DMBS

PROJECT:
PROPOSED VENTILATION REPLACEMENT WORKS

SITE LOCATION:
ENVIRONMENT AGENCY
OLYMPIA HOUSE
GELDERD LANE
LEEDS
LS12 6DD

MECHANICAL SERVICES PERFORMANCE SPECIFICATION

Revision: T1
July 2019

DMBS Design Ltd
United Kingdom
www.dmbs.co.uk

WE EMPLOY LOW CARBON CONSULTANTS

LOW CARBON ENERGY ASSESSORS CIBSE Certification Ltd.

AMENDMENT SHEET

Revision	Description	Date	Author
T1	TENDER	30th July 2019	DM

CONTENTS

MECHANICAL ENGINEERING SERVICES

FOR

SECTION 1 – PRELIMINARIES

SECTION 1 - PRELIMINARY CLAUSES

PROJECT PARTICULARS

1.1 THE PROJECT:

This specification details the detailed performance requirements for the mechanical & electrical services associated with the ventilation replacement works at the following;

Environment Agency
National Laboratory Service
Olympia House
Gelderd Lane
Leeds
LS12 6DD

1.2 THE EMPLOYER:

Gareth Proctor (Facilities Team Leader)
Environment Agency
National Laboratory Service
Olympia House
Gelderd Lane
Leeds
LS12 6DD

1.3 THE ARCHITECT:

Not Applicable

1.4 THE M&E CONSULTANT:

Dean Maude (Project Lead)
DMBS Design Limited
The Old Booking Office
Station Approach
Saxilby
Lincoln
LN1 2HB

1.5 THE SITE

The proposed works shall be carried out within a fully occupied and operational laboratory building. The works shall primarily be localised within the second floor plantroom D217 and rooftop tank room/roof area, however there are ventilation improvement works around habitable areas which the Contractor shall liaise with the Client on phasing the works. The full site address is as follows;

Environment Agency
National Laboratory Service
Olympia House
Gelderd Lane
Leeds
LS12 6DD

1.6 TENDER DRAWINGS

Please refer to the following documentation.

M01 GF Indicative Ventilation Strip Out Works
M02 GF Indicative Proposed Ventilation Works
M03 FF Indicative Ventilation Strip Out Works
M04 FF Indicative Proposed Ventilation Works
M05 SF Indicative Ventilation Strip Out Works
M06 SF Indicative Proposed Ventilation Works

The Contractor shall also read the existing record information relating to the Architectural, Electrical, Structural and Fire Strategy in conjunction with this specification. These drawings are available upon request from site.

The Contractor shall also read the Asbestos register to make themselves fully aware of hazardous areas and identify any areas of concern prior to commencement of works.

1.7 DEFINITIONS

Whenever this specification refers to the 'contractor' this shall be defined as the Mechanical & Electrical Services Contractor. The Contractor shall act as Principal or Main Contractor for the duration of the works. Whenever this specification refers to the 'specialist contractor' this shall be defined as a suitably qualified/competent company employed directly by the contractor

Where used in the documentation the following definitions shall apply and shall be interpreted as such:

- Works: All services shown on the drawings and described in the specification and deemed to be included in the contract.
- Drawings: The tender drawings.
- Elsewhere: Detailed or specified elsewhere in other clauses, sections, shown on the drawings or contained in the specification or conditions of contract.
- Services: Services means the inclusion of one or more system.
- System: All equipment, accessories, controls, supports and ancillary items, including supply, installation, connection, testing, commissioning and setting to work necessary for that section of the Works to function.
- Design process: All the activities necessary to convert design input into design output

- Review: Give notice and submit details to the Employer for his comment and review, which shall be granted in writing only. In the event of the Employer not accepting that submitted, resubmit alternative details for review or modify that submitted in accordance with the Employer comments. Review of any submittal by the Employer shall not mean that the Employer is responsible for the correctness of the submittal or its suitability for purpose and does not relieve any contract responsibilities.

- Competent person: A person, by reason of theoretical and practical training or actual experience or both, is competent to perform the task or function or assume the responsibility in question and is authorised to perform such a task or function.

- Duct: An enclosed space specifically intended for the distribution of services, with direct access for personnel.

- Trench: A covered horizontal service space in the floor or ground with access from above.

- Cavity: A space enclosed within the elements of a building within which services are installed, e.g. the space between ceiling and floor above. See Building Regulations.

- Service Areas: Includes areas within a building with limited finishes such as loading bays, car parks etc.

- Concealed Services: Includes installations within ducts, trenches or cavities.

- Exposed Services: Includes installations outdoors or unprotected within service and occupied areas.

- CIBSE: The Chartered Institution of Building Services Engineers

- BSRIA: The Building Services Research and Information Association

- IET: The Institution of Engineering and Technology

- HSE: Health and Safety Executive

1.8 REGULATIONS

The design, supply, installation, testing and commissioning of the Mechanical & Electrical Installation shall be carried out in accordance with all relevant Acts of Parliament, Building Regulations, which are applicable to the works including but not restricted to the current editions of the following:

- The Construction (Design and Management) Regulations 2015

- Local Authority and Environmental Officer Requirements

- Fire Officers recommendations and requirements

- The Health & Safety at Works Act
- The 17th Edition IET Regulations Incorporating Amendment 3:2015
- The CIBSE Guides and Commissioning Codes
- British Standards including Codes of Practice
- Building Regulations

The pricing of the works shall be based on the current Regulations, British Standards and Codes of Practices.

1.9 SITE SET-UP:

It is not expected a site set up for welfare, storage or offices is required by the Contractor. The Contractor shall be allocated an area/room for storage and the use of existing welfare facilities shall become available. The Contractor must ensure cleanliness outside the plantroom is maintained at all times with use of overshoes and protective flooring. Any frequent complaints by building staff in relation to poor cleanliness, hygiene or mis-use of building welfare facilities by the Contractor(s) shall be actioned immediately. Under these circumstances the Contractor shall provide temporary welfare, storage and office facilities within an allocated section of the carpark at no further expense of the Client.

1.10 ACCEPTANCE OF TENDER:

The Employer and his representatives offer no guarantee that the lowest, or any tender, will be recommended for acceptance or accepted.

The Employer will not be responsible for any cost incurred in the preparation of any tender.

1.11 INSPECTION OF SUPPLEMENTARY DOCUMENTS:

Supplementary documents relating to the contract are available for inspection prior to the submission of the tender.

No adjustment shall be made in the tender sum or claim for additional monies or an extension of time allowed due to failure to inspect the above documents and to make due allowance for the information contained therein.

- Record Drawings

1.12 SITE VISIT:

Before tendering, ascertain the nature of the site, access thereto and all local conditions and restrictions likely to affect the execution of the Contract Works.

Inspect any existing installations relevant to the works and study any relevant existing records.

No claims will be allowed after submission of a tender for lack of information or other reasons which could have been resolved by such a visit to the site.

Arrangements for visiting the site must be made with prior agreement through:
Main Contractors issuing the tender documentation.

1.13 INFORMATION PROVIDED BY OTHERS:

Instructions, drawings, or other information required to be provided upon written request, provided always that such information is not requested unreasonably distant from nor unreasonably close to the date upon which it is necessary.

Provide written request to the Employer in good time for any information required.

1.14 PROVIDE EVERYTHING NECESSARY:

Details of construction or materials which have not been referred to in the contract documents but the necessity for which may reasonably be implied or inferred from the said documents or which are usually or essential to the completion of the Works, shall be installed with no additional cost.

All necessary lifting, scaffolding, platforms and access equipment shall be included to complete the works with no additional works.

1.15 CO-ORDINATION OF TRADES:

Allow for co-ordinating the contract works with the works of other trades and installations which may be on site during the period of the contract.

1.16 CO-OPERATION WITH OTHERS:

Ensure that the contract works integrates with that of others and that full co-operation is maintained during the execution of the Works with that of others.

Co-operate with the Contractor, other subcontractors, suppliers, local authorities and statutory undertakings in the execution of the Works.

In the event of any extra costs being caused by failure to programme and arrange the execution of the Works so that it fully integrates with that of others, the contractor of the Works may be liable for any additional costs thereby incurred.

1.17 NOTICE OF OPERATIONS:

Work that requires interruption or interference with the operation of any existing services or buildings shall not be commenced without prior written permission of the Employer.

14 working days notice of intention to proceed with such works shall be given to the Employer.

1.18 NOISE AND NUISANCE:

Ensure that the contract works are undertaken with as little noise as possible.

Ensure no nuisance by noisy working is caused to the Employer occupants of premises next to the site boundary.

Take all necessary precautions to prevent nuisance from smoke, rubbish and other causes. Fit all compressors, percussion tools and vehicles with effective silencers of a type recommended by the manufacturer's of the equipment.

1.19 PROGRAMME:

All necessary labour shall be included within the tender submission to commence on site within a 2 week lead in time and an anticipated works duration of 4 weeks.

Upon receipt of order the Contractor shall provide a detailed programme(s) clearly illustrating how the overall programme including to phase the works outside the plantroom to the acceptance of the Client

Provide the detailed programme within 1 week of the award of the contract

Due allowance is to be made in the programme(s) for, but not limited to, the following:

- Statutory authority approvals including Building Regulations.
- The latest dates for release of final information required from the Employer.
- Required method statements.
- Ordering dates and manufacturing periods. The proposed delivery to site for each item of major plant to be clearly defined.
- The period required for the production, approval and issue of:
- builder's work information
- co-ordinated working drawings
- installation drawings
- manufacturers drawings.

1.20 PROGRESS:

At regular intervals as agreed with the Employer provide progress reports during the execution of the contract works in addition to any other similar information required by the contract conditions.

The reports shall include:

- particulars of materials and equipment on site, or installed
- site labour employed
- progress of the works
- Record progress of the Works weekly on a copy of the programme.
Mark up for inspection and record purposes a set of the latest drawings as the works progress. The progress drawings shall be available for inspection by the Employer at any time.

1.21 ORDERING SCHEDULE:

Prepare an ordering schedule for submission to the Employer that shall indicate the following data:

- Item of material or plant
- Manufacturer
- Date of order and reference number
- Acknowledgement of order and reference
- Delivery period quoted
- Date required on site
- Allowable programme float
- Date delivered to site
- Update and modify and submit the ordering schedule on a regular basis as agreed with the Employer. Indicate on the schedule any possible problems and when delivery to site has been achieved.

1.22 TECHNICAL SUBMITTALS

The Contractor shall produce detailed technical submittals for all major plant prior to issuing an order with the subsequent manufacturers, to the Consultant for approval. The Contractor shall ensure there is a minimum of 7 working days period for the Consultant to approve.

1.23 USE OR DISPOSAL OF MATERIALS:

Remove from the site any rubbish and debris arising out of the execution of the contract works on a daily basis.

Clear all rubbish and any debris arising out of the execution of the contract works to a central area where others will remove it from the site on a daily basis.

Do not discharge any oil, noxious liquids or gases and all water discharged shall be reasonably free from impurities.

1.24 PROTECTION AND PACKAGING:

All plant, equipment, materials and prefabricated elements of the Works shall be properly packaged and protected against damage during delivery, storage and until fully, finally and properly installed and set to work.

Submit to the Employer a method statement on protection proposals for both stored and installed plant, equipment and materials.

Protection shall also include adverse effects of environmental conditions prevalent in the stored and installed location.

Any plant or equipment subject to incorrect storage or inadequate protection will be deemed unacceptable for incorporation into the works and new plant or equipment will be required as a replacement.

Damaged plant, equipment and materials or that suffering from deterioration shall be replaced prior to handover.

All plant, equipment and materials shall be protected against ingress of water and dust, formation of condensation, extremes and rapid changes of temperature, building works and operations of others.

All open ends of pipes, ducts, conduit, and trunking etc shall be capped except when being worked upon.

After removal of any temporary protection paint parts liable to corrosion.

Filter media shall only be installed when the plant items concerned are commissioned and tested.

Install items such as grilles, diffusers, switches, electrical accessories etc as near to practical completion as practicable.

1.25 SITE PROJECT MANAGER/CLERK OF WORKS

The employer may appoint a Site Project Manager/Clerk of Works whose duty shall be to act as inspector on behalf of the Employer. He/she will also witness the various tests and shall be empowered to issue minor but urgent instructions, the contents of which will then be confirmed by a change order.

The Contractor shall alter/rectify any work that does not fulfil the true intent of the contract at his own expense as requested by the Project Manager/Clerk of Works.

1.26 DEFECTS LIABILITY:

Liability for making good defects in the Works shall be for a period of 12 months from the date of issue of the certificate of practical completion for the installations.

If it is necessary to replace or renew any portion of the contract works as part of liability for defects, the defects liability period in respect of that portion of the contract Works shall be deemed to commence from the date of such replacement or renewal.

The Employer may require that new tests be carried out to demonstrate that the plant is continuing to work satisfactorily if the replacement or renewal may affect the efficiency of the Works or any portions thereof.

In the remedying of defects in the contract Works take all necessary precautions to minimise the risk of damage to the buildings, the decorations, the fittings and the equipment.

In the event of such damage occurring bear the cost of replacement or making good, subject to the proviso of being granted the benefit of any settlement in respect of such damage accepted by the insurers under the insurance policies taken out in accordance with the requirements of the contract.

Agree with the Employer a programme for the carrying out and the completion of any

work not finally finished at the time of the contract Works being offered for acceptance and which does not prejudice the issue of a practical completion certificate. This work may be requested to be executed out of normal hours and no additional costs will be accepted for this action.

Prior to practical completion submit a method statement for the approval of the Employer outlining how the defects which arise during the defects liability period will be rectified to ensure that disruption to the use of the building is kept to a practical minimum.

No additional costs will be accepted for undertaking works executed out of normal hours.

Prepare and submit records of failures or malfunctions of any part of the contract Works during the defects liability period, together with details of remedial action taken, subsequent re-testing and the results.

Notify the Employer of damage, failures or malfunctions to the contract Works demonstrably caused by incorrect operation of the installations, vandalism or other actions by a third party.

Inform the Employer in writing when all defects are finally rectified so that an inspection may be carried out prior to the issue of a Final Certificate.

1.27 SUPPLY OF COMPUTER HARDWARE AND SOFTWARE:

Obtain on behalf of the end user all appropriate licences, permissions, copyright waivers, rights of use and the like from the owners of the software rights. Ensure that the end user is properly registered with the software supplier for support and appropriate updating. Ensure that application software is written in compliance with BS 7649.

1.28 DAMAGE TO STRUCTURE:

Exercise due care and attention in carrying out the contract works and be fully responsible for any damage caused to the structure or building finishes.

Obtain permission from the Employer before any holes are cut in floors, walls or steelwork, etc.

1.29 METHOD STATEMENTS:

Submit method statements to the Employer prior to commencement of the contract works.

1.28 INSPECTION BEFORE CONCEALMENT:

Whenever work requiring inspection or testing is subsequently to be concealed give the following the notice to the Employer so that inspections may be made or tests witnessed before concealment

- 10 working days notice

1.29 EQUIPMENT GUARANTEES:

Plant and equipment guarantees shall commence at the date of practical completion and run for a minimum of 12 months after this date.

Any costs associated with this requirement shall be included in the contract price.

1.30 WORKMANSHIP AND MATERIALS:

All materials, articles and workmanship shall be of the best quality and execution as detailed in the specification and drawings.

All equipment and materials to be installed shall be new unless otherwise indicated. All equipment shall be installed in accordance with the manufacturer's written instructions and recommendations.

All materials considered by the Employer to be unsound or not in accordance with the specification shall immediately be removed and properly replaced to the satisfaction of the Employer at no additional cost. All work carried out imperfectly or with faulty materials must be immediately removed and properly replaced to the satisfaction of the Employer at no additional cost.

The manufactured articles specified shall serve as a quality standard.

Where manufactured items are not specified by name submit with the tender all necessary details of proposed articles. The Employer shall approve these articles before their use is permitted.

1.31 SCHEDULE OF RATES

Following the Tender Return date and upon receipt of a written request, the Contractor shall provide a Schedule of rates within 14 days of receipt of the request.

1.32 COMMISSIONING/USER TRAINING

The Contractor shall include for preparing and completing all necessary commissioning sheets and shall submit to the Employer for approval.

All tests shall be carried out and recorded in accordance with 18th Edition IET Regulations Incorporating Amendment and CIBSE Commissioning Codes.

