| 40 | 48 | 25 | 40 | 50 | 65 | 100 |
| 50 | 60 | 25 | 40 | 60 | 65 | 100 |
| 65 | 76 | 25 | 50 | 60 | 75 | 100 |
| 80 | 89 | 25 | 50 | 60 | 75 | 100 |
| 100 | 114 | 30 | 50 | 70 | 75 | 105 |
| 150 | 168 | 30 | 50 | 70 | 75 | 105 |
| 200 | 219 | 30 | 50 | 70 | 80 | 110 |
| 250 | 273 | 30 | 50 | 80 | 80 | 110 |
| 300 | 324 | 30 | 50 | 80 | 80 | 110 |
| Vessels and flat | | 35 | 50 | 80 | 90 | 115 |

TABLE 3

Minimum thickness of insulation for non-domestic hot water services.
(Reference BS 5422:2009 - Table 17)

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

TABLE 4

Environmental thickness of insulation for domestic central heating installations (+75ºC) and hot water supply systems (60ºC) to control heat loss in potentially unheated indoor areas with ambient air temperature of -1ºC.

| Outside Diameter of Copper Pipe (mm) | Water temperature of 60ºC / 75ºC | |
|---|---|---|
| | Thickness of insulation (mm) | |
| | • Phenolic foam | • Mineral wool |
| 10 | • 15 | • 25 |
| 12 | • 15 | • 25 |
| 15 | • 15 | • 30 |
| 22 | • 20 | • 40 |
| 28 | • 20 | • 40 |
| 35 | • 25 | • 40 |
| 42 | • 25 | • 40 |
| 54 | • 25 | • 50 |
| Cylinders | • 35 | • 50 |

TABLE 5

Environmental thickness of insulation for ductwork carrying warm air.
(Reference BS 5422:2001 - Table 10a)

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

TABLE 6

Thickness of insulation for condensation control on ductwork carrying chilled air in ambient conditions 25ºC, 80% rh.
(Reference BS 5422:2009 - Table 12 – low emissivity finish 0.05)

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

TABLE 7

Minimum thickness of insulation required to give protection against freezing under specified commercial and institutional conditions.
(Reference BS 5422:2009 - Table 29)

| Initial water temperature | | + 2 ºC | | + 2 ºC | |
|---|---|---|---|---|---|
| Minimum ambient temperature | | -6 ºC (Indoor unheated areas) | | -10 ºC (Outdoor) | |
| Evaluation period | | 12 h | | 12 h | |
| Permitted ice formation | | 50 % | | 50 % | |
| Pipe size (mm) | | Thickness of insulation (mm) | | | |
| O.Dia | Bore | Phenolic foam | Mineral wool | Phenolic foam | Mineral wool |
| Copper pipes | | | | | |
| 15.0 | 13.6 | 35 | 59 (size not available) | 130 | 269 (size not available) |
| 22.0 | 20.2 | 10 (15) | 19 (20) | 20 | 46 (50) |
| 28.0 | 26.2 | 7 (15) | 12 (20) | 20 | 24 (25) |
| 35.0 | 32.6 | 5 (15) | 9 (20) | 9 (15) | 16 (20) |
| 42.0 | 39.6 | 4 (15) | 7 (20) | 7 (15) | 12 (20) |
| 54.0 | 51.6 | 3 (15) | 5 (20) | 5 (15) | 8 (20) |
| 76.1 | 73.1 | 2 (15) | 4 (25) | 4 (15) | 6 (25) |
| 108.0 | 105.0 | 2 (15) | 3 (25) | 3 (15) | 4 (25) |
| Steel pipes | | | | | |
| 21.3 | 16.0 | 30 | 40 (40) | 75 | 126 |
| 26.9 | 21.6 | 10 (15) | 19 (20) | 30 | 42 (45) |
| 33.7 | 27.2 | 7 (15) | 13 (20) | 20 | 25 (25) |
| 42.4 | 35.9 | 5 (15) | 8 (20) | 9 (15) | 15 (20) |
| 48,3 | 41.8 | 4 (15) | 7 (20) | 7 (15) | 12 (20) |
| 60.3 | 53.0 | 3 (15) | 6 (20) | 5 (15) | 9 (20) |
| 76.1 | 68.8 | 3 (15) | 4 (25) | 4 (15) | 6 (25) |
| 88.9 | 80.8 | 2 (15) | 4 (25) | 3 (15) | 5 (25) |

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

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

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

TABLE 8

Minimum insulation thickness to satisfy the requirements of Enhanced Capital Allowance Scheme Maximum Permissible Heat Losses for Non-Domestic Hot Water.

| Steel pipe size (mm) | | Water temperature of 60ºC | |
|---|---|---|---|
| | | Thickness of insulation (mm) Phenolic foam | Maximum permitted heat loss (W / m) |
| NB | OD | | |
| 10 | 17 | 15 | 6.04 |
| 15 | 21 | 20 | 6.45 |
| 20 | 27 | 25 | 7.00 |
| 25 | 34 | 25 | 7.71 |
| 32 | 42 | 25 | 8.46 |
| 40 | 48 | 25 | 9.01 |
| 50 | 60 | 30 | 9.94 |
| 65 | 76 | 30 | 11.25 |
| 80 | 89 | 30 | 12.17 |
| 100 | 114 | 35 | 14.29 |
| 125 | 140 | 35 | 16.09 |
| 150 | 168 | 35 | 18.24 |
| 200 | 219 | 35 | 22.06 |
| 250 | 273 | 40 | 25.95 |