MECHANICAL ENGINEERING SERVICES

SECTION 2 – GENERAL CLAUSES

SECTION 2 – GENERAL TECHNICAL SPECIFICATION

2.0 GENERAL DESIGN, QUALITY OF MATERIAL AND WORKMANSHIP

The whole of the works shall be in accordance with good engineering practice and to the approval of the Engineer throughout and shall be left in working order to his satisfaction. Approval by the Engineer shall in no way relieve the Contractor of his obligations under the Contract.

The works shall be arranged and installed to facilitate access, inspection, testing, cleaning, replacement and repair. The plant shall be capable of maintaining the required performance with the minimum of adjustment. Operating satisfactorily and continuously without supervision.

The Contractor shall ensure all equipment shall operate at any load or speed up to its specified limits and shall in respect of noise and vibration comply with current standards and shall be satisfactory to the Engineer. Notwithstanding the Contractor's responsibilities as defined in other clauses of this document.

Except where indicated otherwise, all materials and equipment supplied shall be new, of the best quality and of the class most suitable for the purpose.

Noise levels shall be kept to within recognised legal limits or below and the Contractor shall provide and fix sound and vibration insulation equipment as necessary to ensure that such sound levels are not exceeded.

All exposed moving parts of machines including parts fixed at high level to which there is not permanent means of access shall be fitted with guards. The guards shall be so designed and installed that they can be removed without disturbing other parts for maintenance without removal of the complete guard. The guards must comply with the requirements of the Factory Inspectorate and the Health and Safety at Work Act.

The whole of the equipment supplied shall operate under all normally expected conditions without causing unnecessary interference with any part of the power supply system or with any apparatus connected to it.

The Contractor shall use every endeavour to standardise in the selection of the plant. Corresponding parts throughout the system shall be interchangeable wherever possible.

If required, samples of material to be used in the construction of the plant shall be submitted for approval.

All instrument gauges and all major items of plant shall be clearly labelled and mounted in an approved manner. Current calibration certificates shall be submitted for all such equipment.

All nuts, bolts and fastenings on any part of the works shall, where required, be securely locked by approved means to the satisfaction of the Engineer.

All bolts and nuts shall be hexagonal to approved metric standards and truly faced washers shall be provided under all nuts and screws unless otherwise approved. Each plant item shall be supplied with all necessary holding down bolts together with base frames and anti-vibration equipment.

All heavy parts of plant shall be provided with convenient arrangements for slinging and handling during erection and overhaul. Items of plant normally stripped or lifted during

maintenance operations and which are greater than 20kg weight shall be marked with their weight.

All equipment selected must comply with all applicable Standards and Codes of Practice of the British Standards Institution. All reference to the British Standard Specification and Codes of Practice shall be deemed to be the latest edition.

All equipment and materials supplied and all work carried out must comply with statutory requirements and Local Authority regulations.

All work shall be carried out by competent and experienced workmen and in such a manner accepted as standards of good engineering practice. Particular attention shall be paid to the general appearance of the complete installation.

METRICATION

All items of plant and equipment, including gauges, meters, all drawings and schedules shall be in the Systems International (SI) Units. The specific approval of the Engineer shall be obtained before any other equipment dimensioned or calibrated in Imperial units shall be incorporated into the works.

CLEANING AND PROTECTION OF MATERIALS

The Contractor shall be responsible for all cleaning and protection of all materials, plant and equipment installed under this Contract.

All bright polished, chrome planted or similar finished components shall be wrapped with self-adhesive plastic at the maker's works and the contractor shall maintain this wrapping until the components are put into use.

All reasonable precautions shall be taken to prevent the ingress of dirt into the installation. All pipework and ductwork shall be stored clear of the ground on suitable racks.

All electrical equipment shall be protected before and after installation with thick plastic covers or similar protection to prevent the entry of dust and debris. Panels shall be protected with hardboard covers to prevent damage to the panel finish. The covers shall be removed to the minimum extent necessary to facilitate connection to the site wiring and shall be replaced at the end of each day's work.

Externally mounted equipment and installations shall be of weatherproof construction and properly protected against adverse weather conditions that could arise from driving rain, dust, exposure to full sun, settled snow and ice as may be applicable whilst in normal operation and when not in use.

All equipment shall be adequately protected during transit, storage and after installation to prevent damage and corrosion.

2.1 PIPEWORK GENERAL

The following shall be taken as a general specification relating to all pipework unless otherwise indicated :

The Contractor shall be responsible for the detailed design of all pipework systems. All pipework shall be installed in such a manner as to provide a neat appearance. The Engineer reserves the right to instruct to Contractor to dismantle and re-erect pipework which does not conform to reasonable appearance and standards.

Pipes shall be thoroughly cleaned before erection and shall be free from burrs and other defects. All pipe ends shall be suitably prepared.

All jointing shall be carried out in accordance with the manufacturer's instructions and all joints shall be cleaned after completion.

The Engineer reserves the right to instruct the Contractor to remove sections of pipework in order to demonstrate that burrs have been removed and joints have been correctly prepared. Sections of pipework found to be unsatisfactory shall require removal of additional section of pipe until they are found to be in order. The Contractor shall fit new pipework at his own expense.

All pipework and fittings left temporarily open during erection shall be closed off, by metal or plastic plugs, to prevent ingress of dirt. Paper covers or similar shall not be used.

Joints shall not be permitted within the thickness of walls, floors or ceiling structures.

Sleeves shall be provided for each pipe passing through a wall or floor. The sleeves shall terminate proud of the floor or wall finish and the space between the pipe and the sleeve shall be adequately caulked with mineral wool to reduce noise transmission. Where necessary the sleeves shall be of an approved fire resistant pattern. Sleeves shall not be used as supports and in all cases pipes shall be clear of the sleeves.

Reduction in line sizes shall be made by reducing fittings. Eccentric fittings shall be used where necessary to facilitate venting and draining. Branches shall not be fitted to reducers.

Reductions at pumps shall be concentric in vertical lines or top flat in horizontal lines.

Appropriate adapter fittings shall be used for connections between different pipework materials.

Pipework within trenches, ducts, false ceilings elsewhere, where not easily accessible, shall be welded throughout.

Flanges, unions, or other suitable and approved joints shall only be provided for each item of the plant, unless otherwise indicated.

Pipe fittings shall be of one manufacture throughout, a mixture of types shall not be accepted under any circumstances.

Socket weld flanges shall not be permitted, flanges should be slip-on or welded neck types.

Slip-on flanges shall not be welded direct onto but welded fittings.

Finish to flange faces shall be suitable for use with either Walkers Sentinel asbestos free or spiral wound gaskets.

Joints between flanges shall normally be made with full face asbestos free jointing or Taylors rings, purpose made, not cut from sheets on site.

Joint rings shall be fixed concentric with pipe bore and the Contractor shall ensure they do not obstruct the pipe bore.

Pipework layouts shall be planned for ease of removal of equipment for inspection, servicing and isolation.

Pipework shall not impede access to plant equipment or valves.

To permit access for the removal or maintenance of a pipe fitting, valve, or appliance without the necessity to disturb adjacent pipework, a minimum clearance of 25mm shall be provided between parallel lines, outside of insulation or between flange and pipe insulation.

Flanges and unions used for the connections to plant and fittings shall not be used as supports for that plant etc. No pipework movement either horizontally or vertically shall take place once the fittings are dismantled.

Clearance shall be allowed so as to provide maintenance access to internal pipes located in multiple pipe racks.

PIPEWORK SYSTEMS

Steel Pipework

a) Pipework up to and including 50mm nominal bore shall have screwed joints to BS EN 10226-1 : 2004 external taper threads into fittings with BS EN 10226-1 : 2004 internal taper or BS EN 10226-1 : 2004 internal parallel threads.

Pipework 65mm nominal bore and above shall have welded or flanged joints.

b) Pipework shall be arranged so as to allow ease when dismantling.
Dismantling points, shall be in straight runs at intervals not exceeding 10m, at main branches, or where pipework is connected to appliances, flanges and/or unions shall be used. Ground in, spherical seated unions shall be used for pipework up to 50mm nominal bore and flanges for pipework above 50mm bore. Screwed joints shall be made with unsintered PTFE tape to BS 7786 or with approved jointing compound to BS EN 751 Parts 1, 2 and 3. Hemp and paste joints are not to be used.

Welding joints shall be butt welded with tube ends suitably prepared.

c) All pipework installed concealed in trenches, ducts, ceiling and roof spaces, wall chases and floor ducts shall be WELDED. Welding fittings shall be heavyweight quality seamless to BS EN 10253.

d) The ends of the pipework and fitting shall be adequately bevelled before welding which shall be carried out by the oxygen acetylene to BS 2971 Class II or electric process, the latter being by metallic arc with covered electrodes which shall be in accordance with BS 2633 Class I.

e) Where welding is employed branch welds shall be as follows:

1. Where the size of the branch is equal to or one size below that of the main, purpose made welding tees shall be used.

2. Where the size of the branch is two sizes or more below the size of the main, a purpose made branch bend 'shoe' shall be used. Flanges shall be manufactured from mild steel, faced and drilled to
British Standard table 'E' or BS 4504 PN10.

Flange joints shall be made with corrugated brass Taylor rings with approved jointing compound and secured by the correct size and number of nuts, bolts and washers as required by the British Standard
Specification.

f) Unless otherwise approved by the Engineer all bends in steel pipework shall be of the long radius type and tees shall be of the easy sweep or twin elbow pattern.

g) Bushes, longscrew connectors, backnuts and plain malleable iron fittings shall not be used without the explicit approval of the Engineer.

Copper Pipework

a) Copper pipework installations shall be in light gauge copper tube to BS EN 1057 Table 1. Where formed bends or offsets are employed, a correctly sized bending spring or former shall be used. No pipe shall be permitted where any kinking, rippling, or distortion of the bore has occurred.

Formed 90° bends shall not be permitted where pipework is installed on view in rooms.

Fittings used on copper tubes shall be "Yorkshire" capillary fittings having integral solder rings, fitted to the pipework strictly in accordance with the manufacturer's instructions. Compression fittings, where used, shall be nondezincifiable.

b) All pipework installed concealed in trenches, ducts, ceiling and roof spaces, wall chases and floor ducts shall be brazed.

WELDING

All oxyacetylene welding and testing shall be in accordance with BS 2971 for oxyacetylene welds in mild steel pipelines up to 1700 kN/m² (250lb/sq in) and/or temperature up to 220°C (425°F).

Metal arc welding shall be in accordance with BS 2971 or BS 2633 as applicable. Bronze welding should be carried out in accordance with BS 1724.

All welding on site or at works shall be carried out by welders qualified to comply with the above standards and to the approval of the Engineer. Welders shall hold the appropriate certificate of competency issued by the National Joint Industrial Council of the Heating and Ventilation Industry, British Oxygen Company or Lloyds.

The Engineer shall reserve the right to ask the welders employed to submit a test weld at the Contractor's expense.

The Engineer shall reserve the right to ask for a sample welded joint to be removed for detailed testing at the Contractor's expense.

All surfaces to be welded shall be prepared in an approved manner, suitably cut and cleaned. On completion each weld shall be coated with one coat of red oxide paint.

PIPEWORK SUPPORTS

The Contractor shall provide and fix all necessary supports for pipework services in accordance with the following table :-

Maximum Intervals Between Supports (metres)						
Nominal Bore (mm)	Steel Pipes			Copper Pipes		
	HORIZONTAL	VERTICAL		HORIZONTAL	VERTICAL	
	Bore	Insulated		Bore	Insulated	
15	2.0	2.0	2.0	1.4	1.4	1.4
20	2.4	2.4	2.4	1.4	1.4	1.4
25	2.7	2.7	2.7	1.7	1.5	1.7
32	2.7	2.7	3.2	1.7	1.5	1.9
40	3.0	2.7	3.5	2.0	1.8	2.2
50	3.4	2.9	3.9	2.0	1.8	2.2
65	3.7	3.2	4.3	2.0	1.8	2.2
80	3.7	3.2	4.3	2.4	2.2	2.6
100	4.1	3.6	4.6	2.7	2.5	2.9

No structural concrete or steelwork shall be cut or drilled for fixing supports without the explicit permission of the Structural Engineer. Where fixings shall be permitted to existing structural concrete they shall be by means of 'Redhead' bolts or similar type fixings supplied and fixed by the Contractor. Shot type fixing may not be used.

Multiple pipe runs shall be carried on proprietary systems eg. Unistrut or purpose made angles or channel iron framework securely fixed to the walls, floor or ceiling as necessary. The pipes shall either rest on special purpose skid assemblies or shall be supported from the framework by rod hangers and flat iron beds.

Hanger rods on pipework subject to thermal expansion shall have double nuts and bevelled washers to allow the hanger rods to swing.

All U bends except where used as anchors shall have a pair of nuts and washers on each leg with the supporting steel flange clamped tight between the pair of nuts to form a rigid guide and allowing pipe to slide axially. U bolts shall be provided as an alternative pipe bracket except where otherwise specified.

Pipework at valves and mechanical equipment, eg. Pumps etc. requiring periodic maintenance shall be supported so that the valves and equipment can be removed without the need for temporary pipe supports.

Small pipework running along skirtings or at low level shall be supported by standard build-in or screw-on type clips. Plastic push type clips shall not be permitted.

On copper pipework, brass munsen rings shall be provided between the pipework and steel supports.

All pipework supports shall be arranged so as to allow free movement of pipework in the desired direction due to expansion and contraction and shall be adjusted to give the correct levels for drainage and air venting.

All pipework shall be individually supported. Pipes hung from other pipes shall not be permitted without the approval of the Engineer.

All supports shall be connected to the building structure in an approved manner.

Drawings of all major types of support shall be submitted for approval, in such time so as not to cause delays to the contract works.

PROVISIONS FOR EXPANSION AND FLEXIBILITY OF PIPEWORK

The Contractor shall make all necessary provision in pipework services to allow for thermal expansion. Details of expansion points and equipment used shall be submitted to the Engineer for approval in line with the contract works and shall be indicated upon the installation drawings.

The temperature used for calculation of thermal expansion shall be the maximum operating temperature.

Wherever possible provision for expansion shall be made by changes in direction of the pipework. For excessive runs expansion shall be catered for by purpose made expansion loops. Where expansion loops are provided they shall be installed with the correct amount of 'cold draw'.

The Contractor shall provide and fix suitable purpose-made guides on both sides of each expansion joint in accordance with the manufacturer's recommendations to ensure that expansion takes plate in correct alignment.

The Contractor shall provide and fix all necessary pipe anchors to ensure that all expansion takes place in the intended direction and be responsible for ensuring that the anchor loads have no detrimental effect on the building structure.

Unless the load imposed is too great al pipe anchors on steel pipework shall comprise two 12mm diameter rod iron U bolts threaded and pulled tight onto the pipe. 150mm long flat iron strips shall be welded to the pipe to butt against the U bolts to prevent the pipe sliding.

Anchors on copper pipes shall be similar to those used for steel pipes except that the strips attached to the pipe shall be copper.

All anchor points shall be secured to the structure in an approved manner.

Each anchor shall be designed to withstand the load imposed on it by the expansion of the pipework. Detailed drawings of all pipe anchors shall be submitted for approval before construction.

All pipework systems shall be designed so that the loads and movements applied at the flanges of mechanical equipment eg. heater batteries, pumps, etc. shall not exceed the permissible reactions for the equipment.

Where differential settlement between items of equipment may be expected sufficient flexibility should be provided in the connecting pipework, by the installation of flexible pipe connections.

For timber frame the design shall minimise anchor loads to be transmitted to the timber frame of the building. Adequate anchor and guide brackets shall be provided. Positions shall be co-ordinated with the timber frame specialist such that additional bracing of the structure shall be provided.

Evidence will be required during the design phase that a fully engineered solution is being provided and that information has been passed to the timber frame specialist for their input.

2.2 AIR RELEASE AND DRAIN POINTS ON WATER SYSTEM

The Contractor shall provide and fix sufficient air release and drain points to ensure that no air locks can occur and that each section of system can be completely drained. All pipework shall be graded to suit air release and drain points.

Air pockets shall be provided to high points and elsewhere as necessary to satisfy site conditions.

At each high point where air would normally be trapped the Contractor shall install key operated air cocks. Extended 8mm soft copper vent pipes shall be provided to permit air cocks to be fitted in accessible locations.

Automatic air vents where deemed necessary, shall have gunmetal or brass bodies, stainless steel floats and guides, non-corrodable valves and seats. Each automatic air vent shall be fitted with a lockshield valve and union.

Air release pipework shall discharge via a permanent pipework system running to a suitable location to be agreed with the Engineer. Air release points on small items of equipment shall be fitted with an approved air cock. The air cocks shall be fitted in easily accessible positions.

All air vents and air release pipework shall be installed in such a manner so as to prevent freezing.

Drain points shall be provided for the following:
- All low points on pipework systems.
- Each major item of equipment to enable the plant items to be drained independently.
- Each main circuit and sub-circuit to enable sections of the system to be drained independently.
- Drain points in plant room shall be fitted with a drain cock of the bronze gland type having a hose union and loose key, as Crane Fig. 8 No D3441/2 or equal and approved. Elsewhere throughout the system drain cocks shall be Crane Fig. No D340 or equal and approved.

All steel pipework throughout the installation which does not receive a decorative finish shall be wire brushed and given one coat of red oxide paint or similar. This includes pipework which shall be insulated.

Steel pipework, which shall receive a decorative finish, shall be wire brushed, all excess jointing tape or compound shall be removed from joints and the pipework shall be left in such a condition that it can be painted by others.

2.3 PROTECTIVE PAINTING

Steelwork used for brackets, drop rods, supports, sleeves etc. shall be wire brushed and painted two coats red oxide paint or similar, one coat to be applied before erection and one coat after. Steelwork brackets, etc. in boiler rooms and plant rooms shall in edition to the two coats of red oxide be painted two coats of black heat resistant paint. This included all pipework flanges, steel valves etc. which are not to be insulated.

PROVISION FOR THERMOSTATIC CONTROL AND INSTRUMENTS

The Contractor shall provide and fix all necessary screwed bosses, thermometer pockets etc. to pipework and ductwork for thermostats, instruments and associated equipment.

Where pockets are to be installed in pipework of 15mm to 80mm nominal bore, every effort shall be made to install the pockets in normal bends and in each case the bend shall be replaced by a tee so that the pocket may be installed in the third leg of the tee.

Notwithstanding the installation of permanent dial type temperature and pressure gauges, if deemed necessary/appropriate the Contractor shall provide and install in all locations dictated by site conditions, temperature and pressure test points of the self-sealing insertion type as manufactured by Binder Engineering Ltd or equal and approved.

The Contractor shall supply and install a minimum of the following gauges. These shall be in addition to any other pockets required for the controls system and test points for balancing during commissioning:

a) A combined altitude and temperature gauge to the main flow header pipework in plant room.
b) Altitude gauges at suction and discharge sides of all pump sets.
c) Temperature gauges to each boiler flow connection.
d) Temperature gauges after mixing valves.
e) Temperature gauges to each sub-circuit flow and return, within the plant room area.
f) Temperature gauges to all discharge ductwork from heater batteries and air handling plant.
g) Dwyer gauge or similar pressure differential sensing device across each bank of filter media.
h) Where the plant room/area is served from a district heating main a combine altitude and temperature gauge shall be fitted to the main flow and return pipework prior to any branch/sub mains within that platform/area.

All gauges shall have 100mm diameter faces and shall be calibrated to fully display the temperature and pressure of the line in which the gauge is located. Due regard shall be given to the type of gauge used with respect to the fluid within the line and the exposure to weather of the gauge.

LABELLING AND IDENTIFICATION

Each valve shall be fitted with a label valve identification number manufactured from suitably engraved 'Traffolyte'. The labels shall be attached to the valves by means of brass chains and key rings so as to remain visible at all time.

A pipe identification chart mounted in a framed and painted glass fronted board shallbe supplied and installed in the boiler room or other location as dictated by the Engineer.

The chart (or charts) shall show all pipework diagrammatically and identify the purpose and location of each valve.

All pipework insulation shall be fitted with colour coded identification bands having lettered symbols designating the service, pipe size and direction of flow at all valves, junctions, where pipes enter or leave rooms and 2m intervals throughout the installation. All pipe sizes shall be indicated in mm.

ACCESS

The Contractor shall ensure that all plant offered can be accommodated within the space available in the building. The plant shall be delivered to site in either sections or kit form to suit access arrangements. Special attention shall be given to the relationship between the contract programme and delivery of major items of equipment with regard to access requirements. The Contractor shall allow for all craneage, ancillary equipment and labour attendance during off loading and
installation. Sectional and kit form plant to be site assembled by the manufacturer.

CLEARANCES

When preparing the work drawings and carrying out the installation work, the Contractor shall ensure that adequate clearances are available for man access, maintenance, removal and replacement of plant and equipment, operation of valves and dampers, reading of instruments, inspection, changing filters and similar activities.

Horizontal and vertical clear access ways shall be 1.0m and 2.1m respectively. Any deviations from these principals and dimensions shall be brought to the notice of the Engineer at the time of preparation of the working drawings.

The Contractor shall supply all relevant information, including dimensioned sketches, manufacturer's certified drawings and options available to assist in making decisions with regard to arrangements.

MAINTENANCE

The Contractor shall provide a complete sets of all special tools, gland keys, lockshield valve keys, air cock keys and the like, required for erecting, testing, operating, maintaining or dismantling all items of equipment. Each set of tools shall be provided in a steel box fitted with a padlock. The tools shall not be used during the erection of the plant.

Duplicate keys shall be provided for all locks supplied as part of the Contract. The Contractor shall ensure that he obtains a signed receipt for all these items of equipment handed over under this section.

LTHW HEATING INSTALLATION PIPEWORK AND FITTINGS

All LTHW heating pipework shall be black mild steel 'medium' grade tube to BS 1387 or copper tube to BS EN 1057 Table 1 as specified in Section 3.

The exceptions to this shall be heating system cold feed and open vent pipework, which shall be galvanised mild steel 'heavy' grade tube to BS 1387.

Horizontal pipework shall have a gradient to permit draining at low points and venting at vent points, or at radiators, of not less than 1 in 250. Where fixed along walls or floors the pipe surfaces (or if lagged, the lagging) shall have a clearance of 25mm from wall and 50mm from floors at the lowest points. All reductions in size of horizontal pipework shall be made with eccentric fittings. Careful observance of parallels and symmetry of arrangements is required throughout, always providing that
the air gradients are maintained. Pipework in plant rooms shall be arranged so that a minimum of 25mm shall remain between the lagging on any two pipes.

All pipes shall be fixed with sufficient clearance from walls, floors, joists, or other obstructions capable of resisting length-wise expansion. In the interests of neatness and to avoid the necessity of pipe joints occurring within the thickness of a wall short radius elbows on heating circuits shall not be used.

Efficient watertight plugs shall be inserted in all pipe ends left disconnected during the progress of the works; plugs of shavings, paper etc. shall not be used.

The Contractor shall include for setting and bending of all pipes. Sets shall be formed on the flow and return branches of all radiators, vertical pipes where the walls reduce in thickness, pipes which pass over floor joists or mouldings, and around window recesses.

RADIATORS

Each radiator shall be fitted with the number of brackets recommended by the manufacturer, which shall be securely fixed to the building structure by means of white metal or plastic plugs and steel screws. Wood/fibre plugs shall not be accepted. All radiators shall comply with BE EN 442.

Each radiator shall have fitted 1 No air vent plug in each of the radiator panels or the connecting piece between panels.

The protective packaging of the radiators shall be kept on throughout the duration of the works. Small holes shall be made as required in the packaging material for brackets and connections during installation.

The Contractor shall ensure that the radiators are suitably protected between their installation and handover. Damaged radiators will not in any event be accepted by the Engineer.

The Contractor shall include labour for taking down each radiator twice for decoration purposes and re-fitting and venting same upon completion.

VALVES

Valves shall be fitted to the manufacturer's requirements (in line with good practice) in accordance with the following :-

Circuit Isolation Valves
Up to and including 50mm.
Bronze gate valves, with screwed connections manufactured in accordance with BS 5154, with a pressure rating of PN 20. Valves to be wheel head or lockshield type as applicable.

65mm and above
Cast iron gate valves, with flanged connection, manufactured in accordance with BS EN 1171, with a pressure rating of PN 10.

Commissioning Valves
Valves incorporating orifice flow measuring devices shall be fitted in heating circuit return pipework.

Double regulating valves shall be fitted in the heating circuit bypass pipework as required.
Up to and including 50mm
Orifice flow measuring devices shall be of bronze construction, with screwed connections to a pressure rating of PN20, complete with 2 No self sealing pressure tappings.

Double regulating valves shall be of the bronze oblique pattern type manufactured in accordance with BS 5154, with screwed connections, complete with positions indicator, lockable adjustable setting position and characterised regulating plug, with a pressure rating of PN20.

65mm and above
Orifice plates shall be of stainless steel construction, with flanged connections to BS 1092, PN16, complete with 2 No self-sealing pressure tappings.

Double regulating valves shall be of the cast iron oblique pattern type manufactured in accordance with BS EN 13789, with flanged connections to BS 1092, complete with position indictor, lockable adjustable setting position and characterised regulating plug, with a pressure rating of PN16.

Heating System Valves

Isolation

Steel	15-50dia	Hattersley fig 33X/XLS
Steel	65-100dia	Hattersley fig M511 PN10
Copper	15-35dia	Yorkshire YP415G/M/415GMLS
Flow regulation	15-50dia	Boss venturi FODRV
	65-100dia	Hattersley M2733

MCWS

Isolation Copper 15-28	Yorkshire YP501DZR
Isolation Copper 35-54	Yorkshire YP501GM

HWS

Isolation Copper 15-54	Yorkshire YP415GM
Individual isolation 15-22	Kuterlite 480 at draw off point Chrome plated

Radiator Valves
Flow connections
The flow connections to specified radiators shall be fitted with thermostatic radiator valves. Those valves shall be Drayton TRV4. Where thermostatic valves are not required the flow valves shall be angle or straight pattern hand wheel valves.

Return connections
The return connections to all radiators shall be fitted or straight lockshield pattern valves.

Drain cocks in plant rooms and in concealed positions shall be bronze to BS EN 1982 and shall be Crane Fig No D3441/2 or equal and approved.

Drain cocks at low point elsewhere in the system shall be bronze to BS EN 1982 and shall be Crane Fig No D349 or equal and approved.

All valves shall be suitable for the working pressure and temperature of the pipeline to which they are fitted except that no valve shall have a working pressure of less than 3.5 bar.g (50 psig).

Isolating valves shall close with clockwise rotation of the hand wheel which shall be clearly marked with the works 'open' and 'shut' with adjacent direction arrows and be fitted with a clear position indictor.

The location of valves shall be arranged to facilitate ease of access.

2.4 HWS AND CWS INSTALLATION PIPEWORK AND FITTINGS

Water Regulations
The Contractor shall install the water services in accordance with the 'Water Supply (water fitting) Regulations 1999.

The Contractor shall either confirm in writing that they are an WIAPS approved plumber or provide a copy of the notification documentation required under Regulation 5 prior to commencing any work on the water services.

In addition, the Contractor shall provide a copy of the notification documentation required for operations listed in the table of Regulation 5 and upon completion issue a 'Contractors Certificate' stating that the installation complies with the requirements of the Regulations.

Where it is identified that the contractor is responsible for the design of the water services installation and a new water supply is required the contractor shall submit the following information to the respective water authority governing the proposed works, with a view to obtaining a quotation for the water/supply to the site :

a) The necessary application form.
b) A plan of the proposed works.
c) A diagrammatic arrangement of the pipework and fittings to be installed.
d) A schedule of all known water fittings to be installed.

Where the site is a refurbishment and the contractor is responsible for the design of the works the contractor shall obtain from the water authority a separate form under Regulation 5. The form shall be duly completed, with all necessary supportive information and re-submitted to the water authority with a view to obtaining a quotation for a new, or upgraded water supply to the site.

All hot and cold water service pipework located internally shall be carried out using light gauge copper tube to BS EN 1057.

Where formed bends or offsets are employed, a correctly sized bending spring or former shall be used. No pipework shall be permitted where any kinking, rippling or distortion of the bore has occurred. Formed 90° bends shall not be permitted in exposed pipework.

Fittings used on copper tubes shall be 'Yorkshire Potable' capillary fittings and have integral solder ring, fitted to the pipework strictly in accordance with the manufacturer's instructions. Fittings shall have non-dezincifiable duplex, brass will not be accepted.

All mains cold water service pipework carried underground externally shall be medium density polyethylene (blue) tubing.

Stopcocks shall be fitted to each appliance having a float operated ball valve.

Gate valves shall be fitted to the HWS and TCWS.

Stopcocks or gate valves shall be fitted to each draw off or range to draw off points as applicable.

All meters on the mains cold water supplied shall be approved by the appropriate Water Authority and shall be valved both sides.

WATER STORAGE TANKS

Shall be one piece or sectional GRP tanks fully pre-insulated and manufactured in accordance with Regulation R27.1 and R16.13/14. Complete with bolted top, screened overflow and access trap. They shall be located on suitable staging within the roof void/designated tank room as appropriate and be fully accessible for maintenance purposes.

FLUSHING OUT OF THE DOMESTIC HOT AND COLD WATER SYSTEMS & CHLORINATION AND CLEANSING

The hot and cold water service systems shall be thoroughly flushed out before commissioning and handover of the installation in accordance with current Water Authority regulations.

All water services pipes and tanks are to have suitable chlorination treatment (in conjunction with the supplying Authority) and flushing out followed by confirmatory tests to ensure that bacteriological contamination is not present. The Contractor shall provide Certification to the Consulting Engineers detailing the results of these tests.

WATER TREATMENT OF HEATING SYSTEM

Unless otherwise stated the whole of the heating system shall be treated with Fernox C.H. anti-corrosion liquid.

The liquid shall be applied to the manufacturer's recommended concentration of 1 in 20.

The correct content of the heating installation must be calculated by the Contractor.

Water treatment is not regarded as essential for water used for small purposes of pressure testing and it is assumed that small sections or the whole of the work may be pressure tested using raw mains water.

If the system or any part of the system is drained (eg. for repair of leakages and removal of radiators for painting), then raw water added to the installation must be treated as above.

On completion of the treatment a sample of the water is to be taken in the presence of the Consulting Engineer or his representative forwarded to Messrs Fernox for analysis and comments.

Fernox Corrosion Proofing Liquid is manufactured by INDUSTRIAL (ANTICORROSION) SERVICES, Britannica Works, Clavering, Essex, CB22 4QZ.

SLEEVES

A copper sleeve manufactured form the same material as the service pipe comprising a short length of pipe shall be provided on all pipes passing through walls and floors.

Care shall be taken to ensure that sleeves are positioned with the ends flush with the wall plaster or floor finish. After completion of the wall or floor finish, the Contractor shall ensure that no plaster or cement has entered the sleeve, and that the pipe is free to move within the sleeve without cracking the plaster or other finish.

FLOOR PLATES

The Contractor shall fix chromium plated floor plates to all pipes passing through walls, floors or ceilings where visible in rooms. Pipes shall be installed at the correct clearance from the building finished surfaces to permit fixing of plates.

FIRE STOPPING ON PIPEWORK

All pipework when passing through a fire compartment wall shall be fire stopped by packing the gap between the pipe and its sleeve with an approved asbestos free fire stopping material.

PIPEWORK THERMAL INSULATION

The following specification refers to the requirements for heating domestic hot water, cold water services and the Contractor shall apply the appropriate clauses in conjunction with the respective materials and systems specified.

No insulation shall be applied until completion of pressure and circulation tests.

All pipework etc. shall be installed so that there is adequate space between pipes, walls, floors and ceilings for the insulation to be correctly fitted. No insulation shall touch a wall, floor or ceiling or the insulation of another pipe. If this occurs, the pipework shall be removed and re-fixed to give the necessary clearance, at the
Contractor's own expense.

A neat appearance must be maintained throughout the installation and the Contractor shall be held responsible for setting out of pipe runs so that insulation may be properly applied.

Each pipe shall be individually insulated.

To ensure that the correct thickness has been applied the Contractor shall remove one section of each type of insulation specified, the cost of cutting out or removing a section of each type shall be included in the Contract. If defects are revealed the Contractor shall at his own expense remove the whole of the covering and provide and fix new installation to the satisfaction of the Engineer.

Where roller supports are specified the insulation shall terminate to allow for the expansion of the pipe such that the insulation remains clear of the roller support.

All pipework in plant rooms, roof void, ducts, false ceilings, vertical ducts or boxed out must be insulated.

Cold Water, Domestic Hot Water and low Pressure Hot Water heating pipework, vessels, tanks and equipment shall be insulated with :

Kooltherm non HCFC Phenolic Foam, bore-coated pre-formed sections or slabs with factory applied Bright Class O reinforced aluminium foil facing. As manufactured by Kingspan Industrial Insulation or equal and approved.

a) Insulation Thickness Environmental thickness of insulation for domestic hot water services.