TABLE 9

Minimum insulation thickness to satisfy the requirements of Enhanced Capital Allowance Scheme Maximum Permissible Heat Losses for Non-Domestic Heating Supplies.

| Steel pipe size (mm) | | Water temperature of 75ºC | |
|---|---|---|---|
| | | Thickness of insulation (mm) Phenolic foam | Maximum permitted heat loss (W / m) |
| NB | OD | | |
| 10 | 17 | 20 | 7.78 |
| 15 | 21 | 20 | 8.42 |
| 20 | 27 | 20 | 9.05 |
| 25 | 34 | 25 | 9.86 |
| 32 | 42 | 25 | 10.83 |
| 40 | 48 | 30 | 11.42 |
| 50 | 60 | 30 | 12.61 |
| 65 | 76 | 35 | 14.12 |
| 80 | 89 | 35 | 15.28 |
| 100 | 114 | 35 | 17.51 |
| 125 | 140 | 40 | 19.72 |
| 150 | 168 | 40 | 22.34 |
| 200 | 219 | 40 | 26.61 |
| 250 | 273 | 45 | 30.91 |

# 3 Specific Project Conditions

## 3.1 Programme of Works

See Main Contract Documents for full details.

## 3.2 Regulations and Standards

The Mechanical Contractor shall ensure that his installation and works are installed in accordance with the Local Water Bylaws, Requirements of Gas Undertakers, Local Authority Building Regulations, Local Fire Officers Requirements, and any specific Manufacturer's instructions and recommendations.

The Mechanical Contractor shall ensure that all installations are designed, installed, inspected and tested in accordance with the following:

1. CIBSE Guides, Technical Memorandum and Application Manuals.
2. IET Regulations for Electrical Installation 18th Edition BS7671 2018 including Amendments and Guidance Notes.
3. Statutory Acts including Health & Safety at Work Act, Electricity at Work Regulations 1989 and Workplace (Health, Safety and Welfare) Regulations.
4. British Standards and British Standard Codes of practice. Where an appropriate standard does not exist, CENELEC Harmonisation or IEC Standard shall be used where relevant.
5. National Inspection Council for Electrical Installations, Contractors Standards for Installation.
6. The requirements of the Electricity Supply Authority.
7. Local Authority Building Regulations.
8. Local Fire Officers Requirements.
9. Any specific manufacturers' instructions or recommendations.
10. The Gas Safety (Installation and Use) Regulations (GSIUR) 1998.

## 3.3 Drawings and Manuals

The Mechanical Contractor shall allow for providing for the approval of the Consulting Engineer, full CAD Working Drawings and As Fitted Drawings as required throughout the Contract.

These shall be updated on a regular basis for any room layout changes. The Mechanical Contractor shall allow for all necessary printing costs and for distributing these Drawings to both the Design Team and the General Contractors carrying out site works.

All "As Fitted" Drawings shall be available in CAD format compatible with AutoCAD LT 2025 as a DWG file, in addition to providing the standard printed Drawings for insertion into the As Fitted Manuals.

In addition to the hard copies of drawings and manuals specified here and in Section 2, the contractor is to provide an electronic version in PDF format.

## 3.4 General Description

This specification covers the works to be carried out and the materials to be used for the mechanical installation for new SEN building at Burlington Avenue, Langwith Junction consisting of:

- New Heat Pump and Comfort Cooling VRF System
- New Domestic Hot and Cold-Water Services.
- New Heat Pump Low Pressure Hot Water Heating Services
- New Ventilation Systems
- New Above Ground Drainage

under the supervision of:

EP Consulting
Alpine House
Alpine Street
Old Basford
Nottingham NG6 0HS

## 3.5 Contract Conditions

The Mechanical Contractor will be a Domestic Sub Contractor to the Main Contractor, with the Mechanical Services being a **Contractor Design Portion** of the Main Contract Package.

## 3.6 Contract Drawings

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

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

It is the responsibility of the Contractor to make due allowance in his Tender for all materials, items of equipment, etc necessary to provide a complete finished installation as intended and for minor offsetting and alteration of service runs to achieve coordination with the building and other services/equipment, etc.

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

Claims for additional payment for alterations or additions to the works brought about by conflict between the works and building detail or other services will not be considered if the information was available to avoid such conflict prior to Tender.

## 3.7 Design and Working Drawings

The Contractor shall be responsible for the production of fully detailed design and working drawings of each service to be installed including all, purpose made plant and equipment. These working drawings must be fully coordinated with all other services and the structure.

The Contractor shall work in conjunction with other sub-contractors to ensure that all working drawings are fully coordinated.

Working drawings shall include detail and positions of all supports and fixings.

The Contractor shall ensure that the requirements of other Contractors are taken fully into account prior to any installation commencing.

Working drawings shall be produced in accordance with a programme to suite the overall programme for the project. Reasonable allowance shall be made for incorporating any comments made by the Engineer. Work on site should only commence after working drawings have been issued upon which, the Engineer has no further immediate comment.

The Contractors working drawings shall include the following:

| | |
|---|---|
| Co-ordinated Floor Layouts | 1:50 |
| Co-ordinated Services Distribution Layouts | 1:50 |
| Co-ordinated Plant Layouts and Sections | 1:20 |
| Schematic Diagrams of Respective Services | N.T.S. |
| Builders Work Drawings | 1:50 |
| Manufacturers Drawings of all Plant and Equipment Details | 1:20 |
| External services | 1:200 |

The Contractor will be required to take site dimensions during the preparation of working drawings and shall be responsible for their accuracy.