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	30	50
200	219	30	50
250	273	30	50
300	324	30	50
Vessels and flat		35	50

b) Environmental Thickness of insulation for non-domestic heating installations

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

c) 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 25°C and relative humidity of 80%.

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

Pipework in Floor Space, Boxings, Ceiling Spaces and Vertical Ducts
Insulation shall be foil covered preformed sections. All joints to be close butted and sealed with aluminium foil adhesive tape minimum 50mm wide. Each section shall be firmly secured with three additional bands of self-adhesive foil tape per section.

Boiler Rooms
Pipework insulation in all Boiler Rooms shall be rigid glass fibre sections securely fixed and coated with stucco, patterned aluminium sheet cladding and including endcaps etc. Bends and changes shall be effected using neatly formed lobster back bends of at least four-piece construction and purpose made manufactured bends suitable for the pipework and its thickness of insulation.

Tees shall be fully chamfered.

Heating Feed and Expansion Tank HWS Feed Tank and TCWS Storage Tank Insulation shall be 25mm thick expanded polystyrene comprising two sides, two ends and one top. The polystyrene shall be applied with Lowstik adhesive and the ends and sides shall be secured with galvanised wire netting: the top shall be left loose to allow access inside the tank.

Painting
All steel pipework throughout the installation which is not to receive a decorative finish shall be wire brushed and given one coat of red lead paint or similar. This includes pipework, which is to be insulated.

Steel pipework, which is to receive a decorative finish, shall be wire brushed, all paste and hemp shall be removed from joints, and the pipework shall be left in such a condition that it can be painted by others. Steelwork used for brackets, drop rods, supports, sleeves etc. shall be wire brushed and painted two coats red lead paint or similar, one coat to be applied before erection and one coat after. Steelwork brackets, etc. in boiler rooms and plant rooms shall, in addition to the two coats of red lead, be painted two coats of black heat resistant paint. This included all pipework flanges, steel valves etc. which are not to be insulated.

Identification
All insulation regardless of finish shall have lettered symbols designating the service, pipe size and direction of flow at all valves, junctions, where pipes enter or leave plant room and at 3m intervals throughout the installation. All pipe sizes shall be indicated in mm. All in accordance with BS 1710.

2.5 VENTILATION DUCTWORK

Except where otherwise specified all sheet metal ductwork shall be fabricated from stripmill cold reduced steel continuously hop dip galvanised to BS 2989 and BS EN 10142 Group 2 : Class 2A and shall be constructed in accordance with the Specification for Sheet Metal Ductwork, DW/144 Low and High Velocity Air Systems issued by the heating and Ventilation Contractors Association and amended as necessary to comply with the following requirements :-

Self-tapping screws shall not be used without explicit approval of the Engineer.

External ductwork, which is not insulated externally, shall be galvanised after manufacture.

Regardless of the thickness of sheet metal stated in Specification DW/144, all ducting with any dimensions exceeding 750mm shall be fabricated from at least 1.2mm nominal sheet thickness with the appropriate 'Diamond' stiffening.

All ductwork shall be true to size with ±3mm, true in section and shall not in any way be twisted.

Ductwork shall be erected so as to be rigid and free from sway, drumming and movement and shall be accurately lined up.

Should drumming occur in any ductwork system the Contractor shall at his own expense add further stiffening as necessary to eliminate such drumming to the satisfaction of the Engineer.

Where ductwork passes through walls or holes in masonry or concrete, the hole shall be lined with a galvanised sheet metal sleeve approximately 25mm larger than the duct in both dimensions. The gap this formed shall be adequately caulked.

Connections to all items of plant shall be made with angle iron flanged joints except where otherwise specified. Plant connections shall comply with DW/144 related to increased sheet thickness and stiffening.

Ductwork shall be manufactured with make-up sections between all branched and changes in direction. Reasonable provision shall be made for dismantling ductwork by means of bolted and gasketed flanged joints.

Lengths of duct and other constructional details shall be selected to achieve maximum economy of manufacture and erection, subject to compliance with the construction standards and access into the building.

A solution test shall be applied to all joints and seams made in low velocity ductwork, and defects shall be rectified at the Contractors expense to the satisfaction of the Engineer.

Where change of direction occurs in ductwork, these shall be created by means of 'SQUARE' bends, complete with turning vanes. Turning vanes shall be of double skinned construction as detailed in DW/144. Bends turning down to connect to grilles and diffusers shall also be fitted with turning vanes.

The Contractor shall take all necessary site dimensions to ensure that the ductwork can be accommodated in the spaces actually available. Particular attention shall be given to the positioning of flanges, supports and stiffeners in relation to the ceiling supports and structures.

The Contractor shall be responsible for the preparation of the final shop and installation drawings showing the fabrication details and the installation of the ducting shall be co-ordinated with other services and with the details of the building.

The Contractor shall ensure the drawings are submitted to the engineer for comment prior to manufacture and that no delay to contract occurs with regard to this item.

The ductwork section of this Specification shall be subject to all other relevant clauses within this Specification.

All ductwork shall be installed in such a manner as to give a neat appearance.

Particular attention shall be paid to the appearance of all visible ductwork. The Engineer reserves the right to instruct the Contractor to dismantle, remake and erect ductwork which does not conform to reasonable appearance standards.

All ductwork must be manufactured and fixed by a company approved by the Engineers.

Expansions and Contractions
Expansion shall be made upstream of branch connections whilst contractions shall be made downstream of branch connections, the slope of either an expansion or contraction shall not exceed 22½° on any side. Branches should not be connected to an expansion or contraction section.

Changes of Shape
Changes of shape sections may be used to avoid obstructions provided that, the cross-sectional area remains unchanged, the slope shall not exceed 22½° on any side or, where the cross-sectional area is temporarily reduced by not more than 20%, the slope shall be 22½° upstream and 15° downstream of the obstruction.

Connections to Equipment
Expansions shall have a maximum slope of 30° on any side whilst contractions shall have maximum slope of 45° on any side.

Where spacers will not permit the slopes stated above, they may be increased only with the prior approval of the Engineer and providing internal splitters are added.

Hangers and Supports
All hangers and supports will be spaced and constructed as detailed in DW/144.

Where there is a possibility of vibration or noise transmission, care shall be taken to isolate the duct from the building fabric. Ductwork shall not exert any physical load upon items of equipment and vice versa.

Finishes and Protection
All steel sections, angles, flats, rods etc shall be painted with one coat of red oxide paint or zinc chromate paint prior to erection and a further coat upon completion and erection. Surfaces that are inaccessible after erection shall receive two coats prior to erection.

Regulating Dampers
For setting fan volumes regulating dampers shall be fitted on each fan inlet or discharge.

A regulating damper shall generally be fitted to each supply or extract terminal device.

A regulating damper shall be provided in all main supply and extract ducts.

Regulating dampers shall be provided elsewhere are required.

Dampers shall be of the multi-leaf, opposed blade type, be of rigid construction and shall be substantially air tight when closed. They shall be constructed to prevent distortion and jamming when operated. Damper blades over 300mm wide shall be of a streamlined form without sharp edges and mounted on robust spindles. Hand
control dampers shall be provided with locking quadrant on the outside of the duct and a position indicator located parallel to the blade. Spindles shall be extended to the outside of the duct and shall be provided with a slot-cut to indicate blade positions. Spindles shall be mounted in non-ferrous metal or nylon brushes, or in ball bearings.

Where dampers are automatically controlled, provision shall be made for the lubrication of bearings; a linkage system shall be attached to the end of the spindle control by remote cable system or thruster device.

Fire Precautions

The ductwork shall generally be to DW144 except where fire rated ductwork is specified in Section 3.

All ventilation system ductwork entering or leaving plant rooms, fire compartments, escape routes or where specified shall be fitted with smoke/fire dampers complete with HEVAC installation frames and access door/panels as specified in Section 3.

Access Doors and Openings
Provide and fix all necessary airtight access doors. Access openings shall be rigidly framed and their covers shall be simply and speedily removed and re-fixed. Multiple set screws or self-tapping screws shall not be accepted as a method of fixing.

Access doors and other openings in ductwork shall be provided for the inspection and maintenance of all items concealed in the ductwork such as dampers, thermostat bulbs etc.

Inspection openings shall generally be not larger than 300mm high by 375mm wide unless essential for access to equipment, in which case the size shall be agreed prior to manufacture, the openings in the duct shall be adequately stiffened and door cover sufficiently rigid to prevent distortion.

Approved sealing gaskets and suitable fastenings shall be provided to ensure airtight sealing. Adequately sized access openings shall be provided at the base of all vertical ducts to allow the removal of any building debris which has accumulated during erection. If the base of a vertical duct incorporates tuning vanes openings shall be provided in both sides of such vanes.

Test Holes for Test Equipment and Instruments
Test holes shall be provided in all main ducts and brand ducts to correctly establish air flows and to check the performance of fans and regulating dampers. Such holes shall be 25mm diameter and suitable strengthened. Cover plates shall be screwfixed to the duct and sealed, alternatively suitably sized rubber grommets shall be inserted so as to form an airtight seal.

Co-ordination of Grilles and Diffusers
The Contractor shall be responsible for co-ordinating the fixing of the grilles and diffusers and their relationship with the suspended ceilings and shall prepare drawings showing the fixing of typical diffusers. The grilles and diffusers shall be fixed to the ductwork and not directly to the ceiling. Any grilles/diffusers connected using flexible ductwork shall be supported from the building structure.

FIRE RATED DUCTWORK
Any fire rated ductwork is to comply with the Building Regulations Approved document B3 Section 10 (1991) BS 476 Part 24 (1987) and BS 9999. The system is inclusive of the ductwork joints support brackets, fixings and the fire resistance of the system is to comply with the rating indicated on the drawing sand listed below. Single skin or double skin systems are acceptable, however, the internal finish should be
smooth and the air flow resistance should not differ from that of standard ductwork.

Fire Stopping
The Contractor is to note that where fire rated ductwork crosses through a compartment wall or crosses from one compartment to another the duct must have the same fire resistance as the structure through which it passes, in terms of stability integrity and insulation. Ductwork within its own compartment is required to maintain its own stability and integrity only.

Insulation
The fire rated ductwork shall be installed with Rockwool Conlit to provide 1½ hour fire rating (insulation) unless specified elsewhere in this Specification.

Cleanout Panels
The cleanout panels are to be DW144 with sliding conlit panel.

Installation
The system shall be installed to the manufacturers recommendations/requirements. The manufacturers shall provide all the necessary installation drawings detailing fixing requirements and centres. All fixings for support bracket are to be taken back to the structure and not rely upon supports from other service brackets.

Acoustic Attenuators
Any kitchen extract attenuators shall be Melinex lined and are to be capable of withstanding 300°C for 1 hour, manufactured in accordance with Allaway Acoustics standard high temperature specification; heavy gauge casings, RSA flanges, additional angle girths/bracketing and using all steel fixings. The construction is to maintain stability and integrity. Fire rated insulation to be applied by contractor.

2.6 DUCTWORK THERMAL INSULATION

General
The insulation work shall be carried out by a member of the Thermal Insulation Contractors Association. The thermal insulation specialist shall make himself fully acquainted with all the site conditions and programme of works and shall execute his works within such confines and programme.

The thermal insulation shall not be applied until the ductwork installations have been tested.

Insulation materials and finishes shall be inherently proof against rotting, mould and fungal growth and attach by vermin, be non-hygroscopic and in all respects be suitable for continuous use throughout the range of operating temperatures and within the environment indicated.

Any work not of acceptable standard shall be removed and replaced at no cost to the contract.

All insulation materials and finishes shall be installed in accordance with the manufacturers recommendations.

No insulation material containing CFC components shall be accepted.

Codes of Practice
BS 5970 : Thermal Insulation Range Minus 10°C to Plus 870°C
BS 8313 : Accommodation of Building Services in Ducts
The Building Regulations for England and Wales
Approved Document B

Ductwork Systems
Unless otherwise indicated, the following services shall be thermally insulated and also vapour sealed where noted :

a) Warm air ventilation distribution ductwork insulated to suit temperatures.
b) Air conditioning distribution ductwork insulated and vapour sealed.
c) Fresh air intake ducts to plant insulated and vapour sealed.

d) Return air to plant room insulated to suit temperature.
e) Ductwork exposed on roof or other external locations. As above, but with additional weatherproof finish.

Rectangular Ductwork
Insulation shall comprise of 40 kg/m³ nominal density CFC free rigid phenolic foam laminated with reinforced aluminium foil facing autohesively bonded to one face during manufacture.

The aged conductivity of the laminate shall not exceed 0.018 W/mK @ 10°C mean.

The laminate shall be Kooltherm Duct Insulation as manufactured by Kingspan Industrial Insulation Limited.

Circular Ductwork
Ductwork up to 350mm diameter is to be insulated with foil faced 35kg/m³ density Kooltherm phenolic foam sections or radius and bevelled lags. Larger ductwork is to be insulated with Kooltherm 40kg/m³ phenolic foil faced laminate, slotted so as to accommodate surface curvature.

Insulation Finishes – Ductwork

Service Ducts, Ceiling Voids and Floor Voids
The insulation shall be supplied with a factory applied Class "O" foil finish. All joints in the foil jacket, penetrations through the jacket or exposed edges to the insulation shall be sealed with 100mm wide self adhesive foil tape, or Kinsgpan Childers CP 76 Butyl sealant.

Internal, exposed to view
Specification will be as above plus Kingspan Childers KP 13/ canvas finish.

Internal in Plant Rooms or Boiler Houses
Specification will be as above with fabricated sheet aluminium casings 0.8mm thick.

Cladding to ductwork operating at temperatures below ambient, to be secured with stucco aluminium bands and matching seals at 450mm centres and at circumferential joints which shall be overlapped by a minimum of 40mm.

Specification will be as above. Insulation shall have a weatherproof coating of minimum 0.8mm thickness Polyisobutylene sheeting bonded to the insulation with minimum 30mm wide circumferential and longitudinal lap joints which shall be fully solvent welded in accordance with the manufacturers instructions.

Standards of Workmanship
All thermal insulation shall be bonded to the duct with Kingspan Childers KP 31 general purposes adhesive.

On rectangular ductwork, the insulation shall be cut on site so that the top and bottom slabs overlap the sides at all four corners of the duct. Insulation to inverted surfaces, or on sides of ducts exceeding 600mm in depth, shall be additionally secured with pre-bonded insulation pins and washers spaced at 300mm centres.

On circular and flat oval ducting the insulation shall be additionally supported with 15mm wide aluminium strapping with matching seals applied as circumferential bands at minimum 350mm centres.

All foil joints and any protrusions through the facing shall be sealed with 100mm wide self adhesive foil tape.

Ductwork supports for insulated ductwork shall incorporate Kooltherm foil faced High Density phenolic foam strip between the support and the ductwork to the thickness of adjacent insulation. The vapour seal shall be maintained by taping over the joint between the support foam and standard density insulation slab.

The insulation shall be carefully formed around access openings, damper arms and test holes to give adequate access whilst maintaining the vapour seal and providing protection from mechanical damage.

Where the insulated ductwork is external at roof level, insulation to the ductwork topside shall be fitted to falls to avoid 'ponding' of rain water in way of the weatherproof membrane.

Identification of Services
The Contractor shall include for the identification of those services both insulated and uninsulated.

Identification on insulated ductwork shall be by means of BS 1710 painted nonferrous colour bands, fastened around the insulation. Directional arrows or other labels denoting supply or extract where specified, shall be either PVC adhesive tape or painted symbols as agreed with the Engineer.

Colour band identification, and when specified directional arrows and labels, shall be made at:

a) 3 metre centres on exposed ductwork
b) 6 metre centres on concealed ductwork
c) Adjacent all dampers, changes of direction, inlets and exits to ducts and buildings and at either side of walls and floors.

All arrows used to indicated direction of flow shall be either black or white to contrast with the colour of the insulation finish.

2.7 GAS INSTALLATION PIPEWORK FITTINGS

The gas installation must be installed in accordance with the requirements of the Gas Safety (Installation and Uses) Regulations 1998. The installation must be carried out by a GAS SAFE registered installer.

All gas service pipework internal to the building shall be heavy quality mild steel tube to BS 1387 or copper tube to BS EN 1057 Table 1 as specified in Section 3.