Setting out of the works on site shall be carried out by the Contractor and any errors arising from inaccuracies in setting out shall be rectified at the Contractors expense.

The Contractor shall be solely responsible for the accuracy of the drawings and for any equipment shown being suitable for the purpose for which it is intended and in accordance with the Specification.

Drawings shall be produced on AutoCAD 2025 or agreed CAD system.

The Engineer requires a minimum period of 10 working days to comment on the working drawings from receipt of the drawings.

## 3.8 'As Fitted' Drawings

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

The Contractor shall produce the "As Fitted" drawings, which shall be based on the Tender drawings and shall be equal in quality to the tender drawings. The drawings shall include all relevant information and shall exclude any information that is relevant during Tender and construction. Each drawing shall be clearly labelled "As Fitted Drawing" and shall bear the Contractors title block.

The Contractor shall submit one set of "As Fitted" drawings to the Engineer for approval. Immediately following such approval, the Contractor shall forward to the Engineer, one set of drawings on paper and one compact disk containing all the drawings in .dwg and .pdf format.

The Contractor's attention is drawn to the requirements of the CDM Regulations 2015 and shall include all relevant information for inclusion in the building Health & Safety file.

## 3.9 Operating and Maintenance Manuals

Three approved copies of the Operating and Maintenance Manuals shall be provided at or before handover such that the Main Contractors is fully informed of the correct operational techniques necessary for its safe use. Failure to comply with this requirement may delay handover acceptance.

The manuals shall include:

- A fully detailed written description of the installation and its controlled. The description shall be suitable for non-technical and separately for technical personnel.
- Copies of all test certificates and commissioning sheets.
- Specialist drawings of plant and equipment.
- Specifically identified manufacturers data sheets all cross-referenced with the "As Fitted" drawn details.
- A tabulated representation of recommended maintenance tasks showing frequency, suggested spares, etc.
- Diagrammatic / schematic drawings.
- Simplified operating procedures under both normal and emergency circumstances written in "layman's" language.

The manuals shall be bound and fitted, contain an index for ease of reference and prominently display the name and address of the Contractor and the Main Contractor together with emergency telephone numbers. The Contractor shall include relevant information within the building Health & Safety File.

## 3.10 Conflict

Any contradiction between the Specification and Drawings must be brought to the attention of the Engineer during the tender period when a ruling will be given. A discrepancy between the Specification and drawings will not be accepted as a basis for additional payment after receipt of tenders.

If details given in the Specification conflict in any way with manufacturers installation instructions or the requirements of the British Standards or Codes of Practice, then the relevant section of the Specification shall not be adhered to. Any such conflicts shall immediately be brought to the attention of the Engineer.

## 3.11 Staff Instruction

The Contractor shall include within his tender sum, an adequate allowance to brief the end users' personnel upon the new installations and the complete system operating parameters. The brief is to take the form of two separate seminars given by the Contractor at the school.

## 3.12 Ease of Maintenance

In laying out the works, the Contractor shall at all times give proper consideration to the future maintenance of the plant and shall include for such component parts as are available from the manufacturer of the equipment or plant to ensure ease of maintenance.

The Contractors attention is drawn to the CDM Regulations 2015 and in particular the Designer's and Principal Contractor's duty of care.

## 3.13 Samples for the Engineer's Approval

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

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

In those cases where the original material samples were obtained from a specified manufacturer and the Engineer decides upon an alternative, the Contractor shall be reimbursed for any additional expenditure he incurs arising from the Engineers decision.

All other expenditure in connection with original samples submitted for approval shall be borne by the Contractor.

## 3.14 Standard of Installation

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

Any installation or parts thereof installed by the Contractor deemed by the Engineer to be untidy, installed incorrectly or not in accordance with the above will be removed and correctly installed to the satisfaction of the Engineer at the Contractors cost. Any subsequent costs caused by abortive builders works, making good, delay or disruption to other trades will be met by the Contractor.

## 3.15 Materials and Equipment

All materials and equipment shall be new.

The Contractor should note that the site has recently developed numerous areas of the site and specific manufacturers or suppliers may be mentioned within the specification in order to provide continuity to the Site Management staff with maintenance contracts and other spare parts, etc. The Contractor therefore should allow within their Tender specific manufacturers or suppliers equipment, unless it is stated equal and approved. Approval for alternative manufacturers should be attained in writing from the Consultant during the Tender process, alternative manufacturers or suppliers will not be considered after the appointment of a successful contractor.

Materials and equipment shall be as detailed in this Specification or on the tender drawings. Where detail or descriptions are given, these are for guidance only and the Contractor shall ensure that full allowance is made for all associated materials and equipment to provide a fully complete and operational installation.

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

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

Any costs incurred by the Contractor though not installing materials in accordance with the manufacturer requirements will not be reimbursed.

## 3.16 Protection of the Installation, Equipment and Materials

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

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

Any materials or equipment stored in an unsuitable method will be rejected by the Engineer and replaced at no cost to the Client.

# 4 Domestic Hot and Cold Water Services

## 4.1 General Description

The proposed SEN building is to be constructed on the site of the original school, which has previously been demolished on open Playing Fields adjacent to the existing nursery building.

The existing nursery building is provided with an incoming Mains Cold Water supply from the Incoming Mains Service.

It is proposed that the new SEN Nursery Building is provided with a Mains Cold Water supply from the existing Mains Cold Water Services within the existing Nursery.

A new 32mm diameter MDPE (Blue) Mains Cold Water shall be trenched from the existing stop tap within the existing nursery building, where it will connect into the existing 35mm copper distribution within the ceiling void of the existing Nursery Changing Room. A new stop tap shall be provided at point of connection clearly identifying the use.

Mains Cold Water shall enter the plantroom and covert back to copper prior to distributing around the building.

Hot Water shall be generated with Mains Pressure fed local electric water heaters. These will either be horizontal located within the ceiling void or vertically mounted within the Kitchen base units depending on location.

Water is to be stored and distributed at 60°C and mixed at all hot water service outlets to 41°C with thermostatic mixing valves, including sinks. The exception to this shall be the hot water outlet in the Staffroom which is to be unblended.

## 4.2 Water Heaters

The Mechanical Contractor shall supply and install a number of Direct Electric Local Water Heaters to provide hot water to all of the building outlets. The Water Heaters will be located in ceiling voids or within the

The Water heaters are to be suitable for use with Mains Pressure Cold Water, with suitable accessory kits, including but not limited to the following, Isolation Valves, Strainer, Check Valves, Pressure Reducing Valves, Pressure and Temperature Relief Valves.

All pressure relief discharge pipework is to be taken to the nearest waste discharge point via a visible tundish.

The water heaters shall be as per the schedules on the drawings, generally from the Heatrae Sadia Multipoint Range complete with 3 kW Immersion Heaters.

Water Heater shall be supplied by Messrs:

Heatrae Sadia
Hurricane Way
Norwich
Norfolk HR6 6EA
Tel: 01603 420220

## 4.3 Controls

Each Domestic Water Heater shall be complete with a 24-hour timeclock.

The Time Clock shall be a Timeguard NTT-02 – 16A Rated Time switch.

## 4.4 Pipework

Pipework shall be carried out in copper tube to EN 1057 R250 Half Hard.

Fittings are to be Yorkshire capillary type suitable for potable water supplies with lead free solder rings or equal approved.

## 4.5 Valves

Isolating valves within the plantroom and on pipework to be insulated shall be Peglar PB350EL, or equal approved.

Double Regulating valves are to be located at the end of every secondary return connection.

Isolating valves on pipework not insulated shall be Peglar type PB350, or equal approved.

Service isolation valves shall be fitted to every outlet and these shall be Peglar type CxUN Chrome, or equal approved.

Drain cocks are to be fitted to all low points to facilitate draining and these shall be Peglar type 833LS, or equal approved.

## 4.6 Pipe Supports

Pipework shall generally be in accordance with Clause 2.20 of the Standard Specification. Under no circumstances will plastic clips be accepted.

## 4.7 Disinfection

The Water Services System shall be potable and it shall therefore be necessary for the Contractor to disinfect the whole of the new potable water service system including hot water service distribution before handover of the system. The contractor shall allow for sufficient injection points to allow for the chlorination to take place.

The Contractor will be responsible for obtaining water samples and analysis after chlorination of the system to prove bacterial levels and Legionella Levels are within recommended guidelines by the Water Authorities, these shall be taken a period of not less than 48 hours after Disinfection has taken place. The sampling points should include all new appliances and the reference sink/basin as a minimum.

All Cleaning, Disinfection and Testing is to be carried out to BS EN 806 and BS8558:2001. Legionella Testing shall be carried out in accordance with ISO 11731:2004 and BS7592. All testing shall be carried out by an independent UKAS Accredited Laboratory.

Biological Analysis shall be tested for Legionella, TVCC, Escherichia Coli, Coliforms and Pseudomonas Aeruginosa.

Disinfection shall be carried out utilising a suitable disinfectant which is determined to be safe for the pipework and fittings installed and the existing pipework. If sodium hypochlorite is to be used as the disinfectant it should be dosed to achieve 50ppm of free chlorine, retained for one hour, after which time the pipework should be thoroughly flushed with clean water until the level of chlorine is less than 1ppm or that of the incoming site water supply.

The Contractor shall ensure that Water Services Disinfections carried out a minimum of 14 days prior to handover and Test Results for Bacterial Counts and Legionella are available at handover stage.

Due to the early completion of the Disinfection, after disinfection throughout the remainder of the Construction Phase of the Project the Mechanical Contractor will be responsible for a Flushing Regime to these Outlets.

This Flushing Regime will take the form of 2 minutes flushing of Hot and Cold Water Outlets once every day. The Mechanical Contractor will be responsible for providing documented evidence that the flushing has taken place, with signed confirmation. This document will be provided fortnightly to the Consulting Engineer.

Should the Mechanical Contractor fail to complete the Flushing Regime, he will be responsible for the Disinfection of the entire Hot and Cold Water Services Pipework

Distribution from which the Wash Hand Basins are fed and the Sampling for Bacterial Analysis and Legionella.

Samples shall be taken 48 hours after any Chlorination or Disinfection Processes have been carried out, or further samples will be required.

Certification is to be provided by the Contractor to show:

- The Specification in use
- The Disinfectant used
- Disinfectant and pH Reading at the commencement and end of the Retention Period (Free Chlorine readings to be indicated)
- The length of the Retention Period
- Free Chlorine readings and corresponding pH readings at the end of the Neutralisation Period or Flushing

## 4.8 Thermal Insulation

All hot and cold water pipes in the ceiling voids spaces, boxes, service risers, floor voids and wall cavities shall be insulated in accordance with the Schedules in the rear of this Specification.

However, due to the nature of the project, the type of insulation used throughout shall be of bore coated CFC free phenolic foam such as Koolphen K or equal approved.