The pipework shall be erected as described for heating pipework. Square tees shall be used throughout.

Sleeve and floor plates shall be fitted as described in Clauses 2.21, 2.22 and in the Gas Safety Regulations 1988.

Gas cocks shall be fitted to all outlet points, these shall be Crane type D191/TPN25 ball valves complete with 'T' handle capable of being locked in the fully open or closed position.

Unions shall be fitted on gas pipework to allow for dismantling the pipework and on the downstream side of each cock and at the connection to each item of equipment.

The unions shall be Navy type with spherical brass seats.

All gas service pipework buried underground externally shall be medium density polyethylene (yellow) tube.

All meters on incoming supplies shall be a type approved by Transco.

TESTING, BALANCING AND COMMISSIONING

The Contractor shall include in his tender sum for the testing, balancing and commissioning of the mechanical services plant installed under this Contract.

Where required or detailed in the Specification, specialist equipment shall be tested and commissioned by the manufacturer of the equipment and the cost of this shall be included in the tender price.

The Contractor shall be responsible for ensuring that this work is carried out to coincide with the contract programme. Test Certificates shall be provided by the Contractor showing results of each test. The Contractor shall be responsible for ensuring that when a test or commissioning procedure has been satisfactorily carried out, two copies of the Test Certificate are signed by the Engineer or his representative. One copy shall be retained by the Contractor and the
other shall be returned to the Engineer.

The Contractor shall include in his tender for attendance during the testing, commissioning and acceptance of all plant and equipment included in the contract.

Inspection Prior to Testing, Balancing and Commissioning.

Prior to a test taking place on a system or a section of a system, a general inspection of the work to be tested shall be made by the Contractor and the Engineer or his representative.

In the course of these inspections, the following points shall be checked :-

a) That all components comprising the system or section of a system, as described in the Specification and drawings have been installed.
b) That these components conform exactly to the requirements of the Specification and drawings, and have been installed correctly.
c) That all manufacturer's test data for plant or components necessary for testing, balancing and commissioning have been provided and are available for reference.

Any plant supplied by the Contractor or any work carried out by him which is found to be unsatisfactory by the Engineer or as a result of a test, shall be replaced by new plant or the fault corrected after which the test shall be repeated to the satisfaction of the Engineer at the Contractor's own expense.

Test Instruments
All apparatus, fans, etc. measuring instruments or meters required for inspection or tests under this contract shall be provided by the Contractor together with any equipment or electrical connections necessary.

All testing and measuring instruments shall carry their own individual calibration certificates (manufacturers' guarantees shall not suffice). A schedule of all test equipment to be used along with copies of their calibration certificates shall be forwarded to the Engineer, prior to any testing/commissioning taking place.

Cleaning of the System and Plant
On completion of sections of the system, that system shall be flushed and thoroughly cleaned out to remove any foreign matter and shall be cleaned externally to remove any paper labels, dirt and grease etc.

Prior to any tests, the plant and all equipment shall be thoroughly cleaned out by the Contractor.

Pressure Tests
The systems shall be tested in sections following completion of the work to a static pressure equivalent to the normal operating pressure of the system under test for ductwork and as follows for pipework :-

Heating and Hot Water Services - 1.5 x design pressure or 2.5 barg whichever is greater for not less than 2 hours

Mains Cold Water Services - 1.5 x design pressure or 2.5 barg whichever is greater for not less than 2 hours

Gas Service - 300mm WG or twice the working pressure whichever is greatest using nitrogen for purging.

Where necessary one test shall be carried out on ductwork using leak detection solution or smoke tubes and bulbs. If any joint or associated connection is shown to leak during the course of these tests, then the Contractor shall be responsible for rectifying the leak and re-testing the section at his own expense.

Inspection After Tests
After the heating installation has been set to work and operating at normal pressure and temperature conditions, it shall be inspected for leaks by the Contractor and the Engineer or his representative. The minimum duration of the test shall be 24 hours.

Balancing the Heating and Ventilation Installation

The Contractor shall demonstrate to the satisfaction of the Engineer or his representative that each item of plant or equipment performs to the specified duty. In establishing the performance of a plant item, the Contractor shall measure and record motor and plant speeds, voltages, currents, pressures, air quantities, water quantities and temperature etc.

The system shall be balanced as described in the CIBSE Commissioning Codes and BSRIA Commissioning Codes.

The balancing shall be carried out in two stages, preliminary balancing and final balancing and shall last a total of not more than two weeks, which may be split into separate and discontinuous periods. The balancing may have to be carried out outside normal working hours and the Contractor shall be required to allow for this.

The preliminary balancing shall be carried out as a final stage in the completion of the building.

The final balancing shall be carried out when the system is ready to be handed over, the records, certificates etc. of the systems duties shall be supplied to the Engineer.

During the balancing the Contractor shall operate the installation under normal working conditions and he shall for this in his tender.

For the ventilation systems the Contractor shall allow for setting each individual outlet to obtain the correct air flow pattern over each room or space as directed by the Engineer or his representative.

Plant Proving Tests
Prior to balancing each installation, the Contractor shall carry out all necessary plant proving tests relating to the mechanical equipment.

These tests shall include verification that all equipment has been correctly wired, rotating parts move in the correct direction and are correctly balanced dynamically etc.

The Contractor shall ensure prior to the operation of any item of plant or equipment that all moving parts are correctly lubricated and shall be responsible for any fault arising from failure caused due to his negligence regarding his procedure and shall replace all damaged parts of equipment.

Commissioning
On a date to be decided by the Engineer, after the completion of all the installations, building works and all systems have been balanced, the Contractor shall carry out commissioning of each of the installations described in the Specification.

During the commissioning the Contractor shall set all the installations to work, demonstrate and explain the operation and maintenance procedures for each system, for each item of plant to the Employer's Representative and in the end in the presence of the Engineer or his representative.

Should any part or component of the installation be found to be unsatisfactory, in the opinion of the Engineer, the fault shall be rectified and new components fitted and commissioned by the Contractor at his own expense. Any system, or part thereof, affected by the replacement shall then be re-balanced and commissioned at the Contractor's own expense.

2.8 EXISTING UNDERGROUND SERVICES

It will be the Main Contractor's responsibility to establish whether any existing underground services require diverting and in this respect shall arrange for the statutory undertakings to attend site prior to any excavations taking place. Should any site scans be necessary these shall be arranged by the Main Contractor.

MECHANICAL ENGINEERING SERVICES

FOR

SECTION 3 – PARTICULAR CLAUSES

SECTION 3 – PARTICULAR SPECIFICATION

3.1 SCOPE OF WORK

The Contractor shall include to strip out, design, supply, deliver, offload, store, install, test, commission the complete Mechanical & Electrical Services associated with replacement of Air handling Units 01 & 02 and SF Extract Fan all located in plantroom D217 along with modifications and extension of ductwork in the building.

The scope of works is summarised below, but not limited to the following;

- De-commission, isolate, drain, strip out, remove from site redundant services and equipment left under these works (Ventilation Plant in D217 Plantroom identified as AHU01, AHU02 and SF Extract Fan including sections, modifications, changes to ductwork around the building as indicated in appendices)
- New replacement Supply only Air Handling Unit to serve Ground, First and Second Floor Laboratories and circulation areas to be installed in place of stripped out unit in D217
- New local Heat Recovery Unit (HRU02) c/w LTHW coil, filters, attenuation, dampers mounted in D217 Plantroom to serve admin and staff dining room on second floor
- New local passive heat recovery unit (HRU01) and new ceiling void mounted supply and extract fans to serve First Floor admin areas
- Strip out and replace existing diffusers and grilles with new diffusers and grilles sized to meet the revised design duty.
- Interface New Plantroom D217 Laboratory AHU and HRU02 units together with LTHW F&R CT circuit with new controls panel
- New duty/standby Wilo Circulation Pumps and LTHW F&R CT circuit to serve the new AHU and HRU located in D217
- All Electrical Works associated with the works to IEE Regulations (power, containment to new plant and equipment)
- Thermal Insulation
- Design & Working Drawings
- Testing, and Commissioning
- As Installed Drawings
- O&M Manual, Building User Guide

<u>Specialist Systems</u>

The Mechanical Contractor shall include to appoint a specialist to design, supply, deliver, offload, store, install, test, commission the following specialist Mechanical Services to meet the performance brief of the tender documentation;

- Changes to Automatic Controls (Trend Approved Partner)
- Ductwork Installation (HVCA Registered Company)

3.2 REGULATIONS AND STANDARDS

The design, manufacture, erection, installation, testing and commissioning of the Mechanical and Electrical Installation and ancillary equipment will be carried out in accordance with the latest issue of the following:

- The Health & Safety at Works Act 1974
- BS8000 Workmanship on Building Sites

- NJUG Guides
- The Building Regulations
- Water Regulations 1999 and WRAS
- The 17th IEE Wiring Regulations
- All relevant CIBSE design guides and publications
- All relevant Codes of Practice
- Local Authority Requirements
- The Fire Officer's recommendations and requirements
- British Standards, including Codes of Practice
- CIBSE TM13, BSRIA publications and HSE L8
- CIBSE Commissioning Codes
- CIBSE Guides, HVCA Guides, BSRIA Guides and Memorandums
- Construction (Design and Management) Regulations 2015

3.3 DESIGN RESPONSIBILITY

The Contractor shall be responsible for the full design of the Mechanical services detailed in this specification from first principles. This shall include estimation of loads, all calculations necessary to size and select equipment compliant with this specification and any relevant standard and all planning necessary to provide fully operational services. **For the avoidance of any doubt, the entire design and construction responsibility shall remain with the Contractor**.

No pre-existing design information, calculations, modelling data (inputs and outputs), drawings, etc. will be provided to the Contractor. The Contractor must also allow for the preparation and submission of all design information which is complete in every respect and is based upon original information developed solely by the Contractor.

The routes, sizes and locations of equipment and services referred to in the specification or shown on any drawing are indicative only. Equipment selection, locations, distribution routes, etc. shall be determined by the Contractor. In preparing the tender, the Contractor shall include for all material and labour costs which result from the design development of the indicative layouts in accordance with this specification. This may lead to installation of alternative plant and equipment, quantities, sizes, duties, distribution routes and alternative positions necessary to co-ordinate with the building layouts prepared by other members of the contract and/or design team.

The Contractor's responsibilities shall include (but not limited to) the following:

a) Developing the detailed design calculations from first principles, equipment sizing and equipment selections based on the requirements of this performance specification and the indicative design drawings.
b) Preparation and production of design drawings, calculations and other documentation for submission to include a 'Design File'.
c) Submitting all design information to the Principal Contractor, the Design team, the Employer and the Employer's Representatives.
d) Attendance at design team meetings held during the contract.
e) Co-ordinating the electrical services design with the mechanical services and the building structure and finishes, in full collaboration with the other design team members, Principal Contractor and Employer's Representatives.
f) Identifying builder's work required in connection with the electrical services installations through preparation of drawings and schedules.

All design information shall be provided in a Design File as detailed below.

The design planning shall include (but not limited to) the following:

a) Procurement of all equipment, materials, sundries and labour for the fully execution of the Works. This shall include identifying and interpreting all quantities, manufacturers' references, material finishes and colour, builders work requirements, etc.
b) Final equipment installation, controls, cabling and all other system elements layout and co-ordination details and design of ancillary supports, expansion, anchor and suspension systems, associated steel and fixings.
c) Final co-ordination of equipment, controls, cabling and other ancillary systems, layout and installation within the total services system design and the structural and architectural configuration, in co-operation with other Contractors.
d) Co-ordination of all control systems panels, sensors, actuators, control cabling and testing, commissioning and operability of the system.
e) Preparation and planning of all builders' work requirements associated with the Works. To include preparation and production of builders' work drawings and schedules.
f) Preparation and production of construction working installation drawings. To include submission of drawings for comment prior to the commencement of any Works.
g) Attendance at design team meetings held during the contract for reviewing and co-ordination of the Works.

3.4 Mechanical Design Standards

DOMESTIC HOT WATER SYSTEM DESIGN

Not Applicable.

DOMESTIC COLD WATER SYSTEM DESIGN

Not Applicable.

VENTILATION SYSTEM DESIGN

VENTILATION SYSTEM DESIGN

Air change rates in all areas shall be designed to comply with the minimum standards given in
the current CIBSE guides, Building Regulations if these exceed performance standards detailed elsewhere in this specification. The most onerous rate shall be taken in all cases.

Extract systems shall exhaust directly to outside i.e. dirty systems shall not to be re-circulating, and they shall provide extract rates in accordance with the current CIBSE guide

Ventilation Ductwork Sizing
The ductwork systems shall be designed in accordance with the recommendations laid down in the CIBSE guide to current practice and the following parameters: -

1. General supply and extract velocities within ductwork systems shall be limited to:

Maximum Velocities
Main Ducts within plant rooms 6 m/s
Main ducts in risers and bulkheads 5 m/s
Main ducts within ceiling voids and exposed to view 4 m/s
Branch ducts 3 m/s
Final run outs to grille or diffuser 1.5 m/s

2. The maximum pressure drop per metre run of ductwork shall be limited to 0.4 Pascal's per metre run on supply and extract systems.

3. Velocities given above shall be reduced further if necessary as required to ensure noise regeneration does not exceed the noise levels given and the specific fan powers and energy consumption criteria are met. Terminals shall be located so as not to cause a noise nuisance.

4. Ductwork shall be sized on a constant pressure drop basis throughout all systems with balancing dampers as required.

The replacement ventilation system shall ensure the following criteria is met;

Ground Floor (New AHU01 System)

Room D7:	Room Pressure (-Ve): 80% of Fume Cupboard Extract (assume 6 ACH for costing)
Room D9:	Room Pressure (-Ve): 80% of Fume Cupboard Extract (assume 6 ACH for costing)
Room D14:	Room Pressure (-Ve): 80% of Fume Cupboard Extract (assume 6 ACH for costing)
Circulation:	Minimum 6 ACH (3No Grilles)

First Floor (New HRU01 System)

Room D114:	12.0 litre/sec/person (Room Occupancy: 1 Person)
Room D117:	12.0 litre/sec/person (Room Occupancy: 4 Persons)
Room D117A:	12.0 litre/sec/person (Room Occupancy: 1 Person)

First Floor (New AHU01 System)

Room D124:	Room Pressure (-Ve): 80% of Fume Cupboard Extract (assume 6 ACH for costing)
Room D108:	Minimum 6 ACH (Circulation)
Room D110:	Room Pressure (-Ve): 80% of Fume Cupboard Extract (assume 6 ACH for costing)
Room D107:	Room Pressure (-Ve): 80% of Fume Cupboard Extract (assume 6 ACH for costing)
Room D102:	Room Pressure (-Ve): 80% of Fume Cupboard Extract (assume 6 ACH for costing)
Room D101:	Room Pressure (-Ve): 80% of Fume Cupboard Extract (assume 6 ACH for costing)

Second Floor (New HRU02 System)

Room D205:	12.0 litre/sec/person (Room Occupancy: 12 Persons)
Room D215:	12.0 litre/sec/person (Room Occupancy: 4 Persons)
First Aid Room:	12.0 litre/sec/person (Room Occupancy: 2 Persons)
Room D214:	12.0 litre/sec/person (Room Occupancy: 6 Persons)

Second Floor (New AHU01 System)
Room D207: Room Pressure (-Ve): 80% of Fume Cupboard Extract (assume 6 ACH for costing)

EXTERNAL AMBIENT CONDITIONS
The Mechanical services installations shall be designed to provide the specified internal environmental parameters when the building is subject to the following external conditions:

External Ambient Design Standards
Winter external (fabric) -6°C/100%RH

Maximum noise level (With all plant operating at peak output, 3m from building perimeter) 5 dB below current ambient level, NR35 or Building Control Requirements, whichever is the most onerous.

3.5 STRIP OUT SERVICES

The Contractor shall de-commission, isolate, drain down, strip out and remove from site all redundant services under these works which include but not limited to;

- Existing Plantroom D217 Supply Air Handling Units 01 & 2.
- Existing Plantroom D217 Second Floor Ducted Extract Fan
- Existing Supply & Extract Grilles and replace with New
- Strip out, modify, change, extend ductwork in Plantroom D217 and in Building Ceiling Voids to meet proposed layout/changes

Prior to commencement of the above strip out works the Contractor shall employ a commissioning agent to establish existing duties of the ventilation systems and establish which areas of the building they serve.

3.6 ABOVE GROUND DRAINAGE

General

The Contractor shall design, supply, install, test and commission the complete condensate system from the new Air handling units and heat recovery units in accordance with;

- Manufacturers Requirements
- BS EN 12056-2
- Approved Document H Drainage and Waste Disposal
- Local Authority Requirements
- Generally accepted standards of good practice

The condensate pipework shall be carried out in copper BSEN1057 pipework with soldered fittings and shall run to nearest plantroom floor gulley. Should pipework run across a walkway, adequate protection and visible signage shall be installed (fixed step overs with hazard markings) .

3.7 HEATING SERVICES

General

The Contractor shall design, supply, offload, store, install, test and commission a new LTHW F&R constant temperature circuit extended from the valved/capped header branches to serve the air handling/heat recovery units in accordance with the specification and drawings. The heating system shall be supplied and installed in accordance with the current British Standards and Codes of Practices including the following specific requirements;

- CIBSE Commissioning Codes
- CIBSE Guides
- BSRIA Technical Memorandums
- Building Regulations Part L2
- British Standards
- IEE Regulations
- Manufacturers Instructions/Recommendations
- Clean Air Act 1956 with amendments

As part of the heating replacement works, there is a valved and capped off DN50 LTHW F&R future connections from the low loss header. The Contractor shall extend to serve the new Laboratory air handling unit (AHU01) and heat recovery unit (HRU02) located in the plantroom D217. The new constant temperature circuit shall include new Wilo inverter driven duty/standby circulation pump, strainer, non return valve, F&R isolation valves, temperature gauges and temperature sensors all interfaced back to the local automatic control system.

Assume Operating Temperatures: 82°C /71°C

The Constant temperature circuit shall be sized to serve the new LTHW heating coils mounted in the new air handling unit and heat recovery unit complete with necessary 3 port motorised diverting valves, flushing bypass, isolation valves and commissioning stations local to each unit.

3.8 MAINS COLD WATER

Not Applicable

3.9 HOT WATER SERVICES

Not Applicable

3.10 PLANTROOM BMS AUTOMATIC CONTROLS

General

The Contractor shall modify the existing Trend automatic controls to incorporate the operation and monitoring of the new plantroom mounted Air Handling Unit AHU01 and Heat Recovery Unit (HRU02) together with the new Constant Temperature LTHW circuit and pumps

The entire design, supply, installation, testing and commissioning shall be carried out in full accordance with but not limited to;

- IEE Regulations
- Irish and British Standards
- Local Authority
- Manufacturers Requirements
- Employers Requirements
- Trend Expert / Trend Approved Partner / Independent Trend Technology Centre (TTC)

Scope of Works

The Contractor shall appoint a Trend Expert/Trend Technology Centre to carry out modifications to the local plantroom automatic control system to incorporate the new plant and heating circuit.

The control system shall be installed to cover all HVAC systems within the second floor plantroom to include the following as a minimum;

- Heating Immersion temperature sensors (F&R secondary)
- Zone 4: CT Heating Circuit (twin pumps/auto changover/Flow Proving/time scheduling)
- New Air Handling Unit 01 (LTHW Coil Controls. 3 Port LTHW Valve, Immersion Temp Sensors, Filter Clean/Dirty Status, Supply Fan Enable/Fault, time scheduling, airflow sensors)
- New Heat Recovery Unit 02 (LTHW Coil Controls. 3 Port LTHW Valve, Immersion Temp Sensors), Monitor Unit Status inc. Time Scheduling
- Interface Heat Recovery Unit and Air Handling Unit to local Control Panel (Enable/Fault Lamps, On/Auto/Off switches, AHU01 Filter Dirty Lamp)
- LTHW CT Circulation Pumps (auto changeover)
- D217 Plantroom mounted Ventilation plant & CT Heating 7 day time scheduling
- Electrical wiring and containment to ALL new plant and equipment to complete the works

THIS BMS SECTION IS DETAILED ON A PERFORMANCE BASIS ONLY AND IS NOT FULLY EXHAUSTIVE. THE SPECIALIST SHALL SUPPLY ALL ITEMS WHETHER DETAILED HEREIN OR NOT TO MAKE A FULLY COMPREHENSIVE CONTROLS PACKAGE FOR THE PROJECT. REFERENSE SHOULD BE MADE TO THE ENTIRE SPECIFICATION TO ENSURE ALL SYSTEMS ARE INTERFACED, INCLUDING BUT NOT LIMITED TO VENTILATION SYSTEMS, SPECIALIST POOL PLANT AND SPECIALIST SPRINKLER, SMOKE, UFH SYSTEMS.

The control panel, pipe detectors, etc., and any item fixed directly to the plant shall be fitted by the Controls Specialist in the positions agreed with the Engineer and the Contractor. Motorised valve bodies and any pipework mounted items shall also be fixed by the Contractor. Where motorised valves are specified the Contractor shall further allow the fixing of the motors themselves and he shall allow for all necessary linkage kits for this operation. Room detectors and any other wall mounted items shall be installed by the Controls Specialist.

The Contractor shall be fully responsible for liaising with the BMS Contractor to determine the exact location of all control items and he shall allow for undertaking of this work and instructing other trades accordingly.

The Contractor shall undertake all cabling (power and controls) associated with the installation. This shall include power cabling to motors, packaged plant etc, interconnecting controls wiring between the control panel and control devices, fire alarm interfaces between the control panel, fire valves, and the fire alarm panel etc.

The Contractor shall include for the development of detailed controls strategies based on the performance requirements of the mechanical tender documents to provide automatic control of the mechanical systems in line with the design intent and to maximize energy efficient operation of the building.

The Contractor shall include for design, supply and installation of all necessary controls items and equipment necessary and all commissioning and demonstration of the complete controls systems prior to completion.

The BMS controls system design shall ensure that each and every function it controls is verified as functioning in the way the BMS dictates. Assumptions in the BMS system as to status of equipment being controlled will not be acceptable. I.e. Run status will be confirmation of the system actually running and not just an assumption that is running because the BMS has enabled it.

The contractor shall supply and install containment for the mechanical services power and control wiring.

The contractor shall be responsible for all electrical design and wiring to complete the works.

The contractor shall select supply, fix and wire all items of control equipment for the mechanical services including but not limited to; ventilation systems, LTHW heating systems, hot and cold water services required for the plantroom including, but not limited to; control panels, speed controllers, space and external temperature sensors, damper actuators and linkages, control valves, pipe and duct temperature sensors, fans, pumps and the like, to achieve the control functions.

Wiring diagrams, general arrangement drawings, and a full description of operations for all control panels and systems shall be submitted to Consultant Engineer for comment six weeks prior to manufacture.

1.01.1 Control Panels General Requirements

It is envisaged that 1 No mechanical new control panel / motor control centre shall be provided part of heating replacement works (other contract). The mechanical control panel(s) shall comprise an IQView8 display panel installed to the front of the main control panel to allow complete interrogation of the system and set-point and time routine adjustment, receive and display system/plant alarm conditions monitoring status and log of the same, provide an energy monitoring function via automatic collection of data from all meters/sub meters and display for each meter and linked to any other plantroom panel. The main panel shall be connected to a fire alarm interface to shut down the BMS panel(s). The Contractor shall allow to incorporate the new air handling unit and heat recovery unit HRU02 with this panel.

Each item within the panels shall be identified with a label giving the item number if appropriate, the item of plant controlled and the duty of the unit in question, together with a clear numbered identification of each cable and terminal to correspond to the final panel circuit drawings, a copy of which shall be provided in a purpose made pocket fixed within each panel.

A label shall be securely fixed under each switch, push button, or indicator lamp, duly inscribed with the appropriate function.

The Contractor shall design and wire the control circuits to achieve the following wiring sequence and control functions.

Power shall be supplied to items of plant through the main switch, then MCB's, contactors, control relays and switches to outgoing terminal blocks for final field wiring.

Motor control circuits shall be wired to give a visual indication of when individual items are running and when they have tripped.

Items of plant shall have three position rotary switches wired into their control circuits and labeled 'ON', 'AUTO' and 'OFF'. In the 'AUTO' position control shall be via the BMS system as detailed below, in the 'ON' or 'OFF' positions control shall be direct from the above rotary switch and independent of the BMS system.

The controls panels shall provide power where detailed, ON/OFF and speed control to all items of mechanical and natural ventilation plant.

All fault conditions for each items of mechanical plant shall be indicated on the BMS panel via a LED indicate lamp (RED).

CT Pumps

When a demand is present for AHU heating, then the relevant duty CT pump will be enabled.

The duty pump will change over on a weekly basis (168hrs). This will change over at Wednesday afternoon or by activating a BMS software switch.

An under-current relay will monitor the CT pumps. Should a low current occur when the duty pump is enabled, a flow failure will be indicated and the standby pump will be enabled. The system will reset automatically every 24 hrs or by operating a software switch on the BMS system.

The pump speed will be controlled in order to maintain the system pressure at the required setpoint (user adjustable). Three pressure sensors are located approximately 2/3rds along the main distribution branches.

The minimum pressure of the three is utilised for the speed control. An alarm will be generated on the BMS system if the system pressure is not achieved.

The CT pumps will be interlocked with the LPHW pressurisation unit. If a low pressure occurs then the pumps will be prevented from operation.

The CT system pressure is monitored by the BMS system at three locations.

Air Handling Units

The Contractor shall allow lamps and switching to extend the panel to serve the future replacement air handling unit and heat recovery unit (HRU02) within the plantroom.

Spare Capacities

All Control panels, power sections, control sections, trunking, DDC controllers shall have a minimum 25% spare capacity for future extension.

3.11 VENTILATION

General

The Contractor shall design, supply, install, test and commission (by specialist) the complete ventilation system in accordance with HVCA Specification DW144 for low pressure/low velocity systems and DW143, Class A leakage and DW/TM2 'Intermediate' level of cleanliness.

The works shall be carried out in full compliance of the following;

- CIBSE Guidelines and Technical Memorandums
- HVCA DW144
- HVCA DW172
- CIBSE Commissioning Codes
- BSRIA Technical Notes

The Contractor shall appoint a Ductwork specialist contractor who shall be a member of the Heating & Ventilation Contractors Association.

The ductwork shall be fully identified in accordance with BS1710.

Supply AHU Handling Unit (AHU01)

The Contractor shall design, supply, install, test, commission and set to work new dedicated supply Air Handling unit to reconnect to existing ductwork serving Laboratories on all levels to provide minimum tempered fresh air and make up for fume cupboard and LEV use to rooms.

The unit shall be manufactured by BARKELL or Equal and Approved.

The pre-packaged air handling unit shall be of a suitable construction for the environment in which it is installed and comprise of the following components;

- Motorised inlet damper (Supply)
- Supply Panel filter (G4 Grade)
- Supply Bag filter (F7 Grade)
- Frost Heating Coil (LTHW) Air Temperature rise -6°C to 5°C
- Main Heating Coil (LTHW) Air Temperature rise -5°C to 22°C
- Supply Fan (Inverter driven)
- Intake and supply Attenuators

The AHU unit shall have a 5 year warranty. The Contractor shall refer to indicative drawings and for 'Air Handling Unit General Specification'.

For costing purposes only, the air handling unit indicative design airflow rate shall be based on the following. Note it is the Contractor's responsibility to design the final airflow rate to provide make up air for Laboratories to the acceptance of the Client Representative.

New replacement AHU Indicative Airflow Rate: 11,000.0 m³/h

All LTHW feeds to each Air Handling Unit to be energy metered and interfaced with BMS Energy Metering software.

All Electrical Supplies up to and including local Isolators to rooftop Ventilation plant shall be provided by Electrical Contractor.

The SFPs and heat recovery shall be designed to comply fully with current Document L building regulations for Ireland and the initial assessment BRIRL.

For brief scope of works for the control strategy please refer to BMS section.

Passive Heat Recovery Unit (HRU01)

The Contractor shall supply & install a passive heat recovery unit manufactured by Vent Axia (type HR500DR) to serve the first floor office areas as indicated on the indicative drawings. All fans, ductwork and heat recovery unit shall be mounted in the ceiling void c/w air valves and/or 4 way diffuser grilles (supply & extract).

For costing purposes only, both the supply and extract fans indicative design airflow rates shall be based on the following. Note it is the Contractor's responsibility to design the final airflow rate to provide make up air for Laboratories to the acceptance of the Client Representative.

New Supply Fan Indicative Airflow Rate: 260.0 m³/h
New Extract Fan Indicative Airflow Rate: 260.0 m³/h

Heat Recovery Unit (HRU02)

The Contractor shall design, supply, install, test and commission a supply and extract heat recovery unit to be installed in Plantroom D217, as indicated on the drawings. The unit shall be manufactured by NUAIRE or Equal and Approved.

The supply and extract ventilation unit shall be as indicated on the drawings. The unit shall have a high efficiency aluminium heat exchanger matrix, supply and extract filters, automatic summer bypass, integral minimum and maximum infinitely variable speed controls, inlet and outlet attenuation and motorised inlet and exhaust dampers to shut when not operational.

For costing purposes only, the heat recovery unit indicative design airflow rate shall be based on the following. Note it is the Contractor's responsibility to design the final airflow rate to provide make up air for Laboratories to the acceptance of the Client Representative.

New Heat Recovery UnitHRU02 Indicative Airflow Rate: 1,260.0 m³/h
Minimum LTHW Off Coil Air Temperature: 22°C

The units shall be constructed with removable panels allowing maintenance access from both sides (Contractor to confirm access handling as part of working drawings, prior to ordering).

The units shall come complete with a factory fitted LTHW heater coil with integrated automatic controls.

The unit shall be interfaced with the automatic controls and include 7 day time scheduling.

ALL supply, extract and intake ductwork shall be fully insulated when in ceiling voids or exposed. There is no requirement to insulate exhaust ductwork to atmosphere (downstream of heat exchanger).

The Contractor shall ensure manufacturers recommendations are observed at all times.

Local Supply & Extract Fans

The Contractor shall supply and install local extract fans as indicated on the tender drawings. The fans shall be manufactured by the following;

Vent Axia
Type: ACM200
Or Equal and Approved

The fans shall shall be provided with hard wired user controller with on/off and automatic function to monitor the air quality within the offices (CO2 levels).

Automatic/weighted backdraught shutters shall be provided to all fans to prevent ingress of outdoor air when not operational.

Lourves/Grilles

The grilles and diffusers shall be complete with all fixings and dampers to complete the installation and shall be matt polyester powder coated to a pure white colour as manufactured by Gilberts (Blackpool) Air Distribution Ltd or Equal and Approved.

Volume Control Dampers

The Contractor shall design, supply and install volume control dampers to all major ductwork branch positions and to each outlet/inlet.

Each damper shall be complete with a cast aluminium operating lever and quadrant incorporating a self-lubrication sintered bronze bearing, operating lever locking screw and the words 'OPEN' and 'SHUT' cast on the quadrant. Damper levels shall be at an easily accessible location and not be obstructed by other building services and building fabric.

On multi-blade dampers where observation of the damper blades cannot be readily obtained a 100mm diameter inspection hole with cover shall be fitted adjacent to be observed.

Fire Dampers

The Contractor shall design, supply, install, test and commission fire dampers to ductwork penetrating 30min and 60min fire compartments (floors, ceilings, walls), in accordance with the mechanical and architectural drawings and fire officer requirements.

The Contractor shall include fire dampers and pipe sleeves wherever services penetrate fire compartments, whether shown on the drawings or not. The Contractor shall review the fire compartment drawing during tender stage, and shall have deemed to have included all necessary items to retain the fire integrity in these areas.

Fire dampers shall be of the single blade pattern and comply with the fire test requirement of BS 476 Part 1 1963, and as follows:

a. The damper blade shall be manufactured from not less than 4mm (8 gauge) mild steel complete with gravity weights and suspended off-centre with EN56AM stainless steel pivots

from a mild steel casing of not less than 3.2mm (10 gauge).

b. The damper blade shall be retained by a fusible link-set to fuse at 70°C (158°F).

c. Internal mild steel framework and sealing stop with ample clearance to allow for blade expansion.

d. Fire Dampers shall be provided with suitable installation frames for wall or partition installation as required.

e. Access to linkage shall be through an inspection door provided in the damper unit. The access door shall be of the bolt-on type fastened by wing nuts and sealed with a non-asbestos gasket. The position and size of the access door shall be such that the damper blade can be reset with ease and a new fusible link fitted.

f. Blades shall be parallel to the long dimension of the damper unit.

g. Fire dampers shall be supplied and installed with a remote status indication system to enable the users to identify the status of dampers without removing ceilings or access panels.