The Contractor shall be aware that all pipework drops and low-level horizontal runs will be boxed in and therefore require insulating.

## 4.9 Thermostatic Mixing Vales

The Contractor shall supply and fix thermostatic mixing valves to all hot water service outlets (Excluding Staff Room) within the proposed works.

Mixing valves will be wall mounted beneath wash hand basins and sinks and shall be Horne 15 Thermostatic Mixing Valves with integral isolating valves, wall mounting kit and white cover. Ref. No: H15 – 23B.

Thermostatic Mixing Valves are to be set to achieve 41°C Outlet Temperature from all hot taps.

Thermostatic Mixing Valves are to be supplied by Messrs:

Horne Engineering Ltd
PO Box 7
Rankine Street
Johnstone
Scotland PA5 8BD

## 4.10 Showers

The Contractor is to supply and install Electric Showers to the Changing Room.

Electric Showers shall be Mira Advance Flex (8.7 kW) Electric Thermostatic Accessible Showers, as manufactured by Messrs.

Kohler Mira Ltd
Wyke Way
Melton
Hull
Humberside
HU14 3BQ

Telephone: 0344 571 1000

# 5 VRF Heating and Cooling Services

## 5.1 General

The Heating and Cooling to the Building will be via Variable Refrigerant Flow (VRF) system utilising fan coils to key spaces and utilising a Hydrobox supplying an LPHW circuit to Low Surface Temperature radiators in circulation spaces and toilets.

LPHW Circuits - 55°C Flow - 45°C Return

All pipework shall be sized with a maximum pressure drop of 220 Pa/m, with the stated temperatures above.

Generally, the building has been designed to achieve 21°C DB internally; with an external temperature of -5°C DB, but some areas, such as the Changing Room will be designed to achieve more comfortable higher temperature in line with BB102.

The LPHW radiator circuit shall be provided with a room thermostat, located in the rear corridor, which shall call for heat to the circuit from the Hydrobox, and each radiator is to be provided with a Thermostatic radiator valve for individual room control.

All rooms served by the VRF systems shall be provided with individual room controllers and shall also be centrally controllable.

## 5.2 Variable Refrigerant Flow and Direct Expansion Equipment

The Mechanical Contractor shall provide a single VRF System to serve the building.

The Outdoor VRF unit is to be externally mounted to the rear of the building.

Details of the equipment is to be as the Equipment Schedules in the Specification and on the Drawings.

Heat Pump Equipment shall be High S.C.O.P. and S.E.E.R. Inverter Driven Heat Pumps.

All VRF equipment will be charged with R410a Refrigerant.

The Indoor Units shall be provided with a single Hard Wired Wall Mounted Controller per room. At Commissioning Stage Individual Controllers will be limited as to control from the Building Occupants.

All VRF systems shall link back to a central controller located in the plantroom, which shall include a BacNet Interface for linking to a future BMS.

The equipment should be provided by Messrs:

Daikin Airconditioning UK Ltd.
2470 Regents Court
The Crescent
Birmingham Business Park, B37 7YE

Contact: James Oates
Tel: 07973 744 593
Project No: 1627290/2015739

The Electrical Contractor will provide suitably sized power supplies to the Outdoor Units, Indoor Units and Branch Selector Boxes but the Mechanical Contractor shall provide all necessary Communication and Power Cabling to Controllers.

It should be noted that **"SY" and "YY" Cabling will not be permitted** for Mains Voltage Cable of any kind.

## 5.3 Condensate Drainage

The Contractor is to supply and install a condensate management system for the indoor AND outdoor units.

Each indoor unit should be supplied with a condensate Mini-pump that is to be mounted within the unit. The Outdoor Units shall collect Condense to discharge away from footpaths into the rainwater discharges.

The drainage pipework is to be PVC and the Contractor is to include for connection into the drainage soil and vent stack.

## 5.4 Refrigerant Pipework and Insulation

The Contractor shall allow to supply and install refrigerant pipework in the manner described below.

All refrigerant pipework shall be carried out using finest quality copper tube fittings to BS2871 Part 2. All tubes and fittings shall be degreased and dried before installation. Tube stored before use shall be capped and sealed to prevent dirt and moisture ingress.

Pipework installation shall be continuous and when complete, the pressure test shall be witnessed and a certificate signed by the Contractor, which will state the installation is damage free.

Joints in copper tubes shall be brazed, with or without capillary fittings, with the exception of in -line components of fittings up to ¾" o.d.

Pulled bends shall be used in preference to fittings, and where circumstances dictate, the use of the latter, long radius continuous formed bends shall be used.

Brazing shall be carried out using oxygen-free nitrogen as an inert gas shield supplied to the inside of the pre-formed pipework to inhibit scale formation.

On all vertical risers, oil traps shall be fitted at the bottom of all risers and at 3m intervals. At the top of all vertical risers, a loop shall be installed. On all discharged lines where the condenser is above the compressor, check valve shall be installed.

All pipework shall be firmly secured and supported to minimise vibration. All pipes shall be independently clamped using Hydro-zorb type cushioned clips secured to a supporting channel. These channels would be fitted to either brick piers, drop rod type hangers, galvanised type cable tray or when directed. Support shall be provided at 1.2m centre unless otherwise stated.

Systems using a thermostatic expansion valve shall be fitted with liquid line solenoid valve, fitter drier and moisture indicating sight glass.

Suction pipework shall be insulated with Class O Armaflex and shall be continuous, all joints vapour sealed. In addition, all Armaflex will be painted using manufacturers recommended paint.