Smoke & Fire dampers are to be manufactured by the following (or equal and approved):

Actionair Ltd
Joseph Wilson Ind. Estate,
South Street,
Whitstable, Kent CT5 3DU
Tel: (01227) 276100

3.12 PLANTROOM VENTILATION

The Contractor shall ensure adequate existing plantroom ventilation is provided to the plantroom to comply with manufacturers requirements and British Standards for both combustion air and to limit summertime overheating.

3.13 THERMAL INSULATION/IDENTIFICATION

General

All pipework, ductwork, plant and equipment insulation in plantrooms, service ducts, ceiling voids, floor voids, boxings shall be insulated with foil faced rigid phenolic section/foam to the thickness calculated using BS EN ISO 12241.

LTHW/DHWS

Environmental insulation thickness for non-domestic hot water service areas to control heat loss, in accordance with the requirements of the Building Regulations (England and Wales) Part L2 Approved Documents.

Phenolic Foam λ= 0.018 W/mK

Outside diameter of copper pipe (mm)	Thickness of phenolic foam (mm)

15	15
22	15
28	15
35	20
42	20
54	20
67	20
108	25

MCWS/BCWS

Environmental insulation thickness for non-domestic hot water service areas to control heat loss, in accordance with the requirements of the Building Regulations (England and Wales) Part L2 Approved Documents.

Outside diameter of copper pipe (mm)	Thickness of phenolic foam (mm)
15	25
22	15
28	15
35	15
42	15
54	15
67	15
108	15

Supply Ductwork

Environmental insulation thickness for non-domestic hot water service areas to control heat loss, in accordance with the requirements of the Building Regulations (England and Wales) Part L2 Approved Documents.

Temperature Difference between air in Duct and ambient air	Thickness of phenolic foam (mm)
25°C or less	25

All cold water services shall be vapour sealed along its full length including supports, valves, unions, flanges etc, and be carried through walls and ceilings without a break in the seal.

All insulation shall have an Ozone depletion potential of zero and have 5 or less global warming potential.

Do not apply insulation until the installation has been fully tested and all joints proved sound. The insulation to be kept dry at all times.

All pipes, ducts and plant and equipment thermal insulation in plantrooms and areas deemed exposed to accidental damage shall be encased within Aluminium cladding (flat or profile) with a proprietary jointing method all in accordance with BS 5970 table 5.

All strainers, double regulating valves, safety valves, drain cocks and commissioning sets shall be left uninsulated, to ensure clear identification to maintenance staff. All remaining valves shall be fully insulated using insulation jackets, woven glass fibre fabric to BS 476, mineral wool insulation infill and heavy duty pull cord and Velcro fastening.

All methods of identification shall be compatible with the pipe and operating conditions.

Identification of services shall comply with BS 1710 and BS 4800.

When it is required to supplement the warning colour with warning sign to comply with statutory requirements references should be made to BS 5499: Part 5.

Identification bands shall be applied in a logical and tidy manner with lettering an flow arrows clearly visible. Where several pipelines are installed in parallel to each other the identification bands shall be applied at the same location on each pipe.

Valve labels and charts

Each valve shall be provided with a label indicating the service being controlled, together with a reference number corresponding with that shown on the valve chart(s) and record drawings. The labels shall be made from 3 ply (black/white/black) traffolyte material showing white letters and figures on a black background. Labels shall be tied to each valve with chromium plated linked chain. Adhesive labels will not be acceptable.

A wall mounted, glass covered plan to the approval of the Consultant shall be provided and displayed in each plantroom showing the plant layout with pipework, valve diagram and valve schedule indicating size, service, duty, etc.

Identification of services

Pipework and ductwork shall be identified by colour bands 150 mm wide or colour triangles of ao least 150 mm/side. The bands or triangles shall be applied at termination points, junctions, entries and exits of plantrooms, walls and ducts, and control points to readily identify the service, but spacing shall not exceed 4.0 metres.

All thermal insulation installation shall be undertaken by a specialist contractor employed by the Contractor. The Contractor will not be allowed to employ their own staff for this purpose.

3.14 COMMISSIONING AND TESTING

General

The Contractor shall include to clean the existing ductwork upon completion of the modification and changes of the system.

The Ductwork cleaning shall done in accordance with BESA TR/19: Internal Cleanliness of Ventilation Systems. The existing ductwork being retained shall be internally steam cleaned or equivalent to remove the vast amount of deposits and sterilise the ductwork prior to being brought back online. A minimum of 3No samples shall be taken at random locations to verify the cleanliness.

The new LTHW constant temperature circuit serving the new air handling unit and heat recovery unit HRU02 shall be flushed twice the volume and pressure tested to 1.5 times working pressure.

3.15 SPARES

General

The Contractor shall include the following spare parts to handover to the end user upon completion of the works as defined in the appendix.

3.16 BUILDERS WORK

The Contractor shall include all necessary builders work in connection with the works including making good of works to accommodate the installation to acceptance of the Client Representative.

APPENDIX A

SPECIFIED SUPPLIERS SCHEDULE.

The following is a list of products and suppliers which have been specified in the Tender Documents and one of which must be included in the Tender.

The Tender Drawings are based on equipment generally complying with the "Market Standard".

The tender drawings and specifications are based upon a particular manufacturer, selected from this list. The manufacturer used is detailed within each of the individual equipment schedules. Where the contractor selects an alternative manufacturer from this list he shall include for any modifications to pipework connections, ductwork connections, mountings arrangements, electrical requirements, etc.

The Tenderer, at the time of submitting his tender, shall indicate his choice of firm where there is a choice by striking out the names of other firms. Where no specific name is listed, the Tenderer shall insert the name of the firm included. Failure to complete the list will imply that the Engineer reserves the right to choose any of the firms listed for the produce of work, with no adjustment to the Contract Sum.

PRODUCT	SUPPLIER
Circulating Pumps	WILO
Air Handling Unit	BARKELL
Heat Recovery Unit HRU01	Vent Axia
Heat Recovery Unit HRU02	NUAIRE
Thermal Insulation Sub Contractors	HVCA REGISTERED FIRM
Ductwork Fabricators/Installers	HVCA REGISTERED FIRM
Grilles & Diffusers	Gilberts (Blackpool) Ltd
Automatic Controls	Trend Approved Partner

APPENDIX B

EQUIPMENT SCHEDULES

EQUIPMENT SCHEDULE: PIPELINES – CAST IRON – COPPER

SERVICE:	**PERFORMANCE :**	
Above Ground Soil, Wastes &	**Max. Working Temperature**	**: 90 °C**
	Max. Working Pressure	**: + or – 38 mbar**
Vents	**Required Test Pressure**	**: + or – 76 mbar**

DIMENSIONS	**22 mm - 54 mm**	**75 mm - 100 mm**	**Ancillaries**
PIPELINES			
Material	Copper	Cast iron	N/A
Standard	BS EN 1057 – R250	BS EN 877	
Ends	Plain	Plain	
Finish	Plain	Externally: Acrylic anti-corrosive red-brown primer. Internally: Two part epoxy coating.	
FITTINGS			
Material	Copper	Cast iron	N/A
Standard	BS EN 1254 – Part 1	BS EN 877	
Ends	Capillary	Plain	
Finish	Plain	Externally: Acrylic anti-corrosive red-brown primer. Internally: Two part epoxy coating.	
Jointing	Integral lead free solder rings	2-piece couplings	
APPLICATION			
	Waste and Vent	Soil/Waste/Vent	

EQUIPMENT SCHEDULE: PIPELINES – CAST IRON – uPVC

SERVICE: **Above Ground Soil, Wastes,** **Vents & Overflows**	**PERFORMANCE :** **Max. Working Temperature : 90 °C** **Max. Working Pressure : + or – 38 mbar** **Required Test Pressure : + or – 76 mbar**		
PIPELINES	**20 mm - 50 mm**	**75 mm - 100 mm**	**Ancillaries**
Material	uPVC	Cast iron	N/A
Standard	BS EN 1329:2000	BS EN 877	
Ends	Plain	Plain	
Finish	Plain	Externally: Acrylic anti-corrosive red-brown primer. Internally: Two part epoxy coating.	
FITTINGS			
Material	uPVC	Cast iron	N/A
Standard	BS 4514:1983	BS EN 877	
Ends	Capillary	Plain	
Finish	Plain	Externally: Acrylic anti-corrosive red-brown primer. Internally: Two part epoxy coating.	
Jointing	Solvent weld	2-piece couplings	
APPLICATION			
	Waste and Vent	Soil/Waste/Vent	

EQUIPMENT SCHEDULE: PIPELINES - POLYPROPYLENE

SERVICE	PERFORMANCE	
Laboratory Waste and vent pipes	Max. Working Temperature Max. Working Pressure Required Test Pressure	: 95^{0}C : 76 mbar : 150 mbar

PIPELINES	38mm-102mm	COMMENTS	
Material	Black polypropylene	To be manufactured by Durapipe – S&LP their 'Vulcathene Enfusion' range. Mechanical joints to be provided at appliances and equipment. The installation shall be in strict accordance with the manufacturers written instructions. 2.3litre dilution recovery traps with 38mm connections is to be fitted to all laboratory sink wastes.	
Standard	No BS or EN available for this system		
Dimensions	Plain		
Ends	Natural extrusion		
Finish			
FITTINGS			
Material	Black polypropylene		
Standard	As for pipe		
Ends	Fusion socket		
Finish	Plain		
Jointing	Electrofusion		
Manufacturer	Durapipe		

EQUIPMENT SCHEDULE: PIPELINES – uPVC

SERVICE:	**PERFORMANCE :**	
Above Ground Soil, Wastes, Vents &	**Max. Working Temperature**	**: 90 °C**
	Max. Working Pressure	**: + or – 38 mbar**
Overflows.	**Required Test Pressure**	**: + or – 76 mbar**

DIMENSIONS	**20mm - 50 mm**	**75 mm - 100 mm**	**Ancillaries**
PIPELINES			
Material	uPVC	uPVC	
Standard	BS EN 1329:2000	BS EN 1329:2000	
Ends	Plain	Plain	
Finish	Plain	Plain	
FITTINGS			
Material	uPVC	uPVC	Expansion couplings to comply with the Manufacturer's recommendations.
Standard	BS EN 1329:2000	BS EN 1329:2000	
Ends	Solvent socket	Solvent socket	
Finish	Plain	Plain	
Jointing	Solvent weld	Solvent weld	
APPLICATION			
	Waste and Vent	Soil/Waste/Vent	

EQUIPMENT SCHEDULE: HOT & COLD WATER; OVERFLOWS; CONDENSATE

SERVICE: **Mains Cold Water,** **Domestic Hot & Cold Water,** **Condensate Drainage**	**PERFORMANCE :** **Max. Working Temperature : 65** **℃ Max. Working Pressure :** **3.0 Bar** **Required Test Pressure : 6.0 Bar (1 hour)**		
PIPELINES	**15mm – 28mm**	**35mm – 54mm**	**67mm – 156mm**
Material	Copper		
Standard	BS EN 1057 – R250		
Ends	Plain		
Finish	Plain		
FITTINGS			
Material	Copper / Copper alloy	Copper / Copper alloy	Copper / Copper alloy
Standard	EN 1254 Part 1		
Jointing	Integral lead-free Solder Rings	Yorkshire Tectite	Yorkshire PressFit
	Yorkshire Tectite	Yorkshire PressFit	
	Yorkshire PressFit		
APPLICATION			
	Provide union couplings at all valves and terminations	Provide union couplings at all valves and terminations	Provide Flanges at all valves and connections.
ANCILLARIES			
	Condensate traps and connections to damage system are detailed on the mechanical services drawings		

EQUIPMENT SCHEDULE: THERMAL INSULATION

Service	HOT AND COLD WATER SERVICES
Pipe Size	15mm to 108mm
Standard	A1 Boilerhouse and Plantrooms A1 False Ceilings and Service Voids A2 External
Valve and Flange Boxes	D1. Plantrooms and External. D2. Risers and Ceiling Voids.
Fittings	All pipe fittings and components shall be provided with purpose made pre-formed sections / fittings to provide a neat appearance and match the profile of the fitting or component.
Remarks	All pipework shall be insulated.
Brackets	Dense rigid insulation spacers or purpose made proprietary insulation spacers shall be provided at every bracket, to the thickness of the insulation, and shall be suitable for the support loads of the pipework.

THICKNESS – Hot and Cold Water Services Systems Thickness Table

Thermal Conductivity (W/mK)				
Nominal Pipe Bore	Up to 0.026	0.027 to 0.04		
15	15	30		
20	20	30		
25	20	30		
32	20	30		
40	20	40		
50	20	40		
65	20	40		
75	20	40		
108	20	40		

EQUIPMENT SCHEDULE: THERMAL INSULATION (Cont.)

Service	INSTALLATION STANDARDS
Standard A1 to Pipelines	Thermal insulation to pipelines, standard A1, shall consist of rigid glass-fibre or rigid mineral wool pre-formed sections faced with Class O reinforced aluminium foil laminate. The facing shall be continuously-bonded to the insulation and shall form a hinge between the segments on one side and a 25mm lap on the other side. Sections shall be carefully cut and shaped around site made bends, filling cavities with plastic compound. Additional facing shall be applied as required to give a continuous covering across the joints. The sections shall be further secured by means of 25mm wide aluminium bands at 300mm centres, ensuring that a band is located at each end of a pipeline fitting.
Standard A2 to Pipelines	Thermal insulation to pipelines, Standard A2, shall consist of rigid glass-fibre or rigid mineral wool pre-formed sections faced with FIBAROLL FR UV sensitive sheet. The FIBAROLL sheeting shall be supplied by : FTI Industries Anglo Trading Estate Shepton Mallet Somerset BA4 5BY Tel: 01749 344544 Fax: 01749 344733
Standard D1 Valve and Flange Boxes	Refer to Specific Equipment Schedule for all Valve, Ancillary and Flange casings located within Plantroom
Standard D2 Valve and Wrap	Refer to Specific Equipment Schedule for all Valve, Ancillary and Flange wrap for risers and voids.

EQUIPMENT SCHEDULE: PIPELINE ANCILLARIES

SERVICE :	PERFORMANCE :		
Mains Water, Drinking Water, Domestic Hot & Cold Water & Dirty/Lab Hot & Cold Water.	Max. Working Temperature	:	65 °C
	Max. Working Pressure	:	3.0 BAR
	Required Test Pressure	:	4.5 BAR (1 hour)

APPLICATION	15mm - 54mm	67mm – 156m
Mains Cold Water Distribution Isolation	WRc Approved Stop Valve to BS 1010 Part 2 with compression ends to suit copper tube. Yorkshire Fig. YP508GM	N/A
Domestic & Dirty/Lab Hot & Cold Water. Distribution Isolation.	WRc Approved Ball Valve with compression ends to suit copper tube.	Cast iron butterfly valve to BS 5155. Hattersley Fig. No. 940. To suit BS4504 PN16 flanges.
Domestic & Dirty/Lab Hot & Cold Water. Appliance Isolating	WRc Approved ball type,screw driver/key operated, coppper alloy body with compression ends to suit copper tube.	N/A
Drain Cocks Low points on hot & cold water services.	UKWFBS listed, Kitemark certified . Screwdown type to BS2879,type 1	N/A
Single check valves on hot and cold water services.	Yorkshire Fig. 424	N/A
Double check valves on hot and cold water services.	Yorkshire Fig. 4424	N/A
Lock shield regulating valves on hot water service.	WRc Approved Regulating Ball Valve with memory stop and compression ends to suit copper tube.	N/A

EQUIPMENT SCHEDULE: PIPELINE ANCILLARIES (Cont.)

SERVICE :	PERFORMANCE :		
Natural Gas	Max. Working Temperature	:	N/A
	Max. Working Pressure	:	30 mbar
	Required Test Pressure	:	60 mbar (1 hour)

APPLICATION	15mm - 50mm	65mm - 200mm
General Isolation	British Gas Approved Ball Type. Copper alloy, lever operated, lockable, screwed to BS21 to suit steel tube. Hattersley Fig. 100 YL and 100 CYL	Cast Iron butterfly valve to BS5155. Hattersley Fig. No. 971 YL To suit BS4504 PN16 flanges.

Note:
WRc approved applies to all fittings included in the WRc Directory of Fittings and Materials.
Exposed appliance isolating valves to be screw driver operated, concealed to be lever operated.