Any pipework which passes through the building structure, shall be sleeved with Armaflex Class O fire rated insulation.

On completion of the refrigeration, pipes shall be pressure tested to 30 bar using oxygen free nitrogen with a small holding charge of refrigerant to facilitate leak testing. The pressure test shall be held for four hours.

When a system is under test, suitable warning notices shall be posted advising other trades the system is under test.

All tests to be witnessed by the Engineer and signed Test Certificates obtained. The certificate is to give full details and also state the works are free from any damage. The Installation Engineer to advise H & V Contractor of any protection to the pipework necessary to prevent damage from other trades.

If for any reason the installation is suspended, the pipework installed will be capped and witness re-tested.

## 5.5 VRF Hydroboxes

The Contractor is to supply and install a refrigerant-to-water "Hydrobox" as part of the VRF systems.

The water heaters shall provide LPHW circuits at 55°C flow - 45°C return, supplying heat to the LPHW circuit, as shown on the mechanical services drawings.

The Hydrobox is to be complete with integral circulating pumps, filters, expansion vessels and safety valves.

The Hydrobox is to be supplied by Messrs:

Daikin Airconditioning UK Ltd.
2470 Regents Court
The Crescent
Birmingham Business Park, B37 7YE

Contact: James Oates
Tel: 07973 744 593
Project No: 1627290/2015739

## 5.6 Pressurisation Units and Expansion Vessels

The LPHW circuit shall be provided with independent manual filling loops.

Hydroboxes are to be fitted with integral expansion vessels.

## 5.7 Radiators

Generally radiators shall be from the Contour Heating Deepclean Range as manufactured by Messrs:

The Mansions
43 Broadway
Shifnal
Shropshire, TF11 8BB

All radiators shall be installed with both bottom opposite end connections and radiators not fed from time and temperature control manifolds shall be fitted with a;

- Herz-TS-90-Reverse Angle Thermostatic Valve (Ref. 1 7728 91)
- Herz- Design Thermostatic Head "Mini" (Ref. 1 9200 30
- Herz-RL-1-Return Valve Angle Model (Ref. 1 3724-41).

Radiators casings are to be constructed from steel with a minimum of 1.25mm thick and be coated to RAL 9010.

All radiators are to comply with BS EN442 and tested to a minimum of 6 Bar.

The Contractor should ensure that all of the Radiators are suitably sized in relation to Output Required, especially in relation to the lower temperatures provided by the Hydroboxes.

## 5.8 Pipework

Heating pipework from the Hydrobox shall be carried out in copper tube to EN 1057 R250 Half Hard.

Fittings on copper tube shall be Yorkshire capillary type or equal.

## 5.9 Valves

Isolating valves up to 50mm shall be Peglar PB550EL bronze ball valves, 65mm and above shall be Peglar V905 wafer lugged type butterfly valves, or equal approved.

Commissioning stations up to 50mm shall be Peglar 900S series, 65mm and above shall be Peglar 900XSS, or equal approved.

Double Regulating Valves up to 50mm shall be Peglar 901S series, 65mm and above shall be Peglar 901XS, or equal approved.

Drain valves shall be Peglar 833LS or equal approved.

## 5.10 Automatic Air Vents

All high points on the LPHW systems where venting is necessary shall be fitted with an automatic air vent as manufactured by Messrs Peglar and their Model No. 775.

The automatic air vents shall be complete with independent shut off valve and discharge pipe within a suitable discharge position.

## 5.11 Draining

Adequate provision shall be made for the whole of the systems to be drained and to ensure this; all droppers shall be fitted with Peglar drain cocks type 833LS complete with hose union connection.

## 5.12 Pipe Supports

All pipework supports shall generally be in accordance with Clause 2.20 of the Standard Specification; under no circumstances will Plastic Clips be accepted.

## 5.13 Thermal Insulation

All heating hot pipes in the ceiling voids spaces and boxes shall be insulated in accordance with the Schedules in Section 2 of this Specification. All insulation in the plant room will be enclosed with aluminium cladding.

The type of insulation used throughout shall be of bore coated CFC free phenolic foam such as Koolphen K or equal approved.

The Contractor shall be aware that all pipework drops and low-level horizontal runs will be boxed in and therefore require insulating.

## 5.14 Chemical Dosing

The contractor shall include for the dosing of all systems using a suitable corrosion inhibitor, and external pipework to the Monoblock units shall be provided with a Glycol content.

The contractor shall use `Sentinel` Commercial System Corrosion Inhibitor, which shall be used in accordance with the manufacturers written instructions.

The LPHW systems will be dosed to achieve the following limits, and any further limits stated in manufacturers literature:

| | | |
|---|---|---|
| Acidity level (water non-treated) | - | 7.5 - 9 pH |
| Acidity level (water treated) | - | 7.5 – 8.5 pH |
| Conductivity | - | ≤ 500 µS/cm (25°C) |
| Chlorides | - | ≤ 70 mg/l |
| Other components | - | < 1 mg/l |
| Water Hardness | - | 0.1 - 2,0 mmol/l<br>5 – 11°dH<br>1 – 20°F |

The Contractor shall provide Certification of the Chemical Content and Water Quality for each system.

## 5.15 Equipment Support System

The Contractor shall design, supply and install a purpose designed concrete plinth and protective cage for the Outdoor unit.

## 5.16 Thermal Insulation

All pipes in the roof voids spaces, wall recesses, wall voids and boxes shall be insulated in accordance with the Schedules Section 2 of this Specification.