EQUIPMENT SCHEDULE: TEMPERATURE/PRESSURE GAUGES

Manufacturer	**See Appendices**
Type:	Thermometers: Dial-type mercury in steel, complete with steel pockets for heating and brass pockets for copper installations. Scale Range: 0-100°C Domestic and Dirty/Lab Hot Water Services.
	Pressure Gauges: Bourdon pattern gauges, complete with syphons, gauge cock and loose red pointers. Scale range to be adequate to enable normal operating pressure condition to be indicated at between ½ to ²/³ of scale range.
Location:	As shown on the schematic drawings and as described within Specification.

Note:

1. All thermometers and pressure gauges shall be supplied by the same manufacturer and be of a matching type as for mechanical services installations.

EQUIPMENT SCHEDULE: THERMAL INSULATION

Service	**LTHW HEATING**			
Pipe Size Range	15mm to 300mm			
Standard	A1	False Ceilings and Service Voids		
	A2	External, Boilerhouses and Plantrooms		
Valve and Flange Boxes	D1	Plantrooms and External		
	D2	Risers and Ceiling Voids.		
Remarks	All pipework shall be insulated as standard unless specifically excluded on the tender drawings.			
Brackets	Dense rigid insulation spacers or purpose made proprietary insulation spacers shall be provided at every bracket, to the thickness of the insulation, and shall be suitable for the support loads of the pipework.			
	INSULATION THICKNESS TABLE			
Nominal Pipe Bore	Water Temperature			
	Up to 80°C		80 to 100°C	
	Minimum Thickness of Insulation (mm)			
Pipe sizes based on heavy grade steel	Phenolic Foam	Mineral Wool	Phenolic Foam	Mineral Wool
15	15	30	20	40
20	20	40	20	40
25	20	40	25	40
32	20	40	25	50
40	20	40	25	50
50	25	40	30	50
65	25	40	30	50
80	25	50	30	60
100	25	50	35	60
150	30	50	35	60
200	30	50	40	60
250	30	50	40	60
300	35	50	45	60
Flat Surfaces	35	50	45	70

Based on BS 5422:2001 - Table 12; Environmental insulation thickness for non-domestic heating installations to control heat loss. (The thicknesses shown have been rounded up in increments of 5mm to nearest sizes normally available from manufacturer)

EQUIPMENT SCHEDULE: THERMAL INSULATION (Cont.)

Service	**DOMESTIC HOT WATER SERVICES**	
Pipe Size Range	15mm to 159mm	
Standard	A1	False Ceilings and Service Voids
	A2	External
	A3	Boilerhouses and Plantrooms
Valve and Flange Boxes	D1	Plantrooms and External
	D2	Risers and Ceiling Voids.
Remarks	All pipework shall be insulated as standard unless specifically excluded on the tender drawings.	
Brackets	Dense rigid insulation spacers or purpose made proprietary insulation spacers shall be provided at every bracket, to the thickness of the insulation, and shall be suitable for the support loads of the pipework.	
	INSULATION THICKNESS TABLE	
Nominal Pipe Bore	Water Temperature	
	Up to 60°C	
	Minimum Thickness of Insulation (mm)	
Pipe sizes based on Copper Table X	Phenolic Foam	Mineral Wool
15	15	30
22	15	30
28	20	30
35	20	40
42	20	40
54	25	40
67	25	40
76	25	40
108	25	50
133	30	50
159	30	50
Flat Surfaces	35	50

Based on BS 5422:2001 - Table 13; Environmental insulation thickness for non-domestic hot water services to control heat loss. (The thicknesses shown have been rounded up in increments of 5mm to nearest sizes normally available from manufacturer)

EQUIPMENT SCHEDULE: THERMAL INSULATION (Cont.)

Service	**DOMESTIC COLD WATER SERVICES**	
Pipe Size Range	15mm to 159mm	
Standard	A1	False Ceilings and Service Voids
	A2	External
	A3	Boilerhouses and Plantrooms
Valve and Flange Boxes	D1	Plantrooms and External
	D2	Risers and Ceiling Voids.
Remarks	All pipework shall be insulated as standard unless specifically excluded on the tender drawings. All Insulation to cold water pipelines shall be fully vapour sealed.	
Brackets	Dense rigid insulation spacers or purpose made proprietary insulation spacers shall be provided at every bracket, to the thickness of the insulation, and shall be suitable for the support loads of the pipework.	
	INSULATION THICKNESS TABLE	
Nominal Pipe Bore	Water Temperature	
	Up to 10°C	
	Minimum Thickness of Insulation (mm)	
Pipe sizes based on Copper Table X	Phenolic Foam	Mineral Wool
15	15	20
22	15	20
28	15	20
35	15	20
42	15	25
54	20	25
67	20	25
76	20	30
108	20	30
133	20	30
159	25	40
Flat Surfaces	30	50

Based on BS 5422:2001 - Table 8; Environmental insulation thickness for non-domestic hot water services to control heat loss. (The thicknesses shown have been rounded up in increments of 5mm to nearest sizes normally available from manufacturer)

EQUIPMENT SCHEDULE: THERMAL INSULATION (Cont.)

Service	**AIR HANDLING DUCTWORK and PLANT**	
Pipe Size Range	15mm to 159mm	
Standard	C1	False Ceilings and Service Voids
	C2	External
	C3	Boilerhouses and Plantrooms
Remarks	All supply and extract ductwork shall be insulated externally, in plant spaces and service voids. The exhaust "legs" from the dirty extract fan ands fume cupboard ectract fan units to external louvres / discharges shall not be insulated. Supply ductwork within ceiling voids shall be insulated. General extract ductwork shall be insulated in ceiling voids All Insulation to supply ductwork shall be fully vapour sealed.	
Brackets	Hardwood spacers shall be provided at all brackets to maintain insulation thickness and vapour barrier.	

INSULATION THICKNESS TABLE					
Warm Air Ducting and Plant					
Temperature difference between air inside ductwork and ambient air (°C)					
10		25		50	
Environmental thickness of insulation (mm)					
Phenolic foam	Mineral wool	Phenolic foam	Mineral wool	Phenolic foam	Mineral wool
20	40	30	50	35	65

Based on BS 5422:2001-Table 11; Environmental thickness of insulation for ductwork carrying warm air. (The thicknesses shown have been rounded up in increments of 5mm to nearest sizes normally available from manufacturer).

Cold Air Ducting and Plant							
Minimum air temperature inside the ductwork (°C)							
15		10		5		0	
Thickness of insulation (mm)							
Phenolic foam	Mineral wool	Phenolic foam	Mineral wool	Phenolic foam	Mineral wool	Phenolic foam	Mineral wool
20	25	30	50	40	65	50	90

Based on BS 5422:2001-Table 10; Thickness of insulation for condensation control on ductwork carrying chilled air in ambient conditions 25°C, 80% rh. for insulation having a low emissivity finish (The thicknesses shown have been rounded up in increments of 5mm to nearest sizes normally available from manufacturers).

EQUIPMENT SCHEDULE: THERMAL INSULATION (Cont.)

INSTALLATION STANDARDS

Standard A1 to Pipelines	Thermal insulation to pipelines, standard A1, shall consist of sections faced with Class O reinforced aluminium foil laminate. The facing shall be continuously bonded to the insulation and shall form a hinge between the segments on one side and on the other side a 25mm lap. All circumferential and longitudinal butt joints to be sealed self-adhesive foil tape in accordance with the manufacturers recommendations. Sections shall be carefully cut and shaped around site made bends, filling cavities with plastic compound. Additional facing shall be applied as required to give a continuous covering across the joints. The sections shall be further secured by means of 25mm wide aluminium bands or additional bands of self-adhesive foil tape at 300mm centres, ensuring that a band is located at each end of a pipeline fitting.

Standard A2 to Pipelines	Thermal insulation to pipelines, Standard A2, shall be as per pipeline standard A1 plus additional, impact, protection. The protection shall be provided with the application of 0.9mm stucco hammer finish 'aluzinc' sheeting, secured to the pipe with pop rivets on longitudinal and circumferential overlaps, or, by means of lock form on longitudinal joints and pop rivets on circumferential overlaps. The hammer finish Aluzinc sheeting shall be Dobelshield type as manufactured by Dobel Coated Steel Ltd.

Standard D1 Valve and Flange Boxes	Refer to Specific Equipment Schedule for all Valve, Ancillary and Flange casings located within Plantroom

Standard D2 Valve and Wrap	Refer to Specific Equipment Schedule for all Valve, Ancillary and Flange wrap for risers and voids.

EQUIPMENT SCHEDULE: THERMAL INSULATION (Cont.)

Standard C1 to Ductwork	Thermal insulation to ductwork, Standard C1, shall consist of rigid mineral wool or zero ODP phenolic, faced one side with reinforced aluminium foil laminate overlapped at joints by at least 50mm or self-adhesive foil tape at least 100mm wide. The slabs shall be fixed to the ductwork by continuously bonding with adhesive. The slabs shall be further secured with hangers and washers at 600mm centres. The sections shall be overlapped at the corners of the ducting and the arises slightly rounded.

Standard C2 to Ductwork	Thermal insulation to ductwork Standard C2 shall be as Standard C1 with additional protection. The protection shall be provided with the application of 0.9mm stucco hammer finish 'aluzinc' minium sheeting, secured to the ductwork with pop rivets on longitudinal and circumferential overlaps, or, by means of lock form on longitudinal joints and pop rivets on circumferential overlaps. The hammer finish Aluzinc sheeting shall be Dobelshield type as manufactured by Dobel Coated Steel Ltd.:

Note:

All external insulations shall be one size larger than the selction from the tables above.
All insulation materials shall have zero glabal warming potential.
Should the contractor wish to propose a manufacturer, who is not detailed within Appendix A Specified Supplier's Schedule. This must be submitted on Appendix D Schedule of Alternative Manufacturers within the specification at Tender return, complete with the effect on tender price. No change in specification will be permitted following the award of contract.

PERFORMANCE SCHEDULE: Insulated Valve and Flange Covers

Manufacturer	J G Black Polymers Ltd		
Description	Pre-Formed, Rigid, closed cell, expanded Polyiscyanurate, valve and flange covers, purpose formed to fit the specified valve and flange types. To be installed with the use of reusable Velcro straps and vapour sealed where specified.		
Materials	Type Properties Density Thermal Conductivity Operating Temperatures Fire Properties	Expanded Polyiscyanuarate 50kg/m3 (minimum) 0.023W/mK -10°C to 120°C Class 1 Surface Spread (to BS476:7) Class P Ignitability (to BS476:5)	
Vapour Seal	(To be applied to services as listed below) A Non-Setting, flexible mastic seal shall be applied to the mating surfaces of the two sections of the cover and also to any cut outs for pipework and valve stems, etc. This shall form an air tight and water tight vapour seal. This seal shall also be applied to all external valve and flange covers, irrespective of service, to give a water tight seal.		
Particular Requirements (where applicable)	Service	Colour Finish	Vapour Seal
	LTHW Heating	Crimson	☐
	Domestic Hot Water Service	Crimson	☐
	Mains Cold Water Service	Blue	☐
Extent of Application	All Plant Room Valves and Pipeline Flanges >32mm∅ All External Valves and Pipeline Flanges		
Finish	All Internal Valve and Flange Covers shall be painted with 2 Coats of paint to the colour finish as specified above, to identify the service. All external valve covers and flange covers shall be painted with 2 coats of waterproof paint to provide UV protection to the cover material. All painting of covers shall be carried out prior to installation and the application of mastic seals (where applicable).		

Notes.

All insulated valve & flange covers have been selected from the manufacturer specified above. Please refer to Appendix C for a list of approved manufacturers.

Should the contractor wish to propose a manufacturer, who is not detailed within Appendix A Specified Supplier's Schedule. This must be submitted on Appendix D Schedule of Alternative Manufacturers within the specification at Tender return, complete with the effect on tender price. No change in specification will be permitted following the award of contract.

The contractor shall ensure that installation is in full accordance with the manufacturers recommendations.

PERFORMANCE SCHEDULE: Insulated Valve Wrap

Manufacturer	GasForce Technical Services Ltd	
Description	Valve wrap covers shall be an insulated blanket with tie wraps to allow easy removal and re-instatement onto the valve. The blanket shall be manufactured from a ceramic fibre material having the properties as specified below. The Inner and outer skins of the blanket shall be manufactured from silicone coated woven glass fibre which is stitched to the blanked via kevlar coated glass sewing thread.	
Properties		
	Nominal Thickness:	38 mm
	Density:	128 kg/m3 (minimum)
	Thermal Conductivity:	0.04 W/mK
	Operating Temperatures:	-10°C to 120°C
	Fire Properties:	To be flame retardant and non combustible
	Other Properties:	Oil and Water resistant
		Non-Asbestos
Extents of Application	All Valves in vertical risers, ceiling and floor voids. All valves in plantroom <40mm∅	

Notes.

All insulated valve wrap covers have been selected from the manufacturer specified above.
Should the contractor wish to propose a manufacturer, who is not detailed within Appendix A Specified Supplier's Schedule. This must be submitted on Appendix D Schedule of Alternative Manufacturers within the specification at Tender return, complete with the effect on tender price. No change in specification will be permitted following the award of contract.
The contractor shall ensure that installation is in full accordance with the manufacturers recommendations.
Statement of "All Valves…" detailed within extents of application above shall refer to ALL valves within the facility irresepective of system. This shall include (but not be limited to) LTHW, DHWS, MCWS BCWS, etc.

EQUIPMENT SCHEDULE: TEMPERATURE + PRESSURE GAUGES.

Manufacturer	**See Appendices**
Thermometers:	Dial-type mercury in steel, complete with steel pockets for heating and brass pockets for copper installations.
	Scale Range: 0-100°C - DHW & LTHW 0-30°C - CHW.
Pressure Gauges:	Bourdon pattern gauges, complete with syphons, gauge cock and loose red pointers. Red pointers shall be set by the sub contractor to the commissioned system operating pressures.
	Scale range to be adequate to enable normal operating pressure condition to be indicated at between ½ to ²/³ of scale range.
Location:	As shown on Contract Drawings and as described within Specification.

Notes.

The contractor shall ensure that installation is in full accordance with the manufacturers recommendations.
All thermometers and pressure gauges shall be supplied by the same manufacturer and be of a matching type.
Should the contractor wish to propose a manufacturer, who is not detailed within Appendix A Specified Supplier's Schedule. This must be submitted on Appendix D Schedule of Alternative Manufacturers within the specification at Tender return, complete with the effect on tender price. No change in specification will be permitted following the award of contract.

EQUIPMENT SCHEDULE: FLEXIBLE CONNECTIONS

DESCRIPTION	SERVICE	SIZE	PN Rating	Type	DESCRIPTION
UNTIED Flexible Connectors	LTHW and CHW	32-200	PN 16	UT 'Untied'	A single sphere EPDM rubber membrane with high tensile synthetic reinforcement with steel wire reinforced raised face sealing collars fitted with galvanised carbon steel swivel flanges. All membranes are coded with the batch number and date of manufacture. Flanges drilled to BS4504 PN16 Zinc plated finished. Maximum working pressure 16 bar. Working Temp -10 to 900C.
TIED Flexible Connectors	LTHW and CHW	32-200	PN 16	T 'Tied'	A single sphere EPDM rubber membrane with high tensile synthetic reinforcement with steel wire reinforced raised face sealing collars fitted with galvanised carbon steel oval flanges with Tie bar assemblies. Tie bar assemblies consist of a set length of threaded bar fitted with 2 no rubber Top Hat Washers, backing washers and lock nuts. The Top Hat washer ensures complete isolation between tie bar and flange. All membranes are coded with the batch number and date of manufacture. Flanges drilled to BS4504 PN16, Zinc plated finished. Maximum working pressure 16 bar. Working Temp -10 to 900C.
Union Rubber bellows	LTHW and CHW	15-32	PN 16	UT 'Untied'	A single sphere EDPM rubber membrane with 4-textile cord layers reinforcement. Connection shall be galvanised carbon steel female union. Maximum working pressure 16 bar. Working Temp -10 to 900C.

NOTES

All Flexible Connections have been selected from the Fabricated Products Range range. Please refer to Appendix C for a list of approved manufacturers.

Should the contractor wish to propose a manufacturer, who is not detailed within Appendix A Specified Supplier's Schedule. This must be submitted on Appendix D Schedule of Alternative Manufacturers within the specification at Tender return, complete with the effect on tender price. No change in specification will be permitted following the award of contract.

The contractor shall ensure that installation is in full accordance with the manufacturers recommendations.

Flexible connections shall be installed in the locations indicated on the Drawings.