However, due to the nature of the project, the type of insulation used throughout shall be of bore coated CFC free phenolic foam such as Koolphen K or equal approved.

The Contractor shall be aware that all pipework drops and low level horizontal runs will be recessed in walls and therefore require insulating.

# 6 Ventilation

## 6.1 General Description

The building is to contain a combination of naturally ventilation and mechanical ventilation zones.

The SEN building shall have two dedicated balanced supply and extract ceiling void mounted heat recovery units.

The internal rooms (Sensory Room, Intervention Room and Meeting Leader's Office) shall be served via a single balanced supply and extract ceiling void mounted heat recovery unit.

The Toilets and Shower will be served via a separate single ceiling void mounted Heat Recovery Unit.

The fresh air in and discharges shall pass through the external walls of the building and terminate in external weather louvres.

The remainder of the spaces shall be Natural Ventilated through opening windows and powered opening

## 6.2 Air Quality Monitoring

The Contractor shall supply and install $CO_2$ monitors to the following rooms to provide a means of monitoring air quality in compliance with Part F of the Building regulations and Building Bulletin 101:

- Class 1
- Class 2
- Class 3
- Class 4
- Class 5
- Class 6
- Sensory
- Intervention

The $CO_2$ monitors are to be NDIR type mains powered monitors, positioned at breathing height away from any ventilation openings and people as far as practical.

## 6.3 Heat Recovery Ventilation Units

The Contractor is to provide and install the following equipment in the location indicated on the Mechanical Services Drawings:

| | | |
|---|---|---|
| HRU-001 | VAM500J8 | Daikin Heat Recovery Unit |
| HRU-002 | UNI-X-580-C | Nuaire Heat Recovery Unit |

A central Daikin Controller controller shall be installed within the Plantroom to provide overall control to all the Daikin units including the VAM Heat Recovery Units. The Nuaire Unit shall be controlled with 2 No. PIR Sensors to the WC Corridor and Staff WC Corridor with a thirty minute run on timer.

The equipment should be provided by Messrs:

Daikin Airconditioning UK Ltd.

2470 Regents Court
The Crescent
Birmingham Business Park, B37 7YE

Contact: James Oates
Tel: 07973 744 593
Project No: 1627290/2015739

And Messrs:

Nuaire
Western Industrial Estate
Lon-Y-Llyn
Caerphilly CF83 1NA
Tel: 02920 858200

## 6.4 Ventilation Ductwork

The entire ductwork installation on this project shall be carried out in sheet metal ductwork to DW144 Specification. Ductwork is to be Class A, Low Pressure with a combination of Rectangular and Circular ductwork.

Rectangular ductwork is to be constructed from single galvanized sheet with a minimum thickness of 0.6mm and a single Grooved Longitudinal Seam (Fig. 1) or Grooved Corner Longitudinal Seam (Fig. 2). Ensure that all necessary stiffeners are fitted.

Straight connections of ductwork lengths will be with integral or slide on flanges (Fig. 83). Slip joints of any kind will not be acceptable.

Bends on ductwork will be medium radius bends (Fig. 87).

Tees will be radius tees with turning vanes (Fig. 90).

Offsets will be mitred offsets (Fig. 97).

Branches will be Shoe branches (Fig. 106).

Air terminal connections will be Plenums with top or side connections as necessary (Fig. 120 or Fig. 121), cover plate connections are not acceptable (Fig. 122).

Circular and Flat Oval ductwork is to be spiral wound with straight connections being carried out using Socket and Spigot with connectors (Fig. 125 - Male). Slip joints will not be acceptable.

Bends on ductwork will be pressed bends (Fig. 127).

Tees will be pressed twin bends (Fig. 131).

Tapers will be concentric or eccentric (Fig. 132), short tapers will not be acceptable (Fig. 133).

Offsets will be mitred offsets (Fig. 134).

Branches will be Shoe branches (Fig. 136 or Fig. 140). Square and pressed branches will not be acceptable (Fig. 139 or Fig. 141).

No flexible ductwork will be permitted where on view.

The Contractor will be required to produce scaled dimensioned working drawings for all ventilation ductwork prior to installation.

Any work carried out by the contractor without dimensioned working drawings being officially approved by the Engineer will be at the contractor's risk.

## 6.5 Louvres, Grilles and Diffusers

The Contractor shall supply grilles and diffusers as detailed in the Schedules indicated on the drawings.

Grilles and diffusers internally shall be provided standard RAL 9010 30% Gloss. The external weather louvre shall be PPC in a colour yet to be specified by the Architect. Mill finish will not be acceptable.

Louvres, Grilles and diffusers will be supplied by Messrs:

Gilberts Ltd
Gilair Works
Clifton Road
Blackpool
Lancashire FY4 4QT
Tel: 01253 766911

## 6.6 Fire Dampers

Where ductwork systems pass through fire barriers, sprung leaf fire dampers shall be fitted.

The Contractor is to ensure that all fire dampers have access panels within the ductwork adjacent to them.

These shall be Firegard FG2 for rectangular ductwork, Firegard FG3 for circular ductwork and Firegard FG4 for flat oval ductwork as manufactured by Messrs:

Gilberts Ltd
Gilair Works
Clifton Road
Blackpool
Lancashire FY4 4QT
Tel: 01253 766911

## 6.7 Rectangular Balancing Dampers

Dampers installed within ductwork systems shall be Airgard Model Volume Control Dampers as manufactured by Messrs.

Gilberts Ltd
Gilair Works
Clifton Road
Blackpool
Lancashire FY4 4QT
Tel: 01253 766911

## 6.8 Circular Balancing Dampers

Circular Balancing Dampers are to be Gilberts Series 'RD' Type, Iris Dampers. Circular balancing dampers are to be supplied by Messrs:

Gilberts Ltd
Gilair Works
Clifton Road
Blackpool
Lancashire FY4 4QT
Tel: 01253 766911

## 6.9 Attenuators and Acoustic Insulation

The Contractor shall supply and install attenuators and acoustic insulation to all Ventilation Plant, to ensure noise levels within the Teaching Spaces are equal to Building Bulletin 93 and Building Bulletin 102. Attenuators shall be supplied by Messrs:

Allaway Acoustics
Tradeforce Building
8 Cornwall Place
Bradford BD8 7JT

# 7 Above Ground Drainage

## 7.1 General Description

The Contractor shall supply and install all new uPVC soil system and allow for any connectors to existing clay pipework and new below ground drainage.

The Contractor is to allow for the drainage system to discharge wastes from all sanitary ware appliances including Sinks, Basins, WC's etc, together with drainage from Mechanical Services equipment, Overflow Discharges, Condense and Waste from Cooling Equipment and any Safety Discharges.

The contractor is to allow stacks as required to allow connection from drains and wastes to discharge into the below ground drainage system.

The Contractor is also to allow for venting of Soil Stacks both through the roof of the building and with Air Admittance Valves where appropriate.

## 7.2 Pipework

All the works shall comply with BS6455 304 or BS8301 1985 CP312301 and 2005 whichever is relevant in the latest British Standard.

The Contractor shall take particular care to position pipes and access with view to easy maintenance. Concealed or inaccessible shall be arranged by the Contractor so that joints are accessible for maintenance or removal.

All branches, bends wherever possible shall be long radius and access pipes and access bends or fittings that are removable for access shall be fitted so that any length of pipe can be easily cleared.

All PVC pipework and fittings shall be of the solvent cement type with 'O' ring expansion joints as necessary. These shall be as manufactured by Messrs Caradon Terrain or equivalent and shall comply in all respects with BS4514.

All pipework of 75mm and larger shall be in Caradon Terrain soil system series 100 and pipework of 50mm diameter and smaller shall be Key Terrain high temperature waste system series 200 or equivalent.

Where pipework passes in and out of fire barriers and all floors, the pipes shall be fitted with preformed intumescent collars of a proprietary manufacture. Where pipework passes through occupied spaces, pipework shall be Acoustically Insulated to eliminate noise transfer.

The pipework and fittings shall be installed in strict compliance with the manufacturer's instructions and recommendations and with CP312.

Storage of all PVC pipe and fittings shall be arranged as recommended by the manufacturers and any damage or default pipework or fittings shall be rejected and under no circumstances will be installed.

Pipework and fittings for overflows shall comply in all respects with the relevant British Standard Specification.

Overflows shall terminate in such a manner not to cause inconvenience or harm to pedestrians, traffic or occupants but at the same time, be conspicuous when discharging.

Approval must be obtained from the local Water Authority to ensure that the proposed overflow installation meets their requirements.

# 8 Tender Summary and Form of Tender

## 8.1 Summary of Tender – Mechanical Services

| | | |
|---|---|---|
| 1. | Preliminaries and Design Coordination | £ |
| 2. | External Mains Cold Water | £ |
| 3. | Supply and Install Domestic Hot and Cold-Water Services | £ |
| 4. | Supply and Install New VRF System | £ |
| 5. | Supply and Install Mechanical Ventilation Services | £ |
| 6. | Supply and Install LPHW Heating Services | £ |
| 7. | Thermal Insulation | £ |
| 8. | Potable Water Services Disinfection and Testing | £ |
| 9. | Testing, Balancing and Commissioning | £ |
| 10. | O&M Manual and As Fitted Drawings | £ |
| Sub Total | | £ |
| Provisional Sum – Additional Fire Separation (Dampers) | | £ 5,000.00 |
| Provisional Sum – Acoustic Treatments due to Planning | | £ 7,500.00 |
| Contingencies | | £ 10,000.00 |
| TOTAL TENDER SUM | | £ |

Signed: .....

For and on Behalf of: .....

Date: .....

**Note: Tender will not be valid unless submitted on this form.**

## 8.2 Daywork Rates – Mechanical Services

| | | |
|---|---|---|
| Labour | | Normal Time |
| Advanced Fitter/Welder | Rate | £..... |
| Fitter | Rate | £..... |
| Assistant/Mate | Rate | £..... |
| Refrigeration Engineer | Rate | £..... |
| Rates for overtime working, excluding statutory holidays: | | |
| **Labour** | | Time and half |
| Advanced Fitter/Welder | Rate | £..... |
| Fitter | Rate | £..... |
| Assistant/Mate | Rate | £..... |
| Refrigeration Engineer | Rate | £..... |
| **Labour** | | Double Time |
| Advanced Fitter/Welder | Rate | £..... |
| Fitter | Rate | £..... |
| Assistant/Mate | Rate | £..... |
| Refrigeration Engineer | Rate | £..... |
| **Daywork Percentage Additions** | | |
| Materials | nett cost | + .....% |
| Labour (HVCA/RICS Definition) | nett cost | + .....% |
| Sub-Contracts | nett cost | + .....% |
| Plant | nett cost | + .....% |

Signed: ..... Dated: .....

Company: .....

Address: .....

.....

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